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Subcommittee on Oversight and Management Efficiency
United States House of Representatives

Hearing on Oversight of Federal Efforts to Address Electromagnetic Risks

May 17, 2016

Chairman Perry, Ranking Member Watson Coleman and Members of the Subcommittee:

Thank you for the privilege to appear before you today to discuss electromagnetic threats to the electric grid in the United States. My name is Joe McClelland and I am the Director of the Federal Energy Regulatory Commission's Office of Energy Infrastructure Security (OEIS). I am here today as a Commission staff witness, and my remarks do not necessarily represent the views of the Commission or any individual Commissioner.

In the Energy Policy Act of 2005, Congress entrusted the Commission with a major new responsibility to approve and enforce mandatory reliability standards for the Nation's bulk power system. This authority is in section 215 of the Federal Power Act. It is important to note that FERC's jurisdiction and reliability authority under section 215 is limited to the "bulk power system," as defined in the FPA, which excludes Alaska and Hawaii, as well as local distribution systems. Under the section 215 authority, FERC cannot author or modify reliability standards, but must depend upon an Electric Reliability Organization (ERO) to perform this task. The Commission certified the North American Electric Reliability Corporation (NERC) as the ERO. The ERO develops and proposes for the Commission's review reliability standards or modifications, which the Commission can either approve or remand. If the Commission approves a proposed reliability standard, it becomes mandatory in the United States and is applicable to the users, owners and operators of the bulk power system. If the Commission remands a proposed standard, it is sent back to the ERO for further consideration. The Commission is required to give "due weight" to the technical expertise of the ERO when reviewing any of NERC's proposed standards.

Section 215 of the Federal Power Act provides a statutory foundation for the ERO to develop reliability standards for the bulk power system. However, the

nature of a national security threat by entities intent on attacking the U.S. by exploiting vulnerabilities in its electric grid using physical or cyber means stands in stark contrast to other major reliability events that have caused regional blackouts and reliability failures in the past, such as events caused by tree trimming practices. Widespread disruption of electric service can quickly undermine the U.S. government, its military, and the economy, as well as endanger the health and safety of millions of citizens.

I note that Congress took steps to address such a situation late last year, including in the Fixing America's Surface Transportation Act (FAST Act) a section entitled, "Critical Electric Infrastructure Security." That section assigned notable new authority to the Department of Energy (DOE) and the Commission, among other Federal agencies. Under this new authority, DOE can declare a grid security emergency and order actions to address it. As I will discuss further below, DOE is also to consult with the Commission regarding development of a Strategic Transformer Reserve Plan to reduce the threats from physical, cyber, EMP, GMD, severe weather, and seismic events. The Commission, in consultation with DOE, is to develop regulations governing the designation, protection, and appropriate sharing of Critical Electric Infrastructure Information. In addition, under the Cybersecurity Act of 2015 also enacted late last year, Congress directed the Federal Government to share and receive cybersecurity threat and mitigation information, while restricting its regulatory use, with non-federal entities including state governments and industry.

Consistent with these requirements, the Commission established OEIS in late 2012 to provide a more agile and focused approach to growing cyber and physical security threats. The mission of OEIS is to provide expertise and assistance to the Commission, other federal and state agencies and jurisdictional entities in identifying, communicating and seeking comprehensive solutions to significant potential cyber and physical security risks to the energy infrastructure under the Commission's jurisdiction. This includes threats from geomagnetic disturbances (GMDs) and electromagnetic pulses (EMPs*).*

Specific to the subject of this hearing, GMD and EMP events are generated from either naturally occurring or man-made causes. In the case of GMDs, naturally occurring solar magnetic disturbances periodically disrupt the earth's magnetic field which, in turn, can induce currents on the electric grid that may simultaneously damage or destroy key transformers over a large geographic area. Regarding man-made events, EMPs can be generated by devices that range from small, portable, easily concealed battery-powered units all the way through missiles equipped with nuclear warheads. In the case of the former, equipment is readily available that can generate localized high-energy bursts designed to disrupt, damage or destroy electronics such as those found in control systems on

the electric grid. The EMP generated during the detonation of a nuclear device is far more encompassing and generates three distinct effects, each impacting different types of equipment; a short high energy RF-type burst called E1 that destroys electronics; a slightly longer burst that is similar to lightning termed E2; and a final effect termed E3 that is similar in character and effect to GMD targeting the same equipment including key transformers. Any of these effects can cause voltage problems and instability on the electric grid, which can lead to wide-area blackouts.

