Statement Of
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Before The
United States House of Representatives
Appropriations Subcommittee on
Energy and Water Development
March 25, 2014

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's Fiscal Year (FY) 2015 budget for the Department of Energy's (DOE) Office of Electricity Delivery and Energy Reliability (OE).

It is the mission of this office to lead national efforts to modernize the electricity delivery system, enhance the security and reliability of America's energy infrastructure and facilitate recovery from disruptions to the energy supply. A modern electricity grid is vital to the Nation's security and economy, providing the foundation for critical services that Americans rely on every day. Electricity is woven into nearly every modern activity. At any given moment, millions of people expect to be able to flip a switch, turn on the water, get money out of an ATM, pump gas into their cars, or do any of the countless activities that make up modern daily life – all without having to think about whether or not they have electricity.

Modernizing the Nation's aging energy infrastructure is a complex challenge. OE's FY 2015 budget request makes critical investments that support the Administration's all-of-the-above energy strategy. In addition to investing in applied research and development to develop advanced tools, analysis, and techniques, OE also helps states in their efforts to improve their policies and state laws to enhance the capabilities of the system in the following ways:

- *Reliability* – high-quality, consistent power flow;
- *Flexibility* – the ability to adapt to changing supply and demand patterns;
- *Efficiency* – delivery of electricity with reduced losses and greater asset utilization rates;
- *Cost Effectiveness* – optimization of technologies and systems to minimize cost; and
- *Resiliency* – the ability to withstand and recover more quickly from disruptions, and maintain critical functions.

Improvements to all five of these operational capabilities, together with end-to-end security from both manmade and natural threats, are necessary for a modern and reliable grid. To achieve energy security for the Nation, we must have a secure grid. Recognizing that security for energy delivery systems is most effective when it is built into the system from the very beginning, OE has worked closely with the electricity sector for over a decade to improve protection and resiliency of the grid.

With the growing dependence of our economy on electricity and the economic and personal losses from electricity outages due to severe weather becoming greater each year, building in resiliency has assumed an even greater degree of urgency. Power outages resulting from extreme

weather events disrupt lives and cost the economy billions of dollars. Eight of the top 10 hurricanes in terms of damage and economic loss have occurred over the last decade. In 2012, there were 11 different weather disaster events each with estimated losses of $1 billion or more across the U.S. The impact of events such as Superstorm Sandy, the vulnerabilities of our communities, and the critical importance of coordinated preparation, response and recovery become increasingly clear.

Preparing the Nation for the impacts of climate change is a top priority for this Administration. The President's Climate Action Plan offers a strategy for steady, responsible actions, including building stronger and safer communities and infrastructure that can adapt to climate change and recover from severe weather events more quickly. A resilient energy infrastructure that can recover quickly from a severe weather event is critical for climate adaptation.

As you can see in our FY 2015 budget request, we have a notable increase to expand the Operational Energy and Resilience program that will include the construction of the Energy Resilience and Operations Center. Being able to respond quickly and effectively to situations such as this winter's storms and the propane and heating fuel shortages that affected 34 states is critical.

OE's budget request for FY 2015 further broadens our capabilities to protect against and mitigate cyber threats to the energy infrastructure. Cybersecurity for the energy sector has emerged as one of the Nation's most serious grid modernization and infrastructure protection issues. Intelligence reports indicate that cyber adversaries are becoming increasingly targeted, sophisticated, and better financed. Cybersecurity practices must address not only the threats and vulnerabilities of traditional information systems, but also issues unique to electric grid technology. Adapting to the changing cyber landscape is critical as the threat of attack grows.

Climate change and an evolving cyber threat are not the only kinds of change that are redefining the energy landscape. The electric grid itself and the technologies, tools and techniques associated with the system are also rapidly changing to accommodate change in the world – from growing deployments of renewable and distributed energy resources to the greater adoption of advanced communications and control technologies that can better respond to system disturbances, reduce systems losses, and help customers better manage their electricity use. At the same time, we are becoming even more dependent on electricity as our society becomes more connected and digitized.

