Statement of
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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) 2016 budget for the Department of Energy's Office of Electricity Delivery and Energy Reliability.

At the end of 2013, policymakers came together on a bipartisan basis to partially reverse sequestration and to pay for higher discretionary funding levels with long-term reforms. We have seen the positive consequences of that bipartisan agreement for our ability to invest in areas ranging from research and manufacturing to strengthening our military. We have also seen the positive consequences for the economy, with an end to mindless austerity and manufactured crises contributing to the fastest job growth since the late 1990s. The President's Budget builds on this progress by reversing sequestration, paid for with a balanced mix of commonsense spending cuts and tax loophole closers, while also proposing additional deficit reduction that would put debt on a downward path as a share of the economy.

Meanwhile, the President has made clear that he will not accept a budget that reverses our progress by locking in sequestration going forward. Locking in sequestration would bring real defense and non-defense funding to the lowest levels in a decade. As the Joint Chiefs and others have outlined, that would damage our national security, ultimately resulting in a military that is too small and equipment that is too old to fully implement the defense strategy. It would also damage our economy, preventing us from making pro-growth investments in areas ranging from basic research to research, development and demonstration of advanced technologies needed to further accelerate modernization of the Nation's electric grid at the Department of Energy. As the President has stated, he will not accept a budget that severs the vital link between our national and economic security, both of which are important to the Nation's safety, international standing, and long-term prosperity.

A modern electricity grid is vital to the Nation's security, economy and modern way of life, providing the foundation for essential services that Americans rely on every day. Whether it's flipping a switch when entering a dark room, withdrawing money from an ATM, pumping gas, or doing any of the other tasks that make up modern life, Americans expect to be able to go about their daily lives without thinking about whether the power is flowing.

The Nation's power grid, however, is aging and faces a future for which it was not designed. Four critical challenges are rapidly re-defining the energy landscape:

- Changes in demand are being driven by population growth, the adoption of more energy efficient technologies, dynamic economic conditions, and broader electrification, including

possible mass-markets for electric vehicles. Consumers have adopted energy efficient end-use technologies that interact differently with the grid than traditional loads. At the same time, our dependence on electricity has increased.

- Changes are occurring in the supply mix and the location of the Nation's portfolio of generation sources. Electricity generation is shifting from relatively few large central station plants to many smaller generators. Much of the new generation depends on the sun or wind and is variable, requiring a system that can adapt to changes in supply.
- Increasing variability and uncertainty on both the supply and demand sides, driven by factors such as the integration of variable renewables and more active participation by consumers, are making managing the grid progressively more challenging.
- Challenges to the reliability and security of the electric infrastructure from more frequent and intense extreme weather events, cyber and physical attacks, and interdependencies with natural gas, liquid fuels, and water systems are growing.

In order for the electric grid to successfully meet these challenges, this essential infrastructure must be modernized.

Our mission is 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. We lead the Department's efforts to strengthen, transform, and improve our energy infrastructure so that consumers have access to reliable, secure, and clean sources of energy. The goal for the future grid is to provide a platform that delivers reliable, affordable, and clean electricity to consumers where they want it, when they want it, and how they want it.

To accomplish this vital mission, we work closely with private industry and Federal, state, local, and tribal governments on a variety of initiatives to modernize the electric grid and enhance key characteristics of the U.S. electric transmission and distribution systems, which include:

- Reliability – consistent and dependable delivery of high quality power;
- Flexibility – the ability to accommodate changing supply and demand patterns and new technologies;
- Efficiency – low losses in electricity delivery and more optimal use of system assets;
- Resiliency – the ability to withstand and quickly recover from disruptions and maintain critical function;
- Affordability – more optimal deployment of assets to meet system needs and minimize costs;
- Security – the ability to protect system assets and critical functions from all hazards; and
- Minimal environmental footprint – grid system designs that reduce total environmental impact of grid components and connected systems.

Improvements to all of these operational capabilities, together with end-to-end protection from manmade and natural threats, are necessary for a modern and reliable grid.

Our FY 2016 budget request makes critical investments that support the Administration's all-of-the-above energy 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 request is part of the Department's Grid Modernization Crosscutting Initiative, a coordinated program of activities to help set the Nation on a cost-effective path to a reliable, integrated, secure, and affordable grid system. The Initiative will build on past successes and current activities. Aspirational goals, such as reducing the economic losses of power outages by ten percent over the next ten years, will guide future activities, with appropriate metrics used to measure progress.

