UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Grid Reliability and Resiliency Pricing	)	**Docket No. RM-18-1-000**

REPLY COMMENTS OF ADVANCED ENERGY ECONOMY

November 7, 2017

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I. Introduction and Executive Summary

Pursuant to the Federal Energy Regulatory Commission's ("FERC" or the "Commission) October 2, 2017 Notice Inviting Comments[1], Advanced Energy Economy ("AEE") submits these comments on behalf of itself and its members in response to the Secretary of Energy's September 28, 2017 proposed rule for final action by the Commission ("DOE NOPR")[2] under section 403 of the Department of Energy Organization Act.[3]

AEE is submitting these reply comments as a supplement to the Joint Industry Reply Comments of a coalition of industry associations and individual companies,[4] in which AEE has joined. AEE also supports the reply comments submitted by the American Wind Energy Association.[5] In the following comments, AEE underscores the lack of a sufficient record basis for the Commission to take further action in this docket, and most importantly, highlights the central role of advanced energy technologies in any future examination of the resilience of the electricity system. As discussed below, the Commission must ensure that any future investigation it conducts into resilience is fuel and technology neutral and includes an examination into the role of all technologies in ensuring reliability and resilience as market forces drive changes in the nation's resource mix. Moreover, AEE urges the Commission to continue to build on its success in fostering competitive wholesale markets by considering how market mechanisms can be utilized to spur cost-effective and innovative investments that enhance reliability and resilience.

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[1] *Grid Reliability and Resilience Pricing*, Notice Inviting Comments, Docket No. RM18-1-000 (issued Oct. 2, 2017) ("October 2 Notice").
[2] Grid Resiliency Pricing Rule, 82 Fed. Reg. 46,940 (Oct. 10, 2017) ("DOE NOPR").
[3] 42 U.S.C. § 7173 (2012).
[4] *Joint Reply Comments*, Docket No. RM18-1-000 (November 7, 2017) ("Joint Industry Reply Comments").
[5] *Comments of the American Wind Energy Association*, Docket No. RM18-1-000 (November 7, 2017) ("AWEA Comments").

AEE is a national organization of businesses making the energy we use secure, clean, and, affordable. AEE and its state and regional partner organizations, which are active in 26 states across the country, represent more than 1,000 companies and organizations that span the advanced energy industry and its value chains. Technologies represented include energy efficiency, demand response, natural gas, solar photovoltaics, solar thermal electric, ground-source heat pumps, wind, storage, biofuels, electric vehicles, advanced metering infrastructure, transmission and distribution efficiency, fuel cells, nuclear power, combined heat and power, and enabling software. Used together, these technologies and services will create and maintain a higher-performing energy system—one that is reliable and resilient, diverse, cost-effective, and clean—while also improving the availability and quality of customer-facing services. AEE promotes the interests of its members by engaging in policy advocacy at the federal, state, and regulatory levels, by convening groups of CEOs to identify and address cross-industry issues, and by conducting targeted outreach to key stakeholder groups and policymakers.

The record developed in this proceeding provides no basis for the Commission to move forward in this docket to finalize the discriminatory out-of-market payments to coal and conventional nuclear resources proposed by DOE in the NOPR, or to take any other action to provide preferential treatment to these resources. As explained in detail in the initial and reply comments joined by AEE (and supplemented briefly here),[6] and in the vast majority of initial comments filed with the Commission, the record fails to demonstrate that there is a reliability or resilience emergency that has caused the existing Regional Transmission Organization and Independent System Operator ("RTO/ISO") markets to become unjust and unreasonable. As a

[6] *Joint Industry Comments Opposing the DOE Proposal*, Docket No. RM18-1-000 (October 23, 2017) ("Joint Industry Comments") at 5.

result, under Section 206 of the Federal Power Act ("FPA"), the Commission's inquiry in this docket must come to an end.[7]

Even if the Commission were able to proceed to consider a final action in this docket – which it cannot and should not – the record is completely devoid of substantial evidence that would support adopting the unduly discriminatory and preferential payment scheme proposed by DOE, even temporarily. As a threshold matter, as demonstrated in the initial Joint Industry Comments and the initial Comments of the Advanced, Renewable, and Storage Energy Industry Associations,[8] the NOPR lacked key details regarding its proposed scope and implementation that denied the public of adequate notice and a reasonable opportunity to comment. The few commenters supporting further action in this docket recognize this fact, and seek to fill in the critical implementation details that were left out of DOE's NOPR or provide alternative pathways for the Commission to act under FPA section 206. However, as explained in the Joint Industry Reply Comments, the Commission may not "bootstrap notice from a comment."[9] Even if it were to attempt to do so, these commenters have failed to demonstrate that any of their proposed alternatives for implementing DOE's proposed pricing scheme or taking other action under FPA section 206 are just and reasonable. For all of these reasons, the Commission has no record basis on which to act here.

AEE recognizes that the Commission may wish to further consider the issue of resilience of the wholesale electricity grid in separate proceedings. To the extent that it does so, we emphasize that any undertaking to examine resilience and how resource attributes that contribute

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[7] *See, e.g., Emera Maine v. FERC*, 854 F.3d 9, 24 (2017) (reaffirming that the Commission must find an existing rate is unjust and unreasonable *before* proceeding to set a new rate that is just and reasonable).

[8] Joint Industry Comments; *Comments of the Advanced, Renewable and Storage Energy Industry Associations,* Docket No. RM18-1-000, (October 23, 2017) ("Energy Associations Comments").

[9] Joint Industry Reply Comments at 16, referencing *Fertilizer Inst. v. EPA*, 935 F.2d 1303, 1312 (D.C. Cir. 1991).

to resilience are accounted for in FERC-jurisdictional markets and rates must include an analysis of the reliability and resilience benefits that advanced energy technologies – both behind-the-meter and in front of the meter – can provide. Such technologies – including wind energy, solar energy, battery storage, and demand response – have already been shown to provide significant benefits during resilience events like those cited in the NOPR and in comments supporting it. In fact, a key deficiency of the NOPR is that it relies on events like the Polar Vortex to purportedly demonstrate that the grid is at risk from a potential lack of generators with on-site fuel supplies and that special out-of-market payments to those resources are necessary, while failing to acknowledge the key role that advanced energy technologies like wind and demand response played in ensuring reliability throughout that event. This fact demonstrates that adopting a solution like that proposed in the NOPR would not only be unjust and unreasonable, but also unduly discriminatory and preferential.[10]

To avoid the potential for such unjust, unreasonable, and unduly discriminatory outcomes, the Commission should ensure that any future proceedings to address resilience do so in a way that is fuel and technology neutral. As the record in this proceeding shows, there is no universally-accepted definition of "resilience." Accordingly, any Commission proceeding to assess resilience must begin with a broad assessment of all aspects of the concept of resilience, including how all aspects of the grid (from generation to transmission to distribution) contribute to maintaining resilience. On-site fuel supply is not the sole measure of reliability or resilience; to the contrary, resilience involves all aspects of the electric grid, especially the transmission and distribution system.

[10] Energy Associations Comments at 29.

Furthermore, the Commission should focus on defining the attributes that are needed for resilience (such as responding quickly to grid disturbances or reducing reliance on the transmission and distribution system), rather than focusing on specific technologies. Doing so will ensure that the ability of all technologies to contribute to resilience – including advanced energy technologies – are accounted for. AEE emphasizes that this approach is especially important as advanced energy technologies that can provide key resilience attributes continue to proliferate on the grid. Ensuring that their ability to provide those attributes is recognized will avoid creating barriers to their ability to provide services in the market, and the market inefficiencies that result.

Finally, AEE urges the Commission to focus on fuel and technology neutral market-based approaches to procuring needed resilience attributes. As explained in more detail below, this could include reconsidering how the suite of ancillary services necessary for reliability and resilience are priced and procured, and whether all needed grid services are separately defined and monetized. Focusing on market-based approaches ensures that consumers will continue to receive the cost and innovation benefits that have resulted from the Commission's long-standing reliance on market forces to ensure just and reasonable rates and guard against undue discrimination and preference.

