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## Charge to the Committee and Agenda Review

George W. Arnold, Eng.Sc.D.  
National Coordinator for Smart Grid Interoperability  
National Institute of Standards and Technology  
September 29, 2010



### *Smart Grid Advisory Committee Charter*

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The Committee shall provide input to NIST on the Smart Grid Standards, Priorities and Gaps and on the overall direction, status and health of the Smart Grid implementation by the Smart Grid industry including identification of issues and needs. Input to NIST will be used to help guide Smart Grid Interoperability Panel activities and also assist NIST in directing research and standards activities.

The duties of the Committee are solely advisory in nature in accordance with the provisions of the Federal Advisory Committee Act.

## *My Goals for the Committee*

- Seek inputs from the Smart Grid Advisory Committee (SGAC) on our current activities
- Work with the SGAC to formulate short-term Smart Grid Program and Research Planning
- Develop long-term future directions for the Smart Grid Program including a Research Agenda
- Develop a performance assessment tool for the Smart Grid Program
- Produce Committee report for the Director of NIST
- Maximize the impact of the SGAC for NIST
- Respecting the valuable time of the SGAC members

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## *Outline of Today's Activities*

- Orientation and Ethics Briefing
- Overview of current NIST Smart Grid Program
- Smart Grid Research and Gaps
- Smart Grid Research Needs
- Questions for the Committee
- Plans and Organization of Committee

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## *NIST Questions for the Smart Grid Advisory Committee*

Are we doing the right things?

- What should the Focus Areas and Priorities be for NIST work related to Smart Grid?
  - Address both the standards/interoperability work as well as research on measurements needed for the Smart Grid
  - Are current programs addressing industry needs? Are new programs needed?
- What timeframes should NIST efforts be targeting?
- What should a mature Smart Grid effort look like?
  - in 5 years? 10 years?
  - What should the roles of industry, government, regulators be?

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## *NIST Questions for the Smart Grid Advisory Committee (Continued)*

Are we doing things right?

- How can NIST do a better job of engaging the Smart Grid community
  - Industry
  - Regulators
  - Academia
  - Consumers
  - Others
- How can we improve the effectiveness of the NIST Interoperability Standards Program
  - Include recommendations both for NIST as well as SGIP
- Is NIST engagement with international Smart Grid efforts adequate? How can it be strengthened?
- What should we pay attention to as we evolve the structure of Smart Grid efforts within the NIST organization?

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# SUMMARY OF ETHICS RULES FOR SPECIAL GOVERNMENT EMPLOYEES 2010

**CONFLICT OF INTEREST LAWS - APPEARANCES OF BIAS - BRIBES AND GIFTS - FINANCIAL CONFLICTS OF INTEREST - MISUSE OF GOVERNMENT RESOURCES - NON-GOVERNMENT ACTIVITIES - POST-FEDERAL EMPLOYMENT RESTRICTIONS - STANDARDS OF CONDUCT - CONFLICT OF INTEREST LAWS - APPEARANCES OF BIAS - FINANCIAL CONFLICTS OF INTEREST - NON-GOVERNMENT ACTIVITIES - BRIBES AND GIFTS - MISUSE OF GOVERNMENT RESOURCES - POST-FEDERAL EMPLOYMENT RESTRICTIONS - STANDARDS OF CONDUCT - CONFLICT OF INTEREST LAWS - BRIBES AND GIFTS - NON-GOVERNMENT ACTIVITIES - APPEARANCES OF BIAS - MISUSE OF GOVERNMENT RESOURCES - FINANCIAL CONFLICTS OF INTEREST - POST-FEDERAL EMPLOYMENT RESTRICTIONS - STANDARDS OF CONDUCT - CONFLICT OF INTEREST LAWS - APPEARANCES OF BIAS - BRIBES AND GIFTS - FINANCIAL CONFLICTS OF INTEREST - MISUSE OF GOVERNMENT RESOURCES - NON-GOVERNMENT ACTIVITIES - POST-FEDERAL EMPLOYMENT RESTRICTIONS - STANDARDS OF CONDUCT - APPEARANCES OF BIAS - FINANCIAL CONFLICTS OF INTEREST - NON-GOVERNMENT ACTIVITIES - BRIBES AND GIFTS - MISUSE OF GOVERN**

**ETHICS LAW AND PROGRAMS  
DIVISION  
OFFICE OF THE ASSISTANT  
GENERAL COUNSEL FOR  
ADMINISTRATION  
UNITED STATES DEPARTMENT OF  
COMMERCE  
202-482-5384  
ethicsdivision@doc.gov  
www.ogc.doc.gov/ethics.html**

## **PUBLIC SERVICE IS A PUBLIC TRUST**

The role of consultants and advisors and other limited-service employees is vital to the effective functioning of the Federal Government. All employees are held to a high standard of conduct. As an employee who serves less than 130 days per year, you are considered a “special Government employee” and are subject to many, but not all, of the ethics rules applicable to Government employees who serve for longer periods of time. This document is intended to help familiarize you with those rules.

**If you have a question regarding an ethics issue, contact the Ethics Law and Programs Division of the Office of the Assistant General Counsel for Administration at 202-482-5384 or [ethicsdivision@doc.gov](mailto:ethicsdivision@doc.gov).**

Designated Agency Ethics Official:  
Cameron F. Kerry, General Counsel

Alternate Designated Agency Ethics Official:  
Barbara S. Fredericks, Assistant General Counsel for Administration



## FINANCIAL CONFLICTS OF INTEREST

USG

### **Basic Principle: No Self-Dealing**

One of the most basic ethics rules concerns self-dealing. To ensure public confidence in the integrity of the Government, a conflict of interest statute prohibits you from working as a Government official on a matter affecting your personal financial interests (or the interests of those close to you). Such participation would create a conflict between your personal interests and your duty to the Government.

**General Rule.** You may not participate as a Government official on a matter that will have a direct and predictable effect on your financial interests or those of your spouse, minor children, or general partners; persons with whom you are seeking employment; organizations for which you serve as an officer, director, trustee, general partner, or employee; or, with regard to a matter involving specific parties, a member of your household (unless an exemption applies or you receive a conflict of interest waiver). This includes a matter that affects a company in which you own stock.

**Exemptions from the General Rule.** Exemptions permit you to participate in matters affecting a financial interest if the financial interest is:

- a holding in a diversified mutual fund;
- a holding in an industry sector-specific mutual fund or geographic sector-specific mutual fund of \$50,000 or less (if interests in all such funds are \$50,000 or less);
- a publicly-traded stock or bond holding of \$15,000 or less in a company;
- a publicly-traded stock or bond holding of \$25,000 or less in a company regarding a matter in which it is not a party (and, if it is a broad policy matter, total holdings in the industry or group affected by the matter are \$50,000 or less);
- the financial interest of a non-Federal employer (if you are a member of a Federal advisory committee); or
- one for which you have received a conflict of interest waiver.

**Conflict of Interest Exemptions and Waivers.** If you serve on a Federal advisory committee, a waiver of the disqualification requirement is available if necessary to effectively serve on the committee. To obtain a conflict of interest waiver, contact the Ethics Law and Programs Division at 202-482-5384.



## APPEARANCES OF BIAS (NON-FINANCIAL CONFLICTS OF INTEREST)

USG

### Basic Principle: No Special Favors

Because the public must have confidence in the Government and the impartiality of its employees, it is important that you avoid situations that may give rise to an appearance of a conflict of interest based on your personal relationships. There may be a matter in which you are asked to work that will not create an actual financial conflict of interest, but may, because the matter involves someone with whom you have close ties, create an appearance of favoritism or loss of objectivity.

**General Rule.** You may not participate in a matter involving specific parties if a person with whom you have close ties (a “covered relationship”) is a party or is representing a party in the matter and if your participation would create an appearance of loss of impartiality (unless you receive specific authorization to participate in the matter).

