Hearing Charter

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES

"**Effectively Transforming Our Electric Delivery System to a Smart Grid"**

Thursday July 23, 2009
10 a.m. – 12 p.m.
2318 Rayburn House Office Building

Purpose

On Thursday, July 9, 2009 the Subcommittee on Energy and Environment will hold a hearing entitled: ***"Effectively Transforming Our Electric Delivery System to a Smart Grid."***

The hearing will explore the roles of both the federal government and industry in transitioning our aging power generation and distribution infrastructure into a smart grid. A smart grid will function as a two-way communication system offering utilities and consumers more information regarding electricity supply, consumption, and price which would ultimately modify patterns of electricity usage. Continued efforts to research and develop innovative smart grid technologies and establish the appropriate interoperability standards to enable all these devices and systems to communicate with each other are necessary to make this transformation and realize significant efficiency, reliability, security and environmental benefits. Today, our massive interconnected power grid is a century old and over-burdened. It is imperative that we modernize our electric delivery system so that our economy can thrive and growing power needs will be met efficiently and reliably.

Witnesses

- **Ms. Patricia Hoffman is the Acting Assistant Secretary for the Department of Energy, (DOE) Office of Electricity Delivery and Energy Reliability.** Ms. Hoffman briefly will describe the Department's vision for development of a smart grid and offer testimony on the current research, development and demonstration activities at DOE to achieve widespread use of innovative smart grid technologies. She will discuss the challenges associated with a successful transition to a smart grid and how DOE is working with other federal agencies and stakeholders to address these issues. She also will describe the Department's strategy and timeline for distributing funds available under the American Recovery and Reinvestment Act for smart grid demonstrations, investment grants, transmission planning and other related initiatives.

- **Ms. Suedeen Kelly is a Commissioner at the Federal Energy Regulatory Commission (FERC).** She will provide a brief overview of FERC's actions and programs designed to modernize our electric delivery system and the issues that we must address to ensure we have a successful transition to a smart grid. She will describe FERC's collaboration with NIST to develop interoperability standards for smart grid devices and systems. In addition, she will explain the important role of the states in this transition and the tools FERC has available to help the states implement smart grid strategies.

- **Dr. George Arnold is the National Coordinator for Smart Grid Interoperability at the National Institute of Standards and Technology (NIST).** Dr. Arnold will offer testimony regarding NIST's progress toward facilitating the development of a framework for standards and protocols to achieve interoperability of smart grid devices and systems. He will discuss some of the technical challenges presented with standards development and how NIST will address those issues. In addition, he will describe how NIST is working with other federal agencies and interested stakeholders to achieve widespread use of innovative smart grid technologies.

- **Mr. Paul De Martini is Vice President of Advanced Technology at Southern California Edison (SCE).** SCE is the largest subsidiary of Edison International and supplies electricity to eleven million people in southern California. Mr. De Martini will testify about SCE's research, development and pilot programs related to advancing smart grid technologies and modernization of our electric grid. He also will give an overview of SCE's strategy to deploy innovative smart grid technologies, their work with DOE and NIST, provide a utility perspective on integrating these new technologies with existing technologies, and discuss some of the benefits anticipated for the company and consumers as that strategy is implemented.

- **Mr. Jeff Ross is the Executive Vice President at GridPoint.** Gridpoint is a technology company engaged in the development of innovative smart grid platform that enables utilities to optimize electrical grid management. Mr. Ross will discuss Gridpoint's technology portfolio to illustrate the type of innovation that will facilitate the modernization and advancement of the nation's electricity system, as well as some of the challenges encountered along the way. He will also describe Gridpoint's experience in the smart grid demonstration in Boulder, CO.

- **Mr. Michael A. Stoessl is the Group President for Cooper Power Systems.** Cooper Power Systems engineers and manufactures medium and high-voltage electrical equipment, components, and systems that deliver reliable electric power to homes, industries, businesses, and institutions worldwide. The company is a member of the National Electrical Manufacturers Association (NEMA) and he will testify on NEMA's behalf. Mr. Stoessl will provide a brief overview of NEMA and its history in developing standards for power equipment and the grid. He will discuss how the association is fulfilling its Congressionally-directed role to work with federal agencies and accelerate the deployment of innovative smart grid technologies. In addition, he will describe the

technical challenges of integrating new smart grid technologies with the current grid and provide examples of successful deployment.