II. The Record Does Not Demonstrate That a Reliability or Resilience Emergency Exists That Renders the Current Markets Unjust and Unreasonable.

AEE agrees with the Joint Industry Reply Comments, which demonstrate that the record developed in response to the NOPR does not establish that a reliability or resilience emergency exists that requires Commission action under FPA section 206.

AEE emphasizes that in the hundreds of comments submitted, very few commenters substantially support the idea that a reliability or resilience emergency exists in the wholesale

markets. FirstEnergy, Murray Energy, PSEG, and other commenters who support the NOPR[11] (who are some of the few companies who stand to benefit from it) rely primarily on the 2014 Polar Vortex to support their assertion that a 90-day on-site fuel supply is central to "resilience". However, as explained in the initial Joint Industry Comments,[12] a Rhodium Group analysis found that fuel supply emergencies caused only 0.00007% of customers-hours lost to outage between 2012-2016, a period that encompasses the Polar Vortex event. Commenters fail to address the primary cause of outages noted in the Rhodium Group analysis and other reports – failures in the transmission and distribution system. Moreover, PJM Interconnection ("PJM"), the RTO with operational responsibility for the geographic area hit by the Polar Vortex, notes that it served customers reliably throughout the event and that markets have been effectively utilized to stimulate market participants to make investments that will help to mitigate future similar events.[13] As AEE and others have explained throughout this proceeding, advanced energy technologies, especially wind energy and demand response (the largest advanced technologies deployed in PJM at the time), provided continuous reliability throughout the Polar Vortex.[14] This demonstrated fact is neither noted in the DOE NOPR nor in the comments supporting the NOPR.

Furthermore, it is not clear that a 90-day fuel supply would add significant resilience during events such as the Polar Vortex. For its part, the Foundation of Resilient Societies ("The

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[11] Comments of FirstEnergy Service Company *et al*. in Support of the Grid Reliability and Resilience Pricing Notice of Proposed Rulemaking, Docket No. RM18-1-000 (Oct. 23, 2017) ("FirstEnergy Comments"); Comments of Murray Energy Corporation, Docket No. RM18-1-000 (Oct. 23, 2017) ("Murray Energy Comments"); and Comments of Peabody Energy Corporation, Docket No. RM18-1-000 (Oct. 23, 2017) ("Peabody Energy Comments").

[12] Joint Industry Comments at 3.

[13] *Initial Comments of PJM Interconnection, L.L.C. on the United State Department of Energy Proposed Rule*, Docket No. RM18-1-000 (October 23, 2017) ("PJM Comments") at 25, 26.

[14] The Brattle Group, *Evaluation of the DOE's Proposed "Grid Resiliency Pricing Rule,"* (October 2017) ("Brattle Report") at 13. PJM Comments at 12.

Foundation") points to the North American Electric Reliability Corporation's ("NERC's") 2017 "State of Reliability" report finding that "lack of fuel" was in the top five causes of forced generator outages in 2014 and 2015.[15] What the Foundation fails to note, however, is that the other top recurring causes of forced generator outages between 2012-2015 all apply to steam generation units (i.e., coal steam) that have on-site stores of fuel.[16] (It also bears noting that NERC concluded in its comments here that the North American bulk power system is "reliable and resilient."[17]) Moreover, as detailed in the Joint Industry Comments and PJM's comments, coal piles and conveyor belts froze during the 2014 Polar Vortex, resulting in outages at coal-fired plants.[18] In fact, as PJM notes, the largest source of outages during the Polar Vortex came from coal steam plants.[19]

Critically, while the original DOE NOPR seeks Commission action due to a proclaimed emergency in the RTO/ISO regions, the RTOs/ISOs themselves, who have front-line responsibility for ensuring reliability and resilience, do not conclude that there is a reliability or resilience emergency that requires immediate Commission action to provide out-of-market support to a category of specific types of generators. PJM specifically states that the "DOE NOPR Incorrectly Identifies a Perceived Problem….and then proposed a radical solution,"[20] while the Midcontinent Independent System Operator, Inc ("MISO") states that "[t]he Proposal

[15] *Motion to Intervene and Comments of the Foundation for Resilient Societies*, Docket No. RM18-1-000 (October 23, 2017) ("Foundation Comments") at 13.
[16] North American Electric Reliability Corporation (NERC), *2016 State of the Markets Report* (April 2017) at 120.
[17] *Comments of the North American Electric Reliability Corporation in Response to Notice of Proposed Rulemaking,* Docket No. RM18-1-000 (October 23, 2017) ("NERC Comments") at 5.
[18] Joint Industry Comments at 11. PJM Comments at 11.
[19] PJM Comments at 12.
[20] *Id.*at 5.

identifies no imminent reliability or resilience issues, and no near-term reliability or resilience issues exist in MISO that require immediate action."[21]

Comments supporting the DOE NOPR, including the Foundation,[22] FirstEnergy,[23] and PSEG,[24] claim that the loss of resource diversity and increased reliance on natural gas-fired generation is resulting in the risk of catastrophic outages. These generic claims rely heavily on the fact that recent generator retirements have largely consisted of coal-fired power plants. The facts, however, demonstrate that the electric grid is becoming more diverse, with retiring plants being replaced with a combination of natural gas, renewables, and advanced energy technologies (including distributed energy resources). In addition, energy efficiency improvements and demand response technology have stemmed load growth, flattened load profiles, and reduced costs to consumer while improving reliability and resilience. PJM, the RTO region most impacted by the NOPR proposal, stated in its comments that the PJM generation mix is more diverse and less reliant on natural gas than nearly any other region of the country, including territories falling outside of the NOPR's proposed scope (such as ERCOT and much of the South).[25] Moreover, as PJM also notes, reliance on natural gas, if properly planned for, does not present reliability and resilience risks that are out of the norm.[26]

Many commenters also concoct potentially dire scenarios in which multiple pipelines could be lost to human attack or catastrophic failure, resulting in "common mode failure risk" that must be addressed through preferential payments to coal and conventional nuclear

[21] MISO Comments at 2.
[22] Foundation Comments at 13.
[23] FirstEnergy Comments at 20.
[24] *Comments of the PSEG Companies*, Docket No. RM18-1-000 (October 23, 2017) ("PSEG Comments") at 2.
[25] PJM Comments at 23.
[26] *Ibid*. at 20.

resources.[27] None of these comments state how likely it is that the hypothetical events they suggest could actually occur. The Foundation, for example, suggests that the natural gas transmission system is susceptible to cyberattacks, but fails to explain how likely such an attack is, what measures are already in place to mitigate their impact, and how such an attack might actually impact fuel deliveries.[28] Murray Energy suggests without evidence that the pipeline system "could have been stressed further" during past events where the pipeline system actually operated consistently and reliably;[29] noting that something worse *could have* happened says little in the face of evidence that the events in question were managed effectively. And PSEG points to a pipeline explosion in Pennsylvania and its own lost pipeline capacity, which took over 11 months to repair[30] – yet the company does not explain if those events resulted in a loss of electric generation or any of the reliability and resilience consequences it claims are imminent and require drastic Commission intervention in the markets.