Persons with whom you have a “covered relationship” include:

- persons with whom you have business or financial relationships or are seeking such relationships (other than routine consumer transactions);
- household members;
- close relatives;
- employers and clients of your parents, dependent children, and spouse (and their prospective employers and clients);
- former non-Federal employers and clients (for one or two years depending on the amount of any severance payment and whether you are a political appointee); and
- organizations (other than political parties) in which you are an active participant.

**Exception to the General Rule.** You may be able to work on a matter in which someone with whom you have a covered relationship is a party or represents a party if the interest of the Government in your participation outweighs a concern that someone may question the integrity of the Department’s programs and operations. However, before you participate in such a matter you must receive authorization to do so. Contact the Ethics Law and Programs Division at 202-482-5384 to obtain an authorization if such a situation arises.



## BRIBES AND GIFTS

USG

### **Basic Principle: Avoid Undue Influence**

The United States Government, like all governments, recognizes that the acceptance of bribes is one of the most basic forms of corruption. Similarly, gratuities from persons with matters before the Government may create an appearance of undue influence on Government employees.

**General Rule concerning Bribes.** You may not receive anything of value for taking action or failing to take action in your Government position.

**General Rules concerning Personal Gifts.** You may not accept gifts from a person or firm that has or is seeking business with the Department of Commerce, that is seeking action by Commerce, or that is regulated by the Department, unless an exception applies. You also may not accept gifts that are given to you because of your Government position, unless an exception applies.

**Exceptions to the General Rules concerning Personal Gifts.** You may accept:

- gifts of \$20 or less (other than cash) (up to \$50 per year from the same source);
- gifts from relatives and friends (if based on a personal relationship);
- gifts of meals, lodging, and travel based on your outside business or employment relationships or those of your spouse;
- awards and honorary degrees (in specified circumstances);
- invitations to widely-attended events (if from the host (generally) and if your Government supervisor approves your attendance as in the Department's interest);
- business meals overseas, if a foreign citizen or representative of a foreign entity is present (up to the *per diem* of the city); and
- gifts from a foreign government of \$335 or less—gifts over \$335 may be accepted, but become property of the United States Government.





## NON-GOVERNMENT ACTIVITIES

USG

### **Basic Principle: Avoid Divided Loyalties**

As a special Government employee, you are likely to have employment other than your U.S. Government position. It is important that you consider whether such non-Federal employment, or other personal activities, conflict with your Government duties.

**General Rule regarding Non-Federal Employment.** You may not engage in non-Federal employment that conflicts with your Government duties. An activity may create a conflict if it is barred by law (such as employment with a foreign government) or if it requires your disqualification from assignments critical to the performance of your Federal duties.

**Working for a Foreign Government.** The U.S. Constitution bars you from working for, or accepting any compensation, including salary or travel expenses, from, a foreign government, unless authorized by statute.

**General Rule regarding Political Activities.** The rules on political activities are intended to allow you to actively participate in the political process, but also to ensure that Government activities and political activities are not intermingled. You may not engage in political activities during Government duty hours or while on Government premises. You are also barred from using Government resources (including your Government affiliation) for a partisan political purpose or to aid a political campaign or organization. You may engage in partisan political activities during non-duty hours, even on days in which you are providing services to the Government.

**Service as an Expert Witness.** Unless you receive prior authorization, you may not serve as an expert witness in any case involving the United States Government if you participated as a Government employee in the matter that is the subject of the proceeding. Additionally, if you served for more than 60 days during the previous year, or on a commission established by statute, you may not serve as either a fact or an expert witness in a proceeding before a Federal court or Federal agency if the Department of Commerce is a party or has a direct and substantial interest in the matter, unless you receive prior authorization.



## CONTACTING FEDERAL OFFICIALS ON BEHALF OF OTHERS

USG

### **Basic Principle: Avoid Divided Loyalties**

As a Federal employee, you are subject to some restrictions on your dealings with Federal agencies and courts to avoid any appearance of undue influence.

**General Rules on Contacting Government Officials.** Because you are considered a Federal official, you are subject to some limitations regarding contacts with other Federal officials to influence Government actions on behalf of others.

You may not serve as an agent or attorney (or generally represent) anyone before a Federal agency or court regarding a matter that involves specific parties (such as a contract, grant, license, or litigation in which specific individuals or firms are named) if:

- you participated in that matter as a Federal official, or
- if you served for 61-130 days with the Government during the past 365-day period, the matter is pending before the Department of Commerce.

**Receipt of Compensation based on the Lobbying Activities of Others.** In addition to being restricted from representing others before the Federal Government, you are also barred from accepting compensation for the representational activities of others (such as an attorney in a law firm in which you are a partner) before the United States Government regarding a matter involving specific parties in which you participated personally and substantially or, if you served for 61-130 days, on a matter pending before the Department during your period of service.

**Restrictions on Serving as a Foreign Government Agent or Lobbyist.** You may not perform services on behalf of a foreign government that will require registration under the Foreign Agents Registration Act or the Lobbying Disclosure Act.



## MISUSE OF GOVERNMENT RESOURCES

USG

### **Basic Principle: Do Not Steal**

It is important to limit the use of taxpayer-funded resources to activities that benefit the public rather than the individual employee.

**General Rules.** You may only use Government equipment, supplies, services, and personnel for authorized Government activities. Furthermore, your Government title may not be used in connection with private, non-Government activities. You must avoid circumstances that may imply that the Government endorses a particular private activity with which you are associated. Therefore, it would be improper for you to refer to your Government title or position when conducting personal business. You may not use nonpublic trade data, economic analyses, private personnel information, protected census data, national security information, or other nonpublic information for your private activities or for the benefit of someone else. You also may not use your Government authority, including business contacts obtained through Federal employment, for personal non-official activities.

**Exceptions to the General Rules regarding Use of Your Title and Frequent Flier Benefits.** You may use your Government title in connection with personal activities as part of general biographical data if it is given no more prominence than other significant biographical details. Regarding frequent flier benefits, you may use frequent flier miles and other benefits obtained from Government travel for personal purposes, including personal travel or upgrades on Government travel.



## RESTRICTIONS AFTER LEAVING A FEDERAL POSITION

USG

### **Basic Principle: Avoid Misuse of a Prior Relationship**

After ending your Federal service some restrictions will apply to you, particularly with regard to lobbying the Government or using nonpublic information.

**General Rules.** After you leave Government service you may not contact Federal agencies or courts on behalf of others regarding:

- any matter that concerns named parties (such as a contract, grant, licence, or litigation) if you worked on the matter during your Federal service, or
- for two years, any matter that concerns named parties on which a subordinate of yours worked (or which was under your responsibility) within the past year.

If you are a senior employee (meaning you had a base pay equivalent to \$148,953 per year or more in 2008), you may not for one year after leaving Federal service:

- contact anyone in your former agency on behalf of someone else and
- advise a foreign government or foreign political party or represent a foreign government or foreign political party before any branch of the U.S. Government.

You also may not use or disclose nonpublic information you obtained through your service with the Government.

**Exceptions.** There are exceptions to some post-employment rules, including for contacts made on behalf of a state or local government, educational or medical institution, or international organization; as well as for testimony under oath.

**Seeking Non-Federal Employment.** Please note that during the period you are in employment discussions with a non-Federal Government entity you may not participate as a Federal official on any matter in which the prospective employer has a financial interest. This disqualification begins when you first contact a prospective employer or are contacted by one and continues until you or the prospective employer notifies the other of a lack of interest in pursuing the matter.

Contact the Ethics Law and Programs Division (202-482-5384) for advice or to obtain a handout on these rules.



## FINANCIAL DISCLOSURE

USG

### **Basic Principle: Tell the Whole Truth**

**Basic Guidelines.** As a special Government employee you will be required to file a financial disclosure report. Please keep in mind that the information you disclose is used to provide advice to you to help ensure that you do not inadvertently engage in prohibited activities. To provide this advice (and to certify that the report includes all necessary information) it is important that the information you provide be as complete as possible. Specifically, please be sure to include the following information:

- specific holdings in any IRA, 401(k) account, trust, or investment account;
- a short description of the activities or industry sector of any privately-held company or limited partnership; and
- assets and sources of income of your spouse.

