UNITED STATES OF AMERICA

FEDERAL ENERGY REGULATORY COMMISSION

Reliability Technical Conference Docket No. AD18-11-000

PRE-TECHNICAL CONFERENCE COMMENTS OF STEVEN T. NAUMANN ON BEHALF OF EXELON CORPORATION

Exelon commends the Commission for its work to ensure Bulk Power System resilience including in this docket, in Docket No. AD18-7 and elsewhere. As elements of the Bulk Power System evolve, resilience threats generally and fuel security and diversity threats specifically are increasingly important concerns that need to be carefully studied and, once understood and defined, solved for. Much is at stake; as the Commission recently found "we must remain vigilant with respect to resilience challenges, because affordable and reliable electricity is vital to the country's economic and national security."[1]

Before resilience solutions can be developed, the extent of the resilience issue must be clearly understood and defined. A few studies on resilience/fuel security have been completed and more are underway. However, as elaborated below, these study efforts must be sufficiently robust to be meaningful or they will fail to identify potential problems and without understanding the problems, there would be no ability to generate solutions that will actually address those potential problems. For example, the studies must consider, among other critical issues: (i) recent and expected generation retirement and new build trends which concentrate increasingly on natural gas as the prime fuel source while other firm-fuel sources (particularly nuclear) retire, (ii) how that increased reliance on natural gas and increased interdependencies between the natural gas and electric systems could impact the Bulk Power System, (iii) the actual availability of back-up fuel supplies for natural gas generation, (iv) multiple gas pipeline outages,

[1] *Grid Resilience in Regional Transmission Organizations and Independent System Operators,* 162 FERC ¶ 61,012, at P 1 (2018).

(v) meaningful extreme weather events (alone and in combination with other threats), and (vi) national security threats.

The Commission can play a significant role in ensuring Bulk Power System resilience such as by ensuring that robust studies are completed and solutions are developed by jurisdictional entities. But other organizations and agencies also have a significant role to play given resilience issues extend beyond the Commission's traditional reach and knowledge base. For example, the Commission has limited ability to influence gas pipeline solutions which could be necessary given the increasing gas/electric interdependencies; thus, cooperation from other organizations with such authority will be critical to ensure there is no resilience gap. Similarly, the Department of Energy, Department of Defense and Department of Homeland Security are experts in national security threats that should be factored in as part of any study of threats to system resilience and fuel security. In addition, NERC has a role to play in ensuring resilience, especially in performing assessments. The bottom line is that the Commission and these other organizations and agencies need to work collaboratively to ensure that resilience is preserved.

While I am happy to address any of the Commission's questions, given this priority backdrop, I will focus on the first question regarding top NERC priorities:

> What are or should be NERC's top priorities for the next one to three years? What trends and risks identified in the recently issued 2018 State of Reliability Report warrant the most attention and effort at this time?

Background on NERC Identification of Risks

NERC has identified fuel security and diversity threats as a significant risk with increasing frequency. In the February 2018 ERO Reliability Risk Priorities, RISC Recommendations to the NERC Board of Trustees,[2] the Reliability Issues Steering Committee categorized four risks as "Higher Likelihood, Higher Impact:"

[2] ERO Reliability Risk Priorities, RISC Recommendations to the NERC Board of Trustees, at 3 (Feb. 2018) ("2018 RISC Report").

- Cybersecurity Vulnerabilities;
- Changing Resource Mix;
- BPS Planning; and
- Resource Adequacy.

While each of these risks have discrete impacts, the 2018 RISC Report identified a common underlying risk – fuel security – as follows:

> One common underlying risk that can be tied to multiple [risk] profiles is the increased use of just-in-time fuel delivery. More specifically, several profiles identify challenges from the single points of failure caused by the increased penetration of natural gas as a base load fuel. Natural gas fuel supply and its deliverability impacts reliability and must be fully studied to identify necessary mitigation strategies, including market, infrastructure, or regulatory solutions. The increased dependency on natural gas as a predominant fuel source presents challenges in real-time to system operators, and situational awareness must now include gas sources, pipeline, gas storage, infrastructure maintenance, compressor station location and failures, and deliverability concerns. Further, potential cyber or physical attack on a pipeline highlights the need for increased coordination among pertinent ISACs and the industry to improve response and recovery times due to the interdependency of the gas and electric system. The ability to model and address fuel limitations or shortages in BPS planning is a critical part of system planning. Therefore, there is a need for improved models as well as required data and information to support this planning to ensure the continued reliable operation of the BPS.[3]