In short, because these commenters fail to substantiate the likelihood of such events occurring, or how the generation fleet might respond in such a scenario, their hypotheticals do not constitute substantial evidence that would support a finding that current RTO/ISO market constructs are unjust and unreasonable at this time. While the Commission is permitted to rely on a predicted "theoretical threat" to justify action under section 206 of the FPA, it must develop a sufficient record that demonstrates how likely that threat is to occur and the "reasonable economic propositions" supporting it.[31] At a minimum, some analysis that considers the

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[27] *See, e.g.,* PSEG Comments at 3. FirstEnergy Comments at 20.
[28] Foundation Comments at 14.
[29] Murray Energy Comments at 5.
[30] PSEG Comments at 17.
[31] *See, e.g., South Carolina Public Service Auth. v. FERC*, 762 F.3d 41, 65 (D.C. Cir. 2014) (explaining that the Commission must demonstrate that a theoretical threat is "'at least likely enough to be within the Commission's authority' and . . . based on reasonable economic propositions") (citations omitted).

likelihood of these events and studies how the actual generation fleet would respond (including all of the specific generation and non-generation resources in the fleet, including distributed energy and demand response) is required to make a rational connection between the risk of those events and the choice to incur significant costs (estimated to be $11 billion or more annually)[32] to provide out-of-market support to certain generators to address such risk.

Finally, it bears noting that at bottom, many of the commenters most strongly supporting the NOPR rely heavily on the simple fact that the markets are producing retirements of coal and conventional nuclear generation units to claim that they have become unjust and unreasonable.[33] However, the fact of retirements alone does not establish that the RTO/ISO markets have become unjust and unreasonable. As the Commission and courts have recognized, relying on market forces to ensure just and reasonable rates is permitted, and a market-based rate regime must only guarantee the *opportunity* to recover costs; it is not required to guarantee that resources never retire or do not retire earlier than anticipated.[34] Moreover, the goal of all competitive markets, including the organized markets, is to produce price signals that will stimulate economically-efficient entry *and* exit of competitors. In other words, retirements are to be expected in a competitive market, and where the Commission has chosen to rely on the competitive markets to ensure just and reasonable rates, it should not interfere with them absent extraordinary circumstances.[35] While reliability concerns may justify preventing economic

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[32] Brattle Report at 32.

[33] *See, e.g.*, FirstEnergy Comments at 24 including a list of announced coal plant closures.

[34] *See, e.g., Louisiana Energy & Power Auth. v. FERC,* 141 F.3d 364 (D.C. Cir. 1988); *ISO New England, Inc*., 135 FERC 61,029 at P 252 (2011) ("The Commission has made clear that 'in a competitive market, the Commission is responsible only for assuring that [a resource] is provided the opportunity to recover its costs,' not a guarantee of cost recovery.'") (citations omitted).

[35] *See, e.g., Edison Mission Energy, Inc. v. FERC*, 354 F.3d 964, (D.C. Cir. 2005) (remanding Commission approval of strict cost-based market mitigation measures that unreasonably departed from its choice to rely on competitive market price signals in times of scarcity to incent new investment).

retirements in specific instances– such as those addressed in the RTOs/ISOs' existing Reliability Must Run ("RMR") tariff provisions – a vague notion of "resilience" simply cannot support a massive out-of-market action to broadly retain entire classes of generation, as proposed here.[36]

None of the comments attempting to buttress DOE's unsupported claim that a reliability and resilience emergency exists provide a factual record that would support a conclusion that such an emergency has rendered the RTOs/ISOs unjust and unreasonable. Because the Commission cannot reach a reasoned conclusion based on this record that the RTO/ISO markets are unjust and unreasonable because they fail to ensure resilience, it cannot proceed in this docket to establish new rates.

III. The Commission Lacks a Sufficient Record to Conclude That Any of the Proposals of Commenters That Attempt to Fill in the Critical Details Left Out of the NOPR are Just and Reasonable

For the reasons described above, the Commission does not have a sufficient record to find that the existing RTO/ISO market rules are unjust and unreasonable with regard to the compensation available to generating resources with a 90-day supply of fuel (i.e., coal and conventional nuclear resources). Under FPA section 206, the Commission thus cannot proceed to determine a new just and reasonable rate.[37] Even if the Commission were able to proceed beyond this first step of section 206, however, it does not have a sufficient record to establish a new just and reasonable, not unduly discriminatory, or preferential rate.

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[36] In PJM Interconnection's *Resource Investment in Competitive Markets* (May 5, 2016), the RTO responds affirmatively to the question, "Can we rely on PJM's organized wholesale electricity market to efficiently and reliably manage the entry and exit of supply resources as external forces create tremendous uncertainty and potential industry transformation?"

[37] *Emera Maine v. FERC*, 854 F.3d 9, 24 (D.C. Cir. 2017) (reaffirming that FPA section 206 requires the Commission to make an "explicit finding that existing rates are unjust and unreasonable *before* proceeding to set a new rate" (emphasis added)).

As numerous commenters have explained, the NOPR is too vague with respect to the scope of its application and how it would be implemented in practice to provide reasonable notice of what is contemplated and to allow for meaningful comment by the public.[38] Not surprisingly, the few commenters supporting specific action by the Commission in response to the NOPR seem to recognize this fatal flaw, and go to great lengths to try to rehabilitate the proposal by filling in the basic details DOE failed to provide, or by providing alternative proposals.[39] However, as explained in the Joint Industry Reply Comments, these proposed implementation details and alternatives all fall far outside of the boundaries of the NOPR as proposed, meaning that the public was not provided notice of them. The fact that these proposals were unveiled for the first time in comments, the expedited timeline of just 15 days for reply comments and final FERC action by December 11, and the need to digest numerous details in the proposals means that the Commission cannot adopt any of them in this proceeding consistent with the Administrative Procedures Act.

In any event, as explained in greater detail in the Joint Industry Reply Comments, none of the proposals offered for implementing the NOPR's proposed requirements have been shown to be just and reasonable and not unduly discriminatory or preferential. In particular, the Joint Industry Reply Comments from a broad cross-section of the industry explain (despite the unjustifiably short time for review) how the proposals of FirstEnergy (which include major revisions to the draft regulatory text, especially with regard to environmental compliance,[40] a major expansion of the costs that eligible generators could collect from consumers, and draft

[38] Joint Industry Reply Comments at 14.
[39] *See, e.g.*, FirstEnergy Comments, PSEG Comments, *Comments of Exelon Corporation*, Docket No. RM18-1-000 (October 23, 2017) ("Exelon Comments") and *Comments and Supporting Declarations of the Nuclear Energy Institute*, Docket No. RM18-1-000 (October 23, 2017) ("NEI Comments").
[40] FirstEnergy Comments at 40.

tariff language) and PSEG (which proposes, among other things, to adopt the NOPR on a temporary basis)[41] have not been shown to be just and reasonable and not unduly discriminatory or preferential.

The Joint Industry Reply Comments correctly explain that comparisons between the DOE NOPR proposal to broadly compensate entire classes of existing generation based on a generic need for "resiliency" and the current RMR provisions of RTO/ISO tariff fall flat.[42] AEE emphasizes that the existing RMR provisions do not provide a suitable basis for providing cost-based compensation to generators other than in a short-term, targeted way to specific generating units that have been shown, through rigorous engineering analysis of local conditions, to be needed to meet specific operating reliability concerns. RMR agreements are designed to balance the need to provide cost-based compensation to specific units to maintain reliability while ensuring that planning processes and market forces are allowed to develop long-term solutions to reliability needs in a non-discriminatory manner.[43] In addition, they are focused on resolving violations of reliability standards, not "resilience" (however one defines that concept), and are not a tool to achieve integrated resource planning or generating resource mix goals like those underlying the NOPR. For all of these reasons, the Commission cannot and should not view using or expanding the existing RMR agreement provisions as a legitimate vehicle for retaining the generating plants targeted by DOE for special treatment in the NOPR.

AEE is also joining a number of other entities in Joint Industry Reply Comments rebutting proposals by Exelon, PSEG, and others that the Commission, on the basis of the record here, exercise its FPA section 206 authority to require PJM to file with the Commission its as-yet

[41] PSEG Comments at 3.
[42] Joint Industry Reply Comments at 16.
[43] *See generally New York Independent System Operator, Inc.*, 150 FERC ¶ 61,116 (2015).

to be unveiled proposal to allow inflexible units to set the Locational Marginal Price ("LMP"). As the Joint Industry Reply Comments explain, the record here fails to provide a basis for the Commission to find that the current price-setting rules in PJM or the other impacted RTOs/ISOs – none of which allow inflexible units to the set the market clearing price in the manner described by commenters – are unjust and unreasonable.

