UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

GRID RESILIENCE IN REGIONAL TRANSMISSION ORGANIZATIONS AND INDEPENDENT SYSTEM OPERATORS	))))	DOCKET NO. AD18-7-000

COMMENTS OF THE INSTITUTE FOR POLICY INTEGRITY AT NEW YORK UNIVERSITY SCHOOL OF LAW

Pursuant to the Federal Energy Regulation Commission's ("Commission" or "FERC") January 8, 2018 Order Terminating Rulemaking Proceeding, Initiating New Proceeding, and Establishing Additional Procedures ("Resilience Order"),[1] and March 20, 2018 Order Extending Time for Comments,[2] the Institute for Policy Integrity at New York University School of Law ("Policy Integrity") hereby files these comments in the above-captioned proceeding.

Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in fields of administrative law, economics, and public policy.[3] Policy Integrity submitted initial and reply comments urging the Commission to "take final action" under section 403(b) of the Department of Energy Organization Act by rejecting a proposed rule issued by the Department of Energy ("DOE") that would have undermined wholesale electric markets in the name of grid resilience ("DOE

[1] *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, 162 FERC ¶ 61,012 (2018) [hereafter "Resilience Order"].
[2] *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, 162 FERC ¶ 61,256 (2018).
[3] No part of this document purports to present New York University School of Law's views, if any.

NOPR").[4] Policy Integrity presented the Commission with detailed information on the academic foundations of the concept of "resilience" and recommended that the Commission open a new docket to more carefully and fully consider the resilience of the bulk power system in light of a proper understanding of that concept, if it felt that doing so was necessary.[5] Policy Integrity supports the proposed definition of resilience adopted by the Commission in its Resilience Order, which comports with the academic consensus.[6] And Policy Integrity commends the Commission for recognizing that neither the DOE NOPR nor comments supporting the DOE NOPR provided a record sufficient to justify a finding that there is a national resilience emergency rendering current electricity markets unjust and unreasonable, let alone one that required substantial out-of-market compensation.[7]

In response to the Commission's Resilience Order, Regional Transmission Organizations ("RTO") and Independent System Operators ("ISO") submitted information on the state of resilience in wholesale markets, efforts underway to ensure grid resilience, and opportunities for future improvement. These filings, as well as the joint response comments of the California ISO, ISO New England, Midcontinent ISO, New York ISO, and Southwest Power Pool, make clear that while grid resilience is a critical issue worthy of continued attention, there is not currently a record to support mandatory, national or even regional action to address acute resilience concerns.[8] Rather, the Commission should encourage RTOs/ISOs to continue to systematically

[4] Comments of the Institute for Policy Integrity at New York University School of Law, *Department of Energy Proposal for Final Commission Action*, Docket No. RM18-1-000 (filed Oct. 23, 2017) [hereafter "Policy Integrity DOE NOPR Comments"]; Reply Comments of the Institute for Policy Integrity at New York University School of Law, *Department of Energy Proposal for Final Commission Action*, Docket No. RM18-1-000 (filed Nov., 2017).
[5] Policy Integrity DOE NOPR Comments at 7-12.
[6] Resilience Order at P 23.
[7] Resilience Order at P 15.
[8] Comments of California Independent System Operator Corp., ISO New England Inc., Midcontinent Independent System Operator, Inc., New York Independent System Operator, Inc., and Southwest Power Pool, Inc., *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, Docket No. AD18-7-000 (filed May 8, 2018) [hereafter "RTO/ISO Response Comments"].

evaluate the resilience of the bulk power system, should be open to proposals from RTOs/ISOs and the National Electric Reliability Corporation ("NERC") to make specific resilience improvements when justified by substantial evidence, and should continue to be mindful of the implications for grid resilience as it undertakes other actions.

We write to make the following limited additional comments:

- The Commission should not impose a "one-size-fits-all" solution on all RTO/ISOs.
- The Commission should not consider resilience a "catch-all" concept that opens the door to otherwise unsupported or unnecessary actions.
- The Commission should encourage RTOs/ISOs to conduct cost-benefit analyses in order to justify resilience-based policy changes.
- The Commission's existing authorities are sufficient to address threats that are identified.

