

**STATEMENT OF  
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U.S. DEPARTMENT OF ENERGY  
BEFORE THE  
UNITED STATES HOUSE OF REPRESENTATIVES  
APPROPRIATIONS SUBCOMMITTEE ON  
ENERGY AND WATER DEVELOPMENT  
MARCH 27, 2012**

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) 2013 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 energy supply. A modern electricity grid is a fundamental enabler for the success of technological advances in electricity generation technologies being pursued elsewhere in the Department and by private industry. OE not only invests in applied research and development projects, but pursues tools and techniques and helps improve policies and state laws to modernize the grid and enhance the capabilities of the system in the following ways:

- *Reliability* – high quality, consistent power flow;
- *Flexibility* – the ability to accommodate changing supply and demand patterns;
- *Efficiency* – delivery of electricity with reduced losses and greater asset utilization rates; and
- *Resiliency* – the ability to withstand disruptions and maintain critical function.

Together, improvements in these four operational capabilities describe a modern grid. Inherent within them is an emphasis on end-to-end security as a key component both of a modern grid and of the Department of Energy's mission – we cannot achieve energy security for the nation without a secure grid. Security solutions for energy delivery systems are most cost-effective when they are designed into devices, and OE has been working with the electricity sector for more than a decade to enhance cybersecurity protections and build resiliency into the grid.

In the face of threats from manmade and natural events, DOE is, and must always be, prepared to respond and assist in recovery, and OE executes the Department's responsibilities as the Sector Specific Agency for the electricity grid. In this role, we maintain ongoing efforts to promote reliability and resiliency in the energy sector, and public-private partnerships are critical in this regard.

A more reliable, flexible, efficient and resilient electric power system will better support all types of power generation, but there are unique challenges associated with each,

making collaboration throughout DOE essential as we work towards transforming our Nation's energy systems. The 2011 Quadrennial Technology Review (QTR) established a shared set of priorities across DOE, and in doing so put in place effective methods of collaboration and coordination among the Department's energy programs on crosscutting activities. As we began the process of formulating our FY 2013 budget request, the QTR findings helped to inform our priorities and strategic decisions.

Our FY 2013 budget request prioritizes activities that increase electricity reliability and security nationwide by taking a systems-level approach to grid modernization, developing the computational capabilities to improve system planning and operations, and emphasizing the physical and cybersecurity of both new technologies and legacy energy systems. The request also reflects strategic choices to avoid potential overlap and maximize the value of the Departments' investments, such as the decision to delay requesting new funding for Power Electronics at this time. This decision reflects the fact that ARPA-E is pursuing awards for a wide variety of potentially game-changing power electronics devices. Once ARPA-E's projects are complete, some of the technologies could be well suited for further development into grid-scale applications through OE's research and development program.

OE's FY 2013 request of \$143 million will maintain progress towards the goal of modernizing the electricity system. The request includes \$103 million for Research and Development (R&D) to develop next-generation technologies in transmission systems, smart grid, energy storage, and cybersecurity, and includes funding to establish the Electricity Systems Hub. It provides \$6 million to assist States, regions, and tribal governments that wish to change their own electricity-related policies. Finally, the request includes \$6 million to support the reliability and resiliency of critical energy infrastructure and facilitate recovery from disruptions to the energy supply.

### HIGHLIGHTS OF THE FY 2013 REQUEST

At \$143 million, the FY 2013 budget request is a 3 percent increase from the FY 2012 appropriation, and maintains the Department's commitment to create a modern energy infrastructure. This request is essentially level for the office as a whole, but targets funding to the areas where advances are most critical for success. Priorities include \$20 million to establish the new Electricity Systems Hub, \$30 million for cybersecurity solutions focused on the unique operational requirements of energy delivery systems, and \$10 million for Advanced Modeling Grid Research to develop a greater understanding of the electricity system's operating characteristics. Through our relationships with DOE program offices, industry, academia, and other Federal agencies, we determined that these three areas offered the best balance between nearer-term results and long-term benefits to support the development of a reliable, efficient, and resilient electricity delivery system.