The American Recovery and Reinvestment Act of 2009 invested $4.5 billion to begin the large task of modernizing America's aging electricity infrastructure. This was an important step in accelerating the Nation's transition to a smarter, stronger, and more efficient and reliable electric system. The Recovery Act funding has enabled the deployment of millions of smart grid technologies including phasor measurement units, smart relays, automated feeder switches, smart meters, and distribution management systems. These technologies are now being used across the country to improve the grid's ability to absorb disruptions while maintaining critical functions and quickly return to normal operations. They have also created and shaped new markets and opportunities: utilities use the data from smart meters to better target system maintenance, and entrepreneurs are building businesses based on using these data to better serve customers' needs.

OE's FY 2015 budget request invests in activities that build on the successes of the Recovery Act-funded technology deployments, help communities become more resilient to extreme weather events, and help anticipate the growing challenges and changing dynamics in which the

energy system will operate. The Smart Grid program will also invest in the development of the next generation of high performance smart grid – a concept that we refer to as "Smart Grid 2.0".

To further support our resiliency work, we are developing a capability to predict the impact of energy system disruptions, thus improving our ability to prepare for and respond to extreme weather and other threats to the system.

OE's FY 2015 budget request prioritizes activities that increase the resiliency, reliability and security of the Nation's power grid by taking a systems-level approach to grid modernization, developing the computational capabilities to improve system planning and operations, and emphasizing the security of both new technologies and legacy energy systems.

HIGHLIGHTS OF THE FY 2015 REQUEST

At $180 million, the FY 2015 budget request reflects a 22 percent increase from the FY 2014 appropriation, demonstrating the priority the Department places on OE's role in strengthening the energy infrastructure and modernizing the grid. It emphasizes investments that increase the resiliency of the electric grid, including managing risks, increasing system flexibility and robustness, enhancing visualization and situational awareness, deploying advanced control capabilities, and microgrids. These priorities are reflected in the following highlights.

Developing an Enhanced Capability for Emergency Response and Restoration: The Infrastructure Security and Energy Restoration (ISER) program has the most significant increase in OE's budget request, with a request of $22.6 million, a $14.6 million increase over FY 2014. ISER helps secure the U.S. energy infrastructure against all types of hazards – both natural and man-made – and responds to and reduces the impact of disruptive events, assisting in quickly restoring energy when events occur. The increasing complexity and interdependency of national energy infrastructure – in conjunction with natural disasters, threats from aging infrastructure, human error, potential high-impact low-frequency threats such as geomagnetic disturbance storms or a catastrophic earthquake, and deliberate attacks – represent significant challenges for the energy sector. In carrying out the Department's role as the Sector-Specific Agency for Energy, OE is responsible for collaborating with Federal, state and local governments and the private sector, facilitating the assessment of the sector and encouraging risk management strategies to protect against and mitigate impacts on the energy sector.

Reflecting the sharp increase in the frequency and intensity of extreme weather events such as Superstorm Sandy and from man-made events such as the recent spate of physical attacks on the grid, the FY 2015 request continues the commitment to develop an enhanced capability through the Operational Energy and Resilience (OER) initiative. Begun in FY 2014, the OER will allow the Department to better protect against and mitigate these threats and hazards, with the ultimate goal of quicker recovery by industry and the communities they serve. The FY 2015 request funds for the construction of the Energy Resilience and Operations Center (E-ROC) where OE will monitor, receive and analyze real-time threat and energy sector status, and disseminate information to the appropriate stakeholders. During emergencies, E-ROC will serve as the collaboration hub between the Department, other Federal Agencies, and energy sector partners. The request also provides for hiring 17 additional Federal staff, with one energy advisor within each of the 10 FEMA regions to develop regionally-based solutions and support preparedness

and response, as well as seven technical staff for E-ROC. The expansion of situational awareness tools and real-time visualization capabilities, begun in FY 2014, continues in FY 2015.

Strengthening cybersecurity in the energy infrastructure: Strengthening protection of the critical energy infrastructure against an increasingly active and sophisticated threat of cyber attack is vital to the Nation's energy and economic security. As the energy sector-specific agency, OE has the mission, the expertise, and the relationships to work with industry to mitigate the risks the electricity and oil and natural gas sectors face, and to strengthen the cybersecurity of critical energy infrastructure against current and future threats.