COMMENTS

1. The Commission Should Not Impose a "One-Size-Fits-All" Solution on All RTO/ISOs

As Policy Integrity explained in our comments on the DOE NOPR, addressing resilience requires a consideration of multiple types of threats such as hurricanes, earthquakes, and cyberattacks. The relative probability and magnitude of damage from these threats vary by region.[9] As a result, the most economically efficient way to address any potential resilience threat also varies by region. Therefore, the Commission should allow each RTO/ISO to evaluate and respond to threats specific to their service territory in their own way, rather than imposing a "one size fits all" solution.

As the filings make clear, RTOs/ISOs are in a good position to evaluate their own resilience needs.[10] In fact, a number of RTOs/ISOs have already instituted processes for evaluation of region-specific resilience gaps. For example, PJM's established a Security and Resilience Advisory Committee to "advance the dialog on resilience and identify priority initiatives for the

[9] Policy Integrity DOE NOPR Comments at 36.
[10] *See* RTO/ISO Response Comments at 5 & n. 10.

PJM stakeholder community."[11] PJM has implemented a number of operational improvements to enhance gas-electric coordination to protect against fuel disruption,[12] and has recently proposed a process for systematically evaluating whether current market rules properly encourage fuel-security investments.[13] ISO-NE has comprehensively studied the risk of fuel disruptions in its Operational Fuel-Security Analysis and has established a stakeholder process aimed at developing proposed solutions to mitigate residual risks not already addressed by existing market constructs and reliability standards.[14]

The Commission should be open to these types of efforts and encourage RTOs/ISOs to more fully study the question of whether gaps exist in existing planning and coordination approaches. The Commission can also provide guidelines to ensure that these analyses are conducted in a methodical manner that make reasonable assumptions, including by providing for processes for stakeholder and public interest engagement.[15]

If, as a result of these studies, an RTO/ISO finds that there are significant threats to bulk power system resilience, the RTO/ISO is free to develop responsive proposals to modify its wholesale markets or operational practices in ways that provide incentives for private

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[11] Comments and Responses of PJM Interconnection, L.L.C., *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, Docket No. AD18-7 at 14-15 (filed March 9, 2018) [hereafter "PJM Resilience Response"].

[12] *Id.* at 15-16.

[13] PJM, Valuing Fuel Security (2018), http://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180430-valuing-fuel-security.ashx. Citation to this proceeding should not be taken as support for the particular process that PJM has proposed. While a systematic evaluation of resilience is a positive step, a number of legitimate concerns have been raised about the particular approach and assumptions that PJM intends to use to develop a methodology for payment of capacity resources with fuel-security attributes. *See* Gavin Bade, *PJM Launches Fuel Security Initiative to Counter Gas Reliance*, UTILITY DIVE (May 1, 2018), https://www.utilitydive.com/news/pjm-launches-fuel-security-initiative-to-counter-gas-reliance/522531/.

[14] Response of ISO New England Inc. Grid Resilience in Regional Transmission Organizations and Independent System Operators, Docket No. AD18-7-000 at 8-12 (filed March 9, 2018) [hereafter "ISO-NE Resilience Response"].

[15] For example, PJM's proposed fuel-security resilience analysis would assume that installed capacity meets PJM's reserve margins despite the fact that capacity is expected to substantially exceed reserve margins in the near-future. PJM, Valuing Fuel Security at 4. This inaccurate assumption could lead to misleading analysis of the fuel-security risks of the current PJM system and could overstate the benefits of capacity market reforms.

investments to improve grid resilience. It may then submit such proposals to the Commission for approval under section 205 or 206 of the Federal Power Act.[16] As explained more fully below, the Commission has the legal tools needed to scrutinize any proposals that arise out of RTO/ISO analyses of grid resilience, and the responsibility to approve only those market changes and investments that are just and reasonable.

2. FERC Should Not Consider Resilience a "Catch-all" Concept that Opens the Door to Otherwise Unsupported or Unnecessary Actions

While RTOs should be encouraged to evaluate resilience gaps and propose changes to address them, the Commission should evaluate such proposals with an appropriate level of rigor. Because a wide variety of improvements could, in theory, protect against some risk or assist in the recovery of some hypothetical event, "resilience" risks becoming a concept that interested parties use to justify otherwise unrelated, unsupported, or unnecessary actions that would be harmful to the functioning of the wholesale markets.

