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The Continental Automated Buildings Association is profiling its high-value research including CABA's Connected Home Roadmap 2010, Energy as a Managed Service and the North American Intelligent Buildings Roadmap 2011.

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CABA

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The U.S. Government Approach to Smart Grid

By Ken Wacks

The development of a smart grid has been an evolving process of enhancing the existing electric grid. Since Thomas Edison and George Westinghouse introduced electricity generation as a service industry in the late 1800s, it has been public policy to encourage the growth and availability of reliable electric power. About a century later in the early 1990s, there was a realization that there might be limits to growth in the supply of electricity. Among the public concerns were the locating of generator plants and transmission lines, nuclear power risks, and an emerging green movement. Public utilities were urged to consider integrated resource planning that included both supply and demand.

In 2005 and 2007, the U.S. Congress passed laws requiring that electric utilities investigate demand management, standards for electric network operation, and cyber security among the elements of an electric grid. Congress also asked the administration to provide leadership in the development of a smart grid for electricity and to report back on progress. This paper examines how the federal administration responded to these mandates to improve the reliability, security, and availability of electric power.

Federal agencies in smart grid

Figure 1 illustrates the roles of the U.S. federal government in electric smart grid developments. There are about 3,100 electric utility companies in the United States divided into three categories:

- Investor-owned utilities (about 100)
- Rural cooperatives (about 1,000)
- Municipal power companies (about 2,000)

In addition the federal government operates some hydroelectric power plants such as those at dams on the

Colorado, Columbia, Cumberland, and Tennessee rivers. This power is sold through retail utilities.

The investor-owned utilities supply about 70 percent of the electric power in the U.S. Most operate as monopolies regulated by the 50 states and the District of Columbia. The Federal Energy Regulatory Commission (FERC) regulates the wholesale power industry, but has no direct authority over retail markets.

The U.S. Congress and the President have mandated that the Departments of Energy and Commerce work with the utility industry to create a smart grid.

Department of Energy

In 2004 the Department of Energy created the *GridWise Architecture Council (GWAC)* to guide the utility industry toward a smart grid. The Council consists of 13 experts drawn from the electric and high-tech industries. I am a GWAC member with a focus on the utility customer interface.

The GridWise vision rests on the premise that information technology (IT) will revolutionize planning and operation of the power grid just as it has changed business, education, and entertainment. IT will form the “nervous system” that integrates new distributed technologies such as demand response, distributed generation, and storage with traditional generation, transmission, and distribution assets. Responsibility for managing the grid will be shared by an interconnected network of devices and system entities.

The key challenge for the electric industry according to GWAC is how to overlay IT and communication networks on the existing grid while maintaining operations and then enhancing these operations. The IT purpose is to improve interoperability among the subsystems that

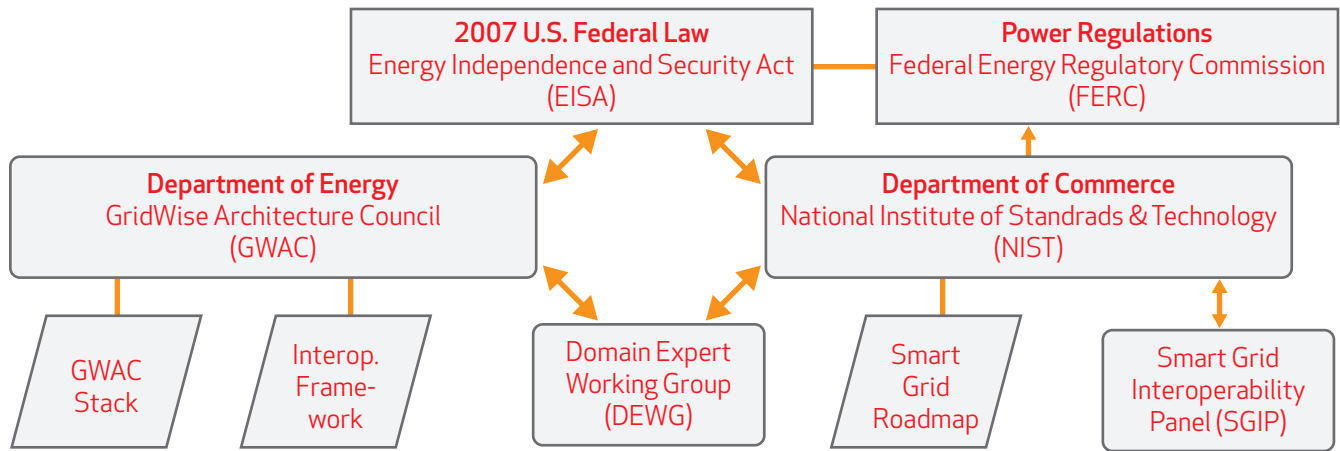


Figure 1 - U.S. Federal Role in Smart Grid

constitute an electric grid. The IT and communication networks can enable better sensing of the operating status of the transmission and distribution network. Traditionally, the electric network terminated at the customer meter. As shown in Figure 2, a smart grid can extend IT beyond the meter into premises to help manage the demand for electricity by building machinery and home appliances. Also, IT can integrate distributed energy resources (DER) such as solar power, wind turbines, and storage facilities.

GWAC has published guidelines to help managers select products that support interoperability and tools to measure how well interoperability has been achieved. Interoperability applies to technical, information, and business systems. More information about GWAC is available in an article I wrote for the winter 2008 issue of *iHomes & Buildings* entitled “The GridWise Path to a Smart Electric Grid.”

Department of Commerce

The U.S. Department of Commerce runs the *National Institute of Standards and Technology (NIST)*. NIST is responsible for metrology standards (measurements of physical parameters such as time, length, and power). NIST does not write communications or industrial standards. However, Congress ordered NIST to determine what standards are needed for a smart grid. NIST is working with standards developing organizations to select existing standards for smart grid or to specify new ones. The key standards are at the interfaces of the subsystems identified by GWAC.