NERC has recognized the potential impact of these risks, at least for the grid as it is today, in the NERC Special Reliability Assessment: Potential Bulk Power System Impacts Due to Severe Disruption on the Natural Gas System.[4] Three of the recommendations from that special assessment are important to the top priorities going forward:[5]

- Regulators should consider fuel diversity as they evaluate electric system plans and establish energy policy objectives. Additionally, regulators and policy makers should expedite licensing of new transmission and natural gas facilities to diversify and distribute risk;
- Cyber and physical security needs to be diligently considered by regulators; and
- NERC registered entities should consider the loss of key natural gas infrastructure in their planning studies.

Finally, building on the 2018 RISC Report and the 2017 Special Assessment, NERC is performing a Special Assessment looking at Accelerated Generation Retirement, going forward. This assessment, which

[3] *Id*. at 10.
[4] NERC Special Reliability Assessment: Potential Bulk Power System Impacts Due to Severe Disruption on the Natural Gas System (Nov. 2017) ("2017 Special Assessment").
[5] *Id*. at ix.

is expected to be published in November, will examine the potential impacts of accelerated generator retirements on:

- Resource and transmission adequacy;
- BPS reliability in event scenarios (e.g., extreme weather, generator fuel supply disruptions);
- Recommend improvements to generator retirement planning processes to mitigate risks where appropriate;
- Assessment focuses on at-risk generation, such as nuclear and coal-fired generators in market areas; and
- Understand long-term implications of decreased resource diversity.[6]

It should be no surprise that NERC identified fuel diversity as needed for a reliable bulk power system. NERC made the same finding in its 2017 Long-Term Reliability Assessment[7] where NERC identified a number of key issues concerning natural gas fuel assurance such as:

- Higher reliance on natural gas can lead to fuel-security issues, particularly during extreme cold weather periods when demand on the natural gas delivery system can be stressed, exposing electric generation to fuel supply and delivery vulnerabilities.

- As part of future transmission and resource planning studies, planning entities will need to more fully understand how impacts to the natural gas transportation system can impact electric reliability.

NERC made similar observations related to the need for fuel diversity and security in post-event analyses of other specific reliability events of the past years such as in its report on the Coal Strike of 1977-78[8] and the January 1994 Cold Wave.[9]

So there is no doubt that the risk of generator retirement especially by firm-fueled resource (such as nuclear), coupled with potential loss of fuel diversity is one of the major risks to the reliability of the Bulk

[6] Accelerated Generation Retirements, Special Assessment Update, MRC Informational Session at 4 (July 18, 2018).
[7] *2017 Long-Term Reliability Assessment*, at 30 ("A diverse resource mix promotes a more reliable supply of electricity, but as more areas are dependent on natural-gas-fired generators, reliability hinges on adequate arrangements for fuel and access to it.")
[8] *The Coal Strike of 1977-78, Its Impact on the Electric Bulk Power Supply in North America*, at p. 2 (May 30, 1978) ("the diversity of fuel types (nuclear, oil, gas and hydro) and diversity of supply sources for those fuels were major factors in permitting the utility industry to minimize the adverse impact of the coal strike").
[9] Blue Ribbon Task Force Report to the NERC Board of Trustees, *Report on Electric Utilities' Response to the Cold Wave of January 1994*, at 5 (Apr. 11, 1994) (extremely cold and icy weather caused natural gas interruptions, oil delivery problems due to icy roads and rivers, and frozen coal).

Power System that needs to be looked at by NERC, Planning Coordinators and regulators. But it also is clear that this "common underlying risk" may require actions not only by NERC, but by the Commission and other regulatory agencies.

For example, NERC has identified the need to assess physical security risks, not only to the Bulk Power System but to natural gas pipelines and other natural gas facilities[10] and the need to assess the risks of such physical attacks.[11] Similarly, NERC has identified that cyber vulnerabilities in other critical infrastructure sections can impact the reliability of the Bulk Power System.[12] But as NERC has recognized, federal regulators other than the Commission, have the authority to take action to ensure that the natural gas delivery system is protected against these threats.[13]

What Needs to Be Done?