In addition, as the Joint Industry Reply Comments note, these proposals ask the Commission to inappropriately bypass the stakeholder process before PJM's proposal has even been released, let alone fully vetted and analyzed. AEE submits that it is particularly important that PJM and its stakeholders (and potentially the other RTOs/ISOs and their stakeholders) be given the opportunity to fully vet and analyze any proposal to allow inflexible resources to set prices at times when they are not selected in the economic dispatch. As a threshold matter, such a proposal appears to go in the wrong direction, valuing inflexibility when analysts agree that what is needed to manage the future resource mix is greater *flexibility*.[44] At a minimum, it will be necessary to determine how PJM's proposal will impact incentives for resources to offer into the market at their maximum flexibility, and to weigh the tradeoffs of allowing inflexible units to set LMP on the potential for over-generation situations, increased self-scheduling, etc. The fact that the Commission does not possess a record here that would allow it to make these determinations and weigh the relevant tradeoffs undercuts any claims that there is a sufficient record to institute a section 206 proceeding now. The Commission should follow its usual approach and allow the stakeholder process to analyze such issues, rather than circumventing it with an FPA section 206 order.

[44] The Brattle Group, *Advancing Past "Baseload to a Flexible Grid,"* (June 26, 2017).

Finally, AEE emphasizes that all of the proposed implementation details and alternatives to the NOPR proposal offered by commenters fail to recognize the fact that a wide variety of technologies – including advanced energy technologies – can provide the reliability and resilience benefits that proponents claim will be lost if preferential payments aren't provided to select generators with 90 days of on-site fuel (i.e., coal and conventional nuclear units). As the initial comments of the Advanced, Renewable, and Storage Energy Industry Associations highlighted, the DOE NOPR proposal to give preferential cost-based compensation to a single technology type – electric generators with a 90-day supply of fuel – fails to recognize that a wide variety of advanced technologies can provide the same reliability and resilience services that the preferred generators allegedly provide, making the proposal unduly discriminatory and preferential.[45] Because all of the proposed implementation details and alternatives offered by supporting commenters to buttress the NOPR suffer from the same lack of recognition of other technologies and resources than can provide the same services, they are likewise unduly discriminatory and preferential and must be rejected.

IV. Going Forward, the Commission Should Be Mindful of the Reliability and Resilience Benefits of Advanced Energy Technologies, and Avoid Mechanisms that Choose Winners and Losers.

For the reasons expressed above and in the comments submitted jointly with a broad cross section of industry, AEE urges the Commission to take no further action in this docket, given the lack of a record that a reliability and resilience emergency exists that would justify Commission action under FPA section 206 to adopt the drastic market intervention proposed by DOE (or the alternatives proposed in initial comments).

[45] Energy Associations Comments at 34.

AEE recognizes, however, that the Commission may well conclude that the changing resource mix and changes in the resilience threats facing the grid require additional study, either through reports, requests for comments, a series of regional technical conferences, or another avenue. As explained below, such additional study must be aimed at analyzing the multitude of factors that can impact resilience, clearly defining what is meant by resilience based on that analysis, and designing market-based approaches that will procure the resource attributes necessary to ensure resilience in a manner that is just and reasonable and fuel and technology neutral.

a. The Commission Must Engage in a True Deliberative Process to Analyze All of the Potential Aspects of and Threats to Resilience, and Clearly Define What is Needed to Maintain Resilience.

The initial comments demonstrate that there is no universally accepted definition of resilience. Most agree that (1) generally, resilience involves the ability of the grid to withstand, and/or recover quickly from, major impacts from extreme weather events, human-caused damage (such an attack by terrorists or foreign government), and other circumstances that cause significant damage, and (2) resilience is a concept not specifically addressed in existing NERC-approved reliability standards (which focus on planning and operational reliability).

Given the uncertainty around exactly what is meant by "resilience" and how it should be assessed, any process initiated by the Commission to further explore this topic should include a holistic analysis of all of the potential threats to grid resilience. As several commenters in this proceeding have explained, any assessment of reliability and resilience must examine the entire grid system, not simply the fuel supply. Commenters such as PJM, for example, have emphasized that that most threats to grid reliability and resilience lie in the potential for impacts

to transmission and distribution, not generation fuel supply.[46] These comments comport with the findings of the National Academies of Sciences, Engineering, and Medicine, which recently issued a report on "Enhancing the Resilience of the Nation's Electricity System" that emphasized that resilience must be assessed by analyzing all of the components of system that could be impacted by a major event. Focusing solely on fuel supply ignores this reality, and risks overreliance on a single factor (not to mention overinvestment in that single factor) to the ultimate detriment of resilience.[47] We encourage the Commission to look at the National Academies' suggested strategy of developing metrics that examine all aspects of resilience. Failing to do so will lead to incomplete solutions, the potential for undue discrimination, and passing on significant costs to ratepayers.[48]

The Commission should also broadly consider the resource attributes that are needed to ensure resilience. In doing so, it is important to identify, in a fuel and technology neutral manner, what grid operators need resources *to do*, rather than what those resources *are.* Said differently, the Commission should focus on the attributes that are necessary to ensure a reliable and resilient grid, and not on whether those resources are a specific type of generator, an advanced energy technology, or a demand-side resource. As we have noted for the Commission, taking this approach ensures that unjust and unreasonable and unduly discriminatory barriers to participation in markets that would inhibit the cost-effective participation of a wide variety of resources are not created.[49]

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[46] *See, e.g.,* PJM Comments at 13.
[47] *Enhancing the Resilience of the Nation's Electricity System*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: The National Academies Press, 2017, p. 33.
[48] *Id.* at 33.
[49] *Comments of Advanced Energy Economy*, Docket No. AD16-20-000, Docket No. RM16-23-000 (February 13, 2017).

In this regard, we note that resource flexibility has been widely identified as an attribute that will be needed in the future as the grid continues to adapt to market-driven changes in supply. This attribute was completely absent from the DOE NOPR. Yet as the Brattle Group explained in a recent report, obtaining flexible resources, along with maintaining sufficient black start capability and adding microgrids and battery storage, will be needed in the future.[50] Others agree; the comments of the Pennsylvania Public Utility Commission, for example, point out, "The DOE Staff Report [on which the DOE NOPR relied] identified other factors that impacted retirement decisions such as low natural gas prices coupled with increased gas generation, the cost of environmental regulatory compliance and *the benefits of other more flexible resources such as demand response and load management tools*."[51]

In short, the Commission should carefully examine all aspects of grid resilience and all potential threats to continued resilience across the generation, transmission, and distribution categories, and seek to define attributes (such as flexibility) that are needed to maintain resilience across the system and address identified threats.

b. Advanced Energy Technologies Can Cost-Effectively Offer Numerous Wholesale Services, Including Those Supporting Reliability and Resilience.

As explained above, a major failing of the DOE NOPR, as well as the of the proposed alternatives, is their lack of acknowledgement of the role that advanced technologies – including battery storage, demand response, energy efficiency, distributed energy resources, wind, solar, CHP, and others - can play in improving reliability and resilience on the grid. As noted in the attached paper, *Bailout Without Benefit*, "demand-side management technologies, such as energy efficiency and demand response, reduce peak demand, thus lowering necessary reserve capacity

[50] *Evaluation of the DOE's Proposed Grid Resiliency Pricing Rule*, The Brattle Group, October 23, 2017 at 20.
[51] *Comments of the Pennsylvania Public Utility Commission*, Docket No. RM18-1-000 (October 23, 2017) ("PA PUC Comments") at 20 (emphasis added).

and improving resource adequacy," while advanced metering infrastructure (AMI) can "improve system restoration by providing grid operators with improved situational awareness and more accurate outage location information."[52] (*Bailout Without Benefit* details more examples of the resilience benefits advanced energy technologies can provide.)

