A POLICY FRAMEWORK FOR THE 21ST CENTURY GRID: A PROGRESS REPORT

Executive Office of the President
National Science and Technology Council

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EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL
WASHINGTON, D.C. 20502

February 2013

Dear Colleagues:

I am pleased to transmit "*A Policy Framework for the 21st Century Grid: A Progress Report*," an update to the original *Policy Framework* released in June 2011. This new report summarizes recent Federal Government actions to deliver on the promise of a 21st century grid while fostering job growth, innovation, and consumer savings. The report was prepared by the Subcommittee on Smart Grid of the National Science and Technology Council's Committee on Technology.

In March 2011, President Obama laid out a blueprint charting a new era for American energy—one in which the National economy is fueled by a wide variety of domestic energy sources designed and produced by American workers. This commitment to an "all-of-the-above" energy strategy requires continued attention to and investment in America's electric infrastructure. Among the actions recently taken in support of that commitment are:

- investing in the development and deployment of smart grid technologies and transmission infrastructure to improve resilience—reducing the incidence of power outages and enabling quicker power restoration when outages occur;
- empowering families and businesses with easy and secure access to their household or building energy data in a standard format;
- establishing new interoperability standards to spur private-sector innovation; and
- launching new programs to address critical grid security needs and strengthen the cybersecurity of critical infrastructure.

Going forward, the Administration will continue to work with states, the electric sector, and other stakeholders to modernize grid infrastructure, develop new tools for a clean energy economy, empower customers, and foster innovation. In so doing, the United States will continue to lead the way toward a clean energy future.

Sincerely,

John P. Holdren
Assistant to the President for Science and Technology
Director, Office of Science and Technology Policy

About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the Executive Branch coordinates science and technology policy across the diverse entities that make up the Federal research and development enterprise. A primary objective of the NSTC is establishing clear national goals for Federal science and technology investments. The NSTC prepares research and development strategies that are coordinated across Federal agencies to form investment packages aimed at accomplishing multiple national goals. The work of the NSTC is organized under five committees: Environment, Natural Resources and Sustainability; Homeland and National Security; Science, Technology, Engineering, and Math (STEM) Education; Science; and Technology. Each of these committees oversees subcommittees and working groups focused on different aspects of science and technology. More information is available at http://www.whitehouse.gov/ostp/nstc.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976. OSTP's responsibilities include advising the President in policy formulation and budget development on questions in which science and technology are important elements; articulating the President's science and technology policy and programs; and fostering strong partnerships among Federal, state, and local governments, and the scientific communities in industry and academia. The Director of OSTP also serves as Assistant to the President for Science and Technology and manages the NSTC. More information is available at http://www.whitehouse.gov/ostp.

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A Policy Framework for the 21st Century Grid: A Progress Report

In March 2011, President Obama laid out a blueprint charting a new era for American energy – one in which our economy is fueled by a wide array of domestic energy sources designed and produced by American workers. This commitment to an "all-of-the-above" energy strategy requires continued investment in a 21st century electric infrastructure.

Building a smarter, more modern power grid will: enable cleaner electricity generation; improve power reliability and resilience; support a growing fleet of electric vehicles; and increase opportunities for families and businesses to make informed choices about their energy use. A modernized electric system will also provide a foundation for innovative new products and services that can help families and businesses save money.

In June 2011, the Obama Administration released "*A Policy Framework for the 21st Century Grid: Enabling Our Secure Energy Future*," which highlights the benefits of a modernized electric system in the United States. Produced by the Cabinet-level National Science and Technology Council (NSTC), the Policy Framework sets four guiding principles to ensure that all Americans benefit from investments in the Nation's electric infrastructure:

1. Enabling Cost-Effective Smart Grid Investments
2. Unlocking the Potential of Innovation in the Electricity Sector
3. Empowering Consumers and Enabling Informed Decision Making
4. Securing the Grid

This report summarizes Federal Government progress in these four areas and the range of recent steps taken to deliver on the promise of a 21st century grid, including: investing in the development and deployment of smart grid technologies and transmission infrastructure; improving access to household or building energy data in formats useful to families and businesses; establishing new interoperability standards to spur private-sector innovation; and launching new programs to address critical grid security needs.

