Statement for the Record of Patricia Hoffman

Assistant Secretary for Office of Electricity Delivery and Energy Reliability

U.S. Department of Energy

Before the

Subcommittee on Oversight and Management Efficiency

Committee on Homeland Security

U.S. House of Representatives

May 17, 2016

Chairman Perry, Ranking Member Watson Coleman, and Members of the Subcommittee, thank you for continuing to highlight the importance of a resilient electric power grid. I appreciate the opportunity to address the Department of Energy's role in in helping to ensure a resilient, reliable, and flexible electricity system in an increasingly challenging environment.

Our economy, national security, and even the health and safety of our citizens depend on the reliable delivery of electricity. The mission of the Office of Electricity Delivery and Energy Reliability (DOE-OE) is to strengthen, transform, and improve energy infrastructure to ensure access to reliable, secure, and clean sources of energy. We are committed to working with our public and private sector partners to protect the Nation's critical energy infrastructure, including the electric power grid, from disruptions caused by natural and manmade events, such as severe weather, physical attacks, cyber-attacks, and electromagnetic pulses (EMP).

The electrical grid is more than just infrastructure. It is an ecosystem of asset owners, manufacturers, service providers, and government officials at Federal, state, and local levels, all working together to run one of the most reliable power grids in the world. Ninety percent of the Nation's energy infrastructure is in private hands, and 3,306 electricity providers serve approximately 148 million customers[i] through a network of 450,000 miles of high-voltage transmission lines.

There are plenty of risks beyond cyber, including physical, severe weather, natural disasters, aging infrastructure, and infrastructure interdependencies. In the face of these diverse threats, we can help ensure that the grid is poised to recover quickly following an incident. Fostering partnerships with public and private stakeholders plays a critical and necessary role in this work.

THE ECOSYSTEM OF RESILIENCE

A crucial factor to meeting these challenges is to be proactive and cultivate what I call an ecosystem of resilience: a network of producers, distributors, regulators, vendors, and public partners, acting together to strengthen our ability to prepare, respond, and recover. We continue to partner with industry, other Federal agencies, local governments, and other stakeholders to quickly identify threats, develop in-depth strategies to mitigate those threats, and rapidly respond to any disruptions.

Our resilience efforts are further bolstered by our broader grid modernization activities, including our support of the research, development, and demonstration of advanced technologies and our work with state, local, tribal, and territorial stakeholders to help them improve their local resilience and energy emergency response capabilities. Of the $4.5 billion that we invested in grid modernization through the American Recovery and Reinvestment Act (ARRA), $3.4 billion was used to help industry accelerate the deployment of advanced technologies that are now reducing costs and keeping the lights on more reliably and efficiently. This smarter grid is helping to prevent outages, reduce storm impacts, and restore service faster when outages occur.

Our model is partnerships first. We are all in this together. It is through working together that we continue to strengthen our ability to bounce back following an event.

PARTNERSHIPS FOR READINESS

DOE-OE has been working with utility owners and operators, regulators, and state and local officials across the country concerning threats to cyber-security and other risks. Through these partnerships, we are providing tools, best practices, new technologies, and funds to support their many ongoing efforts.

We directly support preparedness efforts at the community level, in part through products and tools produced by our Infrastructure Security and Energy Restoration (ISER) division, to inform and educate state and local officials in their energy emergency preparedness activities. This is done through forums, training, and tabletop exercises for Federal, state, and local energy officials.

In early February, DOE Secretary Ernest Moniz signed an updated Energy Emergency Assurance Coordinators (EEAC) Agreement with the National Association of State Energy Officials (NASEO), National Association of Regulatory Utility Commissioners (NARUC), National Governors Association (NGA), and National Emergency Management Association (NEMA). This updated EEAC Agreement lays out concrete items to improve our collective ability to share information, which is essential for making sound response and restoration decisions during emergencies. To support this effort, DOE and state officials will develop information-sharing protocols and processes to streamline response operations. We will also test these processes and information-sharing mechanisms through routine drills and exercises.

The President's FY 2017 Budget Request includes $15 million for a State Energy Assurance program to foster regional hazard preparedness. This program would focus on providing state, local, tribal, and territorial governments with analysis, training, and exercising of shared regional risk factors where entities depend on each other for energy supplies and must work together to resolve energy disruptions to restore energy infrastructure.

This new program would be facilitated through competitive regional cooperative assistance awards to state and local partners. As needed, DOE, including our National Laboratory expertise and capability, would be available to the awardees to enhance preparation and allow for real-world energy emergency support. Lessons learned would be shared with other communities to leverage the program across the nation and help improve resiliency planning.