Much of the increase in our budget request is due to investments in three priority areas.

- Protecting the Nation's critical energy infrastructure from all hazards is a critical element of the mission of this office. Recognizing that many authorities and actions depend upon the states, the request includes $35.5 million to provide grants to state, tribal, and local governments to update energy assurance plans to address infrastructure resilience, as well as $27.5 million to provide grants to states and multi-state entities to address electricity transmission, storage, and distribution reliability. These grants, under the new State Energy Reliability and Assurance Grants program, account for about half of the increase over FY 2015.
- The $10 million Transformer Resilience and Advanced Components program will address unique challenges facing large power transformers and other critical grid components. Specifically, these investments will better characterize the risks to transformers from electromagnetic pulses, following up on a key recommendation from the Electromagnetic Pulse Commission, and support research and development into advanced high-voltage equipment.
- Cybersecurity for the energy sector is one of the Nation's most serious infrastructure protection issues, and it remains a priority in FY 2016. Our budget request further broadens our capabilities to protect against and mitigate cyber threats to the energy infrastructure. Intelligence reports indicate that cyber adversaries are becoming increasingly sophisticated and better financed. Cybersecurity practices must address not only the threats and vulnerabilities of traditional information systems, but also issues unique to the energy sector. The $6.0 million increase for the Cybersecurity for Energy Delivery Systems program includes funding to establish a virtual collaborative environment for conducting real-time advanced digital forensics cybersecurity analysis. In addition, our cybersecurity program will be a key component of the Department's Cybersecurity crosscutting initiative.

With the growing dependence of our economy on electricity and the economic and personal losses from electricity outages due to severe weather becoming greater, 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. 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 with each new severe weather event.

This budget request supports the President's Climate Action Plan which offers a strategy for steady, responsible actions to prepare the Nation for the impacts of climate change, including

building stronger and safer communities. A resilient energy infrastructure that can recover quickly from a severe weather event is critical for climate adaptation.

As we witness the transformation of our Nation's electric grid, the Office of Electricity Delivery and Energy Reliability continues to drive electric grid modernization and resiliency. The American Recovery and Reinvestment Act of 2009 invested $4.5 billion and leveraged almost $5 billion of private sector matching funds to begin modernizing America's aging energy infrastructure. The Smart Grid Investment Grant and Smart Grid Demonstration Programs were important first steps in accelerating the Nation's transition to a smarter, stronger, and more efficient and reliable electric system. The Recovery Act funding enabled the deployment of a wide range of advanced devices and technologies now being used across the country to improve the reliability and efficiency of the system, help consumers better manage their electricity use, and better recover from disruptions and return to normal operations.

Our FY 2016 budget request invests in activities that will 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 invest $14.6 million to develop an integrated operating system at the distribution level and an innovative market-based control system to better manage large numbers of distributed generators. To further support our resiliency work, we will also invest in microgrids and cost-effective solutions that will help strengthen infrastructure. In addition, we are developing a capability to estimate the risk 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 2016 budget request prioritizes activities that increase the resiliency, reliability, and security of the Nation's power grid through working closely with the energy sector and state, local, and tribal partners to take a systems-level approach to grid modernization, strengthen the distribution system, and increase protection of the energy infrastructure.

HIGHLIGHTS OF THE FY 2016 REQUEST

At $270.1 million, the FY 2016 budget request reflects a $123.1 million increase over the FY 2015 enacted appropriation, demonstrating the priority that the Administration places on OE's role in strengthening the energy infrastructure and modernizing the grid. This budget request emphasizes investments that increase the reliability and resiliency of the electric grid, including managing risk, strengthening the distribution system, and providing tools that will help states and local partners improve the resiliency of their communities. These priorities are reflected in the following highlights.

Strengthening Cybersecurity of 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. 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 developed for IT systems are not appropriate for the control systems utilized in the energy sector, which must assure real-time delivery of energy. Innovative solutions designed to meet the unique requirements of high-reliability energy delivery systems

are urgently needed to ensure the transformation of the Nation's power grid to meet future needs for economic growth. At the same time, it is crucial that these solutions not interfere with the critical function of the energy delivery devices they are meant to protect. Effective solutions must be based on industry best practices, sound risk management processes, and improved situational awareness.