The President's Budget for Fiscal Year 2013 recognizes that full modernization of the electric grid will require sustained effort over years and decades and that there is no "one-size-fits-all" technology solution to modernizing the grid. That is why the fiscal year (FY) 2013 budget maintains strategic investments in smart-grid research and development (R&D), standards development, and cybersecurity that focus on finding diverse, cost-effective solutions for a more intelligent, flexible, secure, and reliable electricity infrastructure. The Administration will continue on this path forward while seeking new and innovative ways to work with states, the electric sector, and other stakeholders. The sections that follow describe progress to date toward advancing the four principles laid out in the June 2011 *Policy Framework*.

1. Enabling Cost-Effective Smart Grid Investments

To maintain a competitive edge in the global economy, the United States must act strategically to ensure the quality of its critical infrastructure, including the electric grid. Upgrading the Nation's transmission and distribution infrastructure offers improved reliability, resilience, and efficiency of the Nation's power supply; greater consumer empowerment; and more opportunities for innovation in the energy domain. Investing in these improvements—which include nearly 11,000 miles of new or improved distribution and transmission lines in FY 2012 and 10.8 million smart meters installed since the beginning of this Administration—provide both immediate and long-lasting economic benefits for local communities and America as a whole. The examples below represent just some of the significant steps taken to foster investment in a smarter grid.

Modernizing the grid: The American Recovery and Reinvestment Act of 2009 (Recovery Act) provided the single largest smart grid investment in U.S. history ($4.5 billion matched by an additional $4.5 billion from the private sector), funding both the Smart Grid Investment Grant (SGIG) and Smart Grid Demonstration (SGD) programs, among other programs, to spur the Nation's transition to a smarter, stronger, and more efficient and reliable electric system. As in other areas of the economy, Federal investments in the energy sector provide support and incentives to industry stakeholders. The resulting upgrades will improve energy-savings choices for consumers, increase operational efficiency and grid reliability, and foster the growth of renewable energy sources such as wind and solar power.

Case Study: Electric Power Board (EPB) of Chattanooga

EPB of Chattanooga is installing approximately 1,200 advanced automated feeder switches as well as sensor equipment for 164 distribution circuits. When completed in 2013, EPB of Chattanooga expects that the $226 million effort will result in a 40 percent or greater decrease in customer-minutes lost to power outages, saving local businesses and homeowners at least $35 million a year. These benefits are already beginning to materialize. For example, after a strong, unexpected storm knocked out power to millions of people on the East Coast in June 2012, EPB of Chattanooga found that the outages were cut by at least half due to smart grid investments, and the utility had a 55 percent reduction in duration of outages (58 million avoided minutes of customer interruption). EPB of Chattanooga calculates that the expedited restoration saved the utility $1.4 million, which does not include savings from a broader community perspective.

Strategic investments made through the Recovery Act continue to help:

- **Avoid and recover from blackouts.** The 2003 Northeast blackout started when a high-voltage power line brushed against overgrown trees to cause a local outage, which ultimately spread to affect 55 million people, contributed to six deaths in New York City, cost an estimated $7-$10 billion, and caused four million Detroit residents to boil their drinking water for four days. This event would have likely been contained to Northern Ohio if advanced grid sensors were in place. Recovery Act funds have helped enable the deployment of hundreds of such sensors (343 since June 2011). In total, 800 advanced grid sensors will eventually be deployed, compared to only 166 that were in place before the Recovery Act. Collectively, these sensors will allow grid operators to track, in real-time, nearly 100 percent of the grid system—allowing them to better manage power fluctuations across the transmission system, reduce disruptions, and keep the

lights on for more Americans. To maximize the benefits of this investment, the Department of Energy (DOE) and National Science Foundation (NSF) are co-funding research to develop analytics and visualizations for the information generated from these advanced grid sensors.