**For more information about any of these rules contact the  
Ethics Law and Programs Division of the Office of the General Counsel,  
United States Department of Commerce, at 202-482-5384.**



## EXAMPLES

USG

### NO PROBLEM

1. A member of an advisory committee that advises on regulations affecting all U.S. telephone companies has \$30,000 of telephone company stock, which is included in a conflict of interest waiver.
2. A 90-day temporary employee who has \$60,000 in a broadly-diversified mutual fund with some energy holdings reviews a proposed oil spill regulation.
3. A consultant works on a grant application from a company for which he worked three years ago.
4. A special Government employee makes telephone calls on behalf of a candidate in a partisan election during non-duty hours from her home on a personal cell phone.
5. An advisory committee member (who serves for less than 60 days) contacts a Commerce official for a neighbor on a grant unrelated to the committee's work.
6. An advisory committee member uses an agency-produced publicly-available marketing study to target potential customers for his private business.

### PROBLEM

1. A member of an advisory committee that advises on regulations affecting all U.S. telephone companies has \$30,000 of telephone company stock and no conflict of interest waiver.
2. A 90-day temporary employee who has \$60,000 in a sector-specific mutual fund that focuses on energy holdings reviews a proposed oil spill regulation.
3. A consultant works on a grant application from a company for which he worked three months ago.
4. A special Government employee makes telephone calls on behalf of a candidate in a partisan election during non-duty hours from her Government office on a personal cell phone.
5. An advisory committee member (who serves for more than 60 days) contacts a Commerce official for a neighbor on a grant unrelated to the committee's work.
6. An advisory committee member uses an agency-produced non-public marketing study to target potential customers for his private business.



## CITATIONS TO APPLICABLE LAW

USG

### **Financial Conflicts of Interest**

18 United States Code (U.S.C.) § 208

5 Code of Federal Regulations (C.F.R.) §§ 2635.401-2635.403, 2635.502,  
2640.201-2640.202

### **Appearances of Bias based on Outside Relationships**

5 C.F.R. §§ 2635.501-2635.503

### **Bribes and Gifts**

5 U.S.C. §§ 7342, 7351, and 7353

15 U.S.C. § 1522

18 U.S.C. § 201

5 C.F.R. §§ 2635.201-2635.205, 2635.301-2635-304

### **Non-Government Activities and Lobbying the Federal Government**

5 U.S.C. §§ 7321-7326; 18 U.S.C. §§ 203, 205, and 208

5 C.F.R. §§ 734.201-734.702, 2635.801-2635.809

### **Misuse of Government Position and Resources**

18 U.S.C. § 641

5 C.F.R. §§ 2635.701-2635.705

### **Post-Federal Employment Restrictions**

18 U.S.C. § 207

5 C.F.R. Parts 2635, 2637, and 2641

15 C.F.R. §§ 15.11-15.18

*Prepared by the Ethics Law and Programs Division, Office of the Assistant General Counsel for  
Administration, United States Department of Commerce – January 5, 2010*

# NIST Smart Grid Interoperability Program

George W. Arnold, Eng.Sc.D.  
National Coordinator for Smart Grid Interoperability  
National Institute of Standards and Technology  
September 29, 2010

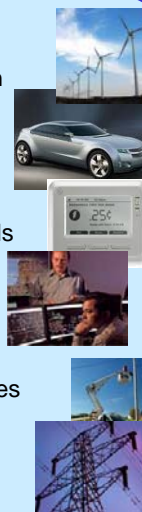


## Smart Grid – A National Priority

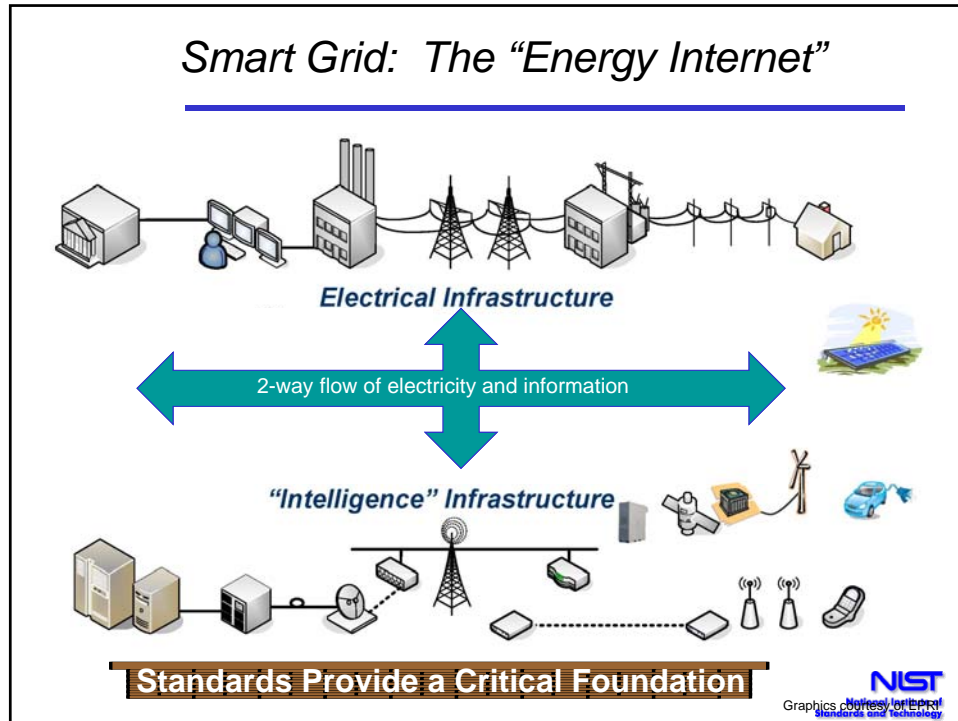
- “We’ll fund a better, smarter electricity grid and train workers to build it...”  
President Barack Obama
- “To meet the energy challenge and create a 21<sup>st</sup> century energy economy, we need a 21<sup>st</sup> century electric grid...” Secretary of Energy Steven Chu
- “A smart electricity grid will revolutionize the way we use energy, but we need standards ...”  
Secretary of Commerce Gary Locke

### Smart Grid Enables:

- Higher Penetration of Renewables
- Smart Charging of Electric Vehicles
- Consumers to Control Energy Bills
- Efficient Grid Operations & Reduced Losses
- Reduced Distribution Outages
- Improved System Reliability & Security







## Smart Grid Interoperability

- Interoperability: The ability of 2 or more networks, systems, devices, applications, or components to communicate & operate together effectively, securely, & without significant user intervention
  - Communication requires agreement on a physical interface & communication protocols
  - Exchanging meaningful & actionable information requires common definitions of terms & agreed upon responses
  - Consistent performance requires standards for the reliability, integrity, and security of communications
  - Interoperability may include:
    - "Plug and play": connect them & they work together
    - Interchangeability: Ability to readily substitute components

## Benefits of Interoperability Standards

- Make it easy for consumers to use smart devices regardless of location & provider
- Protect privacy while enabling consumers to securely access information on their own energy consumption
- Prevent premature obsolescence, facilitate future upgrades, & ensure systems can be scaled up for larger deployments
- Provide for backward compatibility, integrating new investments with existing equipment
- Expand product markets & promote vendor competition: reducing costs, accelerating innovation, & increasing choice
- Ensure the security & enhance the reliability of the power grid

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## Why Do We Need Standards?



### **Example: Smart Meters**

- Key element of smart grids
- 40 million to be deployed in the next several years in US
- Rapid technology evolution
- Absence of firm standards

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## Why Do We Need Standards?

