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Introduction

Chairman Upton, Ranking Member Rush, and Members of the Subcommittee: Thank you for the opportunity to appear before you today to discuss the subject of defining reliability in a transforming electricity industry. I appreciate the Subcommittee's attention to this important issue.

While this is an exciting and transformational period for the electric power industry, we must be mindful that developments not threaten the robustness or security of the electric grid. The reliability and resiliency of the electric grid is vital to our nation.

The Federal Energy Regulatory Commission's Role in Supporting Reliability and Resiliency of the Electric Grid

The Federal Energy Regulatory Commission (FERC) is an independent agency with jurisdiction that covers a wide array of energy matters. FERC supports the reliability and resiliency of the electric grid in several ways. My testimony today will discuss FERC's ongoing work to support reliability and resiliency through: first, regulatory oversight of reliability standards, including more recent efforts to address the cyber and physical security of the electric grid; second, regulatory oversight of rates and markets; and third, infrastructure development.

Reliability

The Energy Policy Act of 2005 gave FERC the new responsibility to approve and enforce mandatory reliability standards for the grid. This authority is limited to the "bulk-power system," as defined in section 215 of the Federal Power Act (FPA), and excludes Alaska and Hawaii, as well as local distribution systems.

Under FPA section 215, FERC cannot directly write or modify reliability standards, but must rely on the Electric Reliability Organization (ERO) to perform this task. In 2006, FERC certified the North American Electric Reliability Corporation (NERC) as the ERO. Under the section 215 construct, NERC develops and proposes for FERC's review new or modified reliability standards. In addition to approving or remanding a reliability standard proposed by NERC, FERC may direct NERC to address a specific matter through a new or revised reliability standard and has done so on various occasions.

Once FERC approves a proposed standard, it becomes mandatory and enforceable in the continental United States, and is applicable to the users, owners and operators of the bulk-power system. An entity that violates an approved standard may be subject to enforcement by either NERC or FERC, and may be subject to a monetary penalty of up to one million dollars per day per violation.

With guidance from FERC, NERC and industry stakeholders that assist NERC in developing proposed standards have put in place a robust set of “baseline” reliability standards to address day-to-day grid reliability issues, like tree trimming, relay setting, communications, system planning, and emergency operations. The maturation of these “baseline” reliability standards has allowed FERC and NERC to focus more of their efforts on standards related to cybersecurity, physical security, and the potential grid impact of a geomagnetic disturbance (GMD).

In 2008, FERC approved NERC’s first set of proposed cybersecurity standards, referred to as “Critical Infrastructure Protection” or “CIP” standards. Since then, FERC has worked with NERC on a number of increasingly robust versions of the CIP standards, which address how to identify, categorize and protect cyber assets and systems; processes and procedures for maintaining these systems; and ensuring that only appropriate personnel have access to these systems, among others. In 2016, pursuant to CIP standards approved by FERC, utilities began to implement a tiered approach to cybersecurity. This approach provides protection for cyber assets that is commensurate with their impact on the bulk-power system. In addition, pursuant to FERC’s direction, NERC is currently developing a reliability standard addressing the supply chain for industrial control system hardware, software, and related services associated with the bulk-power system.

In 2014, FERC directed NERC to develop a reliability standard that addresses physical security threats and approved NERC’s proposed physical security reliability standard later that year. The physical security reliability standard requires responsible entities to mitigate assessed vulnerabilities to critical transmission facilities through resiliency or security measures designed to deter, detect, delay, assess, communicate, and respond to potential physical threats and vulnerabilities. In addition, in 2013, FERC directed NERC to develop reliability standards to address the potential impact of a geomagnetic disturbance. Subsequently, NERC developed, and the Commission approved, two GMD-related standards.

FERC, along with NERC and the industry, has dedicated significant attention to improving grid resilience. Resilience efforts cover a range of actions that grid owners and operators can take to reduce the risks associated with the loss of individual or multiple assets and to improve recovery and restoration following such losses. As an example of FERC’s efforts, the Commission has issued orders to provide clarity on how

it will address services provided by Grid Assurance, a company created by several electric utilities to enhance grid resilience and protect customers from prolonged outages. Specifically, Grid Assurance provides subscribing electric utilities with timely access to an inventory of emergency spare transmission equipment, including transformers, that otherwise can take months or longer to acquire.

