U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

HEARING CHARTER

Empowering Consumers and Promoting Innovation through the Smart Grid

September 8, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, September 8, 2011 the Subcommittee on Technology and Innovation of the Committee on Science, Space, and Technology will hold a hearing to examine the status of efforts to develop open standards for smart grid technologies and drive innovation within smart grid development. This hearing will provide the Subcommittee with an update on current standards development accomplishments, as well as the actions needed to empower and protect consumer interests while promoting innovation through the growth of the smart grid.

2. Witnesses

Dr. George Arnold, National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology

The Honorable Donna Nelson, Chairman, Public Utility Commission of Texas

Mr. John Caskey, Assistant Vice President Industry Operations, National Electrical Manufacturers Association

Mr. Rik Drummond, Chief Executive Officer and Chief Scientist,
The Drummond Group, Inc.

3. Brief Overview

The hearing will examine efforts led by the National Institute of Standards and Technology (NIST) to coordinate the development of a common framework and standards necessary to ensure a secure and interoperable nationwide smart grid. The smart grid is a planned nationwide network that uses information technology to deliver electricity efficiently, reliably, and securely. The smart grid is designed to improve the transmission of electricity from power plants to consumers, provide grid operators with information about conditions of the electricity system, integrate new technologies into the grid, and allow consumers to receive more information about electricity prices and

availability from the electricity system. This represents a leap from a one-way, analog system of disconnected power suppliers to a two-way, digital, interoperable national network. As envisioned, the smart grid is a more efficient way to distribute and diversify power sources, creating capabilities to make the grid more efficient by reducing demand peaks and increasing capacity utilization while providing consumers with innovative tools to reduce energy usage, potentially saving them money.

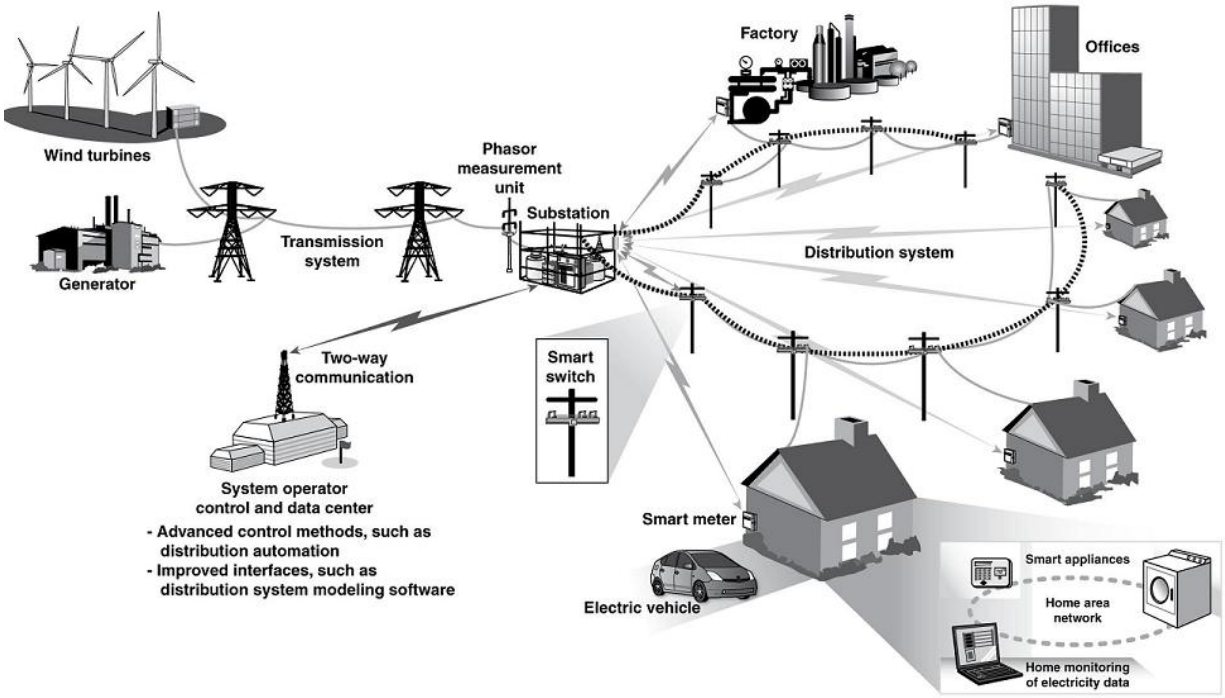

Figure 1. Common Smart Grid Components. Image is excerpted from a U.S. Government Accountability Office report, *Electricity Grid Modernization: Progress Being Made on Cybersecurity Guidelines, but Key Challenges Remain to be Addressed*. GAO-11-117, January 12, 2011. www.gao.gov/products/GAO-11-117.