**Whirlpool Corporation To Produce One Million Smart Grid-Compatible Clothes Dryers by the End of 2011...**

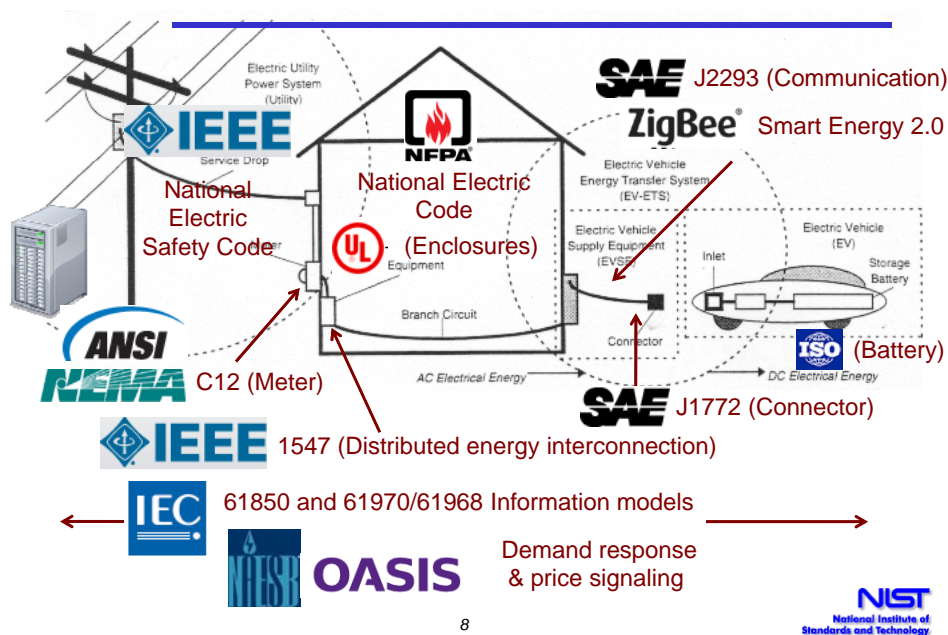
Standards for data communication, price information, schedules, demand response signals



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**NIST**  
National Institute of Standards and Technology

## Electric Vehicles Require Many Standards

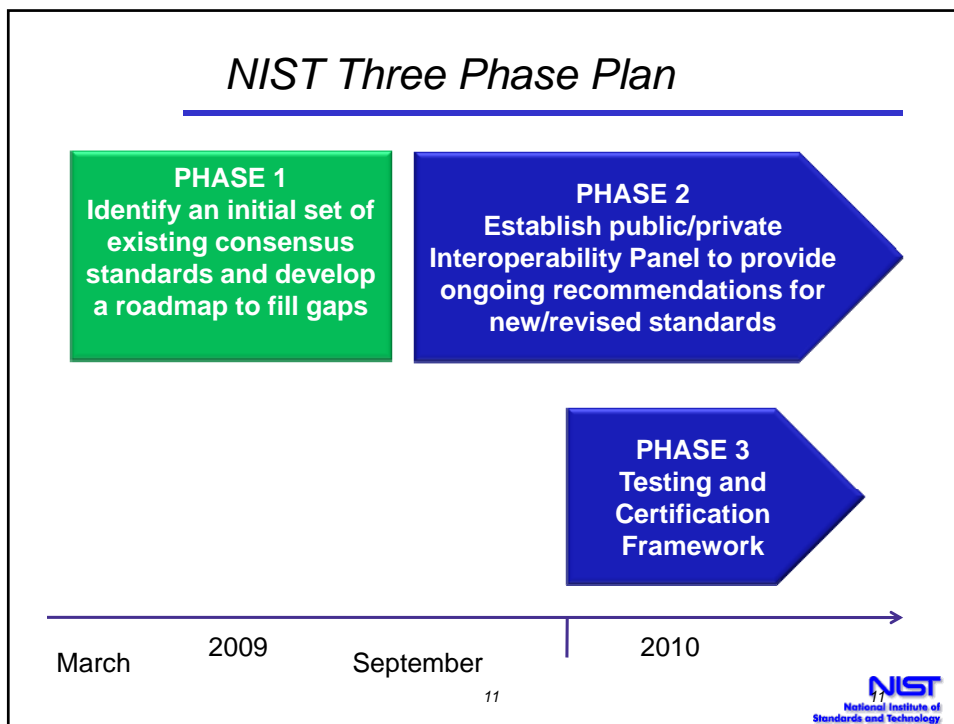


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### NIST Role

- Under Title XIII, Section 1305 of 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...”*
- Congress directed that the framework be “flexible, uniform, and technology neutral”
- Use of these standards is a criteria for DoE Smart Grid Investment Grants
- Input to FERC and state PUC rulemaking



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### *White House Meeting May 2009*

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- Chaired by Secretaries of Energy and Commerce
- 66 CEOs and senior executives, federal and state regulators

- Commitment to accelerate development of a roadmap



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## Open, Public Process

- Three public workshops
- More than 1500 participants
- Hundreds of companies, organizations, agencies
- Online collaboration wiki
- White House-sponsored blog
- Federal Register Notices
- Web conferences
- All information publicly available on-line

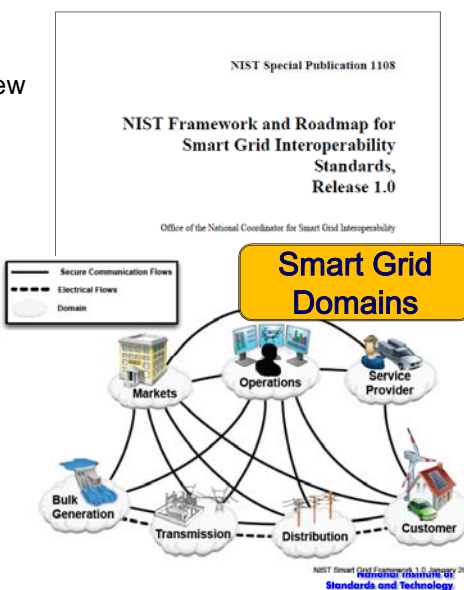


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## Smart Grid Framework and Roadmap 1.0

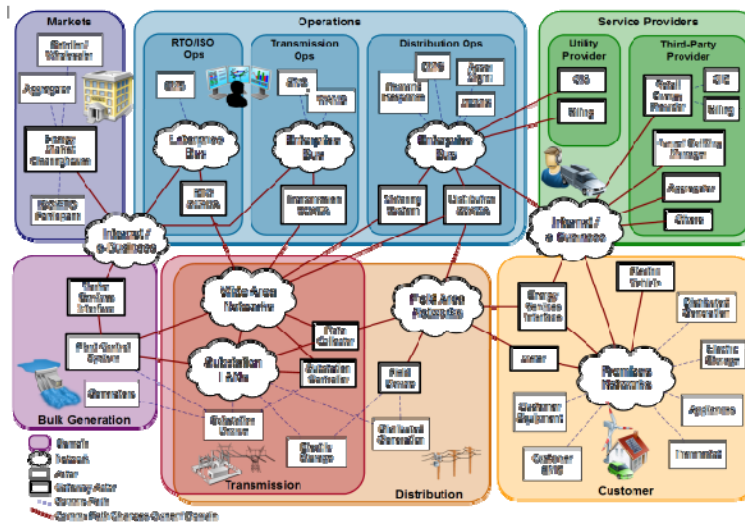
- Published January 2010
  - Extensive public input and review
  - Completed in Less than 1 year
- Smart Grid Vision & Reference Model
- Identified 75 existing standards
- 16 Priority Action Plan Projects are filling key gaps
- Companion Cyber Security Strategy

<http://www.nist.gov/smartgrid/>



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## Smart Grid Reference Model



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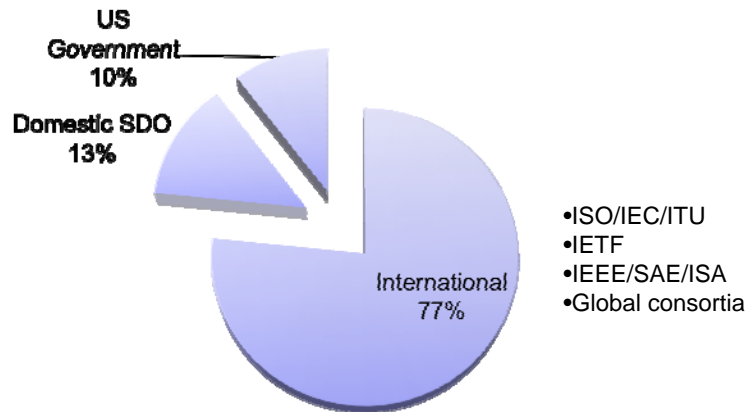
## The Standards Address...