*Establishing the Electricity Systems Hub* – The electricity grid is a complex system of systems that serves as a key enabler to facilitate energy independence and increased economic prosperity. OE's FY 2013 request includes \$20 million to establish the Electricity Systems Hub focusing on the seam between transmission and distribution – a pinch point of grid modernization where power flows, information flows, policies and

markets intersect – to tackle the critical issues and barriers associated with integrating, coordinating, and facilitating the numerous changes that are happening system-wide. The hub activities will accelerate new technical adoption within a policy and regulatory framework that allows for efficient utilization of assets and capital investment, including minimizing consumer costs for grid modernization

As we modernize the grid to adapt to changes in the generation mix (renewable energy resources, distributed generation, increased use of natural gas, etc.), changing loads (electric vehicles, energy storage, LED lighting, etc.), and the increasing use of digital control and communications technologies (building energy management systems, demand response, sensors, phasor measurement units (PMUs), etc.), it is vital that a systems-level approach is taken to achieve seamless systems integration.

The integrated Hub concept brings together a multidisciplinary group of experts covering applied science, technology, economics, and policy to address the grand challenges of system-wide modernization. This management structure encourages creative risk-taking and accelerates innovation by providing flexibility for dynamic course correction in an integrated environment. The topics addressed through the Electricity Systems Hub are different from those that have been addressed through the Department's other Hubs, in that conditions and system needs – such as electricity usage patterns, generation sources, energy policies and regulations, and population densities – vary throughout the country, and must be incorporated into national solutions. In this spirit, two or three regional hubs may be pursued to address the complex regional and local issues associated with grid modernization. By understanding the unique demands of each region, we can identify the needs common to all, and develop solutions that apply nationwide but accommodate local differences.

Potential research topics include advanced devices, components, software, and systems. Exploration of utility business models, improved system understanding, and the cultivation of multidisciplinary thought leaders can help establish an electricity services economy. Additionally, policy and market analyses can help reduce barriers to innovation and system transformation.

*Developing Cybersecurity Solutions for Energy Delivery Systems* – Reliable and resilient energy infrastructure is vital to our Nation's economy, human health and safety, and national security. Cybersecurity for energy delivery systems has emerged as one of the Nation's most serious grid modernization and infrastructure protection issues. The Stuxnet worm, designed to attack a specific control system used in the energy sector, underscores the seriousness of the threat from targeted cyber attacks on energy delivery systems. There are a number of challenges associated with energy system cybersecurity, including protecting legacy devices that were installed before cybersecurity was an issue, the growing sophistication of attackers, and the fact that most cybersecurity solutions are developed for desktop information technology (IT) systems, and cannot be implemented on energy delivery systems that control real-time physical processes without risking a power disruption that rivals that of an intentional cyber attack.

OE's FY 2013 request includes \$30 million for CyberSecurity for Energy Delivery Systems to develop advanced cybersecurity solutions designed specifically to meet the

unique requirements of high-reliability energy delivery systems, and to reduce the risk of energy disruptions due to cyber events. The funding supports activities that include:

- (1) development of resilient networks and communications for the smart grid;
- (2) national SCADA Test Bed research;
- (3) vulnerability assessments, and mitigations;
- (4) next-generation technologies to enhance cybersecurity of energy delivery system platforms;
- (5) secure, resilient smart grid architectures and components, including developing secure, real-time communications that protect the privacy of multiple participants in the shared data stream of advanced metering infrastructure; and
- (6) enhanced cybersecurity protective measures for synchrophasors, a critical smart grid component that provides engineering data needed for wide-area situational awareness of grid operation.

*Enhancing System Understanding through Advanced Modeling Grid Research* – The electricity system will have to operate closer to its limits than ever before. Integration of large amounts of variable generation, mass deployment of electric vehicles, and actively engaged end-users will greatly increase uncertainty in grid operations and planning. To address the growing complexity of the grid, OE’s FY 2013 request provides \$10 million for Advanced Modeling Grid Research to develop the computational and mathematical understanding needed to transform the tools and algorithms that underpin electricity system planning and operations.