- **Improve efficiency of the grid.** Using digital technology to automate and improve the management of the grid can help reduce the amount of electricity that is lost in the transmission and distribution system as waste (which is currently estimated at around five percent of the total amount generated). As of September 2012, approximately 5,000 distribution circuits have been upgraded with digital technology and are already improving the value and performance of the electric grid for homes and businesses nationwide. Roughly 3,000 of these circuits have been upgraded since June 2011.
- **Increase intelligence of electric meters.** Smart meters, which generally record energy usage in hourly or 15-minute increments (compared to monthly usage records provided by older meters), securely provide consumers with potentially useful data, such as when and how they are using electricity. This enables consumers to more actively participate in the management of their energy use. Advanced metering systems can also help utilities improve outage management, including by providing information on the location and extent of outages. More than 12.9 million smart meters have been installed during this Administration under the Recovery Act, with 6.2 million of those meters coming online since June 2011. By the end of 2014, Recovery Act funding will have supported the deployment of 15.5 million smart meters.
- **Add energy storage capacity.** Investments in new energy storage technologies are increasing the Nation's ability to store electricity for use during times of increased demand. Advanced batteries and innovative storage technologies such as flywheels and compressed air energy storage are being developed and optimized for grid-relevant applications. These technologies will grant grid operators greater flexibility to incorporate electricity from renewable sources and help them manage the national electric grid more efficiently. The Recovery Act has invested $185 million and leveraged extensive private sector funding (valued at $585 million) in 16 energy storage projects across 10 technologies. Three of these projects are already operational, with five more likely to be up and running by the end of 2013.
- **Train new workers.** Maintaining a sufficiently large and appropriately skilled workforce is a significant challenge for the electric sector. Under the Recovery Act, smart grid workforce training awards comprising nearly $100 million across more than 50 projects are creating training opportunities for individuals to gain skills for grid-related career tracks. These grants have benefited military veterans by helping them connect to well-paying civilian opportunities. To date, all the projects have been initiated, two awards have been completed, and $46.2 million has been distributed.

Supporting rural infrastructure: The Administration has taken significant steps to improve the lives of rural Americans and support rural communities. In their capacity to support clean energy, energy efficiency, and economic growth, smart grid technologies are a central part of this commitment. The Department of Agriculture Rural Utilities Service (USDA-RUS) is a major source of infrastructure financing for more than 600 rural utilities, including electric cooperatives. USDA-RUS loans to support smart

grid investments in rural America reached $250 million in FY 2012. The 54 loans cover projects across 24 states and include investments to support over 11,000 miles of new and improved distribution and transmission lines, as well as smart meters, geographic information systems, control systems, and other technologies. In total, since 2011, more than $3.7 billion in USDA-RUS loans to rural electric systems have financed the expansion of smart grid infrastructure to increase operational efficiencies and help manage costs for consumers in rural and remote communities.

Case Study: Tri-State Electric Membership Cooperative (Tri-State)

Tri-State, a distribution rural electric cooperative serving Georgia, Tennessee, and North Carolina, has replaced conventional electromechanical meters with solid-state smart meters and implemented advanced service programs to give customers greater control over their energy use and costs.

With its newly installed smart metering system, Tri-State is able to provide several new service options, including: (1) two-way communications that allow customers to monitor their electricity consumption and take steps to better manage their electric bills; (2) a voluntary, pre-payment program that replaces high deposit costs with affordable new service fees; and (3) a web portal that provides daily alerts to help customers save money by making informed decisions about their electricity usage. Research indicates that the daily alerts help residential consumers reduce their electricity consumption by an average of 10 percent. The Tri-State project has also helped customers detect and troubleshoot faulty appliances and equipment.

Tri-State's smart meters have reduced the company's operation and maintenance costs by providing better system information and tools to improve outage management. With the new metering system, the company knows instantly when and where outages occur. As a result, Tri-State spends less money to provide more reliable service and ultimately passes along the savings to its customers.

Leveraging Department of Defense (DOD) capacity: DOD is the Nation's top energy user. In FY 2011, the cost of electricity to operate 160,000 vehicles and power 300,000 buildings on DOD installations—including barracks, data centers, offices, and hospitals—totaled $4 billion. This makes DOD an appropriate place to promote energy technology innovations, including smart grid technologies, which reduce costs, promote efficiencies, and increase the security of facilities. At the same time, DOD is uniquely positioned to overcome traditional boundaries in this high-risk domain because it can use its own facilities as test-beds for promising new technologies and quickly scale-up innovations that prove effective. For example, through the Environmental Security Technology Certification Program, DOD is demonstrating advanced micro-grid technologies on some of its military installations. Microgrids link small, stand-alone electricity-generation sources to small distribution systems in order to reduce day-to-day energy costs by allowing for load balancing (the ability to store excess power during low demand periods for use at later times) as well as demand response (using customer incentives to lower energy use during periods of high demand). These mechanisms allow facilities to shed non-essential loads to help utilities avoid overall outages; and enable facilities to maintain mission-critical loads if and when the grid goes down.