Despite voluminous evidence to the contrary, some parties still claim that advanced energy technologies are creating reliability or resilience challenges. The Foundation for Resilient Societies ("Foundation"), for example, incorrectly asserts that the addition of wind and solar has resulted in fewer ancillary services being provided to the grid.[53] As explained in the initial comments of the Advanced, Renewable, and Storage Energy Industry Associations, wind and solar and other advanced technologies are now providing such services.[54] The Foundation also incorrectly asserts that wind and solar PV are non-dispatchable, and thus unreliable for blackout restoration. The initial comments of the Advanced, Renewable, and Storage Energy Industry Associations rebut this argument as well, pointing out that wind and solar energy are now able to use system controls and other features to allow them to be dispatchable and provide a range of ancillary services.[55] As discussed in the last section of these comments, better definition of reliability and resilience services and the adoption of markets to procure them would send price signals to drive even more investments in such capability by renewables and other advanced energy technologies.

[52] Advanced Energy Economy, *Bailout Without Benefit*, October 2017, p. 6-8.
[53] Foundation Comments at 16.
[54] Energy Associations Comments at 35.
[55] Energy Associations Comments at 42. In addition, as described above and in our earlier comments, the Foundation ignores that wind energy was key to keeping the lights on both during the Polar Vortex as well as during the rolling blackout event in ERCOT in 2011. *Id*. at 20.

Several commenters, including PSEG and Exelon,[56] claim that national security concerns require action to preference coal and conventional nuclear generation. Advanced energy technologies are already playing a major part in improving national security. The U.S. Department of Defense has increased its utilization of advanced energy technologies, including microgrids and solar PV, to ensure mission-critical reliable electric service. Under the President George W. Bush Administration, the Department of Defense, the nation's largest energy user,[57] first began to procure renewable energy,[58] and today the Department has contracted so much renewable energy that the Navy has met its 1 GW procurement target early.[59] Individual branches of the armed services have focused on utilizing advanced energy to meet their missions. The U.S. Army's *Energy Security & Sustainability Strategy* specifically calls out the how energy efficiency plays a role in resiliency efforts, as noted in the attached paper.[60]

In order to ensure that the Commission has a complete record regarding the role that *all* technologies can play in providing needed grid attributes to ensure resilience, any action undertaken to examine resilience must include a transparent, open process that allows for consideration of how a wide variety of technologies can provide reliability services to the grid. AEE stands ready to provide the Commission with information and analysis regarding the role that the nation's advanced energy industry can play in this effort.

c. Any Action Taken by the Commission Regarding Reliability and Resilience Must Be Fuel and Technology Neutral.

[56] PSEG Comments at 3; Exelon Comments at 3.
[57] Accessed at https://www.nrel.gov/workingwithus/defense.html.
[58] Title 10 USC § 2911.
[59] Accessed at http://greenfleet.dodlive.mil/energy/repo-3/.
[60] *Bailout Without Benefit*, p. 8.

Should the Commission move forward to further examine reliability and resilience issues, it is important for the Commission to take a fuel neutral and technology neutral approach. The energy industry is experiencing a period of rapid change and technological innovation, and change will continue to accelerate as consumer demand for new energy solutions grows. Existing, proven technologies such as solar PV and battery storage have seen costs plummet over the past five years, becoming economically viable options for mass adoption. In the 2017 levelized cost of energy ("LCOE") analysis by the financial firm Lazard, utility scale solar LCOE decline from a mean of $125/MWh in 2012 to $50/MWh in 2017.[61] The National Renewable Energy Laboratory's 2016 study of existing energy storage projects found that the normalized cost per kW is down to $2,338.[62] The Lawrence Berkeley National Lab found that energy efficiency continues to be an incredibly inexpensive alternative to new generation. Between 2009 and 2013, the average program administrator cost of saved energy was $0.028/kWh, which does not even include performance incentives that many utilities earn for energy efficiency.[63] These and other technologies are already being adopted by utilities across the country, largely thanks to these declining costs. AEE anticipates that other technologies – many without fluctuating fuel costs – will see major cost reductions in the advanced energy industry as technologies are improved and adopted at large scale. In addition, these technologies deliver reliability and resilience benefits that are described in detail in the previous section.

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[61] Lazard's Levelized Cost of Energy Analysis Version 11.0 (November 2017). Accessed at https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf.

[62] National Renewable Energy Laboratory, *Battery Energy Storage Market: Commercial Scale, Lithium-ion Projects in the U.S.* (October 2016). Accessed at https://www.nrel.gov/docs/fy17osti/67235.pdf.

[63] Lawrence Berkeley National Laboratory, *Trends in the Program Administrator Cost of Saving Electricity for Utility Customer-Funded Energy Efficiency Programs* (January 2017). Accessed at https://emp.lbl.gov/sites/default/files/lbnl-1007009.pdf.

Given the rapid pace of change in technology, the increasing adoption of advanced energy technology solutions, and their declining costs, it would be imprudent for the Commission to define resilience needs based on specific legacy technologies. Doing so would not only fail to recognize that a broad range of existing and emerging technologies can provide reliability and resilience services – it would pick winners and losers in the wholesale markets, making them uncompetitive.[64] It would also create significant market inefficiencies, effectively blocking unchosen technologies that are already being increasingly adopted to meet other needs from also cost-effectively providing reliability and resilience services, and receiving revenues in return for doing so. This result makes the investment calculus for such resources more challenging. This is particularly true for advanced energy technologies like energy storage, utility-scale PV with power control systems, distributed generation, and demand response, which are capable of providing multiple services across the generation, transmission, and distribution functional classifications.

The organized wholesale markets are increasingly able to utilize a wide range of technologies while remaining reliable and resilient, and are providing incentives for continued innovation to address threats and challenges to continued reliability and resilience. As noted by the PJM IMM, "The PJM market design has worked flexibly to address both market exit and entry without preferences for any technologies," and have the benefit of being "dynamic, flexible and resilient."[65] To avoid sacrificing these benefits, any Commission inquiry going forward

[64] Supporters of the NOPR have noted their disinterest in preferential treatment for specific technologies in the energy market. The CEO of Murray Energy, a company that strongly supported the DOE NOPR, is on the record stating, "We just need to get the government out of picking winners and losers in the energy industry." Accessed at http://money.cnn.com/2017/08/22/investing/coal-rescue-trump-murray-energy/index.html.

[65] Monitoring Analytics Comments at 9.

must be technology neutral and consider the role all types of resources play in ensuring the reliability and resilience of the integrated system.

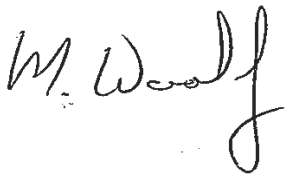
d. The Commission Should Focus on Market Mechanisms for Procuring Needed Reliability and Resilience Attributes, and Should Consider Conducting a Fresh Examination of Ancillary Services and How They Are Procured.

Any Commission examination of resilience should focus on market-based mechanisms to procure necessary attributes in a non-discriminatory manner, rather than out-of-market actions such as returning certain preferred resources to guaranteed profits under cost-of-service rates. The competitive wholesale power markets fostered by the Commission over the past two decades have delivered impressive results for consumers and for the grid, spurring cost-effective investments in generation and transmission that have lowered overall wholesale costs while encouraging technological innovation. There is no reason for the Commission to abandon competitive markets and sacrifice these benefits in order to address resilience. As explained above, the Commission can and should define the attributes that are needed to address resilience threats, and then establish open and transparent market mechanisms to procure them. Doing so is consistent with the Commission's long-standing preference for utilizing market forces to ensure just and reasonable rates and avoid undue discrimination and preference.

