

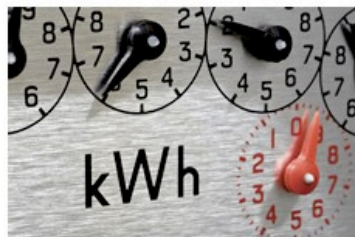
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NIST & the Smart Grid

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The National Institute of Standards and Technology (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 world's largest and most complex machine" are able to work together.

Since its establishment in 1901, NIST has earned a reputation as an "honest broker" that works collaboratively with industry and other government agencies. Over the past century, NIST's mission has been to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.

Today in the 21st century, then, NIST is ideally suited for its latest assignment. As outlined in the "The Energy Independence and Security Act of 2007" (Public Law 110-140, often referred to as "EISA"), NIST has been given "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."

What is interoperability?

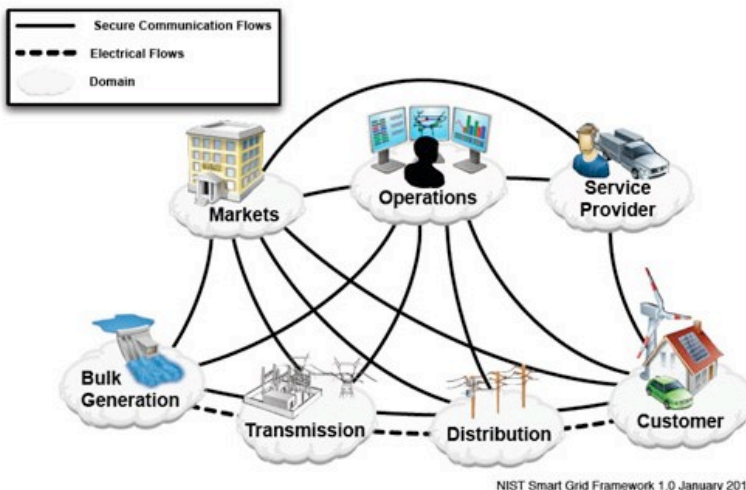
Interoperability—the ability of diverse systems and their components to work together—is vitally important to the performance of the Smart Grid at every level. It enables integration, effective cooperation, and two-way communication among the many interconnected elements of the electric power grid. To achieve effective interoperability, we must build a unifying framework of interfaces, protocols, and the other consensus standards.

These standards facilitate useful interactions so that, for example, "smart" appliances and "smart meters" will tell consumers how much power they are using and at what cost, providing them with more control over their power consumption and energy bills. These standards will also encourage the development of the infrastructure that will enable widespread use of plug-in electric vehicles (PEVs). Furthermore, widely adopted standards will help utilities to mix and manage varying supplies of solar, wind, and other renewable energy sources and to better respond to changing demand.

In some cases, existing standards may work just fine in the Smart Grid. In other cases, however, new standards must be developed for the new interactions made possible by the Smart Grid.

Who is involved?

Because the Smart Grid will touch so many aspects of life in the 21st century, the development of standards involves a wide range of stakeholders—national and international, private and public, large and small. This simplified illustration (see below) shows the many complex relationships and interactions that will take place within the Smart Grid, as electricity and/or information flows back and forth.



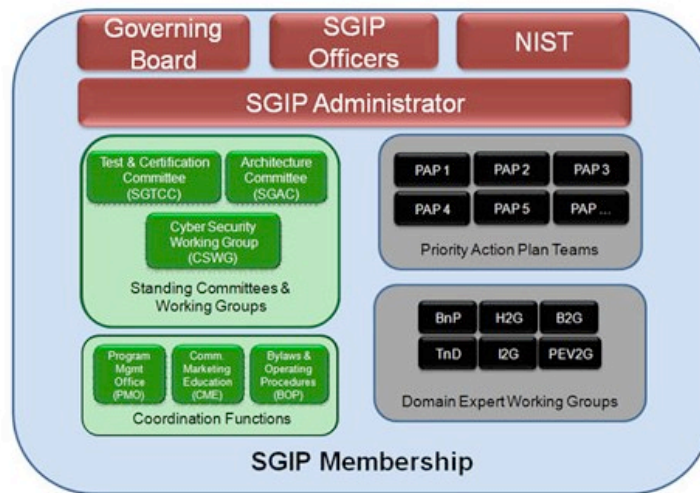
In the terminology being used for Smart Grid discussions, each of these seven categories is called a "domain." Within any particular domain, there may be a number of different "stakeholders" The framework being used by NIST to coordinate this effort identifies 22 stakeholder groups, from "appliance and consumer electronics providers" and "municipal electric utility companies" to "standards-development organizations" and "state and local regulators."

How is the standards-development process being organized?