In FY 2011, a DOD investment of $4 million supported four micro-grid projects, and in FY 2012, an investment of $9 million funded nine such projects. Proposals are currently under review to select additional projects to begin in FY 2013. Taken together, these projects will improve the energy security of our military operations and save taxpayer dollars.

Case Study: The Department of the Navy's Grid Modernization Efforts

With nearly 25 percent of the Department of the Navy's shore budget spent on utility bills, management of its energy resources requires modern tools and analysis. That's why the Navy is deploying advanced smart meters across 102 bases worldwide. Deployment and installation projects have already begun. Current pilot projects will support the development of best practices and cost-effective solutions that are replicable across the Navy's remaining installations. By September of 2014, the Navy expects to deploy 26,900 smart meters, thereby enabling intelligent management of the consumption of electricity, water, gas, and steam at each base. To date, 10,983 smart meters have been installed at 53 bases, with 9,145 installations occurring since June 2011.

The Navy is also piloting a flagship Smart Power Partnership Initiative to leverage existing and planned energy investments inside installation fence lines; enhancing partnerships with energy suppliers; responding quickly to grid outages; and increasing the use of alternative energy to increase combat capability, reduce overall dependence on petroleum, and mitigate energy security risks. Cost savings have come largely from reduced demand and from participation in significant utility demand-response programs in emergencies or when prices peak. Initial findings from San Diego-area installations will be used to validate the concept and potentially export it to other large Navy and Marine Corps base areas.

2. Unlocking the Potential of Innovation in the Electricity Sector

Government entities provide both basic resources and a level playing field for grid-related innovations that empower citizens and grow the Nation's economy. For example, the Federal Government actively supports the development of consensus-based electric industry standards; promotes efforts to make energy data more readily and widely available; ensures rigorous protection of privacy for consumers; and continually seeks out greater energy efficiencies and improved environmental stewardship. Some of the recent steps taken by the Administration to catalyze innovation in these domains—including by fostering the creation of new tools and services and supporting entrepreneurship in the electric sector—are described below.

Developing new tools and services: Open data from the Federal Government and other sources can be a powerful tool for private-sector innovation. In 2012, the Administration launched the Energy Data Initiative to provide entrepreneurs and innovators with newly available and previously underutilized data, and to catalyze the development of new products and services to ensure a reliable energy future. Also in 2012, DOE launched the "Apps for Energy" challenge that resulted in 57 ideas for new and innovative web-based and mobile applications. The challenge resulted in a number of winning submissions in

a range of important sectors, including residential and commercial utility customers, electric vehicles, ENERGY STAR buildings, and others. DOE also provided nearly $3.2 million in Phase I award funding to projects that will demonstrate tools and services to help consumers make more informed decisions about their own energy consumption through improved access to their own electricity consumption data. For Phase II, DOE will select one Phase I award recipient and apply the tools and software to an entire service territory, region, or community.

Setting common standards: Interoperability standards make markets more efficient, help open new international markets to U.S. manufacturers, and reduce the costs of providing reliable, safe power to U.S. households and businesses. The Smart Grid Interoperability Panel (SGIP), which was initiated by the National Institute of Standards and Technology (NIST) and consists of more than 750 domestic and international member organizations, has developed and continually maintains a catalog of standards relevant to smart grid implementation. The SGIP convenes smart grid stakeholders to build consensus in the standards-making process and make progress on identified priority actions. Since June 2011, 41 new standards have been formally added to the new SGIP Catalog of Standards—with robust support from state regulators. Also, in October 2011, the Federal Communications Commission (FCC) adopted an order to affirm its rules for Accessing Broadband over Power Line (BPL) Systems. Electric utility companies use BPL to manage elements of their power distribution operations. The affirmed rules provide increased clarity and certainty, and help balance the needs of BPL users (including utility companies and others interested in smart grid and other broadband applications) with the need to protect radio service users from potential radio frequency interference from BPL systems.