With all of this good work as background, what should be done to deal with these serious risks to the reliability of the Bulk Power System? Since NERC issued the 2017 Special Assessment, ISO-New England performed a fuel security analysis,[14] and PJM announced an initiative to perform its own fuel security analysis.[15] These studies are necessary, but, as discussed above, unless they are sufficiently robust, looking at a broad range of scenarios (including likely fuel mix changes) and threats, they will not be sufficient to provide meaningful information to the Commission on the possible consequences of the impacts of severe weather and/or physical and/or cyber security threats to Bulk Power System reliability. And if the possible consequences are not studied, then possible mitigation for scenarios that are not studied cannot be developed and evaluated.

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[10] *See* 2018 RISC Report at 26 ("Physical damage to generation fuel sources, such as natural gas pipelines, which will degrade the reliable operations of the BPS").
[11] *Id*. ("Assess the risks of physical attack scenarios on midstream or interstate natural gas pipelines, particularly where natural gas availability will impact generation and the reliability of the BPS").
[12] *Id*. at 28 ("Interdependencies from the critical infrastructure sectors, such as Communications, Financial Services, Oil and Natural Gas Subsector, and Water, where sector-specific vulnerabilities can impact BPS reliability").
[13] *See* 2017 Special Assessment at ix ("Policy makers should ensure gas infrastructure is as secure from cyber and physical threats as the grid it supplies").
[14] ISO-New England, Operational Fuel Security Analysis (Jan. 17, 2018).
[15] Letter from Andrew L. Ott to PJM Members (Apr. 30, 2018).

The first step is for planning coordinators to conduct studies, looking at a wide-range of scenarios and threats, to provide information on the potential future range of consequences from these threats to Bulk Power System reliability. Looking at possible future resource mixes is essential to providing an assessment of the impacts to the reliability of the Bulk Power System. Although an imperfect analogy, when NASA launched the Juno spacecraft August 5, 2011, the spacecraft was not aimed at where Jupiter was on August 5, 2011, but where Jupiter would be on July 5, 2016 (GMT). In the same way, planning coordinators should study the Bulk Power System as it is expected to exist not today but in the near future, giving due consideration to likely retirements by firm fuel resources (such as nuclear) and increasing reliance on natural gas and the ramifications that entails.

These studies should start immediately and account for many of the complexities of the increased reliance on natural gas systems, such as the priority of residential natural gas customers.[16] Limitations on the use of secondary fuels for backup due to problems of timely resupply and environmental limitations also must be taken into account.[17] These studies should also consider all relevant threat information including national security threats by incorporating a Design Basis Threat developed based on feedback from organizations such as the Department of Energy that track such information and should consider all likely weather scenarios (described below) in combination with intentionally disruptive activities.[18]

Armed with completed and sufficient studies, planners and regulators can then determine which threats, if any, require mitigation, what if any mitigation should be required, how costs should be allocated and other related questions.

[16] If no gas is available for generation at all due to the residential use priority, electric blackouts could be extensive, potentially precluding even "rolling blackout" alternatives.

[17] One of the recommendations of the 2017 Special Assessment is that generation owners and operators maintain "back up fuel inventories at units to ensure that dual fuel capable units provide adequate resilience in the event of a natural gas outage." 2017 Special Assessment at x. But in addition, planning must consider fuel resupply problems as seen in ISO-New England this winter. *See also Comments of Exelon Corp.*, Docket No. AD18-7, Exhibit A, *PJM Liquid Fuel Survey and Research Results and Recommendations* (May 9, 2018).

[18] *See generally Comments of Exelon Corp.*, Docket No. AD18-7 (May 9, 2018) ("Exelon Resilience Comments").

Need to Look At A Broad Range of Severe Weather Scenarios

While the Commission has recognized there are no industry standards or best practices for performing fuel security analyses,[19] assessments need to look at a wide variety of conditions, and not be limited to recent experience.[20] Arguments that only recent severe weather events need be studied could result in risks to the Bulk Power System. For example, in my over 40 years in the industry, I have seen the Midwest and the Mid-Atlantic grids endure the following:

- Severe winter in the Midwest during the 1977-1978 Winter Season (lasting weeks);
- A coal strike during the 1977-1978 Winter Season;
- Severe winter in the Midwest during the 1978-1979 Winter Season (lasting weeks);
- 1994 Severe cold;
- 2014 Polar Vortex; and
- 2018 Bomb Cyclone.