In this regard, AEE recommends that the Commission consider how ancillary services are procured and priced. Examining how the changing resource mix is impacting reliability and resilience may provide an opportunity to take a fresh look at how the current ancillary services are defined and procured, and whether changes are necessary to address the needs of today's grid. The Commission should also recognize that **many** needed grid services are not currently monetized in the wholesale markets, meaning there are no market incentives for their development. These services include, but are not limited to, primary frequency response, fast

frequency response, fast-responding regulation, dynamic voltage and/or power factor regulation, ramp rate flexibility, and black start capability. The Commission could consider how the market can efficiently value these services separately to properly compensate all technologies that can provide such services (not just generation) and provide incentives for advanced energy technologies to enter the market to provide these services. In this respect, AEE disagrees with NERC's assessment that certain ancillary services should be mandated from specific generators or other resources.[66] Such mandates produce inefficient outcomes, such as requiring less efficient resources (like traditional generators) to provide ancillary services (which may limit their own efficient operation) and denying other resources and technologies that could provide them more cost-effectively the opportunity to do so.[67]

Respectfully submitted,



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[66] NERC Comments at 8.
[67] *Comments of Advanced Energy Economy*, Docket No. AD16-6-000 (February 14, 2017).

Appendix A

BAILOUT WITHOUT BENEFIT

DOE's Proposed Rule Would Drive Up Costs and Do Nothing to Strengthen Grid

By Advanced Energy Economy

October 2017

ADVANCED ENERGY ECONOMY

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INTRODUCTION AND SUMMARY

On September 30, DOE announced that it was filing a proposed rulemaking at the Federal Energy Regulatory Commission (FERC) under its authority in Section 403 of the Federal Power Act to urge FERC to provide out-of-market financial support to uneconomic coal and nuclear power plants. DOE's proposal would reward power plants that have 90 days of on-site fuel supply (coal and nuclear plants) by exempting them from competition in wholesale electricity markets governed by FERC and give them full recovery of their costs and a guaranteed profit paid for by consumers in perpetuity. DOE gave FERC an accelerated timeline of 60 days to take final action on its proposal. FERC is not obligated to adopt the DOE proposal – it could reject it outright, modify it, or conduct further examination through technical conferences or other procedures.

A review of studies and reports by states, regional grid operators, and industry experts shows that there is no reliability or resilience emergency sufficient to justify such hasty regulatory action. Furthermore, neither DOE nor any of the many expert analysts and official agencies that have considered the matter have found that the absence of on-site fuel supply is a cause or contributing factor in disruptions of electric power service associated with either reliability (minor power outages) or resilience (response to and recovery from events such as natural disasters and extreme weather).

Comprehensive analysis of outages in the last decade show that they are hardly ever the result of insufficient fuel supply that would be remedied by on-site fuel storage. Rather, most power outages are the result of mechanical failures, or damage to poles, wires, and other transmission and distribution infrastructure. Appropriately, most of the ongoing work on improving reliability and resilience focuses on maintaining and repairing damage to the network of poles, wires, and other infrastructure that form the transmission and distribution (T&D) system.

Contrary to DOE's claim of resilience benefits from on-site fuel supply, many other technologies – advanced energy technologies – do contribute to resilience in a fast-evolving electric power system. A well-balanced mix of flexible and renewable resources, including natural gas, biomass, solar, wind, geothermal, hydropower, and distributed resources like fuel cells, can work with traditional resources to provide electricity that is both low-cost and reliable. Energy storage, advanced metering infrastructure, demand response, distribution automation, microgrids, high voltage direct current transmission, and smart grid management technologies help to integrate variable generation, increasing the output from these resources and amplifying their

contribution to resource adequacy and providing the grid with other operational benefits. Demand-side management technologies, such as energy efficiency and demand response, reduce peak demand, thus lowering necessary reserve capacity and improving resource adequacy.

These technologies and services would be discriminated against under DOE's proposed rule, in favor of out-of-market support given to coal and nuclear plants that provide no demonstrated resilience benefits. Thus, the rule would also come at the expense of those market participants that are currently winning the competition – namely, high efficiency, low emission natural gas power generation; wind and solar energy, which are increasingly selected by utilities and corporate purchasers based on cost and price stability; and even demand management services like energy efficiency and demand response.

Above all, this rule would come at the expense of ratepayers, at conservative estimated cost of up to $11 billion dollars. With no proven benefit for reliability or resilience, the out-of-market financial support proposed by DOE would be nothing more than a handout to a select group of operators that own power plants long-ago paid for and based on mature, if not outmoded, technologies, at a cost that would paid by all.

BACKGROUND

In a memo dated April 14, Secretary Perry directed his staff at the Department of Energy (DOE) to conduct a study that would "explore critical issues central to protecting the long-term reliability of the electric grid," and specifically to analyze "market-distorting effects of federal subsidies that boost one form of energy at the expense of others."[1] Perry's memo requested that the study highlight the role that so-called baseload resources play in reliability and resilience, and what could be done about coal and nuclear plant retirements, which he terms "premature."

In August, DOE released the *Staff Report on Electricity Markets and Reliability*.[2] The Staff Report found that there was no reliability or resilience emergency. It concluded that "reliability is adequate today despite the retirement of 11 percent of the generating capacity available in 2002, as significant additions from natural gas, wind, and solar have come online since then."

Despite findings to the contrary in its own report, DOE has continued to act as if the threat of coal and nuclear plant retirements create a reliability and resilience emergency requiring urgent action. In an unprecedented use of its authority, DOE announced on September 30 that it was filing a proposed rulemaking at FERC under its authority in Section 403 of the Federal

Power Act to urge FERC to provide out-of-market financial support to uneconomic coal and nuclear power plants.

DOE's proposal would exempt power plants that have 90 days of on-site fuel supply (coal and nuclear plants) from competition in wholesale electricity markets governed by FERC and give them full recovery of their costs and a guaranteed profit paid for by consumers in perpetuity. Initial estimates place the cost of this proposal as high as $11 billion annually.[3]

DOE gave FERC an accelerated timeline of 60 days to take final action on its proposal. FERC is not obligated to approve DOE's proposal – it must only consider it and take some final action. This action could be rejecting the proposal outright or gathering further information on the issues through additional hearings or procedures. FERC would need an adequate factual record to adopt the proposal or a modified version of it, and nearly every analyst and observer agrees that such a record cannot be compiled. However, DOE's aggressive request has put immense political pressure on FERC to respond.

A SOLUTION IN SEARCH OF A PROBLEM

States, regional grid operators, and industry experts all agree: there is no reliability or resilience emergency. As AEE pointed out when the study memo was released in April, Perry's directive was predicated on flawed assumptions that reflected an apparent lack of understanding of how the grid operates today.[4] Grid operators are continuously adjusting to the changing resource mix feeding the electric power system and taking advantage of the reliability and resilience benefits that innovative advanced energy technologies are bringing to the grid.[5] In short, there is no evidence of a reliability or resilience emergency that would support (as a matter of law or policy) a FERC decision to approve DOE's proposal.

The North American Electric Reliability Corp. (NERC) is charged with assuring the reliability and resilience of the bulk power system (BPS). Gerry Cauley, President and Chief Executive Officer of NERC, recently testified before the House Subcommittee on Energy in September that "even with all the changes underway, the BPS remains highly reliable and resilient, showing improved reliable performance year over year."[6] In *Changing the Power Grid for the Better*, AEE described how the deployment of advanced energy is reducing costs and enhancing reliability.[7] Analysis Group, in *Electricity Markets, Reliability, and the Evolving U.S. Power System*, found that retirement of ageing power plants is a natural result of well-functioning power markets

and that replacing these units with newer, more efficient and competitive power sources improves the operations of the grid.[8] Similarly, in *Advancing Past "Baseload" to a Flexible Grid*, The Brattle Group argues that what grid operators need are resources with flexibility, and that markets should compensate this flexibility.[9]

The Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) that manage the day-to-day operations of the grid and wholesale power markets have also made clear that there is no reliability or resilience emergency. At a House Energy Subcommittee hearing, senior executives from all seven RTOs/ISOs testified that grid operations are not under imminent threat due to coal and nuclear plant retirements. A senior executive from PJM Interconnection (PJM), the RTO that would be most impacted by this rule, told Congress that "investors are investing, consumers are enjoying the lowest electricity prices, and our system is more diverse and reliable than it has ever been."[10] Potomac Analytics, the Independent Market Monitor for PJM, wrote in its annual *2016 State of the Market Report for PJM* that "current fuel diversity is higher than ever in PJM."[11]

We Are Already Investing in Improving Reliability and Resilience

Regulators, grid operators, and public utilities across the country are already hard at work improving the reliability and resilience of the grid. In order to maintain constant power supply, regulators and grid operators typically plan for three types of days: a *blue sky day*, a *black sky day*, and the *day after* a black sky day.[12] Notably, DOE's proposal doesn't acknowledge any of these existing efforts or explain why they are failing to ensure reliability and resilience.