Some RTOs, in fact, have already proposed changes that are not clearly related to resilience improvements or necessary to achieve resilience goals. For example, PJM has attempted to justify a price formation proposal on the grounds that it will improve grid resilience.[17] Providing the proper incentives for the entry, exit, and operation of generating units is, of course, critical to efficient operation of wholesale markets. But while PJM's price formation proposal might improve reliability by affecting the efficiency of wholesale markets, it is not clear if or how it would have an additional, quantifiable effect on grid resilience.

Similarly, PJM's request for authority to suspend market operations and use cost-based

[16] Different RTO/ISO governing agreements provide for different circumstances under which tariff revisions must be made under section 205 and 206. MARK JAMES ET AL., HOW THE RTO STAKEHOLDER PROCESS AFFECTS MARKET EFFICIENCY 3-4 (2017), https://www.rstreet.org/2017/10/05/how-the-rto-stakeholder-process-affects-market-efficiency/.

[17] PJM Resilience Response at 78-80.

compensation in extreme situations is, at best, unnecessary.[18] More appropriate federal authorities already exist to address the concerns PJM has raised. While, PJM is correct that emergency authorities are critical to facilitating recovery in the event that a high-impact, low-probability event causes significant outages and damage, Congress has already delegated to DOE and the Commission all authorities necessary to ensure that electric entities can manage and respond to disruptive events:

- Section 202(c) of the Federal Power Act grants DOE the authority to issue emergency orders requiring the interconnection of electric facilities and the generation, transmission, and delivery of electricity.[19] DOE can use its authority under section 202(c) to enable RTOs/ISOs to take specified actions that are otherwise inconsistent with existing tariffs in order facilitate recovery and restoration in the event of an emergency. No additional, independent RTO/ISO authority is needed.
- Section 215A of the Federal Power Act grants DOE the authority to impose mandatory security measures in order to restore critical infrastructure in the case of grid security emergencies.[20]

These authorities provide all of the flexibility needed for relevant generators, utilities, grid operators, and regulators to be able to respond given the particular circumstances caused by a disruptive event. Further, these authorities delegate to FERC, not to RTOs, the responsibility of determining appropriate compensation for any investments made to comply with emergency orders.[21] FERC determination of the just and reasonable compensation for actions taken in response to DOE emergency orders allows the Commission to take into account the particular facts and circumstances of a specific situation and so is a more appropriate mechanism than the blanket cost-of-service approach PJM has proposed. In fact, in terminating the DOE NOPR proceeding, the Commission has clearly explained why cost-based compensation is an

[18] *Id.* at 39-40.
[19] 16 U.S.C. § 824a(c).
[20] *See* 16 U.S.C. § 824o-1.
[21] 10 CFR § 205.376; 16 U.S.C. § 824o-1(a)(6).

inappropriate default option.[22] And unlike the emergency authority proposed by PJM, under existing authorities, DOE and Commission actions are subject to judicial review, which can provide a needed check against decisions that are not supported by a sufficient record or are otherwise arbitrary.[23]

3. FERC Should Encourage RTOs/ISOs to Use Cost-Benefit Analysis to Justify Resilience-based Policy Changes

Even where RTOs identify a particular aspect of resilience that is currently unaddressed and propose policy that may be beneficial for improving grid resilience, the Commission should not approve proposals without a cost-benefit analysis to fully evaluate whether the improved resilience benefits justify the additional costs. Because resilience could almost always be improved by additional investments and ratepayer expenditure, the mere fact that an improvement is possible should not be a sufficient criterion for Commission acceptance of RTO proposals aimed at enhancing resilience.

The Commission and RTOs need a decision framework to decide which investments or policy changes intended to improve resilience are worthwhile and which are not. In the second installment of its Quadrennial Energy Review, DOE suggests that cost-benefit analysis should be used to evaluate resilience investments.[24] In its response to the Resilience Order, the California ISO also advocated using cost-benefit analysis to assess potential resilience interventions.[25] The Commission should adopt cost-benefit analysis as the appropriate decision framework for its evaluation of RTO filings that would enhance grid resilience. In practice, FERC should require

[22] Resilience Order at P 16 & nn. 14, 26.
[23] 16 U.S.C. § 825l(b).
[24] DEP'T OF ENERGY, TRANSFORMING THE NATION'S ELECTRICITY SYSTEM: THE SECOND INSTALLMENT OF THE QUADRENNIAL ENERGY REVIEW at 7-22 (2017), https://energy.gov/sites/prod/files/2017/02/f34/Quadrennial%20Energy%20Review--Second%20Installment%20%28Full%20Report%29.pdf.
[25] Comments of the California Independent System Operator Corporations, Grid Resilience in Regional Transmission Organizations and Independent System Operators, Docket No. AD18-7-000, at 8 (March 9 2018).