Recognizing that security for energy delivery systems is most effective when it is built into the system from the very beginning, we have worked closely with the electricity sector for over a decade to improve protection and resiliency of the grid. Since 2010, we have invested more than $150 million in cybersecurity research, development, and demonstration projects led by industry, universities, and national labs. As a result of these investments, 20 new technologies are now being used to further advance the resilience of the Nation's energy delivery systems. For example, in January, the Oak Ridge National Laboratory announced the licensing of its Hyperion software, which helps detect software that has been maliciously altered.

The Office of Electricity Delivery and Energy Reliability is working to accelerate innovative research and development over the longer term, while also addressing the immediate need for information sharing and response capabilities. All of our cybersecurity activities align with the *Roadmap for Energy Delivery Control Systems Cybersecurity* vision of having resilient energy delivery systems that are designed, installed, operated, and maintained to survive a cyber incident while sustaining critical functions.

The FY 2016 budget request for the Cybersecurity for Energy Delivery Systems (CEDS) program provides $52.0 million to expand and accelerate our efforts to enhance the reliability and resiliency of the Nation's energy infrastructure by reducing the risk of energy disruptions due to cyber attacks. Our focus in FY 2016 falls into four areas:

- Accelerate information-sharing to enhance situational awareness in the electricity and oil and natural gas sectors;
- Expand implementation of the Cybersecurity Capability Maturity Models and Risk Management Process for the electricity and the oil and natural gas sectors;
- Continue investing in research to develop cutting-edge cybersecurity technologies and tools; and
- Exercise and refine the energy sector's cyber incident response capabilities.

Enhancing the Resilience of Large Power Transformers

To ensure a reliable and resilient power system, grid components must be designed and built to withstand the impact of lightning strikes, extreme weather events, space weather events and other natural disasters, electrical disturbances, accidents, equipment failures, and attacks. Building on earlier work funded by OE's Infrastructure Security and Energy Restoration program to monitor and analyze the impacts of ground-induced currents on the electric infrastructure, the new Transformer Resilience and Advanced Components program will advance our understanding of risks associated with geomagnetic disturbances and electromagnetic pulses and their impact on large power transformers and other critical components.

Strengthening the Reliability, Resiliency, and Efficiency of the Electricity Distribution System

Transforming the way 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. The distribution system is where the factors driving change in electricity converge, presenting both opportunities and challenges. Advanced information and communication technologies are creating opportunities for utilities to leverage huge volumes of data for improved operational efficiency and integration of system assets in new ways. At the same time, 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. Consumers also expect more in terms of being able to control and manage their energy usage.

This budget request builds upon these trends by including funds for the development of an Advanced Distribution Management System that enables the integration of a full suite of distribution management applications. This development will fundamentally change the way that a utility operates, allowing disparate, manual processes to be integrated into real-time and near-real-time data and automated processes. Based on specifications and requirements to be developed jointly with utilities, this integrated platform will allow information to flow among applications across the utility enterprise, enabling enhanced visibility and controllability of system assets. The new capabilities will provide greater visibility and control required to integrate large amounts of renewables in a safe and effective manner and will allow utilities to use assets more efficiently during restorations and enable more choices for consumers while also maintaining affordable electricity rates.

Smart Grid investments in FY 2016 will also fund a new control paradigm that allows utilities to balance supply and demand at all levels of the grid by actively seeking participation of customer-owned and third-party assets in grid services through competitive market forces of supply and demand. Also known as transactive control, the combination of market-based control signals with electric distribution operations will create value to both consumers and utilities by allowing customers to fully participate in grid operations while also significantly increasing the system flexibility needed for integrating renewables and moving closer to a clean energy future.

Working with the States to Institutionalize Best Practices and Provide Tools Needed to Help Communities Become More Resilient and Adaptive

States have significant jurisdiction over the electricity system and are test beds for the transformation of the electric power system. In FY 2016, a new Grants for Electricity Transmission, Storage, and Distribution Reliability program will help state, local, regional, and tribal entities advance and integrate electricity reliability, efficiency, renewable energy, environmental protection and climate resiliency planning and actions.

The Federal Government can play a vital role in helping states and local governments by building and maintaining preparedness and assurance capabilities. Building on our successes and lessons learned with previous work in energy assurance across the states and U.S. territories, the new Grants for Energy Assurance program will provide grants for state, local, and tribal governments to update their energy assurance plans; conduct testing, training, and exercises; and ensure that plans and assessments are shared. The assurance grants will improve awardee

capacities to identify the potential for energy disruptions, quantify the impacts of those disruptions, and develop comprehensive plans for responding to the disruptions and to mitigate the threat of future disruptions. The goal of the program is to achieve a robust, secure, and reliable energy infrastructure that is better able to withstand catastrophic events, restore services rapidly in the event of any disaster, and minimize future vulnerabilities.