DOE-OE also focuses on enabling our state, local, and utility partners with information. EAGLE-I (Environment for Analysis of Geo-Located Energy Information), for example, is a DOE-designed and operated web tool that automatically gathers electrical grid service status data

from company websites every 15 minutes, and organizes it into an easy to read picture of electrical service status nationwide. Now covering 75 percent of all U.S. electricity customers, it provides real-time information about the grid – what is up, what is down, the number and location of outages, when service is restored – to DOE and, through our information-sharing efforts, with other Federal agencies.

Geomagnetic Disturbances (GMD) or Space Weather

President Obama and the Administration recognize the threat posed by a GMD from space weather and the Administration continues to prioritize work to address these concerns. In April 2015, the Quadrennial Energy Review highlighted methods to reduce our electric grid's vulnerabilities to multiple forms of risks. The Secretary of Energy has prioritized DOE efforts to help understand and mitigate these risks for the electricity subsector (subsector).

In 2015 the Administration issued the *National Space Weather Strategy* and follow up National Space Weather Action Plan to better understand and address the risks of geomagnetic storms. The plans gave DOE primary responsibility for two of the actions in the Action Plan. First, by the end of 2016, DOE will coordinate with regulatory agencies and the electric power industry to define data requirements that facilitate a centralized reporting system to collect real-time information on the status of the electric power transmission and distribution system during geomagnetic storms. Second, also by the end of 2016, DOE, in coordination with Departments of Homeland Security and Commerce, and stakeholders in the subsector, will develop plans to provide monitoring and data collection systems to inform a system-wide, real-time view of geomagnetically induced currents (GICs) at the regional level and, to the extent possible, display the status of power generation, transmission, and distribution systems during geomagnetic storms.

For several years DOE has taken actions and funded efforts to better understand the risk from space weather. Our space weather strategy included analysis, enhancing science, and collaboration with stakeholders both domestically and internationally. Efforts include:

- Encouraging the development of a North American Reliability Corporation (NERC) GMD task force and supporting it to better understand space weather. The task force developed standards for GMD. In addition to monitoring geomagnetic disturbances, industry is prepared to take action as needed, including reducing load if necessary and changing operational settings to respond to system needs.

- Funding the Electric Power Research Institute's (EPRI) SUNBURST program, a geomagnetically-induced current monitoring system. When our support began there were only 10 monitors, all in the Eastern Interconnection. Now there are over 40 and they are in all three major grids in the Continental United States

- Funding a new program to evaluate and install variometers to collect and share data on changes on magnetic fields during GMDs. Our program will put in 12 variometers to help system owners and operators better model the expected potential currents going into transformers causing grid and possible system damage. With the data grid operators can take informed risk-based decisions on actions to mitigate and protect against GMDs. Prior to the deployment of the first variometer, the United States Geological Survey had only 6 magnetometers to measure such data.

- Funding a study at Oak Ridge National Laboratory (ORNL) to evaluate the susceptibility of the eastern grid to GMD. The study will be completed by year's end.

- Organizing, attending, and participating in several space weather workshops with government and industry stakeholders, including those from some of our allies such as Canada, the United Kingdom, and Ireland.

Electromagnetic Pulses (EMP)

DOE has increased its efforts to better understand the EMP threat to the electric grid and what measures can mitigate its potential adverse impacts. DOE plans to take the necessary steps to develop cost-effective strategies for all hazards to mitigate, respond to, and recover from potential disruptions. We have a multi-pronged approach to addressing EMP threats, allowing the subsector to advance readiness for potential EMP impacts through research to quantify the threat, scientific development of mitigation strategies, and analysis of the policies needed for the future.

A recent GAO Report 16-243 from March 2016 presented recommendations to Federal agencies on methods to address EMP. DOE concurred with the report's recommendations to DOE, including that the "Secretary of Energy direct responsible officials to engage with federal partners and industry stakeholders to identify and implement key EMP research and development priorities, including opportunities for further testing and evaluation of potential EMP protection and mitigation options."

The Fixing America's Surface Transportation Act of 2015 (FAST Act, P.L. 114-94) also gives the Department impetus to enhance planning for events such as EMP. In the Act, Congress enhanced the Secretary of Energy's abilities to take emergency actions related to grid operations during a grid security emergency caused by any high impact event such as an EMP attack.

Other ongoing or planned activities related to EMP include:

- The Department is analyzing the vulnerability of the grid to an EMP event and the potential impact on reliability and delivery of electric power. The analysis will examine options such as hardening, blocking, stockpiles, and planning.

- The Department is conducting a risk analysis for "extreme events" including EMP electricity industry planning.

- The Department is working jointly with the Department of Homeland Security through Los Alamos National Laboratory and DHS's National Infrastructure Simulation and Analysis Center to begin developing methods to analyze the impact and consequences of different sources of EMP and GMD events on U.S. electric power infrastructure and to use those methods to determine events of concern.