RTOs to conduct and present to the Commission such analyses to justify proposed Tariff changes as just and reasonable.[26] Existing tools are available to allow RTOs to conduct such analyses.[27]

Some have raised concerns that high-impact, low-probability events are not amenable to quantitative, probability-based analysis.[28] But experience has shown that this is not a valid concern, at least for naturally-occurring events. For example, in the wake of a number of significant hurricanes, the Public Utility Commission of Texas commissioned a cost-benefit analysis of vegetation management programs, ground-based patrols, infrastructure hardening, and deployment of new technologies.[29] This analysis used a probabilistic hurricane model.

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[26] Commission approval of RTO/ISO tariff submissions should be supported by consideration of costs and benefits. The Commission is required to do so in a general manner. *See* Advanced Energy Management Alliance et al. v. FERC, 860 F.3d 656, 662 (D.C. Cir. 2017) (upholding a Commission approval of PJM tariff revisions when it found that "on balance, increased system reliability justified even a net increase in costs"). And it has rejected RTO/ISO submissions that are insufficiently supported by analysis. *Southwest Power Pool*, 161 FERC ¶ 61,039 at PP 25-26 (2017) (rejecting SPP's proposal because it failed to offer more than "anecdotal evidence" in support of its proposal). However, given the fact that citation to "resilience" could justify any expenditures or tariff changes without a more robust framework, the Commission should hold RTOs/ISOs to a higher analytical standard.

[27] The net benefits of an RTO proposal would then be calculated by subtracted the expected costs of the intervention from the expected resilience benefits.

As part of the Department of Energy's Metrics Analysis for Grid Modernization Project, Sandia National Laboratory has developed a framework for measuring the benefits of resilience intervention using performance-based resilience metrics. ERIC VUGRIN, ANYA CASTILLO & CESAR SILVA-MONROY, RESILIENCE METRICS FOR THE ELECTRIC POWER SYSTEM : A PERFORMANCE-BASED APPROACH (2017), http://prod.sandia.gov/techlib/access-control.cgi/2017/171493.pdf; JEAN-PAUL WATSON ET AL., CONCEPTUAL FRAMEWORK FOR DEVELOPING RESILIENCE METRICS FOR THE ELECTRICITY, OIL, AND GAS SECTORS IN THE UNITED STATES (2015), https://energy.gov/sites/prod/files/2015/09/f26/EnergyResilienceReport_%28Final%29_SAND2015-18019.pdf. Under this framework, RTOs would first calculate the probability-weighted consequences of the current electric system to specified threats (such as a hurricane over a specified magnitude). This would require the use of models, including models that RTOs already use such as power system models, to determine the expected impacts of specified high impact- low-probability events. VUGRIN, CASTILLO, AND SILVA-MONROY at 16-17. RTOs would then simulate expected investments or improvements that would be driven by their proposed Tariff changes or interventions and evaluate the probability-weighted consequences of this hypothetical electric grid. The benefits of the resilience intervention would be the difference in monetized value of the expected consequences in the baseline scenario and the intervention scenario.

RTOs should also calculate the expected costs of a resilience intervention. Primarily, these costs will come in the form of increased utility and generator investments and will be reflected in increased wholesale electricity prices. For RTO proposals that change market rules, calculation of these costs may require use of power sector and electric market modeling to reflect complex relationship between firm and consumer behavior implicated by market rule changes.

[28] PJM Resilience Response at 4.

[29] Quanta Technology, Cost-Benefit Analysis of the Deployment of Utility Infrastructure Upgrades and Storm Hardening Programs 45-66 (2009), http://www.puc.texas.gov/industry/electric/reports/infra/utlity_infrastructure_upgrades_rpt.pdf.