Even on a blue sky day, the grid must be prepared for everything from falling tree branches to squirrels gnawing on distribution equipment to simple human error. The term *reliability* refers to the ability to maintain uninterrupted power supply and grid operations on a blue sky day. Utilities, transmission owners, and grid operators invest heavily in reliability for blue sky days through tree trimming, training, equipment maintenance, and rapid response to isolated power outages.

A black sky day is a rare but extreme event such as a hurricane, terrorist attack, or wildfire that threatens the operation of the grid on a larger scale. *Resilience* is a concept that refers to maintaining or restoring power during or after a black sky day. As with investments to maintain reliability, we also invest heavily in preventing interruptions in power service on black sky days. Transmission owners replace wooden poles in vulnerable locations with poles made of reinforced concrete, which are more resistant to wind, flooding, and wildfires. Power plant owners coat equipment with hydrophobic material that repels flood water and reduces ice build-up during extreme cold. Transmission planners build redundant power lines or place the most vul-

nerable or valuable power lines underground.

The day after a black sky day requires coordinated efforts to restore electric power supply by repairing damage to the grid. At a minimum, regulators and utilities put plans in place to have worker crews on call, activate mutual assistance agreements with neighboring utilities and grid operators that provide support crews from unaffected regions, and stockpile replacement equipment and fuel.[13]

There are also elaborate plans, involving multiple layers of government and private sector actors in place for these efforts. For example, DOE recently determined that an earthquake in the New Madrid Seismic Zone, which surrounds the Mississippi River Valley and produced a 7.7 magnitude earthquake in 1812, could potentially cause outages affecting 100-150 million people by damaging or destroying hundreds of substations, transformers, transmission lines, generators and other parts of the grid infrastructure across many states.[14] Under the banner of the Central United States Earthquake Consortium, DOE, in partnership with state and local emergency managers, federal agencies, and utilities and other private infrastructure companies jointly held exercises in 2014 to plan for a major New Madrid earthquake.[15]

On-site Fuel Supply Does Not Improve Reliability or Resilience

Comprehensive analysis of outages in the last decade show that they are hardly ever the result of insufficient fuel supply that would be remedied by on-site fuel storage. This raises the question of whether DOE's proposal to compensate resources for having 90 days of fuel supply on site would actually achieve DOE's stated objective of improving reliability and resilience, and whether customers would receive any benefits in return for the proposal's massive price tag.

According to a comprehensive study released last year by the National Academies of Sciences, Engineering, and Medicine, with DOE funding, called *Enhancing the Resilience of the Nation's Electricity System*, the T&D system is the most vulnerable part of the grid.[16] As DOE reported in the 2015 Quadrennial Energy Review Report, most power outages are the result of mechanical failures, or damage to poles, wires, and other transmission and distribution infrastructure.[17] Eaton has been tracking power outages in all 50 states and publishing its findings in its *Blackout Tracker Annual Report* for nearly a decade.[18] It breaks power outage data down into root causes with a high level of detail, indicating, for example, if an animal-related outage was caused by a raccoon or a squirrel. However, fuel scarcity is not even listed as an outage type tracked by Eaton's comprehensive report because fuel scarcity is rarely, if ever, the cause of an outage. Recent Rhodium Group analysis of EIA data showed that only 0.00007% of outages in the last five years were the result of fuel supply disruptions.[19] Nearly all that blackout time can be

attributed to a single coal power plant outage in northern Minnesota, which is notable given that DOE's proposal is aimed at preventing coal plant retirements in order to reduce fuel scarcity-related outages. The Rhodium Group study concludes that DOE's proposal "needlessly distracts attention and resources from the other more impactful efforts" to improve grid resilience, such as upgrading poles, wires, and other transmission and distribution infrastructure.

Recent extreme weather events reveal that onsite fuel supplies can themselves be vulnerable. During the 2014 Polar Vortex, the extreme cold caused a winter-record demand for electricity while also contributing to the failure of 22% of the generation in PJM Interconnection. [20] Blackouts potentially affecting tens of millions of people were narrowly avoided due to rapid deployment of demand response and wind resources that were unaffected by the extreme cold conditions. NERC's assessment of the Polar Vortex noted a long list of causes of power plant outage, including frozen, onsite coal supplies.[21] More recently, Hurricane Harvey caused substantial power outages affecting over a quarter million people. In some cases, forced outages were *caused by onsite fuel supply*. The W.A. Parish coal-fired power plant, operated by NRG, was forced to switch two of its units to natural gas fuel for the first time since 2009 because external coal piles became so saturated with water that they were unusable.[22]

Dual-fuel capability has also been used in ISO-NE to mitigate over dependence on natural gas. ISO-NE has implemented market designs to encourage the development of dual fuel capability at gas-fired units, which involves storage of oil on site for availability during winter peak conditions and contracting for guaranteed LNG storage for the same purpose.[23] New England has taken a number of other steps to ensure that the region maintains power system reliability despite a significant dependence on gas-fired generation. These include better coordination between natural gas and electricity providers, pipeline capacity forecasting tools, and market design changes that, among other things, provide market incentives for fuel assurance.

THE TRUE PATH TO RESILIENCE

Whereas DOE's proposal attributes, contrary to the facts, resilience benefits to onsite fuel supply, the real way to cost-effectively improve resilience is by making the grid more flexible and intelligent, and fuel supply more diverse. As the National Association of Regulatory Utility Commissioners (NARUC) wrote in a study on resilience, "resilient infrastructure does more than one thing well, because a resilience investment needs to pay for itself and create value for ratepayers, even when it's not being used."[24] NARUC

points to advanced metering infrastructure (AMI) as an example of an investment that has multiple resilience and reliability benefits because it improves outage management while also enabling other applications, like demand response, that can be used in both emergency and non-emergency situations.

AMI can improve system restoration by providing grid operators with improved situational awareness and more accurate outage location information.[25] One utility reported that using smart meters and other advanced energy technologies saved at least $1 million in restoration costs after an outage.[26] Another utility reported that it was able to expedite recovery after a tornado by using smart meters to precisely map the path of storm.[27] DOE's *Economic Benefits of Increasing Electric Grid Resilience to Weather Outages*, published in August 2013, gives case studies of severe weather and the role played by advanced energy in reducing recovery time.[28] Among other cases, the DOE study reported that PEPCO was able to restore power just two days after Superstorm Sandy due to AMI, which allowed it to pinpoint the location of outages more quickly.[29] These case studies offered no examples of benefits from onsite fuel supply.

There are many advanced energy technologies besides AMI that can provide reliability and resilience services as their primary purpose or as side benefits. A well-balanced mix of flexible and renewable resources, including natural gas, biomass, solar, wind, geothermal, hydropower, and distributed resources like fuel cells, can work with traditional resources to provide electricity that is both low-cost and reliable. Advanced grid technologies are helping to integrate variable generation, increasing the output from these resources and amplifying their contribution to resource adequacy, and providing the grid with other operational benefits. These technologies include energy storage, advanced metering infrastructure, demand response, distribution automation, microgrids, high voltage direct current transmission, and smart grid management technologies.[30] Meanwhile, demand-side management technologies, such as energy efficiency and demand response, reduce peak demand, thus lowering necessary reserve capacity and improving resource adequacy.