Setting national-scale frameworks: In July 2011, FERC and DOE submitted to Congress a proposal to implement a National Action Plan that would help the Nation realize its demand-response potential—the potential to lower energy consumption during periods of high use through customer incentives and other mechanisms. Per Congressional direction, the proposal identifies actions that can be taken by Federal, state, and private-sector organizations to maximize the amount of cost-effective demand response achieved in the Nation; design requirements for a communications program and materials to support demand response; and analytical tools for demand-response design, evaluation, and analysis. As part of FERC's National Action Plan on Demand Response, and with funding from DOE, FERC and DOE have convened working groups of experts to determine in four key areas what remains to be done to allow demand response to achieve its intended benefits. Reports from all four groups will be issued in the first quarter of 2013. ERC is also continually working to ensure that new technologies are included in competitive energy markets; rates are designed to reward utilities for their speed and accuracy; and there is greater flexibility for customers as they face changing system conditions. Finally, the U.S. Energy Information Administration (EIA) is currently modifying its data collection strategy to begin robustly tracking aggregate, national deployment of smart grid technologies such as advanced meters and distribution automation equipment. EIA anticipates implementing these changes in January 2014 when it initiates a call to collect retrospective 2013 data. Once collected, the data will provide deeper insight into the Nation's ongoing transition to a more modern grid.

Promoting public, private, and peer-to-peer collaboration: To better catalog and share best practices and information, DOE has hosted six regional Smart Grid peer-to-peer workshops across the country in partnership with local utilities. The workshops bring together utility representatives and other stakehold-

ers to engage in dialogue to identify lessons learned and best practices for technical implementation and customer engagement. As a result of these workshops, DOE has established a community of practice and a growing repository of lessons learned that can improve project execution, encourage accountability, and reduce duplicative experimentation. DOE also continues to provide technical assistance to state public utility commissioners on smart grid topics through its use of independent experts as well as through a collaborative project involving the Federal Energy Regulatory Commission (FERC) and the National Association of Regulatory Utility Commissioners (NARUC). The FERC/NARUC Smart Response Collaborative provides a forum for Federal and state regulators to discuss smart grid and demand-response policies, share best practices and technologies, and address other issues.

3. Empowering Consumers & Enabling Informed Decision Making

This Administration has sought to empower consumers with the information and tools needed to make informed energy decisions. When armed with data about their own energy use, homeowners and building owners have more opportunities to save on their bills while also saving energy and reducing pollution.

Increasing access to customer data: In order to save energy, consumers must first understand how they use energy. That is why the Obama Administration has partnered with the utility industry to make it easier for electricity customers to get secure online access to their own household or building energy use in computer-friendly formats.

- **The Green Button:** Through industry commitments, the Green Button provides consumers with easy-to-understand information about their own energy use. These data are empowering families and businesses to make better-informed decisions about their energy use. As of October 2012, more than 16 million homes and businesses have access to Green Button functionality to download their data. Utilities and service providers serving an additional 20 million customers plan to make the feature available shortly, and the number continues to rise. With the 35 current utility commitments, more than 36 million households and businesses will have access to Green Button data and be able to use web and smartphone apps to, for example, pick the best rate plan for them; take advantage of customized energy efficiency tips; and better use virtual energy-audit software that cut costs and helps get energy upgrades started sooner. Going forward, the Administration will continue working with utilities, regulators, and the private sector to enable *Green Button Connect My Data*—a functionality that helps customers automatically and securely transfer their Green Button data to authorized third parties. Utilities in California and the Mid-Atlantic serving more than 11 million customers, as well as three utility vendors, have already committed to this innovative opt-in feature, which makes it easy for families and businesses to take advantage of energy-saving opportunities and services, and catalyzes further customer-centric innovation by utilities.
- **Mapping access to energy data:** In March 2012, DOE launched a set of maps that show the access that consumers in different regions have to their own utility bill data, in consumer-friendly formats. More than 796 utilities have already completed the data access questionnaire that allows their data to be added to the maps.

- **Smart disclosure:** In September 2011, the Office of Management and Budget (OMB) issued guidelines on smart disclosure, an initiative to encourage timely release of complex government information and data in standardized, machine-readable formats to help consumers make informed decisions. Similar to nutritional labeling or automobile fuel-economy labeling, smart disclosure is a way for the Federal Government to ensure that consumers know what they are purchasing and are able to compare alternatives. In many cases, smart disclosure also enables third parties to build tools that help individual consumers make more informed choices in the marketplace. The NSTC has established a task force to develop guidelines for making data from consumer markets available and useful for consumer decision-making in this domain. In addition, the U.S. Open Government National Action Plan committed the United States to build on this work in order to promote better disclosure policies. And, in early 2013, a new smart disclosure data community was launched on data.gov to provide centralized access to more than 400 smart disclosure data sets and resources from dozens of agencies across government.