Separate from the regulatory actions discussed above, FERC also uses a voluntary and collaborative approach with its jurisdictional entities, the states, and other federal agencies to help improve grid resilience and security. This approach can be more agile and focused and was developed in response to the growing cyber and physical security threats targeting our nation's energy infrastructure. This work has been led by FERC's Office of Energy Infrastructure Security. These efforts include working closely with industry to help them assess their vulnerabilities, facilitate open and closed briefings regarding the current and emerging threats that they face, and help them identify and implement best practices as appropriate to address any issues that are found. In addition, FERC has worked closely with the states. These efforts include facilitating classified briefings, assisting with the development of state resources and guidelines, and participating in state and regional cybersecurity and physical security exercises. To help accomplish these objectives, FERC collaborates extensively with other federal and private entities. Some recent and ongoing examples of this collaboration include work with the Department of Homeland Security, the Transportation Security Administration (natural gas pipelines), the Coast guard (LNG terminals), the Office of the Director of National Intelligence, the Department of Energy, and NERC.

Rates and Markets

FERC also works to ensure reliability through its oversight of jurisdictional wholesale energy, capacity, and ancillary services markets. FERC ensures that rates, terms, and conditions of service, including market rules and market structures, are just and reasonable and not unduly discriminatory or preferential. For some ancillary services that provide reliability support, the Commission has determined that the provision of the service is best met through a requirement that all resources provide the service as a condition of interconnection, rather than through a market mechanism. The interconnection of a new resource must maintain reliability and, in some circumstances, the cost of providing a service may not warrant the time and expense needed to develop a market mechanism to procure the service. For other services providing reliability support, FERC has undertaken several efforts to ensure that those services are properly compensated, and that energy, capacity, and ancillary services markets send correct price signals to support the investment in and retention of resources and other infrastructure needed for reliability.

As part of these efforts, FERC has been evaluating the essential reliability services necessary for the reliability of the grid. The transformation of the nation's power supply

portfolio, particularly the changing resource mix, makes it important to focus on the resources providing these types of services to the grid. However, it is important to recall that states generally have jurisdiction over the resource mix in their individual states, and that FERC has generally remained resource- and fuel-neutral in fulfilling its core obligations to ensure the reliability of the bulk-power system and to maintain just and reasonable wholesale electric rates. That said, FERC's ongoing evaluation of the grid includes the availability of essential reliability services, including the sufficiency of such services, the types of resources for providing such services, and the compensation for providing such services, when appropriate. As a consequence of this evaluation, FERC issued Order No. 827, eliminating the exemption for new wind generators from the requirement to provide reactive power. Similarly, FERC issued Order No. 828, requiring newly interconnected small generators (no larger than 20 megawatts) to ride through abnormal frequency and voltage events and not disconnect during such events, similar to the requirements already in place for large generators. In addition, FERC is considering requiring all resources newly interconnecting to the grid to install and enable primary frequency response capability as a condition of interconnection. While this proposal is still under review, in one of the first orders issued upon restoration of a quorum, my colleagues and I issued a notice seeking further information from industry and interested stakeholders on primary frequency response capability.

As system needs evolve, FERC continually evaluates market rules to help meet those needs. FERC seeks to establish market rules that ensure the cost effective provision of the services needed to address system needs. While FERC prefers to rely on competitive forces when reasonable, it recognizes that traditional regulatory measures are sometimes necessary in wholesale electricity markets. Also, these changes affect each region of the country differently, and FERC has endeavored to allow markets to evolve to address unique regional needs while taking generic action when it is warranted. For instance, in 2011, FERC issued Order No. 755, which addressed compensation for frequency regulation in wholesale markets operated by Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs). Frequency regulation is a type of ancillary service provided by resources that supports reliability by balancing supply and demand on the transmission system. Prior to Order No. 755, compensation methods for frequency regulation service failed to recognize the greater amount of frequency regulation provided by faster-ramping resources. To address this problem, Order No. 755 required RTOs and ISOs to compensate frequency regulation based on the actual amount of frequency regulation service provided. This allowed market operators to take advantage of the capabilities of faster-ramping resources to improve operational and economic efficiency of the transmission system and reduce costs to consumers in organized wholesale markets.