4. Background

The electric grid has changed little since the end of the nineteenth century. Since President Roosevelt directed the Rural Electric Administration to electrify the continent, electricity and information has flowed in one direction; from generator to end user. Electricity has to be used the moment it is generated, and because the capacity for the generation of power matches the consumption of power, the electricity supply system must be sized to generate enough electricity to meet the maximum anticipated demand. A modern smart grid is designed to change this completely. The smart grid is envisioned to operate with a two-way flow of electricity and information capable of monitoring everything from power plants to customer's individual appliances. This will provide utility operators and consumers the data necessary to better manage energy usage, allowing for better control of costs and lower electric bills.

The Energy Independence and Security Act of 2007 (EISA) (P.L. 110-140) set requirements for a "reliable and secure electricity infrastructure." Under EISA, NIST has "primary responsibility to coordinate development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems." NIST supports one of the key roles in the growth of the smart grid—bringing together manufacturers, consumers, energy providers, and regulators to develop "interoperable standards." In other words, NIST is responsible for making sure the many pieces of the smart grid are able to work together.

The American Recovery and Reinvestment Act (ARRA) invested approximately $4.5 billion, matched by $5.5 billion in private funding, to modernize energy infrastructure in America. The ARRA included funding for NIST to conduct its work on interoperability standards for the smart grid. Interoperability, the ability of diverse systems and their components to work together, is vitally important to the performance of the smart grid at every level. It enables integration, effective cooperation, and two-way communication among the many interconnected elements of the electric power grid.

Because the smart grid will touch so many aspects of life in the twenty-first century, the development of standards involves a wide range of national and international stakeholders, from both the private and public sectors. Stakeholders include appliance and consumer electronics providers; municipal electric utility companies; standards development organizations; and state and local regulators. NIST has identified 22 stakeholder groups—each of whom has representation in the standards development process. NIST's work will cover the entire electricity system including generation, transmission, distribution, and end-user equipment and devices.

Standards Development

NIST's work on the smart grid has been enabled by funding from both the ARRA and NIST's annual appropriations. ARRA funds totaled $17 million to bring together stakeholders to develop a framework for the smart grid and coordinate the development of standards, including $12 million provided by the Department of Energy and an additional $5 million from ARRA funds appropriated directly to NIST. To support the NIST Smart Grid program, Congress appropriated a total of $2.3 million in fiscal year (FY) 2009, $5 million in FY10, and $8.3 million in FY11. The President's budget request for FY12 includes a $22.8 million initiative entitled "Interoperability Standards for Emerging Technologies," which would include an additional $9.1 million to support NIST's Smart Grid program.

NIST has been driving the creation of a smart grid architectural framework, and interoperability standards in a three-phased plan. Phase one (complete) engaged stakeholders to identify applicable standards and requirements, gaps in currently available standards, and priorities for additional standardization activities. Phase two (ongoing) established a public/private partnership called the Smart Grid Interoperability Panel (SGIP) to continue development of interoperability standards and drive longer-term progress. Phase three (ongoing) is the development of a testing and certification framework for smart grid standards.

In January 2010, the NIST-led process published the *Release 1.0 Framework and Roadmap for Smart Grid Interoperability*[1], which provided an initial foundation for an interoperable and secure smart grid. The framework included a high-level conceptual reference model, the identification of 75 existing families of standards applicable to the ongoing development of the smart grid, and 16 high-priority action plans to fill gaps in the standards portfolio (three have been added to the original 16 listed in the Release 1.0 NIST framework). NIST is updating the framework based on work carried out since Release 1.0, and expects to publish Release 2.0 by the end of 2011.

The Smart Grid Interoperability Panel (SGIP)

The SGIP is a private/public partnership that engages stakeholders from the entire smart grid community in a participatory public process to identify applicable standards, gaps in currently available standards, and priorities for new standardization activities for the evolving smart grid. Membership in the SGIP has grown to over 680 organizations, including private companies, universities, research institutes, industry associations, standards setting organizations, laboratories, and Federal, state, and local government agencies. Almost 1800 individuals participate in the committees and working groups, and an elected 27-member governing board representing 22 different stakeholder groups oversees the SGIP.

The SGIP is executing 19 priority action plans to fill standards gaps, and is also continuing work on the Catalog of Standards[2], which contains descriptive information about standards deemed relevant to the smart grid through the SGIP consensus process. The first six entries have been approved by the SGIP membership and have been entered into the catalogue. Each standard considered for inclusion in the catalogue goes through a cybersecurity review by the SGIP Cybersecurity Working Group, to identify potential vulnerabilities and necessary mitigation actions.

The SGIP is also working on the development of a testing and certification framework for the smart grid. The SGIP Testing and Certification Committee published the *Interoperability Process Reference Manual, Release 1*[3], which provided the structure and processes for testing and certification programs relevant to the smart grid.

To guide future planning for NIST's work on the smart grid, NIST also established a Smart Grid Federal Advisory Committee. The Committee's input to NIST helps guide long-term SGIP activities and also assists in directing research and standards activities at NIST. The Committee provides input to NIST on smart grid standards, priorities and gaps, and on the overall direction, status, and health of smart grid implementation by the smart grid industry. The Committee's first report, focused on the long-term direction of NIST's smart grid work is expected near the end of this year.