In 2001, Congress established a commission to assess and report on the threat from EMP. In 2004 and again in 2008, that commission issued reports on these threats. One of the key findings in the reports was that a single EMP attack could seriously degrade or shut down a large part of the electric power grid. Depending upon the attack, significant parts of the electric infrastructure could be "out of service for periods measured in months to a year or more." It is important to note that effective mitigation against solar geomagnetic disturbances and non-nuclear EMP weaponry can also provide an effective mitigation against the impacts of a high-altitude nuclear detonation.

In order to better understand and quantify the effect of EMP and GMD on the power grid, the Commission, DOE and the Department of Homeland Security (DHS) sponsored a study conducted by the Oak Ridge National Laboratory in 2010. The results of the study support the general conclusion of prior studies that EMP and GMD events pose substantial risk to equipment and operation of the Nation's electric grid and under extreme conditions could result in major long-term electrical outages. Unlike EMP attacks that are dependent upon the capability and intent of an attacker, GMD disturbances are inevitable with only the timing and magnitude subject to variability. The Oak Ridge study assessed a solar storm that occurred in May 1921, which has been termed a 1-in-100 year event, and applied it to today's electric grid. The study concluded that such a storm could damage or destroy over 300 bulk power system transformers interrupting service to 130 million people with some outages lasting for a period of years.

To date, a few U.S. entities have taken some initial steps to address EMP on their systems, but much work remains. Internationally, the United Kingdom, Norway, Sweden, Finland, Germany, South Korea, Japan, Australia, New Zealand, South Africa, Israel and Saudi Arabia have GMD and/or EMP programs in place or are in the early stages of addressing or examining the impacts of GMD or EMP. The costs of these initiatives can vary widely depending on factors such as the threshold of protection, the service requirements of the load, the type of equipment that is to be protected, and whether the installation is new or a retrofit.

With these issues and challenges in mind, the Commission has used a two-fold approach to help address the GMD and EMP threats, applying both regulatory and collaborative actions.

First, with respect to regulatory actions, the Commission has directed NERC to propose two reliability standards on GMD. The Commission approved the first of NERC's proposals, a mandatory reliability standard that requires certain entities to implement operational procedures to mitigate the effects of GMD events. The Commission also has issued an order proposing to approve the second of NERC's proposals, a reliability standard that would establish requirements for certain entities to conduct initial and ongoing assessments of the vulnerability of their transmission systems against a benchmark geomagnetic disturbance. The Commission has received comments on its proposed order and held a related technical conference in March. The Commission is currently reviewing this record to determine how to move forward.

The Commission's regulatory authority with respect to rates also may be relevant to addressing these issues. For example, the Commission has issued two orders to provide clarity on how it will address services provided by Grid Assurance, a company recently created by several electric utilities and energy companies. Grid Assurance is intended to enhance grid resilience and protect customers from prolonged outages by providing electric utilities that subscribe to Grid Assurance with timely access to an inventory of emergency spare transmission equipment, including transformers, that otherwise can take months or longer to acquire.

Second, with respect to collaborative actions, the Commission works closely with Federal agencies, state agencies, and industry members in many ways. In general, such collaboration has included efforts to identify key energy facilities; conduct physical and cyber threat briefings, including on GMD and EMP, to industry members; assist with the identification of best practices for mitigation; and cooperate with international partners to convey threat and mitigation information as well as encourage adoption of best practices for mitigation.

Some of the Commission's collaborative actions are relevant to GMD and EMP threats. For example, in November 2014, the National Science and Technology Council (NSTC) created the Space Weather Operations, Research, and Mitigation (SWORM) Task Force to develop high-level strategic goals for enhancing National Preparedness for a severe space weather event. This Task Force is co-chaired by members from the Office of Science and Technology Policy, DHS, and the National Oceanic and Atmospheric Administration. The Commission has participated in the SWORM Task Force's efforts from its inception.

In addition, as required by the FAST Act, DOE, in consultation with the Commission and others, is developing a plan to establish a Strategic Transformer Reserve. The Strategic Transformer Reserve Plan is to identify the sufficient number, type, cost, and location of equipment needed to temporarily replace critically damaged large power transformers and substations that are part of the critical electric infrastructure or that serve defense and military installations. Specific to the subject of today's hearing, the Strategic Transformer Reserve Plan will decrease vulnerabilities related to physical and cyber threats, including both EMP and GMD. The Strategic Transformer Reserve Plan is not limited to transformers, but is also to include other critical electric grid equipment as necessary to provide or restore sufficient resiliency.

The Commission's efforts to date are consistent with the recommendations of the Government Accountability Office's recently released report on electromagnetic risks to the electric grid. I believe that building on previous collaboration among the Commission and other Federal agencies can enhance our collective response in addressing electromagnetic threats to the electric grid in the United States.

Thank you again for the opportunity to testify today. I would be happy to answer any questions you may have.