DOE is committed to helping forge the grid of the future that will be more resilient to all hazards, including EMP. Continued progress in grid modernization is vital to helping us protect the grid from EMP.

PARTNERSHIPS FOR RESPONSE

Our partnerships with private and public stakeholders also focus on quickly identifying threats, developing in-depth strategies to mitigate them and rapidly responding to any disruptions. With 90 percent of the Nation's power infrastructure privately held, coordinating and aligning efforts between the government and the private sector is the only viable path to success.

Under Presidential Policy Directive-21: Critical Infrastructure Security and Resilience and the FAST Act, DOE is the Sector-Specific Agency (SSA) for electrical infrastructure. The SSA plays the pivotal role of ensuring unity of effort and message across government partners, including the Department of Homeland Security, the Department of Defense, and DOE offices.

As the Energy SSA we also serve as the day-to-day Federal interface for the prioritization and coordination of activities to strengthen the security and resilience of critical infrastructure in the electricity subsector. This involves building, maintaining, and advancing our relationships and collaborative efforts with the energy sector. We have invested in public/private partnership programs and initiatives that involve sharing real time information, assessing vulnerabilities, clarifying responsibilities, and engaging in training and exercises.

In addition, the Department of Energy serves as the lead agency for Emergency Support Function 12 (ESF-12) under the National Response Framework. As the lead for ESF-12, the DOE is responsible for facilitating the restoration of damaged energy infrastructure. During a response operation, the Department works with industry and Federal/state/local partners to:

- Assess disaster impacts on local and regional energy infrastructure;
- Coordinate asset delivery to repair damaged infrastructure;
- Monitor and report on restoration efforts; and
- Provide regular situational awareness updates to key decision makers in the Administration and our interagency partners.

To achieve these operational priorities, the Department deploys responders who work directly with the affected utilities and local officials on the ground during a disaster. The responders provide expertise on a variety of energy issues, and have direct access to our subject matter experts in Washington, DC who work with our interagency partners to coordinate the appropriate waivers, when needed, to further speed restoration efforts. In extreme cases, the Department can use its legal authorities under the Federal Power Act, Defense Production Act, and other statutes to assist in response and recovery operations.

The national electricity infrastructure spans 19,000 power plants, 450,000 miles of transmission lines, 55,000 substations, and 6 million miles of distribution lines. The grid is truly a national system of complex systems, where small variations in power output or quality can be felt almost instantly several states away. That said, every piece of that infrastructure is local.

Threats ranging from a fallen tree to a dedicated hacker from overseas can threaten the broader transmission system and the distribution system. When the power goes out, the local utility is the first responder. Should any threat or emergency exceed local public or private resources or require a full-blown national response, a utility CEO, a representative trade association member of the Electricity Subsector Coordinating Council (ESCC), the Electricity Information Sharing and Analysis Center (E-ISAC), or the Federal Government can request what is called a Crisis State Activity. Crisis State Activities are coordinated through the ESCC because, as with

preparedness, we respond through partnerships. The ESCC is a group of leaders from across the electricity subsector that meet regularly with government to coordinate and share information. Together, we work toward collective actions to address the threat or risk.

Congress enacted several important new energy security measures in the FAST Act. The Secretary of Energy was provided a new authority, upon declaration of a Grid Security Emergency by the President, to issue emergency orders to protect or restore critical electric infrastructure or defense critical electric infrastructure. This authority allows DOE to respond as needed to the threat of cyber and physical attacks on the grid. DOE is developing a proposed rule of procedure regarding this new authority.

The FAST Act codifies DOE's role as the lead SSA for energy sector cyber incident coordination. These actions provide a central point of contact for the energy sector and can expedite recovery from cyber and physical incidents.

The FAST Act protections afforded to critical electric infrastructure information provide essential information-sharing tools to enhance the Federal Government's situational awareness while assuring the private sector that sensitive information on vulnerabilities will be safeguarded. DOE looks forward to consulting on the forthcoming Federal Energy Regulatory Commission (FERC) critical electric infrastructure information ruling.

The FAST Act will also enable a more robust response for energy incidents, and DOE is on track to implement the energy security provisions.

PARTNERSHIPS FOR INNOVATION

Innovation and preparedness are vital to grid resilience. In January 2016, the DOE built upon its Grid Modernization Initiative – an ongoing effort that reflects the Obama Administration's commitment to improving the resiliency, reliability, and security of the Nation's electricity delivery system – by releasing a comprehensive new Grid Modernization Multi-Year Program Plan (MYPP). The MYPP, developed in close collaboration with a wide range of key external partners, lays out a blueprint for DOE's research, development, and demonstration agenda to enable a modernized grid, building on concepts and recommendations from the first installment of the Quadrennial Energy Review (QER) and Quadrennial Technology Review (QTR).