4. The Commission's Existing Authorities are Sufficient to Address Identified Threats

While no part of the Federal Power Act specifically directs the Commission to improve electric system resilience, FERC's current authority is sufficient to address any threats to the Bulk Power System identified by RTOs. This includes the ability to:

- evaluate and, if justified, approve RTO/ISO wholesale electricity market changes to enhance generation system resilience by compensating for well-defined resilience attributes;
- establish transmission rates that encourage cost-beneficial investments in the transmission system;
- establish reliability standards that have resilience co-benefits; and,
- encourage or require better resilience-related coordination and planning by RTOs/ISOs.

a. The Commission can approve market rules that create incentives for generation system resilience

We strongly agree with PJM's statement that "assuming that resilience requirements can be clearly articulated, meeting them through market-based solutions that allow resources to compete to meet those requirements is the preferred way to ensure that these objectives are met at the lowest cost to consumers."[30] When resilience-enhancing attributes can be identified, market-based solutions can and should be designed so that the price signals they provide reflect the true value of the resilience benefit they create. As part of its jurisdiction over RTO/ISO-operated wholesale electricity markets, the Commission has authority to approve such proposed changes.

The Commission has jurisdiction over rules and practices affecting wholesale electricity rates,[31] and is responsible for ensuring that those rates are "just and reasonable."[32] Courts have expansively interpreted the Commission's authority over rates and practices affecting rates to include the authority to approve and police a wide variety of RTO/ISO market rules intended to create incentives for market participants to invest in and provide efficient levels of desired

[30] PJM Resilience Response at 68.
[31] 16 U.S.C. § 824d(a).
[32] *Id.*

generator attributes that FERC finds are necessary to ensure just and reasonable wholesale rates.[33]

A number of market-based constructs already exist for procurement of generator or electric system attributes connected to reliability. Many of these attributes also enhance the resilience of the generation system.

- **Ancillary Services Markets.** In some RTOs/ISOs, existing market rules provide for compensation of ancillary services that affect reliability and resilience, such as contingency reserves[34] and black-start.[35]
- **Capacity Markets.** A number of RTOs/ISOs manage capacity markets, market-based constructs intended to meet "resource adequacy"—that is, sufficient generation available to meet anticipated peak demand, plus a reserve margin. While resource adequacy is primarily a reliability attribute, reserve margins can lessen the risk that disruption of certain generation assets by high-impact, low-probability events will result in long lasting widespread outages.
- **Generator Performance.** Partially in response to Commission action taken in the aftermath of the Polar Vortex,[36] PJM and ISO New England have implemented market reforms to charge generators that are unable to meet their capacity obligations a penalty and make additional payments to those that can.[37] These initiatives can provide efficient

[33] *Advanced Energy Management Alliance v. FERC*, 860 F. 3d 656 (D.C. Cir. 2017); *Connecticut Dept. of Public Utility v. FERC*, 569 F.3d 477 (D.C. Cir. 2009); *FERC v. Elec. Power Supply Assoc'n*, 136 S. Ct. 760 (2016).
[34] EPRI, Wholesale Electricity Market Design Initiatives in the United States: Survey and Research Needs at 3-46 to 3-49 (2016), https://www.epri.com/#/pages/product/000000003002009273/ [hereafter "EPRI"]. Contingency reserves are reserves that may be needed in the case of unplanned outages of significant generation or transmission facilities.
[35] *See* Nitish Saraf et al., The Annual Black Start Service Selection Analysis of ERCOT Grid, 24 IEEE Transactions on Power Systems 1867 (2009). Black-start is the ability to supply initial power to generators so that they can be brought back online and is an important resilience attribute that is critical for system restoration. EPRI at 30. Note, however, that not all ISOs/RTOs procure black-start service through a competitive mechanism. For example, CAISO compensates black-start resources on a cost-of-service basis. California Independent System Operator, 161 FERC ¶ 61,116 (2017). Cost-based provision of resilience attributes may be appropriate when market-based solutions are not feasible; however, consistent with FERC's approach to reliability, the use of such mechanisms should be limited and, when possible, time-limited. *PJM Interconnection, LLC*, 110 FERC ¶ 61,053 at P 114 (2005) ("a transparent market process is preferable to cost-of-service rates that can cause high uplift payments . . . . [O]ur policy on reliability compensation will be to rely on markets and proper market design, and to use non-market solutions only as a last resort"); *New York Indep. Sys. Operator, Inc.*, 150 FERC ¶ 61116 at P 16(2015) ("RMR filings should be made only to *temporarily* address the need to retain certain generation *until more permanent solutions are in place*") (emphasis added).
[36] *Order on Technical Conferences*, 149 FERC ¶ 61,145 (Nov. 20, 2014).
[37] DEP'T OF ENERGY, STAFF REPORT ON ELECTRICITY MARKETS AND RELIABILITY STAFF REPORT TO THE SECRETARY ON ELECTRICITY MARKETS AND RELIABILITY 91-92 (2017), https://energy.gov/sites/prod/files/2017/08/f36/Staff Report on Electricity Markets and Reliability_0.pdf. PJM instituted its Capacity Performance Proposal, which was approved by the Commission. *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 ("Capacity Performance Order"), *order on reh'g and compliance*, 155 FERC ¶ 61,157 (2015). The New York ISO identified, adopted, and implemented its Comprehensive Shortage Pricing