Background

In the 20th century, widespread electrification brought power to our homes, businesses, farms and cities, changing our lives dramatically. In 1935 President Roosevelt established the Rural Electric Administration (REA) and directed the agency to electrify the continent. As part of that massive undertaking, innovations were undertaken that included standardized designs for distribution lines, mass production and construction techniques, system protection and wide area distributed power planning. Now, nearly seventy-five years since the REA was created, we still consider electrification one of the greatest engineering achievements of the 20th century.

Electricity has to be used the moment it is generated. While this system has worked for decades, it is not very efficient. Demand for power varies greatly throughout the day and throughout the year as demands for lighting, heating and cooling fluctuate through the seasons. Because the capacity for 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 (e.g. peak demand). This inefficiency becomes more evident when considering that it is possible the peak electricity demand for any given year could be for a very short period – a few days or even hours. The deployment of innovative smart grid devices is intended to reduce this inefficiency.

Our century-old power grid is the largest interconnected machine on earth consisting of more than 9,200 electric generating units with more than one million megawatts of generating capacity connected to more than 300,000 miles of transmission lines.[1] Currently, our electric grid is a centralized, generator-controlled network where electrons and information flow in one direction, from generator to end-user. The transition to a smart grid will change this completely. A modern power grid is envisioned to operate more like an energy internet with a two-way flow of electricity and information that will be capable of monitoring everything from power plants to customer preferences to individual appliances. This transformation will give utility operators and customers the proper tools and information so that electricity generation is better-managed and consumer choices are exercised to control costs and lower electric bills.

Smart grid technologies, including energy storage technologies will offer operators new opportunities for managing distributed power production and zero-emission power generation from solar and wind sources. Also pushing modernization of our electric infrastructure is the increasing demand for electricity driven by population growth, bigger homes, and greater appliance use. While our electric grid is considered one of the most reliable in the world, there have been five massive blackouts over the past forty years, three of those occurring in the past nine years. The recent Northeast blackout of 2003 resulted in a $6 billion economic loss to the region.[2] Further compounding the reliability risks is the trend in our economy to become ever-

[1] *The Smart Grid: an Introduction,* Prepared by Litos Strategic Communication for the U.S. Department of Energy, 2008, page 5.
[2] Ibid, page 7.

more digital and to be more reliant upon electronic equipment and automated manufacturing. These trends place increasing demand on our electric delivery system.

Even as we anticipate continued rising demand for power, underinvestment in the upgrading of our electric infrastructure has left the grid overburdened and inefficient. According to the Department of Energy, if the grid were just 5 percent more efficient, the energy savings would equate to permanently eliminating the fuel and greenhouse gas emissions from 53 million cars.[3] The American Recovery and Reinvestment Act (ARRA) authorized the Department of Energy to spend approximately $4.5 billion on smart grid projects under programs established in Title XIII of the Energy Investment and Security Act of 2007 to begin to address these needs.

From the funds made available by the ARRA, the Department of Energy's Office of Electricity Delivery and Energy Reliability (OE) has issued Funding Opportunity Announcements for smart grid demonstrations, smart grid investment grants, and a smart grid information clearinghouse. The goal of the demonstration projects is to verify smart grid technology viability, quantify smart grid costs and benefits, and validate new smart grid business models at a scale that can be readily adapted and replicated across the nation. These projects could fund different energy storage technologies, including battery storage, compressed air energy storage and other new promising storage options. In addition, these projects could demonstrate synchrophasor measurement technologies and approaches to improve transmission system reliability through large-scale deployment of synchrophasor technology. These synchrophasors or "phasors" have the potential to significantly improve transmission reliability because they take data measurement with Global Positioning System (GPS) timing. The gathered data allow grid operators to see dynamic conditions on the grid in a more real-time (time and location) manner and with greater accuracy. As a result, the operators have better system control and earlier detection of potential grid disturbances for better mitigation.

The Smart Grid Investment Grant Program is intended to gain improvements in cost and performance of smart grid technology. The program will provide federal assistance to fund up to 50 percent of investments by electric utilities and other entities for projects that promote the goal of deployment of smart grid technologies. The investments are designed to help implement the necessary digital upgrades to the electric grid enabling it to work more efficiently and make it better able to effectively integrate power generated from renewable energy technologies, energy efficient technologies, and demand management practices. Demand Response or load management is defined as the planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. These practices or programs refer only to energy and load-shape modifying activities that are undertaken in response to utility-administered programs and not the normal operation of the marketplace.[4] Demand response practices are used today, but will be ever-more prevalent as we transition to a smart grid.