Protecting customer privacy: As part of a comprehensive blueprint to improve consumer privacy protections, strengthen trust in companies that handle personal data, and ensure that the Internet remains an engine for innovation and economic growth, the Administration released, in February, 2012, a Consumer Privacy Bill of Rights. By adapting Fair Information Practice Principles to the digital economy, the Consumer Privacy Bill of Rights provides companies with clear rules of the road and serves as a guide for consumers to understand what they can and should expect of companies that handle personal data.

Case Study: Gulf of Maine Research Institute – Portland, Maine

In Maine, all 7th- and 8th-grade public school students are issued laptop computers with Internet access as part of their educational experience. The Gulf of Maine Research Institute (GMRI) will leverage that program and the rapidly growing network of smart electrical meters in Maine households, to help put energy conservation at the center of science and math learning in that region. Through its PowerHouse program, GMRI will give 7th- and 8th-grade students access to their families' electricity consumption data. The objective is to test innovative digital learning and energy saving strategies, thereby affecting household attitudes and behaviors towards energy consumption and patterns. GMRI has begun testing the effectiveness of the PowerHouse concept with students and teachers and, thanks to its selection as a DOE Smart Grid Data Access award recipient, GMRI will expand the program during the 2012-2013 school year.

Improving user experience: There is no one-size-fits-all smart grid. Consumers make different choices based on their own cost, comfort, and energy preferences. Understanding consumer behavior and decisions in the context of these preferences can help optimize the operation of the smart grid. To that end, with support from the Lawrence Berkeley National Laboratory, DOE is supervising 11 consumer behavior studies that examine customer acceptance of and response to smart-grid-enabled programs, such as time-based pricing (in which rates vary depending on the timing of energy use), and investigating whether behavioral responses are sustained or diminish over time. DOE will analyze project results and disseminate interim and final conclusions within the 2013- 2015 timeframe. In another effort to improve end-user energy experiences, EPA is exploring the potential benefits of strategically connecting ENERGY STAR product functionality to the smart grid. EPA and its ENERGY STAR partners are focusing initially on

residential refrigerators and freezers, room air conditioners, climate controls, and pool pumps, which, if connected to the smart grid, could potentially communicate with other devices in a home and enable information-sharing between and access control from networked devices such as personal computers, televisions, and smart phones. In the future, such connectivity could enable preferential operation of electricity systems when costs are lower or when renewable sources of energy are more plentiful.

4. Securing the Grid

Cybersecurity is a significant and evolving challenge for the electric system given the wide variety of deployed technologies and the dependency of so many sectors and networks on electricity. Protecting this critical system from cyber-attacks and ensuring that it can recover quickly in the event of an attack is vital to national security and economic well-being. To address this concern, the Administration is taking several preemptive measures to enhance the safety and resilience of the grid.

Improving critical infrastructure cybersecurity: In February 2013, the President signed an Executive Order to strengthen the cybersecurity of critical infrastructure industries, including the electric power sector. The Executive Order strengthens the Federal government's partnership with critical infrastructure owners and operators to address cyber threats through (1) new information sharing programs to provide both classified and unclassified threat and attack information to U.S. companies and (2) the development of a framework for cybersecurity practices to reduce cyber risks to critical infrastructure, led by the National Institute of Standards and Technology in collaboration with industry partners. Alongside the Executive Order, the President also released the Critical Infrastructure Security and Resilience Presidential Policy Directive, reflecting the Federal government's commitment to partner with owners and operators to secure our Nation's critical infrastructure against evolving threats. This Presidential Policy Directive is focused on clarifying Federal roles and responsibilities; integrating physical security and cybersecurity analysis and situational awareness; improving information sharing; and increasing the Federal government's effectiveness, so that it can better partner with critical infrastructure owners and operators.