> incentives for generators to change their behavior in ways that reduce expected outages caused by high-impact, low-probability events. For example, generators would be incentivized to invest in weatherization to protect against extreme weather events or to sign firm fuel contracts to protect against natural gas supply disruptions.

To the extent that there are additional measurable services that wholesale generators with particular attributes can provide that can be shown to increase resilience, changes to RTO/ISO market rules may be appropriate.

But due to the Commission's jurisdictional boundaries, there is only so much that can be achieved through market-based solutions at the wholesale level. Because electricity markets primarily affect the entry, exit, and operation incentives for generation resources, market rules are best suited for facilitating the efficient procurement of specific generation resource attributes. As such, they are most appropriate where attributes have been shown to have a direct connection to resilience improvements, and those attributes have been defined with sufficient specificity to allow price formation. At the same time, generation system resilience is not generally considered to be the part of the electric system most in need of resilience improvements as compared to the transmission and distribution system.[38] Therefore, the Commission should approve a market-based solutions only if it can define and quantify generator attributes that actually improve system-wide resilience, and, if those solutions improve resilience enough to justify the costs imposed by the market rule changes.

The Commission should also recognize that market rules designed to compensate for

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enhancements. *New York Independent System Operator Inc.*, 154 FERC ¶ 61,152 (March 1, 2016). ISO New England identified its Pay For Performance capacity market design, to be implemented in 2018. Fuel Assurance Status Report of ISO New England Inc. at 5-9, Docket No. AD14-8-000 (Feb. 18, 2015).

[38] *See* Trevor Houser, John Larsen & Peter Marsters, *The Real Electricity Reliability Crisis* (Oct. 3, 2017), https://rhg.com/research/the-real-electricity-reliability-crisis-doe-nopr/ (showing that only 0.00858% and 0.000007% of major electricity disturbances were caused by generation inadequacy during 2012-2016); ALISON SILVERSTEIN, ROB GRAMLICH & MICHAEL GOGGIN, A CUSTOMER-FOCUSED FRAMEWORK FOR ELECTRIC SYSTEM RESILIENCE 18-20 (2018), https://gridprogress.files.wordpress.com/2018/05/customer-focused-resilience-final-050118.pdf.

individual attributes may improve resilience against certain threats but exacerbate resilience against other threats. For example, a resilience proposal aimed at compensating "fuel security" might, in practice, reward large central-station powerplants that have on-site access to fuel. Yet such resources often pose countervailing resilience concerns because unexpected outages of these resources place more strain on the electric system and they are often less resistant to extreme weather conditions. To the extent additional fuel-security payments increase reliance on such generators or slow the replacement of these resources with newer technologies, such payments may ultimately harm resilience on-net. Use of narrow definitions of resilience attributes such as "fuel security" also risks under-compensating and, therefore, under-providing, the resilience improvements of generation resources *without* fuel requirements. Therefore, RTO/ISO identification of individual attributes that are nominally related to resilience should not be sufficient to justify market changes. The Commission should require RTOs/ISOs to conduct holistic analyses that evaluate how market changes are likely to affect resilience against multiple threats. And the Commission should encourage RTOs/ISOs to develop, when possible, an integrated approach for pricing multiple resilience-enhancing attributes.

b. The Commission can establish transmission compensation rules that enhance resilience

The Commission's jurisdiction over interstate transmission gives it a role to play in insuring the resilience of the transmission system. Because most outages associated with high-impact, low-probability events occur due to disruptions of the distribution and transmission systems, hardening key weak points on the transmission system can enhance system resilience.