Lawrence Berkley National Laboratory (LBNL) cites load shifting, energy efficiency, and renewable energy as viable strategies to improve overall grid reliability and resilience.[31] In 2013, EPRI published the report *Enhancing Distribution Resilience: Opportunities for Applying Innovative Technologies.*[32] In addition to vegetation management, and underground installation of power lines, and other traditional grid hardening approaches, EPRI listed demand response, conservation voltage reduction through distribution automation, use of drones to assess damage, community storage, plug-in electric vehicles, and rooftop solar as investments for utilities to consider in order to improve resilience. Once again, there was no mention of "fuel security" as an element in resilience efforts. In *Storm Reconstruction: Rebuild Smart, Reduce Outages, Save Lives, Protect Property*, the National Electric

Manufacturers Association (NEMA) detailed the benefits of smart meters, grid automation, energy storage, and combined heat and power (CHP) in reducing power outage and restoration time.[33]

Power quality services like frequency regulation are needed to maintain reliability. During extreme weather events when parts of the grid are damaged, power quality can be affected, exacerbating the stress on the system. Voltage must remain within a stable range, and variations in voltage are monitored on very short timescales to ensure the continued operation of the grid. Transmission operators obtain voltage support not only from coal generating units, but also from gas turbines, energy storage, variable frequency drives,[34] solar PV with smart inverters,[35] and newer (Type 3 and 4) wind turbines.[36] As older, inefficient generating units retire, these widely available technologies can be deployed to provide voltage support and ensure continued grid reliability. The National Renewable Energy Laboratory (NREL) found that, with the proper equipment and incentives, wind power can provide important power system control services, often on timescales much faster than conventional generation.[37] Earlier this year, in California, CAISO, First Solar, and NREL conducted a series of tests on a 300 MW solar PV facility to see if it could provide ancillary services as well as a natural gas peaker plant.[38] The tests determined that, in every category of ancillary service, the solar plant performed as well or better than the conventional resource.

Many institutions that consider reliable and resilient power supply to be mission critical are increasingly turning to microgrids to meet their power needs. Across the country, public institutions, hospitals, schools, and military bases are bolstering resilience through investment in microgrids. Microgrids consist of distributed resources (combined heat and power, fuel cells, onsite solar, etc.) and smart grid controls that can work either in conjunction with or in isolation from centralized power plants (in "islanded" mode). These grids are designed to be agile in responding rapidly to changing conditions and can even fix themselves when power supply is disrupted.

Military installations are increasingly using microgrids to power bases during extended outages while also improving resilience to cybersecurity threats.[39] For example, in the *United States Air Force Energy Flight Plan*, the Air Force outlines three goals, including improving resilience and assuring fuel supply. The plan noted that "reducing the Air Force's need for energy is the single best action it can take to improve its energy resilience."[40] In addition to energy efficiency, the Air Force specifically mentions distributed energy resources and smart meters as tools to lessen its vulnerability to fuel supply disruptions while reducing its costs.[41] The Otis Air National Guard Base uses renewables, storage, and advanced control equipment to ensure resilience and provide uninterrupted, mission-critical power supply.[42]

The U.S. Army's *Energy Security & Sustainability Strategy* also highlights the role of

energy efficiency in improving resilience.[43] Specifically, the Army pointed to behavioral changes in how soldiers use energy, networked generators at base camps, purchase of more energy efficient products, combined heat and power, and increasing deployment of distributed renewable resources as tools to support resilience.[44] For example, Fort Hood recently deployed the Army's largest single renewable project, a hybrid wind and solar project that is micro-grid capable and will also provide over $100 million in cost avoidance.[45]

Not all customers need access to microgrids in order to restore power quickly after an extreme event. This year's hurricane season has demonstrated how rapidly advanced energy can be used to restore power after an outage. Earlier this year, Hurricane Irma caused 6.7 million customers to lose power in Florida. Customers, businesses, and cities with solar plus storage and smart inverters that allow the system to operate even when the utility's grid is down, were able to restore power and use refrigerators and microwaves, charge their phones, and access wifi.[46] The city of Coral Springs placed 13 solar-powered temporary traffic lights at major intersections throughout the city until power could be restored to the grid to operate traffic lights.[47] Tampa Electric Co. dispatched all 40MW of its demand response resources to balance supply and demand while it restored parts of the transmission and distribution network to service.[48] The state of Florida is also using waste-to-energy facilities to dispose of debris from the hurricane while also generating power.[49]

Hurricane Harvey caused substantial power outages affecting over a quarter million people. According to EIA, these outages were primarily due to flooding of fuel supplies, travel disruptions from personnel, and damage to transmission infrastructure.[50] Lack of reliable onsite generation to power critical refrigeration equipment caused hazardous chemicals to break down and explode at the Arkema manufacturing plant.[51] Back up diesel generators failed due to flooding. Wind power facilities, in contrast, were quickly back up and running just days after the storm. According to one project owner, "the delay in restarting was mostly because the power lines were damaged."[52]

Puerto Rico's power outages caused by Maria and Irma were absolute; the entire island lost power. This makes restarting conventional generation resources impossible without black start capability – that is, the ability to restart without drawing power from the grid, like how a car engine starts using a battery.[53] A number of advanced energy companies are rapidly deploying microgrid technology in Puerto Rico in response to the storm. Tesla is sending battery systems along with Sonnen GmbH, another battery manufacturer, and Sunnova is installing rooftop solar.[54] Navigant expects that the rapidly declining costs of batteries and demand for more resilient power supplies will encourage $22.3 billion in battery investment like the kind underway in Puerto Rico right now over the next 10 years.[55]

In addition to black start capability, advanced energy can provide many other ancillary services that conventional power

plants are either unable to provide or provide poorly. Battery storage excels at providing power quality services like frequency regulation, something which large power plants sometimes struggle to provide.[56] Renewables equipped with smart inverters, which are increasingly becoming standard-issue in the United States, can also provide power quality services. As NERC has documented, wind can provide "right-through capabilities and other essential reliability services."[57]

PICKING WINNERS OUT OF MARKET LOSERS – AND VICE VERSA

Rather than proposing continued development and deployment of technologies that offer actual resilience benefits, DOE has called on FERC to impose federal cost-of-service regulation for certain power plants in states that have explicitly chosen to rely on competitive markets instead. It would do so only for a narrowly defined set of power plants – those that maintain a 90-day supply of fuel onsite. Not only would this exempt some perfectly solvent coal-fired and nuclear power plants from the discipline of competition and reward them with above-market compensation, it would bail out power plants that would otherwise go out of business as a natural consequence of competitive dynamics, and all at ratepayer expense.

And this rule would prop up these particular power plants for no good reason. Neither DOE nor any of the many expert analysts and official agencies that have considered the matter have documented the absence of onsite fuel supply as a cause of or contributing factor in disruptions of electric power service associated with either reliability (i.e., "blue sky day" power outages) or resilience ("black sky" events such as natural disasters, extreme weather, or even cyberattack). The "pricing rule" proposed by DOE would be nothing more than a handout to a select group of operators that own long-ago paid-for power plants based on mature, if not outmoded, technologies.

This rule would also come at the expense of those market participants that are currently winning the competition – namely, high efficiency, low emission natural gas power generation; wind and solar energy, which are increasingly selected by utilities and corporate purchasers based on cost and price stability; and even demand management services like energy efficiency and demand response. These are all lower-cost, higher-value ways of meeting electric power needs, as demonstrated by market outcomes – and they contribute to a more reliable and resilient grid by increasing flexibility and fuel diversity. It is this market-based reality that the DOE proposed rule would overturn by federal fiat.

NOTES

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