Bringing together, in an open and consensus-based process, all the individuals and organizations involved in the Smart Grid is a challenge—a complicated challenge. There must be forums where technical experts within each domain can discuss and agree upon standards and protocols to be used within that domain. There must be forums where experts from different domains can discuss and agree upon the standards and protocols to be used for exchange of information or electricity between domains. There must be forums where experts can discuss and agree upon specific cross-cutting

issues, such as cyber-security or testing and certification. And there must be a forum that ensures that all the other forums are working together toward a common goal. It's a complicated challenge indeed.

The organizational structure developed to address this challenge is called the Smart Grid Interoperability Panel (SGIP), and its internal structure is shown below:



The various types of forums shown on this chart include:

- Governing Board
- Standing Committees
- Working Groups
- Priority Action Plan Teams
- Domain Expert Working Groups

What is the timeline?

The development of the Smart Grid will be evolutionary and will take place over several decades. This sort of evolution is how the current power grid developed, and it is also how other complicated systems, such as the next generation of the telecommunications network, are being developed.

Although the Smart Grid will take decades to reach maturity, the United States and other countries are taking strong steps right now. Accelerating development of the Smart Grid ranks among the Obama Administration's top priorities, and funding through "The American Recovery and Reinvestment Act of 2009" (Public Law 111-5, often referred to as "ARRA" or "the stimulus package") has provided a tremendous opportunity to "jump start" implementation of the Smart Grid. Included in ARRA was approximately \$11 billion for Smart Grid-related projects.

As an important first step in the decades-long effort to build a reliable and robust Smart Grid, there exists an immediate need for interoperable standards. Recognizing the urgency to accelerate the standards-development process, NIST received \$10 million from ARRA, through the Department of Energy (DOE), to carry out responsibilities assigned under EISA.

NIST's National Coordinator for Smart Grid Interoperability Office provides visible leadership at the national level and focuses accountability for managing NIST Smart Grid resources. In April 2009, the new office launched a three-phase plan to expedite development and promote widespread adoption of Smart Grid interoperability standards:

- Engage stakeholders in a participatory public process to identify applicable standards, gaps in currently available standards, and priorities for new standardization activities.
- Establish a formal private-public partnership to drive longer-term progress.
- Develop and implement a framework for testing and certification.

What's happened so far?

Throughout 2009 and 2010, NIST's Smart Grid program has been vigorously implementing this three-phase plan to develop a roadmap, engage the community of stakeholders, and establish testing programs. Here are some key milestones.

Brought together diverse stakeholders and standards-setting organizations in a series of three public workshops (convened, April, May, and August 2009)

- Launched a consensus-based organization to coordinate the development of standards (Smart Grid Interoperability Panel, established, November 2009)
- Created a collaborative ("wiki") web site for the exchange of information among SGIP members and other technical experts (NIST Smart Grid Collaboration Site, launched, November 2009)
- Developed and published a framework and roadmap to guide the development of interoperable standards (NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0, published, January 2010)
- Organized and hosted, in cooperation with the White House Office of Science and Technology Policy, an online forum to gather public input on questions pertaining to the consumer interface to the evolving Smart Grid, including issues surrounding data ownership, access, and privacy. (Consumer Interface Forum launched, February 2010)
- Developed and published guidelines for Smart Grid cyber security (Guidelines for Smart Grid Cyber Security, NISTIR 7628, published, August 2010)
- Established the Smart Grid Advisory Committee to advise NIST Director Patrick Gallagher on the direction of NIST's Smart Grid related programs and activities (convened September 2010)

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- Identified five foundational sets of standards for Smart Grid interoperability as ready for consideration by federal and state regulators (Letter to Federal Energy Regulatory Commission, sent October 2010)

What happens next?

The work to develop and coordinate Smart Grid standards is ongoing, primarily through the Standing Committees, Working Groups, Domain Expert Working Groups, and Priority Action Plan teams of the SGIP. As these groups develop their recommendations, they are reviewed and adopted by the SGIP, through its governance structure. Throughout the process, the emphasis is on transparency, consensus, and public participation.

In late 2010 and early 2011, we anticipate numerous important milestones to be reached, including the following:

- Standards related to plug-in electric vehicles
- Publication of Release 2.0 of the Interoperability Framework
- Publication of the framework for Testing and Certification.

How can I get involved?

For those interested in following developments at a level accessible to the general public, we recommend visiting the NIST Smart Grid Interoperability website frequently.

For those interested in following developments at a more technical, nitty-gritty level, we recommend visiting the NIST Smart Grid Collaboration Website. Anyone interested in contributing to the Smart Grid Interoperability effort is welcome to join one of the Domain Expert Working Groups listed on the Collaboration Site.

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