The Commission has authority over the rates and tariffs of transmission providers. FERC can use this authority to ensure that transmission developers will be compensated for the provision of services that enhance the resilience of the transmission system. For example, the Commission

has already issued an order that requires utilities to have spare transformers, which provide significant system restoration benefits while reducing the cost needed for all utilities to maintain spare transformers.[39]

In addition, the Commission can use its transmission ratemaking authority to encourage, either directly or through RTOs/ISOs, cost-beneficial investments that will enhance transmission system resilience, including hardening of vulnerable assets against extreme weather such as flooding or earthquakes; burying of key transmission lines; shielding of critical transmission equipment against electromagnetic attack; and more regular and innovative vegetation management.[40] The National Academy of Sciences has recommended a number of interventions that the Commission can utilize with its transmission ratemaking authority.[41]

c. The Commission can approve reliability standards that have resilience co-benefits

Under Section 215 of the Federal Power Act, FERC and NERC are responsible for issuing reliability standards—enforceable requirements intended to ensure the operational reliability of the bulk power system. While reliability and resilience are different concepts,[42] protecting against reliability risks can often have significant resilience co-benefits.

Many of the reliability standards that have been proposed by NERC and approved by FERC establish requirements that also improve the resilience of the bulk power system by preventing damage to the electric grid during a high-impact, low-probability event, or by speeding up the recovery of the system after such an event. For example, the following reliability standards have significant resilience co-benefits:

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[39] *Order on Application for Blanket Authorization for Transfers of Jurisdictional Facilities and Petition for Declaratory Order*, 116 FERC ¶ 61,280 (2006).
[40] EPRI at 25-34.
[41] NAT'L ACAD. OF SCI., ENG'G & MED., ENHANCING THE RESILIENCE OF THE NATION'S ELECTRICITY SYSTEM 117-19 (2017), https://www.nap.edu/catalog/24836 [hereafter "NAS"].
[42] Policy Integrity Comments on DOE NOPR at 11-12.

- CIP-014-2 (Physical Security), requiring identification of critical transmission substations and performance of physical security risk assessments;
- CIP-009-6 (Cyber Security – Recovery Plans for BES Cyber Systems), requiring development and implementation of recovery plans in the event of cybersecurity threats;
- TPL-001-4 (Transmission System Planning Performance Requirements), requiring assessment of the impacts of "extreme events" on the bulk power system and planning for "N-2" extreme events;
- FAC-008-3 (Facility Ratings), requiring ratings for how well facilities operate in emergency situations;
- EOP-010-1 (Geomagnetic Disturbance Operations) and TPL-007-1 (Transmission System Planned Performance for Geomagnetic Disturbance Events), requiring planning and emergency operation procedures in the event of a geomagnetic disturbance.

To the extent that analyses from the Commission, RTOs/ISOs or NERC identify gaps that are not appropriately filled by mandatory standards, improvements to existing reliability standards or promulgation of new standards may enhance both reliability and resilience. For example, in 2016 and 2017, FERC and NERC conducted an extensive study of transmission operator and reliability coordinator system restoration plans and issued two reports outlining a host of improvements that could be made that would further enhance bulk power system recovery from sustained widespread outages.[43] In such cases, the Commission can direct NERC to evaluate opportunities to expand existing reliability standards or propose new standards that improve operational reliability, with the co-benefit of improved system resilience. On the other hand, investigation may show that existing practices and standards are meeting resilience needs.[44]

d. The Commission can encourage RTOs to incorporate resilience into their planning and coordination activities

Given the fractured nature of regulatory and planning responsibilities across the federal system, a key opportunity for improving system resilience is increased RTO/ISO planning and

[43] Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans 1 (2016); Further Joint Study Report: Planning Restoration Absent SCADA or MS (PRASE) (2017), https://www.ferc.gov/legal/staff-reports/2017/06-09-17-FERC-NERC-Report.pdf.

[44] Staffs of FERC and NERC and its Regional Entities, Recommended Study: Blackstart Resources Availability (2018), https://www.ferc.gov/legal/staff-reports/2018/bsr-report.pdf.

coordination with market participants, the Commission, state regulators, and each other. In their filings with the Commission, a number of RTOs/ISOs rightly identified RTO/ISO planning and coordination as providing important resilience benefits and identified potential improvements.[45]

Transmission Planning. RTOs/ISOs have responsibility for transmission planning and must coordinate this planning with "appropriate state authorities."[46] RTOs/ISOs are also required to work with member transmission and generation owners to complete an Annual Transmission Planning Assessment. Regional transmission planers, including RTOs/ISOs, can use these authorities to identify and coordinate cost-beneficial resilience improvements on a system-wide basis.