Recognizing the large scope of the smart grid mandate, NIST started with a roadmap. To develop the smart grid roadmap, NIST hired the *Electric Power Research Institute* and held three large meetings in 2009 with the

utility industry and equipment suppliers. They established the following priorities:

- Wide area situations awareness
- Demand response (DR)
- Electric vehicles
- Electric storage
- Cyber security
- Network communications
- AMI (Advanced Metering Infrastructure)
- Distribution grid management

NIST introduced the roadmap in January 2010 with the following goal: “The expedited development of an interoperability framework and a roadmap for underpinning standards is key to the realization of a modernized, smart electric grid.”

The NIST roadmap includes a list of about 75 standards. There is no agreement in the industry that these are the best standards. Some of us think that NIST should not be proposing standards at all within homes and buildings.

Smart Grid Interoperability Panel

The Smart Grid Interoperability Panel (SGIP) was created in November 2009 as a public/private partnership. The mission is to help NIST fulfill the Congressional mandate to determine if there are sufficient standards for smart grids.

Any company with an interest in a smart grid is invited to join the SGIP. Membership is free and voluntary. There are about 670 members including 70 from outside the United States.

The SGIP is determining where standards are needed and developing requirement for these standards. Neither NIST nor the SGIP writes standards. Once SGIP

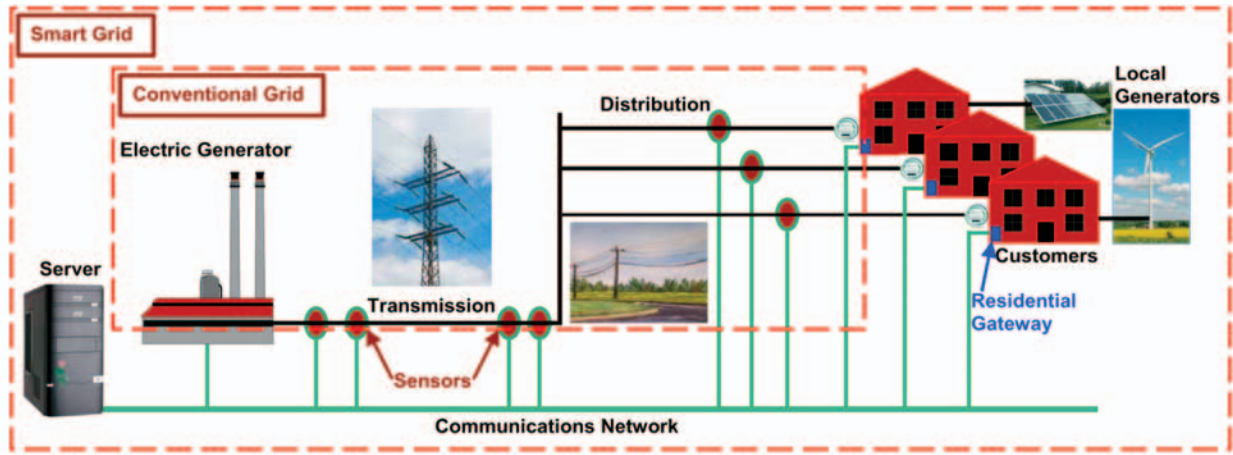


Figure 2 - Smart Grid Additions to a Conventional Grid

determines the requirements for a new or extended standard, the SGIP must find a national or international standards organization that is willing to write the standard. There is no guarantee that the SGIP requirements will be met by a new standard. However, NIST is speaking with standards groups and is seeking cooperation.

The SGIP consists of a governing board that oversees working groups, task forces, and priority action plans. Working groups include architecture, testing, cyber security, and domain expert working groups. *The Domain Expert Working Groups (DEWGs)* were established in 2008 by GWAC and NIST to develop smart grid strategies for:

- Home-to-Grid
- Building-to-Grid
- Industry-to-Grid
- Transmission and Distribution
- Business and Policy

Priority Action Plans (PAPs) are committees that are formed as needed to write requirements for standards. So far, the SGIP has created 18 PAPs on topics such as:

- Metering
- Electricity pricing and price communications
- Electric storage
- Distribution grid management
- Signaling for DR and DER
- Power line carrier communications
- Radio communications

Some PAPs have completed work and are disbanded.

The future government role in smart grid

Since World War II, the United States has used federal funds to stimulate a wide range of industries: interstate highways, integrated circuits, biotechnology, and the

Internet. The intent of the federal activities described in this paper is to initiate long-range smart grid developments by the utility industry and suppliers of equipment and services for smart grids.

The NIST role in the *Energy Independence and Security Act of 2007* is to develop a framework of codes and model standards that support interoperability in the smart grid. NIST is to supply reports to Congress until the work is done or until a federal role in smart grid is no longer needed. FERC may issue smart grid rules for utilities when the NIST work (the totality of the deliverables, not individual standards) has reached sufficient consensus.

The SGIP was created as a public/private activity to seek industry input. For now, the SGIP is not independent of NIST. However, the SGIP could become a self-funded permanent body when federal involvement is no longer needed.

For further information on these topics, please visit:

www.gridwiseac.org

www.nist.gov/smartgrid

www.sgipweb.org. **H**

Dr. Kenneth Wacks has been a pioneer in establishing the home systems industry. He advises manufacturers and utilities worldwide on business opportunities, network alternatives, and product development in home and building systems. In 2008, the United States Department of Energy appointed him to the GridWise Architecture Council. For further information, please contact Dr. Wacks at 781.662.6211; kenn@alum.mit.edu; www.kenwacks.com.