In June 2014, FERC initiated a proceeding to actively explore issues related to price formation in wholesale markets in order to improve competition, promote necessary investment, and produce meaningful price signals that clearly indicate where new supply

and investment are needed. The goals of price formation are to (1) maximize market surplus for consumers and suppliers; (2) provide correct incentives for market participants to follow commitment and dispatch instructions, make efficient investments in facilities and equipment, and maintain reliability; (3) provide transparency so that market participants understand how prices reflect the actual marginal cost of serving load and the operational constraints of reliably operating the system; and (4) ensure that all suppliers have an opportunity to recover their costs.

To facilitate engagement from various stakeholders, FERC held three workshops and published four technical papers on price formation issues. It also asked RTOs and ISOs to submit reports on certain price formation topics to provide FERC with an update on current practices in these areas and help it identify best practices. Based on the discussion, comments, and reports received, FERC identified particular challenges to proper price formation and proposed solutions. Most of the areas FERC identified represented opportunities for incremental improvement, with some attention to areas in which incremental improvement would better value resource attributes, such as flexibility, that contribute to reliability.

For example, in June 2016, FERC issued Order No. 825, which addressed certain practices that failed to provide appropriate price signals for resources to follow dispatch instructions and respond to actual system conditions. To address this problem, FERC required RTOs and ISOs to align dispatch intervals and settlement intervals, and required RTOs and ISOs to trigger shortage pricing for any dispatch interval during which a shortage of energy or operating reserves occurs. Both of these reforms help maintain reliability by facilitating accurate market signals of system conditions, which encourages resources to follow commitment and dispatch instructions. These required changes in market rules provide incentives for more flexible resources and encourage efficient investments in facilities and equipment.

In November 2016, FERC issued Order No. 831 which addressed problems with certain aspects of energy offer caps. Among other things, FERC found that existing offer caps may prevent RTOs and ISOs from dispatching the most efficient set of resources, suppress market prices below the cost of production, and prevent resources from recovering their costs which would discourage them from offering energy into the market. To address these problems, FERC required RTOs and ISOs to revise their energy offer caps to permit energy costs above \$1,000/MWh to be used to set price if they are verified in advance, and required RTOs and ISOs to provide resources the opportunity to recover energy costs outside of the market in certain circumstances if they are subsequently verified. These reforms help support reliability by providing accurate price signals to encourage resources to offer energy, particularly during times of system stress, and they also encourage efficient investment in resources.

FERC is also considering changes relating to the pricing of fast-start resources, uplift cost allocation, and transparency into reporting practices in certain RTO and ISO markets. These efforts, which are still ongoing, would support reliability by, among other things, supporting investment in facilities and equipment, particularly those affecting local reliability.

Finally, there has been much interest in FERC's efforts to foster further discussion regarding the relative roles of wholesale markets and state policies in the Eastern RTOs and ISOs in shaping the quantity and composition of resources needed to cost-effectively meet future reliability and operational needs. In May 2017, FERC held a two-day technical conference on these important issues, featuring a variety of stakeholders and also solicited comments from the public. FERC continues to engage with stakeholders and review comments on these issues.

Infrastructure

A reliable and resilient grid requires the development of needed energy infrastructure. FERC supports infrastructure development through its statutory responsibility to authorize the construction of certain energy infrastructure, such as interstate natural gas pipelines, liquefied natural gas terminals, and non-federal hydropower generation. While the Commission has been unable for much of this year to act on applications for such projects, the Commission is addressing the backlog and will continue to make steady progress in the coming weeks and months.

Conclusion

Given FERC's responsibilities and efforts as to reliability and resiliency, my colleagues and I reviewed the Department of Energy Staff Report on Electricity Markets and Reliability with great interest. The report highlights many of the challenges and changing resource landscape that FERC continues to consider. I will work with my colleagues and FERC staff to analyze the recommendations and areas for further study identified in the report.

Certainly FERC's efforts in these areas will continue to involve cross-sector, interagency and public-private coordination. Working with our federal partners, state colleagues, industry and other stakeholders, FERC will continue to seek ways to ensure the reliability and resiliency of the electric grid. And, of course, I look forward to working with this Subcommittee to continue these efforts.

I would like to once again thank the Members for allowing me the opportunity to be here today. I would be happy to answer any questions you may have.