- Demand Response and Consumer Energy Efficiency
- Wide Area Situational Awareness
- Electric Storage
- Electric Transportation
- Advanced Metering Infrastructure
- Distribution Grid Management
- Cyber Security
- Network Communications

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## Smart Grid Will Use International Standards

### Source of Standards in NIST Roadmap



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**NIST**  
National Institute of  
Standards and Technology



## Smart Grid Interoperability Panel

- Public-private partnership created in Nov. 2009
- Broad range of stakeholders in SGiP developing consensus about standards needed to build a smarter grid
  - Nearly 600 member organizations (with over 50 international organizations) & over 1700 participants from 22 stakeholder categories
- Coordinates the development of standards by Standards Development Organizations (SDOs)
  - Identifies Requirements
  - Prioritizes standards development programs
  - Works with over 20 SDOs including IEC, ISO, ITU, IEEE, ...
- Open, transparent & inclusive process
  - SGiP Twiki: <http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGiP>

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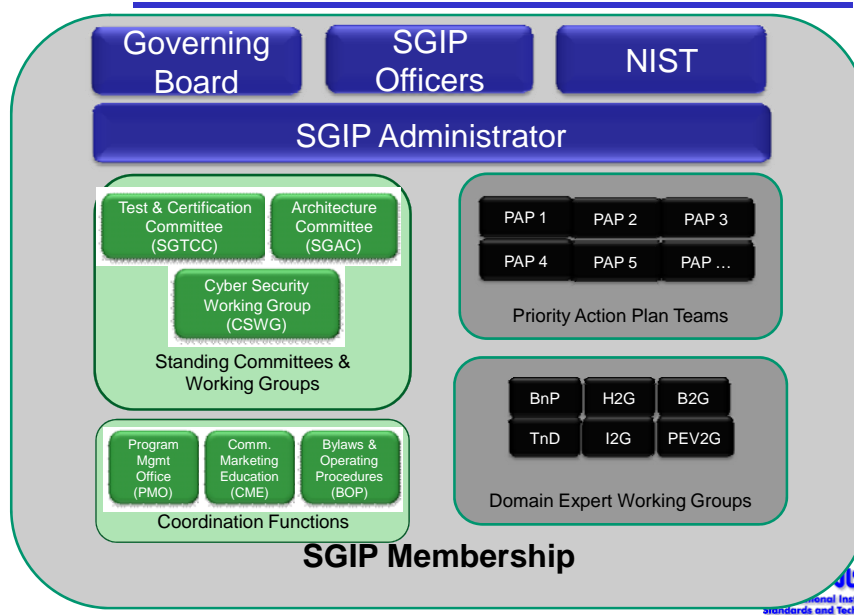
**NIST**  
National Institute of  
Standards and Technology



## Smart Grid Stakeholders

1	Appliance and consumer electronics providers	12	Power equipment manufacturers and vendors
2	Commercial and industrial equipment manufacturers and automation vendors	13	Professional societies, users groups, and industry consortia
3	Consumers – Residential, commercial, and industrial	14	R&D organizations and academia
4	Electric transportation industry Stakeholders	15	Relevant Federal Government Agencies
5	Electric utility companies – Investor Owned Utilities (IOU)	16	Renewable Power Producers
6	Electric utility companies - Municipal (MUNI)	17	Retail Service Providers
7	Electric utility companies - Rural Electric Association (REA)	18	Standard and specification development organizations (SDOs)
8	Electricity and financial market traders (includes aggregators)	19	State and local regulators
9	Independent power producers	20	Testing and Certification Vendors
10	Information and communication technologies (ICT) Infrastructure and Service Providers	21	Transmission Operators and Independent System Operators
11	Information technology (IT) application developers and integrators	22	Venture Capital

## SGIP Organization





## **SGIP Standing Committees**

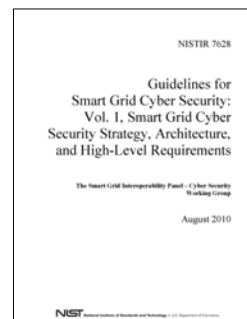
- Smart Grid Architecture Committee (SGAC)
  - Creates & refines SG Conceptual Reference Model, including lists of the standards and profiles necessary to implement the Smart Grid.
  
- Testing & Certification Committee (SGTCC)
  - Creates and maintains the documentation and organizational framework for compliance, interoperability and cyber security testing and certification related to Smart Grid standards
  - Develops & implements certification criteria by which compliance can be verified through testing of vendor products and services

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## **Cyber Security Working Group**

- Building cyber security in from the start has been a paramount concern
- Permanent Working Group
  - Over 460 public and private sector participants
- August 2010 NIST publishes: *Guidelines for Smart Grid Cyber Security*
  - Reflects Comments on Sept 2009 and Feb 2010 Draft *Smart Grid Cyber Security Strategy and Requirements*
- Guideline includes:
  - Risk assessment guidance for implementers
  - Recommended security requirements
  - Privacy recommendations



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## Priority Action Plans (PAPs)

- Created to address gaps in Smart Grid standards

#	Priority Action Plan	#	Priority Action Plan
0	Meter Upgradeability Standard	9	Standard DR and DER Signals
1	Role of IP in the Smart Grid	10	Standard Energy Usage Information
2	Wireless Communication for the Smart Grid	11	Common Object Models for Electric Transportation
3	Common Price Communication Model	12	IEC 61850 Objects/DNP3 Mapping
4	Common Scheduling Mechanism	13	Time Synchronization, IEC 62850 Objects/ IEEE C37.118 Harmonization
5	Standard Meter Data Profiles	14	Transmission and Distribution Power Systems Model Mapping
6	Common Semantic Model for Meter Data tables	15	Harmonize Power Line Carrier Standards for Appliance Communications in the Home
7	Electric Storage Interconnection Guidelines	16	Wind Plant Communications
8	CIM for Distribution Grid Management	17	Customer Facility Smart Grid Information

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## NIST Bilateral Exchanges on SG Standards

### Asia

- Japan
- Korea
- China
- Singapore
- Australia
- India
- Pakistan

### EMEA

- EC
- France
- Germany
- Denmark
- Austria
- Poland
- Israel

### Americas

- Canada
- Mexico
- Brazil

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## NIST Smart Grid Team

- National Coordination Office
  - George Arnold, Dean Prochaska, Cuong Nguyen, Christina Santangelo
- PML (EEEL)
  - Dave Wollman, Jerry Fitzpatrick, Paul Boynton, Tom Nelson, Al Hefner, Eric Simmon, Galen Koepke, Barbara Goldstein, Zulma Lainez, ...
- ITL
  - David Su, Nada Golmie, Hamid Ghavri, Marianne Swanson, Tanya Brewer, Jim St. Pierre, Donna Dodson, Matt Scholl, Annabelle Lee, ...
- EL (BFRL and MEL)
  - David Holmberg, Steve Bushby, ...
  - Keith Stouffer, ...
- Standards Services Division
  - Gordon Gillerman, Ileana Martinez, Dave Alderman, ...
- Public and Business Affairs
  - Mark Bello, Gail Porter, ...
- Program Office
  - Mike Janezic, Allan Eustis, Ajit Jilla
- NIST Counsel
  - Melissa Lieberman, Henry Wixon
- AMD
  - Wanza Jonjo, Mary Johnson, ...
- Congressional & Legislative Affairs
  - Jim Schufreider, Linda Acierto

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## Smart Grid Program Funding