In FY 2013, the Advanced Modeling Grid Research program will focus on accelerating the performance and predictive capabilities of operational systems – which use real-time data from sensors nationwide – to enhance grid resilience and better detect events that drive cascading blackouts. In partnership with universities and industry, the program will apply new scientific insights in advanced computation (working collaboratively with the Office of Science) to electricity system data for improvements in grid planning and operations, including modeling of resource generation, energy markets and electricity flow. This research will enable system models that better predict system behavior and improve large-scale system planning, reducing operational redundancies and maximizing the use of existing electricity infrastructure.

Explanations of the other elements in the FY 2013 request are provided below.

## RESEARCH AND DEVELOPMENT

OE supports the applied research, development and demonstration of technologies that modernize the electric grid, increasing its reliability, flexibility, efficiency and functionality. The Research and Development (R&D) program is OE’s largest, accounting for more than 70 percent of our total FY 2013 request. Through collaboration with private industry, academia and public entities, as well as with other DOE programs including ARPA-E, the Office of Energy Efficiency and Renewable Energy, and the Office of Science, our R&D activities promote national energy independence through the development of an adaptable, reliable, “smart” electricity transmission and distribution system.

The FY 2013 request of \$103 million for the R&D program reflects an emphasis on innovative tools and technologies that will enable greater adoption of variable resources and facilitate the transition to low-carbon energy sources and away from the consumption of oil through the electrification of transportation. In addition to those previously discussed, the request includes funding for: Transmission Reliability and Renewables Integration, Smart Grid Research and Development, and Energy Storage.

The *Transmission Reliability and Renewable Integration* activity, funded in FY 2013 at \$14 million within the Clean Energy Transmission and Reliability subprogram, focuses on developing advanced transmission-level sensors, analysis tools and capabilities. More sophisticated transmission technologies and power system information is essential as the demand for higher quality electricity and the integration of renewable resources grows. This activity focuses on using real-time data from advanced sensors that monitor the flow of electricity and provide information on system health – known as phasor measurement units (PMUs) – to improve transmission system planning and operations. It supports the development of technologies, tools and operational approaches that use this information to enhance the flexibility and reliability of the Nation’s power system.

The *Smart Grid Research and Development* activity focuses on developing the next generation technologies that can integrate two-way communications and digital technology into electricity distribution systems, while encouraging consumer involvement to enable intelligent control over energy use. By providing consumers with information about their usage, along with the ability to participate and communicate with the power system, we can facilitate the potential of energy conservation and demand response to reduce peak demand and increase system reliability. The FY 2013 request of \$14.4 million for Smart Grid R&D prioritizes projects studying distribution automation to reduce system outage duration and frequency; analysis of high penetration of distributed renewable resources; and outreach to both consumers and state regulators on smart grid. It scales back research into the integration of the charging and discharging of plug-in electric vehicles (PEVs) into the grid, as well as the development of microgrids.

The *Energy Storage* subprogram, funded at \$15 million in the FY 2013 request, is designed to develop and demonstrate new and advanced energy storage technologies that will enhance the stability and reliability of the future electric grid. Large grid-scale, megawatt-level energy storage systems, or multiple, smaller distributed storage systems, have the potential to significantly reduce transmission system congestion and manage peak loads, increasing the overall reliability of the electricity grid. OE is focused on lowering the cost of storage devices, proving their performance in utility applications, and facilitating industrial development. The request for energy storage reflects scaled-back research into lithium-ion and sodium-ion batteries. It supports the development of a suite of technologies (e.g. lead-carbon, sodium metal halide, metal air, and advanced flow batteries, and flywheel and compressed air storage) that span the range of services associated with grid applications including frequency regulation, wind and solar ramping, and energy management; as well as different scales suitable for central (large) stations, distributed, and end-user deployment.