Promoting a performance-based cybersecurity culture: In January 2012, under DOE's leadership and in coordination with Department of Homeland Security (DHS) and electric industry partners, the Administration launched the Electricity Sector Cybersecurity Capability Maturity Model Initiative. By combining elements from existing cybersecurity efforts into a common self-evaluation tool that can be used across the industry, the Maturity Model enables the prioritization of network protection investments and provides valuable insights to inform investment planning, research and development, and public-private partnership efforts in the electric sector. In addition, in May 2012, DOE, NIST, and the North American Electric Reliability Corporation (NERC), released the Electricity Subsector Cybersecurity Risk Management Process (RMP) Guideline, which provides utilities and their vendors a flexible approach to managing cybersecurity risks across all levels of an organization. Then, in September 2012, FERC established the Office of Energy Infrastructure Security (OEIS)—a new center for identifying and reducing potential risks from cyber-attacks and such physical threats as electromagnetic pulses. Both the Maturity Model Initiative and RMP Guideline align with the *Roadmap to Achieve Energy Delivery Systems Cybersecurity*, which was developed by industry, facilitated by DOE, and released by the Administration in September 2011. The *Roadmap* provides a strategic framework to achieve the vision that, over the next decade, resilient energy delivery systems are designed, installed, operated, and maintained to survive a cyber-incident while sustaining critical functions.

Setting cybersecurity guidelines for the smart grid: Cybersecurity for the Nation's electric grid is a shared responsibility that requires constant vigilance, commitment, and cooperation among the public and private sectors. Since July 2011, DOE and North American utilities have worked together to augment a library of security profiles for smart grid functionality through the Advanced Security Acceleration Project for the Smart Grid (ASAP-SG), an industry-government collaboration to accelerate smart-grid security standards development. In addition to the previous years' security profiles covering advanced metering infrastructure, third-party data access, and distribution management, ASAP-SG in 2012 developed and released security profiles for Wide-Area Monitoring, Protection, and Control (Synchrophasors), and a security profile for Substation Automation. The ASAP-SG has also published a Smart Grid Security Profile Blueprint and a white paper entitled "How a Utility Can Use ASAP-SG Security Profiles" that help clarify the frameworks, tools, and methods needed to create and customize smart grid domain-specific security profiles that should be applied to the procurement, implementation, and configuration of smart grid systems. Complementing this work, NIST's Cyber Security Working Group has completed over 65 reviews of identified smart grid standards and requirement documents, and has published recommendations to incorporate cybersecurity throughout the smart grid systems' development lifecycle. These recommendations help promote secure and interoperable smart grid technologies and implementation methods. The compiled standards will facilitate the development and implementation of secure, interoperable smart grid systems and the design of effective mitigation plans for managing cybersecurity risks.

Promoting Physical Preparedness and Resilience: The Administration is also acting to better understand and manage physical threats to critical electricity assets. For example, DHS is working extensively to identify and prepare for risks that electromagnetic pulses (EMP) pose to the Nation. Specifically, DHS is working internally and with external stakeholders to reduce risks associated with EMP by exercising various response scenarios and developing plans to help address these evolving threats. In addition, to improve the recovery response of the grid in the aftermath of physical disruptions to extra-high-voltage (EHV) transformers, a critical component of our Nation's transmission grid, the DHS Science and Technology Directorate developed the Recovery Transformer (RecX) program that has designed, built, and recently demonstrated a small and light modular prototype EHV transformer that is easier to transport and install than conventional units. In a March 2012 demonstration, one RecX prototype was transported, installed, commissioned, and energized in less than one week—a dramatic reduction in potential recovery time compared to conventional solutions. The prototype is currently in operation in the grid and being monitored for performance validation. The program is currently working with various stakeholders, Federal and private, to determine the best path forward for transitioning the technology to industry to increase the resilience of our power grid.

Conclusion

Smart grid technologies and programs represent an evolution in how the Nation's electricity system operates. Going forward, the Administration will continue to support grid modernization efforts that benefit all Americans by remaining committed to the four guiding principles laid out in the 2011 *Policy Framework:* enabling cost-effective smart grid investments; unlocking the potential of innovation in the electricity sector; empowering consumers and enabling informed decision making; and securing the grid. With tools for a clean energy economy, opportunities for consumers to engage and save money, efficiency benefits for utilities, and new areas for innovation, a smarter, modernized, and expanded grid can serve as a platform for American leadership in a clean and secure energy future and power a National economy that is built to last.