DETAILED ELEMENTS OF THE FY 2016 REQUEST

Our budget request supports investments in three key priority areas.

- We will increase the resiliency and security of the Nation's energy infrastructure with activities such as our work on cybersecurity and the preparedness exercises we conduct with our partners in government and industry.
- We will develop tools and technologies that measure, analyze, and control the grid of the future.
- We will establish the State Energy Reliability and Assurance Grants program to strengthen our partnerships with states, localities, regions, and tribes and help give them the tools they need for grid transformation.

GRID SECURITY AND RESILIENCE

Cybersecurity for Energy Delivery Systems

Within CEDS, continued support of cybersecurity research and development to ensure a sustainable pipeline of innovation remains a priority in FY 2016. At the same time, we are 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). C2M2, launched in 2012 as part of an Administration initiative led by the Department of Energy and developed with the Department of Homeland Security, industry, and other stakeholders, helps organizations measure and improve their cybersecurity capabilities, informs their cybersecurity investment decisions, and encourages the adoption of best practices. The C2M2 model has helped organizations in the electricity and, since FY 2014, the oil and natural gas sectors to evaluate, prioritize, and improve their cybersecurity capabilities using a common set of industry practices.

CEDS supports the Cybersecurity Risk Information Sharing Program (CRISP), which started as a small OE-funded pilot and transitioned in FY 2014 to a private-sector program primarily managed by the Electricity Sector Information Sharing and Analysis Center within the North American Electric Reliability Corporation. CRISP facilitates the timely bi-directional sharing of classified and unclassified threat information and develops and deploys situational awareness tools to enhance the sector's ability to identify and mitigate threats and coordinate the protection of critical infrastructure. In FY 2016, we will continue to perform classified analytics and reporting in CRISP and will issue a competitive solicitation to identify and fund commercially available technologies and services that can be incorporated into CRISP via operational pilots designed to enhance all aspects of the program.

The ability to detect and mitigate the malicious activity is critical. In FY 2016, CEDS will conduct a competitive solicitation to establish a virtual collaborative environment for conducting real-time advanced digital forensics analysis for the energy sector. This virtual environment will allow analysts to safely inspect malware, vulnerabilities, and advanced threats across multiple stages and different vectors and test mitigations. This environment will be implemented over a two-year timeframe, after which it will transition to the private sector where it will become self-sustaining.

Transformer Resilience and Advanced Components

The Transformer Resilience and Advanced Components (TRAC) program grows out of activities formerly conducted in the Infrastructure Security and Energy Restoration (ISER) program. TRAC addresses the unique challenges facing large power transformers and other critical components of the electric grid.

Large power transformers are one of the most critical components of the grid. A single damaged large power transformer could disrupt power to a half million homes. Moreover, these large custom machines can take up to two years to manufacture and deliver. Geomagnetic disturbances (GMD), electromagnetic pulses (EMP), and other physical stressors can degrade or damage these vital assets. The risks, however, are not well understood.

The $10 million request for TRAC will expand upon previous work to monitor and analyze impacts of ground-induced currents on the electric infrastructure. This will include modeling and testing of transformers to evaluate vulnerabilities and alternative approaches to mitigate the risks from ground-induced currents. The request will also support research and development of power electronics systems that provide new capabilities to mitigate risks and provide advanced capabilities demanded by the future grid.

Infrastructure Security and Energy Restoration

As the Sector-Specific Agency for Energy, under the Department of Homeland Security's National Infrastructure Protection Plan, we work closely with Federal agencies, state and local governments, and industry to protect against and mitigate threats on the energy infrastructure caused by natural disasters, deliberate attacks, or even human error. DOE is also the lead agency for Emergency Support Function 12—also known as ESF-12—for Energy, when activated by the Federal Emergency Management Agency under the Stafford Disaster Relief and Emergency Assistance Act.

In the event of an emergency, we provide situational awareness, coordinate the response among Federal, state, and local agencies, and help facilitate the restoration of energy systems. When activated by FEMA, our team of specialized energy-infrastructure responders can be quickly activated and deployed to the event's location. These ESF-12 responders provide situational assessments, facilitate clear and consistent communication with other deployed responders, provide subject matter expertise to help with restoration, and identify where the Federal government can engage in restoration efforts. ISER was activated for five events during the 2014 storm season and deployed 33 field responders across these activations.