	FY08	FY09	FY10	FY11*
STRS Non-Base	0	\$2.3M	0	0
STRS Base	0	0	\$5M	\$10M
ARRA from DOE	0	\$12M		
ARRA from NIST	0	\$5M		

\* Includes \$5M FY11 Interoperability Initiative in the NIST FY11 budget request

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## *Further Information*

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- Web portal: <http://www.nist.gov/smartgrid>
- Contact:
  - George Arnold, National Coordinator
  - Email: [george.arnold@nist.gov](mailto:george.arnold@nist.gov)
  - Telephone: +1.301.975.2232



27

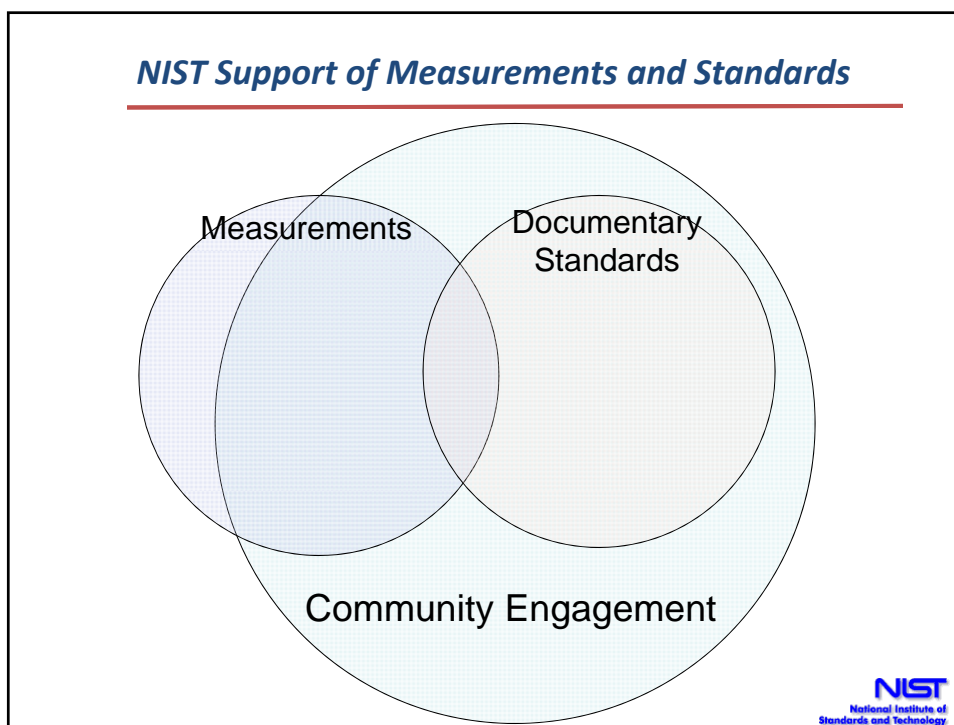
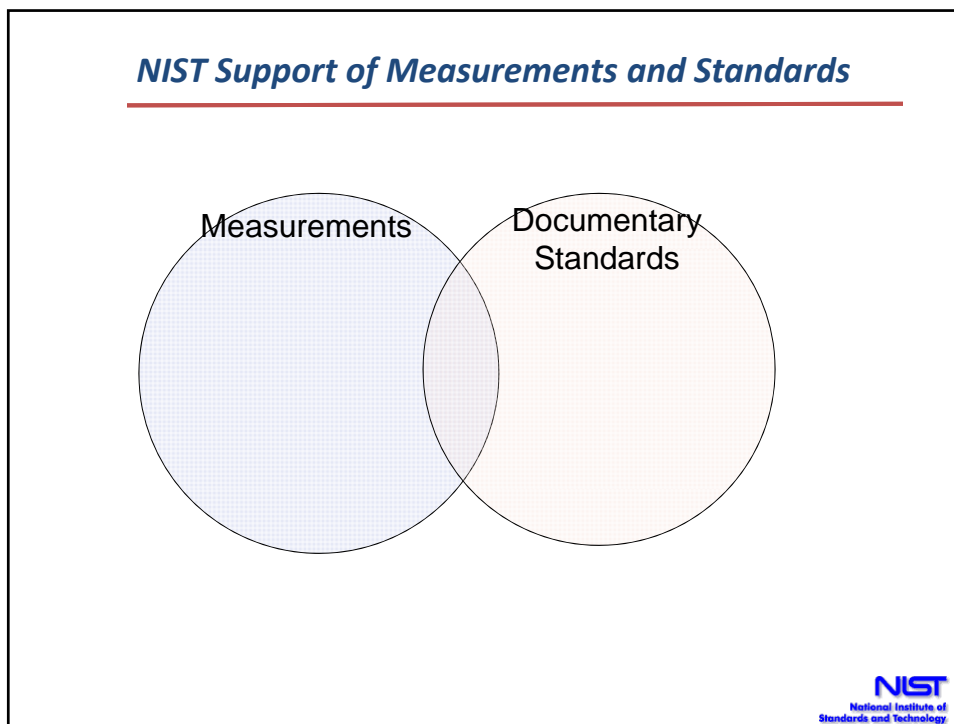
## Smart Grid Research and Gaps

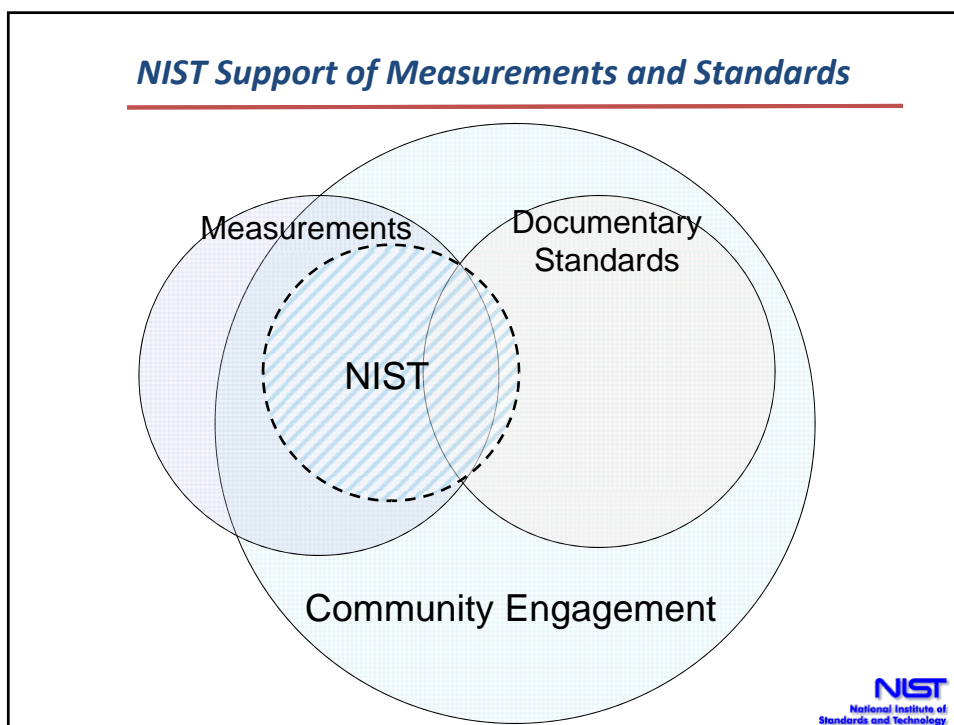
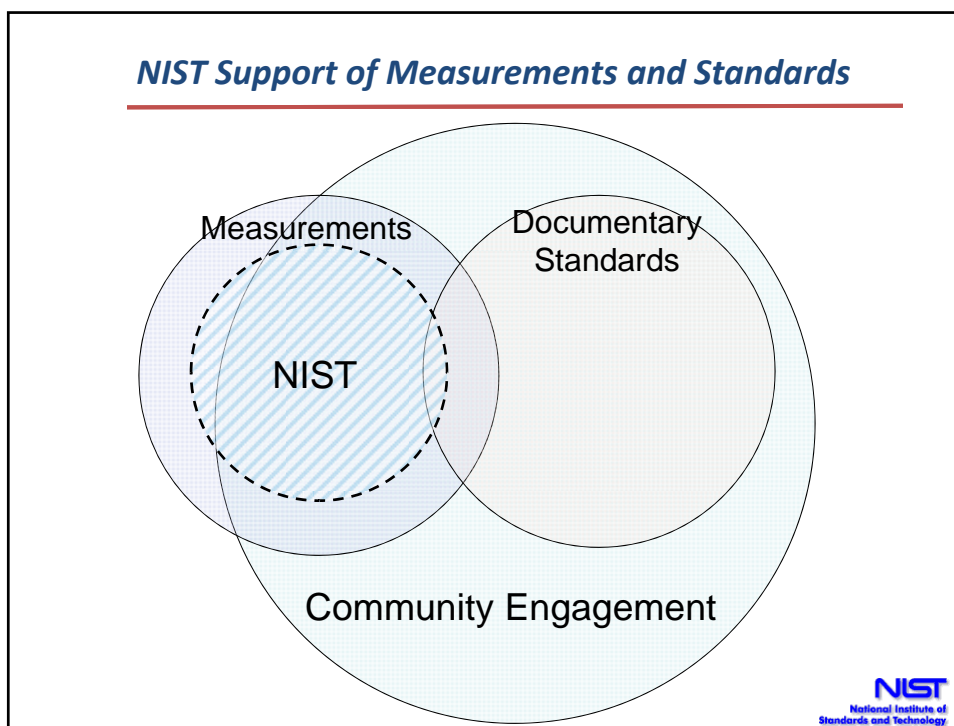
David Wollman  
Smart Grid Team  
Physical Measurement Laboratory  
National Institute of Standards and Technology  
U.S. Department of Commerce