There are a number of challenges unique to energy system cybersecurity, including protecting legacy devices that were installed before cyber threats existed. Another challenge is that most cybersecurity solutions are developed for IT systems, which have important differences from systems that control real-time energy delivery. Cybersecurity solutions for the energy sector are imperative, and it is just as imperative that these solutions not interfere with the critical function of the energy delivery device they are meant to protect.

OE has adopted a strategic approach that is strengthening Energy Sector cybersecurity through sustained action on multiple fronts. We are accelerating innovative research and development today and over the longer term, while we are addressing the immediate need for information sharing and response capabilities. The FY 2015 budget request for the Cybersecurity for Energy Delivery Systems (CEDS) program provides $42 million to expand and accelerate our efforts to address cybersecurity challenges. Our work aligns with the *Roadmap for Energy Delivery Control Systems Cybersecurity*, a strategic framework developed in collaboration with the energy sector.

Our focus in FY 2015 falls into several areas. We will continue investing in research to develop cutting-edge cybersecurity technologies and tools, working with the energy sector, which is fundamental to our continued success in transitioning research into practice. Some examples of innovations available and in use today include technology that protects energy delivery computers from unexpected cyber activity, and cybersecurity gateways that protect communications of field devices and between control centers.

Within the CEDS program, we are also increasing our efforts to help the energy sector improve its cybersecurity posture at the organizational and process levels through expansion of tools such as the Cybersecurity Capability Maturity Model (C2M2). The C2M2, which was launched in 2012 as part of an Administration initiative led by the Energy Department and developed with the Department of Homeland Security, industry and other stakeholders, helps organizations measure and improve their cyber capabilities, informs their cybersecurity investment decisions, and encourages the adoption of best practices. The electricity sector tool has been requested by over 230 organizations including more than 100 utilities. In FY 2014, the C2M2 model was adapted and released for use by the oil and natural gas industry as well.

In FY 2015, we will increase our efforts to enable timely sharing of cyber threat information within the electric sector to enhance its ability to identify and analyze threat data and to coordinate protection of critical infrastructure. OE will continue expanding a pilot application, the Cybersecurity Risk Information Sharing Program (CRISP), to include ten additional electric subsector entities as well as five oil and gas subsector entities to the network in FY 2015.

The FY 2015 request also supports OE's leadership role to strengthen and refine the Energy Sector's cyber incident response capabilities. Through the Energy Sector-Cybersecurity Incident Management Capability effort, OE and its Federal and private sector partners are working to build effective, timely, and coordinated cyber incident management capabilities for operations, information exchange, and technology in the energy sector. OE is leveraging governmental and non-governmental resources to create a suite of deliverables toward this end, including blueprints, playbooks, and a five-year roadmap.

Strengthening reliability, resiliency, and efficiency in the electricity distribution system: This is a pivotal moment, with the distribution system facing many changes that present both opportunities and challenges. Advanced information and communication technologies are opening up opportunities for utilities to leverage huge volumes of data for improved operational efficiency and integration of all distribution system assets in ways that were never before possible. Simultaneously, falling costs of distributed energy resources, electric vehicles, and demand-side management technologies mean that utility distribution systems must accommodate increased deployment of these technologies. That, in turn, is creating greater operational complexity. Consumers also now expect more in terms of controlling and managing their energy use – yet another complication for utility operations.

Transforming the way in which electricity is distributed by developing new tools, technologies and approaches will help improve the reliability, resiliency, and efficiency of the grid, and can help to manage electricity costs. Advanced distribution systems that use microgrids and other distribution control strategies to enhance operational response and system recovery will be crucial to next-generation electric distribution systems that support a 21st century economy and society.

The FY 2015 request of $24.4 million for our *Smart Grid* program expands our investment in transforming electric distribution systems through the development of new tools, innovative grid technologies, and advanced concepts.

One area of priority for FY 2015 is microgrids which are localized grids that can disconnect from the traditional grid to operate autonomously and help mitigate grid disturbances to strengthen grid resilience. We saw the important role microgrids can play in resiliency during Superstorm Sandy, when hospital, university, and building facilities equipped with microgrids were able to provide essential power to critical loads during week-long grid outages. Our work with microgrids in FY 2015 will broaden to include increasing partnerships with more states in microgrid design and implementation, transferring a prototype Microgrid Design Toolset for use by community energy assurance planners, advancing the challenge competition to meet a higher performance standard, developing direct current (DC) microgrids for climate-neutral buildings, and continuing work by our national laboratories to develop microgrids for fast restoration and recovery during grid outages.