Our tactical analysis and situational awareness efforts inform the public, senior government officials, and Congress on energy infrastructure status and provide leadership and technical

guidance on issues impacting the energy sector. These system assurance efforts minimize adverse impacts to electricity, oil, and natural gas operations and strengthen national security through inter-agency coordination.

Ongoing emergency preparedness efforts include maintaining a proactive preparedness and readiness posture, as well as promoting information sharing and communication of best practices for hardening and resilience of energy systems.

The $14.0 million request for ISER will develop advanced mitigation solutions for hardening energy infrastructure against all hazards and increase the breadth and number of energy emergency preparedness exercises. Processes and procedures must be stressed and proven through testing, training, and exercises across all levels of government and industry in order to ensure planning and coordination practices are effective. The request also supports the DOE Response and Operations Center for an operational environment with the technology, methods, and tools to enable analysts to time, monitor, simulate, and track energy disruptions in real time.

TECHNOLOGY INNOVATION

Smart Grid Research and Development

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 smart grid technologies will be crucial to next-generation electric distribution systems. I am proud to mention that a microgrid design for NJ TransitGrid, developed through a technology transfer partnership with the State of New Jersey and Sandia National Laboratory in the aftermath of Hurricane Sandy, is now being built under a competitive grant by the Federal Transit Administration.

The $30.0 million request for the Smart Grid program expands our investment in transforming electric distribution systems through the development of new tools, innovative grid technologies, and advanced concepts. The FY 2016 request includes a new investment to develop an Advanced Distribution Management System (ADMS). This will be an open source integrated software platform supporting a full suite of distribution management applications, such as voltage and frequency regulation; fault location, isolation, and service restoration; dispatching assets; and routing service crews. This platform, based on specifications developed jointly with utilities, will allow information flow among applications across the entire utility enterprise, enabling enhanced visibility and controllability of system assets. We will also explore new applications that can leverage the increased types and volume of available system data to enhance observability and controllability needed to integrate large amounts of distributed generation (e.g., from renewables) in a safe and effective manner, enable greater consumer power choices, and maintain affordable electricity rates.

The Smart Grid program will also explore market-based controls in FY 2016. Market-based controls create value for both utilities and customers using competitive market forces of supply and demand. Utilities would be better able to balance supply and demand at all levels of the grid while also allowing consumers to actively participate in grid operations. Consumers would be able to determine their flexibility on power usage based on the cost of power—for instance, during hours when power is cheaper they may want their HVAC to pre-heat or cool their house

and at other times to restrict HVAC usage, or, if they have rooftop solar power and storage batteries, at some price point they may choose to charge their batteries and at another to discharge power to sell back to the grid. Ultimately, an aggregate price/power flexibility curve across all customers would be available to utilities, which could then find the right price point to balance supply and demand. FY 2016 market-based control signal activities include developing simulation tools and test cases, and validating tools using test cases developed under the Recovery Act. Approaches developed by researchers and industry will be evaluated for controllability, stability, and effectiveness.

Microgrids, which are localized grids that can disconnect from the broader electric grid to operate autonomously and help mitigate grid disturbances to strengthen grid resilience, remain an important focus in FY 2016. 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. Microgrid R&D will focus on activities needed to achieve the DOE 2020 microgrid performance targets and meet resiliency objectives defined by individual communities. We plan to have a funding opportunity announcement during FY 2016 for networked microgrids.

Another priority of Smart Grid in FY 2016 is on R&D for a resilient distribution grid. The R&D program plan will be finalized in June 2015, with input from stakeholders. The program plan has a goal of achieving a twenty percent reduction in the economic impact of loss of load resulting from extreme weather events. Our planned activities in FY 2016 include implementing partnership projects with industry on cost-effective hardening measures and developing two decision analysis tools with national labs. One tool will target utilities designing a resilient electric distribution grid, and the other will target utility operators interested in optimizing their response during system restoration and recovery.

Clean Energy Transmission and Reliability

The Clean Energy Transmission and Reliability (CETR) program improves energy system planning and operations through research, development, and demonstration of measurement, modeling, and control technologies for the grid and through risk assessment of interconnected energy infrastructure systems. CETR disseminates its results to industry partners and state- and Federal-level stakeholders. The $40.0 million request for CETR supports three subprograms: Transmission Reliability, Advanced Modeling Grid Research, and Energy Systems Risk and Predictive Capability.