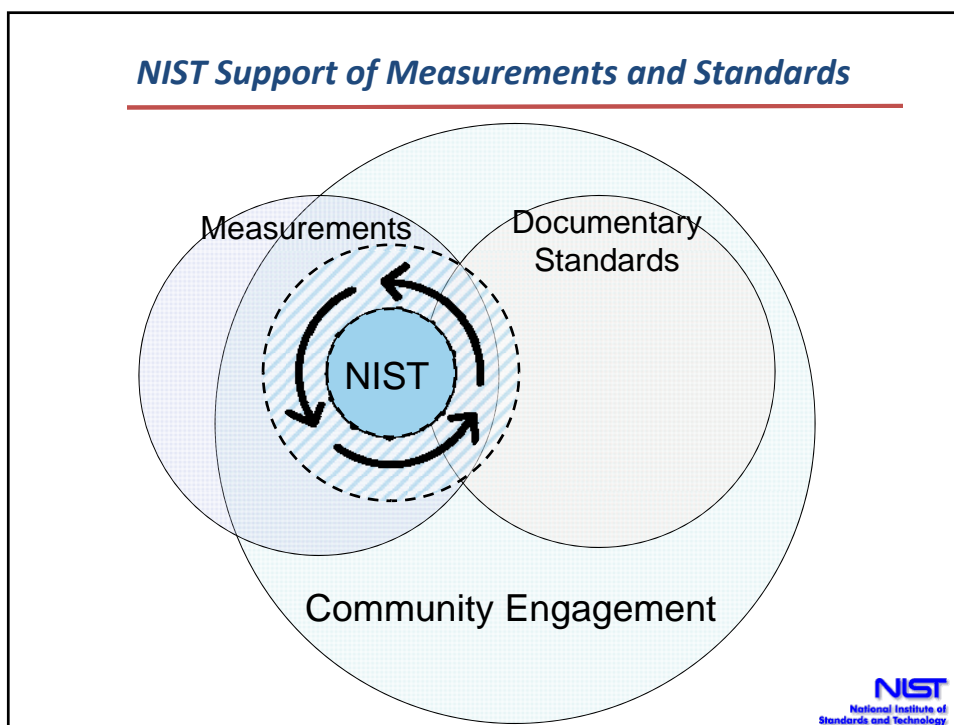
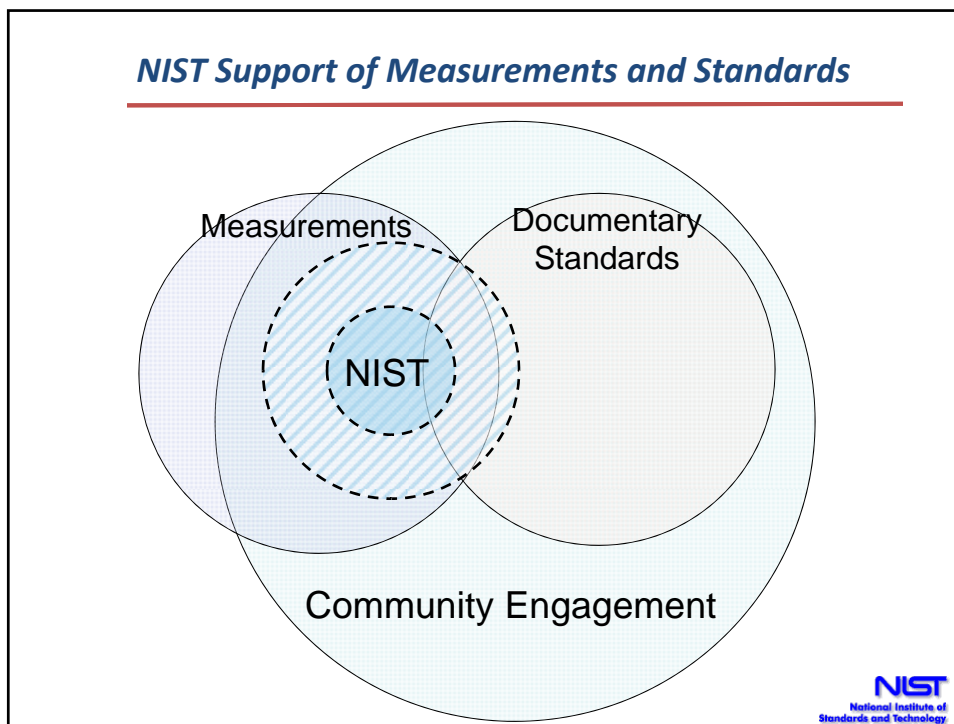
### *Smart Grid Research and Gaps – Outline*

- Measurements and Documentary Standards Introduction
- NIST Three Phase Plan
  - NIST Smart Grid Interoperability Framework, Release 1.0
  - NIST Smart Grid Interoperability Panel
  - How best to include research needs?
- NIST Smart Grid Research
- Smart Grid Research Opportunities
  - Research areas
  - Outreach, potential partnerships