Another priority is to invest in supporting the move towards the next generation of higher performance smart grid which we refer to as "Smart Grid 2.0". Capitalizing on the recent surge in advanced technology deployments and the growth of "big data" will result in being able to leverage change such that the new processes and structures needed to operate the grid in the future do not create obstacles but rather promote the creation of smarter, cleaner, more resilient distribution systems. OE will focus on the development of new, more advanced distribution control systems that integrate multiple applications common within the utility environment and

address such conditions as weather, power flow, asset conditions, and available grid and customer resources. Addressing and accounting for a wider range of interrelated dynamic conditions will allow for localized supply and demand balancing to increase the stability of the entire system.

Expanding analytical and predictive capabilities of energy systems impacts: The FY 2015 request increases investment in the Energy Systems Predictive Capability (ESPC) program to $7 million. This is a $3 million increase from FY 2014, which was the program's first year as a distinct program in OE's budget. ESPC is building a core capability for energy system analysis that supports DOE decision makers and provides key energy system risk information to Federal and state partners, and the energy system owners and operators. The capabilities include criticality and risk analysis, interdependency analysis, and support for emergency events. A predictive capability to better understand potential impacts to energy infrastructure will help in near- and long-term planning and response, motivate infrastructure improvements to improve resilience and security, and reduce vulnerabilities. In FY 2015, ESPC activities build on initial investments made in FY 2014 and could include an assessment of winter weather risks to transportation and heating fuels, electricity supplies and energy markets. Criticality analysis may be extended to include assessing supply chain vulnerabilities for key electricity transmission system components. Together, these predictive products will feed into a capability to provide an "on-demand" impact assessment capability when events do occur.

The request continues to support important work in research and development, modeling and analysis, and support to states and regions on grid and energy infrastructure challenges. Other elements in the FY 2015 budget are discussed below.

TRANSMISSION RELIABILITY

The Transmission Reliability program, funded in FY 2015 at $18 million, develops advanced technologies that enhance the reliability of the electricity transmission infrastructure, with a focus on advanced monitoring and control applications that give transmission system operators real-time information to improve system operations, reliability and efficiency. Time synchronized measurements from advanced sensors installed on the transmission system, known as synchrophasors, can monitor the flow of electricity with much greater precision and provide unprecedented insight and information on system health. These data provide operators with wide area visibility and situational awareness, allowing them to foresee and respond to potentially destabilizing events, thus improving reliability, reducing the number and extent of blackouts, and speeding power restoration. In FY 2015, OE will accelerate development of synchrophasor-based, cyber-protected software applications to become operational, real time systems installed in grid operator control rooms. These applications will monitor and control the grid with advanced analysis, visualization, and decision-support tools, maximizing the value of synchrophasor data now available to grid operators to improve reliability and operations.

ADVANCED MODELING GRID RESEARCH

Turning real-time data into actionable information requires an understanding of not only "what is happening" but also "what could happen." The $11 million requested in FY 2015 for the Advanced Modeling Grid Research program advances and applies computational and mathematical scientific methods and models needed to transform the tools that underpin electric

system operations and planning. Research will focus on the modeling, computational and mathematical advancements that are the foundation for the Next-Generation Energy Management System, used by operators to monitor and control the electric system, improving performance while managing the increased uncertainties of variable renewable resources and customer demands.

Models can provide insight on implications for reliability and help identify the most effective action amidst a myriad of options. Accurate and validated models are a critical enabler of system transformation by applying real-time situational awareness and measurement-based, fast control. Likewise, when a reliability event does occur, model-based decision support tools are essential to identify opportunities for operational flexibility and help guide operators along a path to quick recovery.