The Smart Grid Information Clearinghouse is intended to consolidate public technical, legislative, and other information on smart grid development and practices, and direct website

[3] *The Smart Grid: An Introduction,* Prepared by Litos Strategic Communication for the U.S. Department of Energy, 2008, page 7.

[4] *Keeping the Lights On in a New World,* Electricity Advisory Committee, January 2009, page 84.

users to additional information sources both in the United States and internationally. The goal is to facilitate coordination among all smart grid stakeholders to support the development and deployment of smart grid technologies.

EISA also authorized a federal Smart Grid Task Force that is led by DOE's Office of Electricity Delivery and Energy Reliabilty to coordinate federal activities related to smart grid technologies and practices. The Task Force works closely with the Federal Energy Regulatory Commission and the National Institute of Standards and Technology. The Department also established an Electricity Advisory Committee which issued a report in January 2009 entitled: "*Keeping the Lights On in the New World*". The report discusses current trends for our electricity infrastructure related to both power demand and supply, and it offers options for meeting future electricity needs with recommendations for specific actions by DOE.

The Recovery Act also included $10 million for NIST to conduct its work on interoperability standards for smart grid devices and systems. This standards development process covers the entire electricity system including generation, transmission, distribution and end-user equipment and devices. These standards are essential to ensure that all the different software and hardware components of a smart grid, supplied from various vendors, will work together seamlessly and secure the grid against disruptions. In other words, such standards will support the ability of different devices to exchange data, communicate, and participate in business activities regardless of the operating systems or programming languages underlying those devices. NIST has established domain working groups and is identifying and evaluating existing standards and measurement methods to support the transformation of our electric delivery system.

In mid-May, Secretaries Locke and Chu announced the initial batch of sixteen NIST-recognized interoperability standards. NIST is directed to issue a report to Congress when it determines that the work is completed or that a federal role is no longer necessary for standards development. EISA further calls on FERC to institute a rulemaking proceeding to adopt such standards and protocals as may be necessary to insure smart-grid functionality and interoperability in interstate transmission of electric power and regional and wholesale electricity markets. FERC has authority to determine when NIST's process has led to sufficient consensus of the stakeholders.

A Smart Grid

There is a lot of talk about deploying smart meters, a process that is underway. It is important to note that metering is just one of numerous possible applications that make up a smart grid. The smart grid is far more than meters as it will function like an energy internet and innovative technologies will be empowered by the two-way digital communication and plug-and-play capabilities that exemplify a smart grid.

For consumers, the smart grid means they will have access to real-time pricing and these price signals will help to educate consumers about energy consumption and actively engage them in energy decisions. Ultimately, consumer participation will result in reduced peak demand – when electricity demand is its greatest. Today our electric bills provide little information about energy consumption patterns and costs, and the bills come monthly, days after actual consumption takes place. New smart grid technologies will allow consumers to see the price they are paying for

their energy in real-time, helping them to lower their electric bills as they use less electricity during peak demand times when prices are high. This behavior in turn benefits the utilities because shedding load at peak demand times will help to relieve stress on the grid and avoid costly infrastructure and maintenance costs. Reducing peak demand also allows utilities to reduce reliance on its least efficient generating plants that are necessary to meet peak demand.

It is estimated that smart grid enhancements will ease congestion on the grid and increase capacity significantly, sending 50 to 300 percent more electricity through existing energy corridors.[5] Maximizing the efficiency of the electricity infrastructure reduces the need for owners and operators to pay for additional generation capacity to meet our nation's growing demand for electricity. Transforming our power system to a smart grid will save money, save energy, and lower emissions from the utility sector making this transition a smart alternative to building more power plants, substations, transformers and transmission lines.

In addition, a smart grid will increase reliability of the grid and enhance the grid's security. Today's grid is dominated by central generation with many obstacles for distributed energy resources interconnection. This centralized system can be vulnerable to disruptions from natural or human events. A modern grid would more readily integrate distributed energy resources, such as electric vehicles and other storage technologies, making our power supply less centralized and less vulnerable. Smart grid technology will include an immense communications network and will vastly improve the utilites' ability to manage the grid under emergency conditions. A smooth transition of our electricity delivery system to a smart grid is critical to realize the benefits associated with a more efficient, reliable and secure electricity infrastructure.

[5] Ibid, page 17