Reliability Planning. As reliability coordinators, RTOs/ISOs already perform important planning and coordination functions that can be leveraged to analyze and recommend resilience improvements.[47] For example, as outlined above, transmission operators are required to have reliability coordinator-approved plans for system restoration following a widespread outage or blackout.[48] Similarly, reliability coordinators are required to have reliability coordinator area restoration plans.[49] Where improvements to other resilience phases (limiting initial damage, continued operation during an event) can be justified as improving reliability, FERC and NERC

[45] Comments of Southwest Power Pool, Inc. on Grid Resilience Issues, *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, Docket No. AD18-7-000 at 8-9 (filed March 9, 2018) [hereafter "SPP Resilience Response"] (discussing SPP's role in general system and contingency planning, including scenario planning that covers high impact low probability risks); PJM Resilience Response at 49-50 (identifying a number of ways to think about resilience in the transmission planning process); *id.* at 63-64 (operations plans including load shedding plans help ensure that outages are minimized when they do occur before recovery can begin); Responses of the Midcontinent Independent System Operator, Inc., *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, Docket No. AD18-7-000 at 3-4 (filed March 9, 2018) at 3-4 (discussing importance of transmission planning to identify needed expansions in light of grid resilience).
[46] 18 CFR § 35.34(k)(7).
[47] *See Reliability Coordinators*, NERC, http://www.nerc.com/pa/rrm/TLR/Pages/Reliability-Coordinators.aspx (last accessed May 9, 2018). Note that CAISO does not currently act as its own reliability coordinator.
[48] NERC Reliability Standard EOP-005-2 - System Restoration from Blackstart Resources, Eff. May 23, 2011, http://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-005-2.pdf.
[49] NERC Reliability Standard EOP-006-2 - System Restoration Coordination, Eff. May 23, 2011, http://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-006-2.pdf.

can use their reliability authority to require similar coordination and planning applicable to those phases. FERC and NERC can then conduct a comprehensive assessment of relevant plans, in order to identify weaknesses and make cost-beneficial recommendations for improvement. For example, FERC, NERC and regional reliability entities have already conducted a series of analyses assessing existing restoration and recovery plans.[50]

Other Planning and Coordination. FERC, NERC and RTOs/ISOs can also use their unique national and regional positions to play a less formal information gathering and coordinating function. The National Academy of Sciences has outlined a number of recommendations for these entities, including expanding emergency preparedness exercises,[51] information sharing to disseminate resilience best practices,[52] and coordinating natural gas and electric sectors to reduce fuel disruption risks.[53]

CONCLUSION

Resilience of the electric system to high-impact, low probability events is an important issue worthy of the Commission's attention. However, the Commission should recognize that its existing efforts, in partnership with NERC and RTOs/ISOs, have led to the development of an electric system that is resilient to a variety of external shocks. Thus, there is no need for mandatory, national, or even regional action to address acute resilience concerns. Rather, the Commission should encourage RTOs/ISOs to continue to evaluate electric system resilience and

[50] Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans (2016), https://www.ferc.gov/legal/staff-reports/2016/01-29-16-FERC-NERC-Report.pdf; Staffs of FERC and NERC and its Regional Entities, Further Joint Study Report: Planning Restoration Absent SCADA or EMS (PRASE) (2017), https://www.ferc.gov/legal/staff-reports/2017/06-09-17-FERC-NERC-Report.pdf; Staffs of FERC and NERC and its Regional Entities, Recommended Study: Blackstart Resources Availability (2018), https://www.ferc.gov/legal/staff-reports/2018/bsr-report.pdf.
[51] NAS at 134.
[52] *Id.* at 135..
[53] *Id.*

propose solutions when areas of improvement have been identified. The Federal Power Act provides the Commission and RTOs/ISOs all of the tools needed to implement those improvements. But the Commission should also exercise its authority to approve market changes, investments, and reliability standards only when RTOs/ISOs can show that they are necessary, well-designed, and when the resilience benefits justify the costs.

Respectfully submitted,

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