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[1] *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0*. January 2010. http://www.nist.gov/public_affairs/releases/upload/FERC-letter-10-6-2010.pdf

[2] Available at: http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPCatalogOfStandards.

[3] *Interoperability Process Reference Manual, Release 1.0.* November 2010. http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/SGTCCIPRM/SGTCC_IPRM_Version_1.0_Updated.pdf

Regulation

EISA directs the Federal Energy Regulatory Commission (FERC) to institute a rulemaking to adopt such standards and protocols as may be necessary to insure smart grid functionality and interoperability in interstate transmission of electric power, and regional and wholesale electricity markets" at any time after NIST's work has led to "sufficient consensus" in the Commission's judgment. In the past, few interoperability standards have been adopted in regulation for national infrastructures. The vast majority of standards in these industries are used on a voluntary basis.

Based on work conducted by the SGIP, NIST notified FERC in October 2010[4] that it had identified five families of existing voluntary consensus standards as ready for consideration by regulators. FERC hosted a Technical Conference to invite public discussion of whether sufficient consensus was found to institute a rulemaking proceeding. On July 20, 2011 FERC issued an Order[5] in which it found there was insufficient consensus to institute a rulemaking proceeding at that time to adopt the initial five families of standards.

> "The Commission finds there is insufficient consensus for the five families of standards under consideration. For this reason, the Commission will not institute a rulemaking proceeding at this time with respect to these standards… The Commission encourages stakeholders to actively participate in the NIST interoperability framework process to work on the development of interoperability standards and to refer to that process for guidance on smart grid standards."

The five families of existing voluntary consensus standards were "foundational" standards covering common information models and protocols for utility energy management systems, substations, distribution systems, and intercontrol center communications. The five standards were among the most mature standards identified in the NIST Framework, and the "insufficient consensus" conclusion of FERC calls into question whether voluntary standards for smart grid may be sufficient without a mandatory rulemaking process.

Issues for Examination

Enabling Cost-Effective Smart Grid Investments

The development and adoption of standards for the smart grid has been an unprecedented, complex undertaking, enabling electric utilities to deploy and use technology advancements in an accelerated manner. There has been significant investment in the smart grid, with many smart grid related technologies, such as smart meters, deployed with ARRA funds despite the fact that many standards have not been set. Given the scale

[4] NIST letter to FERC Chairman Jon Wellinghoff, October 6, 2010, available at: http://www.nist.gov/public_affairs/releases/upload/FERC-letter-10-6-2010.pdf

[5] 136 FERC ¶ 61,039, Order, "Smart Grid Interoperability Standards," Docket No. RM11-2-000, issued July 19, 2011, available at: http://www.ferc.gov/EventCalendar/Files/20110719143912-RM11-2-000.pdf

of possible future investment and the need to retrofit existing technologies, interoperability is imperative. The Subcommittee has requested that witnesses address the need to ensure investments in the smart grid are cost-effective to keep electricity affordable. This includes discussing how the interoperability standards being developed through the NIST framework process ensure present investments in new technologies generate future value through interoperability and upgradability.

Unlocking the Potential of Innovation in the Electricity Sector

Transforming the electricity grid to a modern smart grid can help spur the creation and deployment of new products and services in the electric sector, boosting economic growth and job creation. Building an updated transmission infrastructure including modern information and communications technologies provides a foundation for innovation. Witnesses have been asked to address how the development of open, interoperable standards can help create the markets for smart grid technologies essential to America's ability to lead and create jobs. International coordination on smart grid standards will reduce trade barriers in smart grid technologies, helping drive international trade and investment. Witnesses have also been asked to discuss the importance of working to cooperate with other nations on smart grid interoperability standards, which is critical to increasing market opportunities for American industry.

Empowering Consumers

Providing consumers information about energy use and consumption helps them to better understand how they are using electricity, allowing for better management of that use. The Subcommittee has asked witnesses to address how encouraging the development of a portfolio of smart grid technologies and programs, including innovative third-party applications, can help consumers save energy and encourage the development of a market for smart grid technologies. It is important to provide consumers with information and to allow innovation to flourish, but it is also important to protect that data to ensure consumer privacy. Consumers need to be adequately informed about the benefits, costs, and risks associated with smart grid systems.

Securing the Grid

The Subcommittee has requested that witnesses address the complex cybersecurity challenge that smart grid technologies pose. With advanced metering infrastructure, smart appliances, and third-party service providers, there are a great number of entry points through which to stage cyber attacks. By exploiting loopholes in cybersecurity, attackers could breach the privacy of customer power usage data and could potentially overload systems or cause false readings. It is especially important to ensure that the evolution of standards and guidelines keep pace with the evolving cyber threat in order to protect the grid from cyber attacks, improve recoverability, and ensure the Nation's security and economic prosperity.