CETR's Transmission Reliability subprogram develops advanced monitoring applications for the grid that give transmission system operators real-time information to improve system operations, reliability, and efficiency. Prior investments by the Transmission Reliability subprogram resulted in the deployment of devices to measure the conditions of the grid and the systems to synchronize and collect these high-resolution measurements. The data from these systems 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. Past program investments have resulted in a continent-wide measurement system and improvements in the measurement devices. In FY 2016, the $18.0 million request supports developing and deploying synchrophasor-based software applications that improve reliability through real-time high-resolution measurements

and allow operators to identify and react to incipient equipment failures, physical attacks, and geomagnetic disturbance events.

Advanced Modeling Grid Research (AMGR) focuses on modeling, computational, and mathematical advancements as the foundation for energy management systems for operators to plan, monitor, and control the increasingly dynamic, uncertain, and complex electric system. AMGR's research innovations increase the electric system's operational efficiency, improve reliability and resilience, and support visibility and control across electricity transmission and distribution systems. Advanced models transform real-time data into actionable information, assessing not only "what is happening" but also "what could happen." Accurate and validated models are a critical enabler of system transformation by applying real-time situational awareness and measurement-based autonomous control. When a disruption occurs, model-based decision support tools are essential to identify opportunities for operational flexibility and help guide operators along a path to quick recovery. The FY 2016 request of $15.0 million supports a competitive solicitation to accelerate the transition of mathematics research and prototype models developed over the past several years by the program into industry-relevant applications, as well as to expand mathematics and computational research to include uncertainty quantification, model formulation and reduction, and system controls.

The Energy Systems Risk and Predictive Capability (ESRPC) subprogram develops independent and objective risk assessments of energy infrastructure systems and supply chains. Recent efforts include an energy risk and reliability assessment for Super Bowl XLIX in January 2015 and a pilot study on the effect of sea level rise on energy infrastructure in Houston, Los Angeles, Miami, and New York City. A predictive capability to better understand potential impacts to energy infrastructure will help in near- and long-term planning and response, enable improved prioritization of infrastructure improvements to improve resilience and security, and reduce vulnerabilities. The budget request of $7.0 million supports connecting and integrating research from the Transmission Reliability and AMGR subprograms into ESRPC assessments, further developing analytic tools to estimate seasonal and regional energy system risks, and expanding the sea level rise study to Boston, Mobile/Pascagoula, Norfolk, and Philadelphia.

Energy Storage

Energy storage is a necessary and vital component of the future electrical grid, providing a critical buffer between electrical generation and demand. To provide this buffer, the Energy Storage program is focused on the development, demonstration, and deployment of advanced energy storage technologies that will enhance the stability, resiliency, and reliability of the future electric grid while enabling increased deployment of variable renewable energy resources such as wind and solar power. The program is aligned with the 2013 DOE Grid Storage Strategy and focused on developing cost-competitive technologies, validating reliability and safety, establishing an equitable regulatory environment, and promoting acceptance by industry.

Our FY 2016 request of $21.0 million supports work on materials and device research, demonstrations, and cost-benefit analysis. Developing alternative battery chemistries will increase the potential to develop safer and more cost effective storage solutions. Efforts on energy storage safety, including a new quarterly Energy Storage Safety Forum for the storage community, will be expanded to improve acceptance and accelerate the deployment of storage. Energy storage reliability will be further developed with a stakeholder workshop and research to

improve operating lifetimes of energy storage systems. New co-funded efforts with state and regional entities on energy storage demonstrations to quantify storage performance and develop valuation tools for utilities and regulators under a wide variety of applications will be initiated.

Advances in all these areas will be vital in the progress towards commercially sustainable deployment of energy storage solutions to enable a more stable, resilient, and reliable electrical grid with increased deployment of variable renewable energy resources.