## PERMITTING, SITING, AND ANALYSIS

With a requested \$6 million in funding for FY 2013, OE continues to provide technical assistance to State and regional entities that wish to change their own electricity-related policies. Electricity planners from both the public and private sectors are facing new challenges as the Nation moves towards a clean energy future. As utilities have increased their investment in next-generation energy technologies, we have experienced a marked increase in requests from State electricity officials for technical assistance on associated topics, including ratepayer-funded energy efficiency, smart grid and the related subjects of demand response, renewable energy, natural gas and clean coal. In FY 2013, we anticipate increased requests for assistance on reliability issues associated with implementation of EPA regulations and on the impact of cheaper natural gas from increasing shale gas development on utility resource planning.

Maintaining reliability and affordability while the generation portfolio evolves in a number of ways is a challenge. As the deployment of variable renewables grow, much of which can be remote from where the electricity is needed, greater cohesive, regional thinking by state and local officials will be needed. Accordingly, the FY 2013 request supports collaboration with State and regional entities on interconnection transmission and electricity resource planning efforts, focusing on the operating and planning changes necessary to support an evolving electricity generation and delivery structure. The request also continues coordination of Federal authorizations for new transmission facility siting, issuance of permits for cross-border transmission lines, and authorization of electricity exports.

#### INFRASTRUCTURE SECURITY AND ENERGY RESTORATION

The FY 2013 budget request includes \$6 million to enhance the security and resiliency of the electricity grid, and facilitate recovery from disruptions in energy supply. The increasing complexity and interdependency of national energy infrastructure and expanding globalization of energy markets – in conjunction with threats from aging infrastructure, human error, natural disasters, and deliberate attacks – represent significant challenges for the energy industry. 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 the effects of attacks against the energy sector. We have built close relationships with the owners and operators of energy infrastructure as well as other government agencies, and have developed a thorough understanding of the tools and technologies needed to support secure and resilient energy infrastructure. This places OE in a unique position to help discover potential technical solutions to protect critical energy assets, as well as facilitate their adoption by the energy sector.

We will improve our situational awareness capabilities through advancements in tools for natural gas and petroleum modeling visualization tools, power outage and restoration visualization, and near real-time capabilities. We will work with energy sector stakeholders to encourage the open exchange of information on physical and cyber threats to critical infrastructure. We will maintain teams of fully trained emergency responders, prepared to facilitate recovery from energy supply disruptions. We will develop a strategic analytical framework for identifying and modeling foreign energy

infrastructure that, if compromised, could threaten national energy security. And we will work with Federal, State and local officials to strengthen mitigation measures through tabletop exercises, forums and workshops that increase understanding of critical infrastructure protection and security issues, including the potential impact of geomagnetic disturbances, such as solar storms, on the grid.

These activities represent OE's contribution to the security and resiliency of national energy infrastructure, and promote consistent, reliable and efficient energy nationwide.

#### PROGRAM DIRECTION

Our FY 2013 budget request includes \$27.6 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, essentially level with FY 2012 appropriations, funds 112 Full Time Equivalents (FTEs) in FY 2013, based in Headquarters and at the National Energy Technology Laboratory in West Virginia. The request includes support for FTEs that provide critical technical project management and monitoring of ongoing Recovery projects, which will continue for several years.

#### CONCLUSION

Through our investments in 21<sup>st</sup> Century technologies and energy assurance capabilities, OE will continue to provide leadership to ensure that the Nation's electricity grid has the capabilities to provide all Americans with reliable, accessible electricity. This is not a short-term goal, nor is one that can be addressed once and forgotten; constant progress towards a modern power system that is reliable, flexible, efficient, and resilient is key to economic prosperity and protecting one of our Nation's critical infrastructures.

President Obama has laid out an ambitious, "all-of-the-above" strategy for American energy, one that marries the immediate need for inexpensive energy with the development of affordable renewable energy options to secure energy independence in the future. As the recent decrease in natural gas prices shows, we cannot always predict the energy source that will offer the least expensive electricity for American consumers. What we do know is that, regardless of its source, electricity will always need to be transported to consumers reliably, efficiently, and securely.

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