To see the range of possible consequences of natural gas interruptions during the winter, more than a week to two-week events should be analyzed; a weather analysis should analyze a full 90-day winter event. [21]

Need to Look At Intentional Acts or Accidents Affecting the Natural Gas Delivery System

As NERC has recognized, cyber and physical security threats can harm the reliability of the Bulk Power System. For example, in its 2017 Special Assessment, NERC identified clusters that would be susceptible to disruption of the natural gas supply and potential voltage and stability issues.[22] NERC also has recommended that "Pipeline systems should be planned with the equivalent of N-1 to assure deliverability in the event of a pipeline, LNG, or storage outage."[23] While studying N-1 outages of pipeline

[19] *ISO New England, Inc*., 164 FERC ¶ 61,003, at P 52 (2018).
[20] *See id*. and n.145 (inputs include "observed historical data or well-established projections").
[21] *See generally* Exelon Resilience Comments.
[22] *See* 2017 Special Assessment at 17-21.
[23] *Id*. at ix-x.

systems is a start, to see the full range of impacts on the reliability of the Bulk Power System studying the impacts of multiple pipeline outages is required.[24]

Over the past decade, NERC has developed, and the Commission has approved, and continued to direct, improvements to critical infrastructure protection standards for physical and cyber security applicable to the Bulk Power System. Moreover, the NRC has promulgated rules for physical and cyber security applicable to nuclear generating station.[25] However, there are no mandatory standards applicable to the natural gas system.[26]

I emphasize that the studies need to determine the consequences of a wide variety of events. Only then can planners evaluate if mitigation may be needed and then, the Commission and others can have an informed discussion of the risks to the Bulk Power System, the costs to mitigate those risks and what, if any, mitigation Bulk Power System entities should implement.

The consequences of insufficient system performance information beyond scenarios experienced in the past can be significant. Back in 1983, NASA was faced with a difficult decision, whether or not it was safe to launch the Space Shuttle Challenger. NASA and the engineers knew that there had been "burn-by" on the solid rocket booster O-rings on a number of the prior 24 flights. The temperature at launch was expected to be lower than experienced at prior launches, and the engineers had not studied

[24] *See* Exelon Resilience Comments. A recent study conducted by ICF showed that a single extended pipeline outage would put 18,000 MW of generation in PJM at risk. ICF, *The Impact of Fuel Supply Security on Grid Resilience in PJM-Final Report*, at p. 2, Comments of the Nuclear Energy Institute, Docket No. AD18-7 (June 8, 2018). Such an outage also would put at risk an additional 9,000 MW of downstream resources in the NYISO. *Id*.

[25] *See* 10 C.F.R. § 73.54. While the NRC has issued rules requiring physical security protection that apply to nuclear generating stations, NERC's physical security standard does not apply to other generating stations. *See Physical Security Reliability Standard*, 149 FERC ¶ 61,140, at P 99 (2014) ("Order No. 802").

[26] *See* Testimony of Neil Chatterjee Before the Committee on Energy and Natural Resources, at 3 (June 12, 2018) ("While the Transportation Security Administration has the authority to require mandatory cyber security standards for gas pipelines, it has not done so to date, instead relying on voluntary efforts"). The Commission has recognized that "while such proactive commitments by industry are laudable, they do not and cannot substitute for a government regulation subject to compliance and enforcement, including civil penalties for non-compliance." Order No. 706-B, Mandatory Reliability Standards for Critical Infrastructure Protection, 126 FERC ¶ 61,229, at P 34 (2009), *compliance filing dismissed as moot*, 134 FERC ¶ 61,180 (2011) (finding NRC's cyber security rule covers all balance of plant).

the O-ring performance at this low temperature level. Obviously, the launch decision was made over a period of less than 24 hours, but the point is where there are critical decisions to be made, studies are needed to help the decision-maker.