ENERGY STORAGE

The Energy Storage program addresses critical challenges facing the development and deployment of grid energy storage technologies, which can enhance system reliability and resilience, enabling both greater adoption of renewable energy resources and more effective utilization of the existing electric system. The research and development activities focus on improving the economic competitiveness and technical performance of a suite of emerging energy storage technologies. Testing and field demonstration efforts are collaborative with manufacturers, states, and utilities to establish experience and confidence in safety, performance and reliability of storage technologies. Analysis, including the development of analytic tools, serves to inform stakeholders and guide research and development investments. Together these efforts will accelerate implementation of emerging storage technologies to advance the modernization of the electrical utility grid. The request of $19 million in FY 2015 is focused on addressing challenges related to cost reduction, system engineering, performance improvement and validation, value recognition, and deployment confidence and acceptance, as well as an increased emphasis on the safety and reliability of energy storage systems. Advancements in these areas will be vital in the progress towards commercially sustainable deployment of energy storage solutions to enable more clean energy solutions and enhance the reliability and resiliency of the grid.

NATIONAL ELECTRICITY DELIVERY

Developing the grid of the future requires not only advancements in grid technologies and robust analytical capabilities, it also needs a strong portfolio that can help plan for and address new challenges and opportunities. Challenges include a changing electric generation mix, replacement of aging infrastructure (transmission, distribution, and generation), updated communication networks, and accommodating new end-use technologies that all must be balanced against the need for cost control, physical and cyber security, improved reliability and resiliency, and flexibility to deal with market uncertainties and a changing climate. State, regional, and tribal entities may have limited in-house capabilities to consider the effects of these rapidly evolving policies and challenges. With a requested $7 million in funding for FY 2015 for the National Electricity Delivery program, OE continues to provide technical assistance to states, regions, and tribal entities to develop, refine, and improve their programs, policies, and laws related to electricity in order to facilitate the development and deployment of reliable and affordable electricity infrastructure.

The FY 2015 request also supports OE's efforts to facilitate construction and operation of existing and new transmission infrastructure. These efforts include drawing attention to areas of the country that need to address transmission congestion through a triennial congestion study; and permitting of new trans-border transmission lines with Canada or Mexico.

OE also coordinates permitting of transmission infrastructure pursuant to section 216(h) of the Federal Power Act, which requires DOE to coordinate Federal permitting for new transmission projects involving Federal lands. The FY 2015 request supports the Department's efforts in implementing an Integrated, Interagency Pre-Application (IIP) process for transmission projects requiring multiple Federal authorizations as required by a June 7, 2013 Presidential Memorandum and in support of section 216(h).

PROGRAM DIRECTION

The FY 2015 budget request includes $29 million for Program Direction, which supports Federal staff that provides executive management, programmatic oversight, and critical technical and administrative support necessary for the effective implementation of the OE program. The request funds 112 Full Time Equivalents (FTEs) in FY 2015, based in Headquarters and at the National Energy Technology Laboratory in West Virginia.

CONCLUSION

OE's FY 2015 budget request of $180 million will maintain steady, sustained progress towards modernization of the Nation's electricity system. OE's strategy supports and is aligned with the President's "all of the above" strategy, which calls for developing a balanced portfolio of America's energy resources, giving consumers more options to save money and reduce energy use, and promoting the creation of innovative technologies to move the Nation closer to a secure and independent energy future. This vision – with an eye on both the present and the future – is crucial, as more changes that are rapidly redefining the U.S. energy landscape and the Nation's power grid continue to emerge.

Collaboration and seamless integration of efforts are critical. OE not only works collaboratively across its own organization to develop strategic solutions needed to address the challenges of modernizing the grid; OE also works closely with other Department of Energy offices, including through the Department's Grid Tech Team, which evaluates critical technological and institutional needs facing the electric power system. Through this mechanism, OE works to ensure its investments in the grid infrastructure activities are leveraged and coordinated with other Department of Energy offices. OE is also supporting the Department as it examines the challenges associated with the transmission, storage and distribution of electricity through the Quadrennial Energy Review. We also work closely with individuals and organizations across the Nation – from industry, academia, and the Department's national labs to our partners at the local, State and Federal levels.

We are living in a time that demands both steadiness and adaptation; reliability and flexibility; and focus as well as a broader perspective that both considers the urgent needs of the present and anticipates the future. Our FY 2015 budget request invests in activities that will allow us to

address these ongoing challenges and continue moving the Nation towards a more resilient and secure energy future.

This concludes my statement, Mr. Chairman. I look forward to answering any questions that you and your colleagues may have.