For example, large power transformers are critical to grid resilience, and are ripe for innovation. These important grid assets can weigh hundreds of tons, are expensive, and are typically custom made with procurement lead times of a year or more. A significant number of damaged transformers from any type of hazard could result in a long-term impact on the overall resilience of the grid. The QER recognized the risks associated with the loss of large power transformers. The QER recommended that DOE work with other Federal agencies, states, and industry on an initiative to mitigate these risks. Approaches envisioned in the QER include the development of one or more strategic transformer reserves through a staged process, beginning with an assessment of technical specifications and whether new Federal regulatory authorities or cost-share are necessary and appropriate.

The Transformer Resilience and Advanced Components (TRAC) program includes a number of R&D activities to improve the resilience of transformers. Replacing aging grid assets with outdated technology leads to infrastructure lock-in that increases the total cost of grid

modernization. The typical lead time between a large power transformer order and delivery ranges from five to 12 months for domestic producers and six to 16 months for producers outside the United States. The President's FY 2017 budget request of $15 million for TRAC will help develop cost-effective, next generation components that are inherently more resilient.

The FAST Act (Sec. 61004) also addressed this issue and requires DOE in consultation with FERC, the ESCC, Energy Reliability Organization (ERO), and owners and operators of critical electric infrastructure to submit a plan to Congress evaluating the feasibility of establishing a Strategic Transformer Reserve for the storage, in strategically-located facilities, of spare large power transformers in sufficient numbers to temporarily replace critically damaged large power transformers. The plan is to include an analysis of the degree to which electricity subsector initiatives including utility ownership, sharing agreements, etc., satisfy needs and funding options including fees on owners and operators and public private cost share with industry. In January, DOE-OE awarded the analysis project to a team led by the Oak Ridge National Laboratory. The team includes researchers from the University of Tennessee-Knoxville, Sandia National Laboratories, the Electric Power Research Institute, and Dominion Virginia Power.

Secretary Moniz also announced last January an award of up to $220 million over three years, subject to congressional appropriations, to DOE's National Laboratories and partners to support critical research and development in advanced storage systems, clean energy integration, standards and test procedures, and a number of other key grid modernization areas. This Grid Modernization Laboratory Consortium effort recognizes regional differences and will strengthen regional strategies while defining a diverse and balanced national strategy. In addition to projects that address the needs of incorporating individual grid technologies like solar or energy storage, DOE is also developing crosscutting projects that have an impact across multiple technologies. As Secretary Moniz said at the announcement, "Modernizing the U.S. electrical grid is essential to reducing carbon emissions, creating safeguards against attacks on our infrastructure, and keeping the lights on."

Energy storage is a key technology for whole-grid resilience. Energy storage fundamentally changes the relationship between when energy is produced and when it is consumed. The President's FY 2017 budget request supports OE's work on materials research, device development, demonstrations, and grid analysis to help transition selected energy storage technologies from R&D to industrially relevant scales with improved safety, industry acceptance, and reduced cost. Improved energy storage technologies will enable the stability, resiliency, and reliability of the future electric utility grid, as well as increased deployment of variable renewable energy resources.

We have been proactive in advancing technologies to modernize and make our grids smarter and more adaptive to the challenges posed by threats to the grid. For example, DOE-OE has made key investments in the area of synchrophasor technology, which reduces grid vulnerabilities by providing timely and accurate power outage information and better self-healing capabilities, and has also invested in microgrids, which keep local communities up and running during regional and other outages and help supply power to affected areas.

Many of these projects are working in local jurisdictions throughout the United States. Supporting the research, development, and deployment of next-generation technologies enhances the grid's ability to recover quickly from disruptions.

CONCLUSION

Threats continue to evolve, and DOE is working diligently to stay ahead of the curve. The solution is an ecosystem of resilience that works in partnership with local, state, and industry stakeholders to help provide the methods, strategies, and tools needed to help protect local communities through increased resilience and flexibility. To accomplish this, we must accelerate information sharing to inform better local investment decisions, encourage innovation and the use of best practices to help raise the energy sector's security maturity, and strengthen local incident response and recovery capabilities, especially through participation in training programs and disaster and threat exercises.

Building an ecosystem of resilience is—by definition— a shared endeavor, and keeping a focus on local communities remains an imperative. Because DOE has spent decades building—and continues to build—local partnerships and investing in technologies to enhance resilience, the grid is better able to withstand and recover quickly from disasters and attacks.

---

[i] American Public Power Association (APPA), " U.S. Electric Utility Industry Statistics" <http://www.publicpower.org/files/PDFs/USElectricUtilityIndustryStatistics.pdf>