The Need for a Design Basis Threat

While stakeholders may argue whether various outages of the gas system, whether due to physical attack; a cyber attack; a coordinated physical and cyber attack; or an attack during a severe winter or summer load period should be evaluated, planners and policymakers need to have a Design Basis Threat to evaluate which scenarios are within the realm of reasonableness to require mitigation. While a Design Basis Threat for attacks on the natural gas system would require coordination with the Department of Energy and other agencies in the intelligence community, the concept of evaluating the Bulk Power System based on a Design Basis Threat is not new to the Commission.[27] Such a Design Basis Threat should be developed and relied on in studying fuel security issues affecting the Bulk Power System.

For example, in Order No. 779, the Commission directed NERC in developing a reliability standard for Geomagnetic Disturbances ("GMD") to "identify benchmark GMD events that specify what severity of GMD events a responsible entity must assess for potential impacts on the Bulk-Power System."[28] NERC proposed a benchmark event, a Design Basis Threat by any other name, based on a 1-in-100 year frequency of occurrence.[29] The Commission approved the proposed standard based on this benchmark event.[30]

[27] *See, e.g.,* Exelon Resilience Comments.

[28] *Reliability Standards for Geomagnetic Disturbances*, 143 FERC ¶ 61,147, at P 54 (2013) ("Order No. 779")("The Second Stage GMD Reliability Standard must identify what severity GMD events (i.e., benchmark GMD events) that responsible entities will have to assess for potential impacts on the Bulk-Power System").

[29] *Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events*, 156 FERC ¶ 61,215, at P 28 (2016) ("Order No. 830").

[30] *Id.* at P 44. Recently, the Commission issued a Notice of Proposed Rulemaking proposing to approve this modification. *Geomagnetic Disturbance Reliability Standard*, 163 FERC ¶ 61,126, at P 1 (2018)

The Commission took a different approach in developing a Design Basis Threat in its order directing NERC to file a reliability standard for physical security. In that case, because "threats and vulnerabilities may vary from facility to facility," the Commission required the owners and operators of certain critical facilities to evaluate potential threats and vulnerabilities to those specific facilities.[31]

However, in the case of threats to the natural gas delivery system, neither the NERC process for developing the Design Basis Threat, as it did for GMD, nor Bulk Power System owners and operators evaluating the threats to physical security threats are appropriate. While the Design Threat Basis for natural gas facilities that impact the Bulk Power System likely will differ by region, Bulk Power System planners are not in the same position as asset owners in evaluating physical threats to their own facilities.[32] Moreover, information on threats and vulnerabilities will be based on classified national security information and therefore should be compiled in coordination with the Department of Energy and other agencies in the intelligence community.

Conclusion

NERC has identified a common fuel security risk. NERC has done excellent work is identifying this issue, in its event analysis report and multiple assessments. NERC also is working on actions as a result of those assessments.[33] And the Commission is investigating the implication of fuel security to the resiliency of the Bulk Power System. As NERC and the Commission move forward, fuel security must remain a top priority. First and foremost, planners must work to assess their fuel security and resilience situations. Such studies must be rigorous and adequately consider all likely threats, weather and future resource scenarios. Armed with such assessments, regulators can then forge ahead with developing solutions.

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[31] *Reliability Standards for Physical Security Measures*, 146 FERC ¶ 61,166, at P 8 (2014). NERC submitted a standard, CIP-014-1, which also contained for third-party verification and review of the threat assessment. Order No. 802 at P 84.

[32] *See Comments and Responses of PJM Interconnection, L.L.C.*, Docket No. AD18-7-000 at pp. 5, 81 (Mar. 9, 2018).

[33] *See Reliability Assessments, Plan To Address Recommendations from 2017 Reports*, at 2-4 (May 10, 2018) (Board of Trustees Meeting).

Second, a different, more flexible and coordinated paradigm is needed in evaluating fuel security. Given jurisdictional partitioning, increased coordination and collaboration among various agencies and organizations must be pursued. For example, various agencies have national security threat expertise that will be critical in developing a Design Basis Threat. In addition, the fuel security issues encompass not only the authority of NERC to develop standards, but extend to other areas, such as resource adequacy, where NERC can perform assessments but not develop standards. Action there is within the Commission's jurisdiction. Furthermore, regulation of natural gas facilities is not within the jurisdiction of the Commission, but other federal agencies. As interdependencies between critical infrastructure sectors, such as the impact of natural gas facilities on the reliability and resiliency of the Bulk Power System, NERC, the Commission, other federal agencies, owners of Bulk Power System facilities and those entities responsible for planning the Bulk Power System must work together to develop solutions.