INSTITUTIONAL SUPPORT AND ALIGNMENT

State Energy Reliability and Assurance Grants

The Nation's energy infrastructure is undergoing a sweeping transformation including growth in distributed generation resources such as renewables, internet-enabled demand response technologies, increasing electric vehicle deployments, dramatic expansion in natural gas production and use, and integration of energy storage. These changes are placing increasing demands on the energy grid. To assist states, localities, regions, and tribal entities in meeting these challenges, this budget request includes $63.0 million for State Energy Reliability and Assurance Grants. This funding is divided into two separate grant programs:

- $27.5 million is requested for Grants for Electricity Transmission, Storage, and Distribution Reliability. These grants help the states design energy markets and policies that will address system interdependencies and support integrating increasing levels of renewable energy generation into the grid.
- $35.5 million is requested for Grants for State Energy Assurance. These grants will help state and local governments build and maintain their preparedness capabilities through energy assurance planning and the testing, training, and exercising of plans that address the range of complexities that can arise during energy disruptions such as shortages of delivered fuels and impacts on interdependent sectors such as telecommunications and health.

National Electricity Delivery

Beyond advances in grid security, resiliency, and technologies, the electric industry must respond to several emerging challenges that arise from grid transformation. A changing electric generation mix, replacing aging infrastructure (transmission, storage, distribution, and generation), and updating communication networks, are some challenges that we face. Other challenges include accommodating new end-use technologies such as distributed resources, planning for increased interdependencies between natural gas, water and electricity systems, and addressing business models that manage these challenges in providing reliable and affordable electricity service. All of this must be balanced against the need for cost control, physical security and cybersecurity, improved or sustained reliability and resiliency, and flexibility to deal with market uncertainties and a changing climate.

States, regions, and tribal entities may lack sufficient expertise to make decisions on often complicated electricity policy issues. Traditional utility or state boundaries may not be conducive to regional thinking among stakeholders, but transmission lines, demand response, and planning activities are inherently regional in nature. With a requested $7.5 million for the National Electricity Delivery program in FY 2016, OE continues to provide technical assistance to states,

tribes, and regions on their electricity policies, programs, and market mechanisms to help identify approaches that encourage the development and deployment of reliable and affordable electricity infrastructure, whether generation, transmission, storage, distribution, or demand side electricity resources. Our intent through this work is to support strengthening these individual systems, which, in turn, strengthens the entire electricity infrastructure.

In addition to technical assistance, OE will facilitate grid modernization by strengthening the long-term integrated system reliability modeling and analytical tools available to states and others. Decision-making by state, regional, and local entities will be better informed by understanding the range of potential futures and their impacts before decisions are made. These tools will also help manage the complexity of the grid and the additional complexities associated with interdependent infrastructures such as electricity and gas, as well as energy and water. The capability to analyze infrastructure requirements on a range of potential futures is critical as it helps quantify the long-term benefits and costs of constructing long-lived assets, which markets may not adequately signal.

The FY 2016 request also supports efforts to facilitate timely construction and efficient operations of electric transmission capacity. OE plays important roles at the Federal level, authorizing the export of electricity, issuing permits for the construction of transmission infrastructure across international borders, and conducting a triennial national transmission congestion study to draw attention to areas of the country where transmission congestion is a significant concern.

OE also coordinates Federal permitting of transmission infrastructure for new transmission projects involving Federal lands, pursuant to section 216(h) of the Federal Power Act. The request builds on the progress made to achieve multi-agency recognition of an Integrated Interagency Pre-Application (IIP) process for transmission projects requiring Federal authorizations, as required by a June 7, 2013 Presidential Memorandum and in support of section 216(h). Successful IIP process implementation will improve coordination among project proponents and Federal agencies prior to formal application submission, leading to more complete applications and more efficient Federal permitting timelines.

PROGRAM DIRECTION

The FY 2016 budget request includes $32.6 million for Program Direction, which supports Federal staff providing executive management, programmatic oversight, and critical technical and administrative support necessary for the effective implementation of the OE program. The request funds 128 full time equivalents in FY 2016, based primarily in Headquarters and at the National Energy Technology Laboratory in West Virginia.

CONCLUSION

OE’s FY 2016 budget request of $270.1 million will give our team the tools and resources that they need to 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 energy strategy. This vision—with an eye on both the present and the future—is crucial, as we work to meet the challenges that are rapidly redefining U.S. energy landscape and the Nation’s power grid.

The United States has reached an important juncture in the evolution of how electricity is delivered to consumers. As America's population continues to grow and the world becomes increasingly digitized and complex, consumers must have access to reliable, secure, and clean sources of energy to meet the demands and challenges of living in a modern, vibrant society. As the Nation and the world continue changing, the Nation's power grid must also change and adapt to climate change, the diversity and uncertainty of future energy demands and generation portfolios, and growing threats.

OE's FY 2016 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.