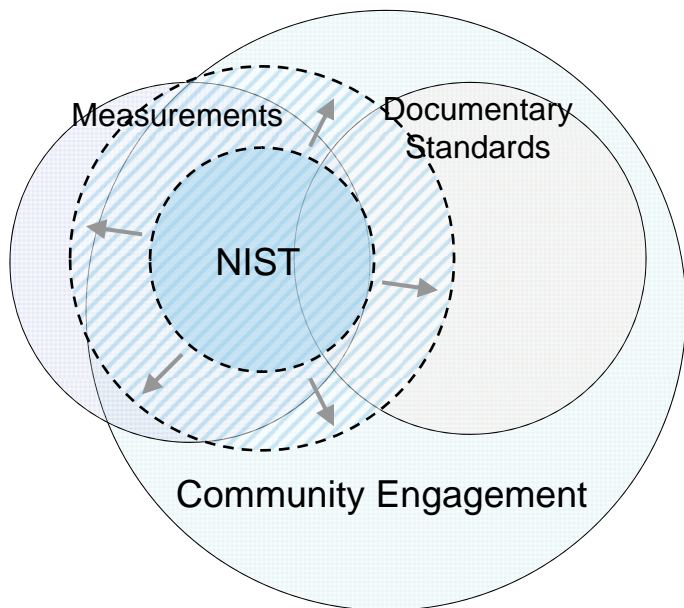




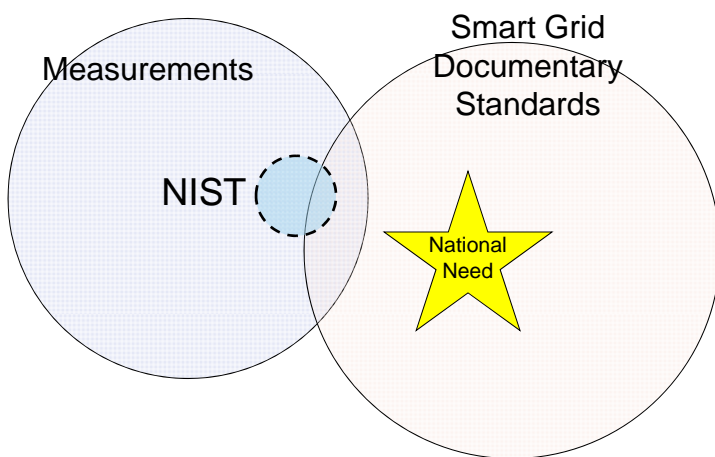


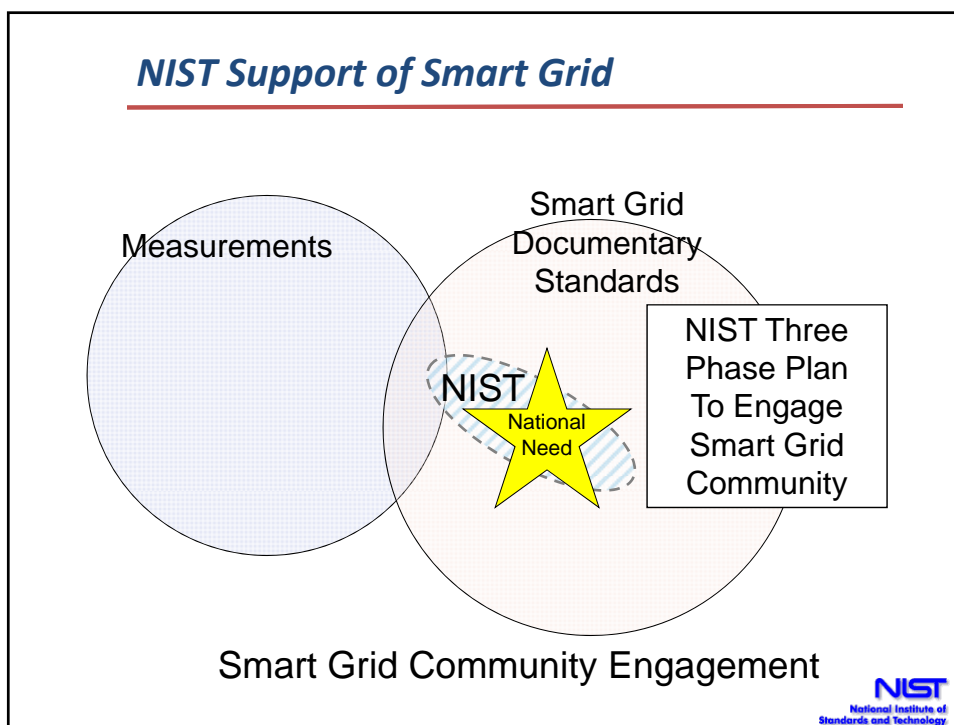
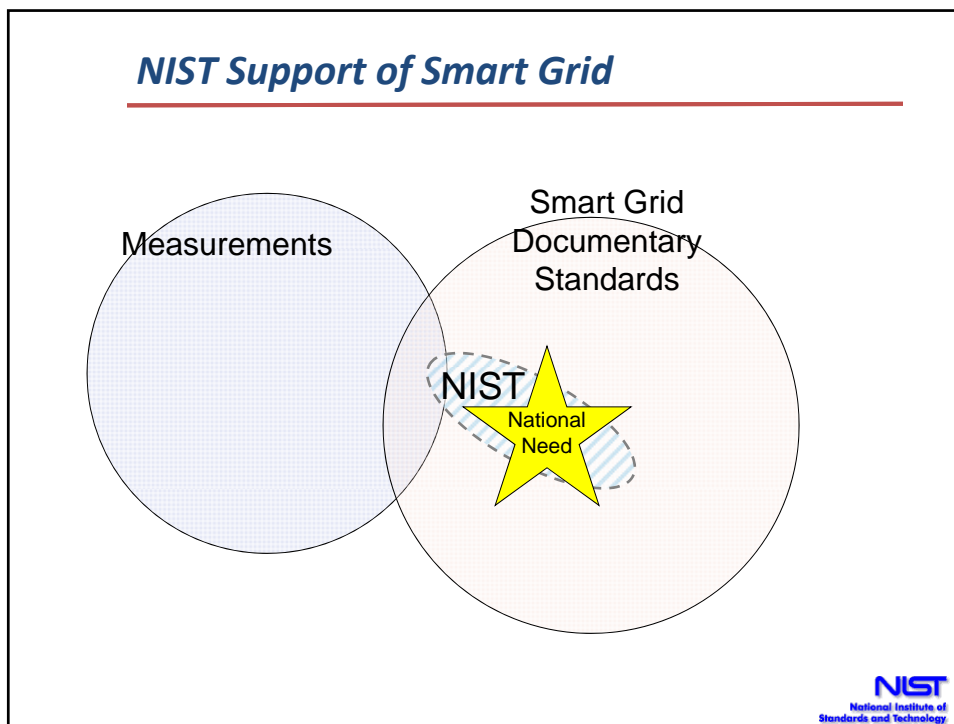


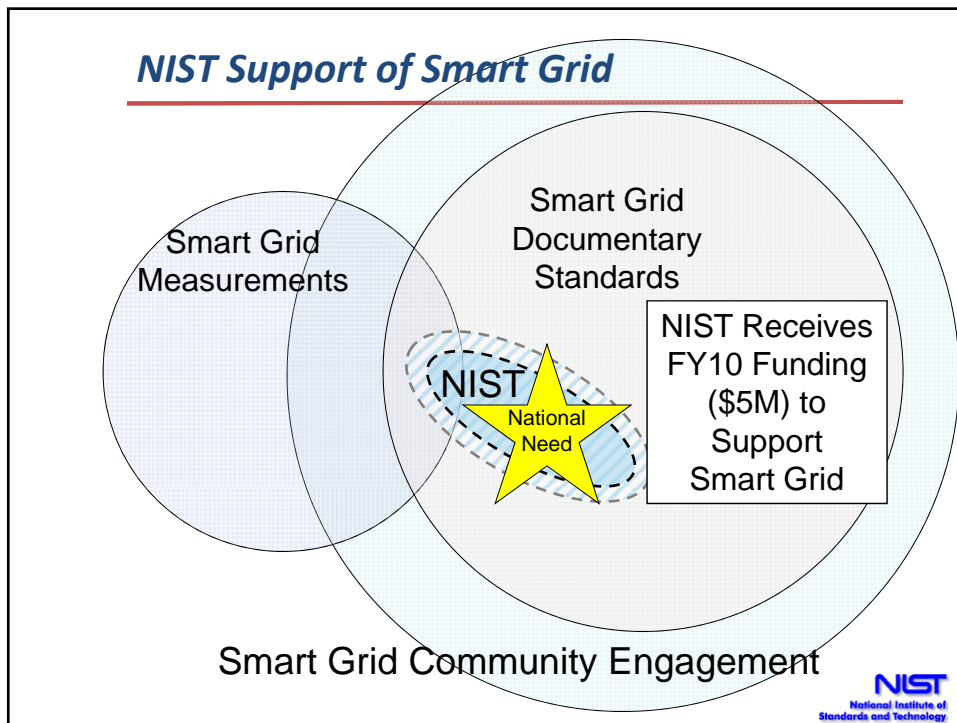
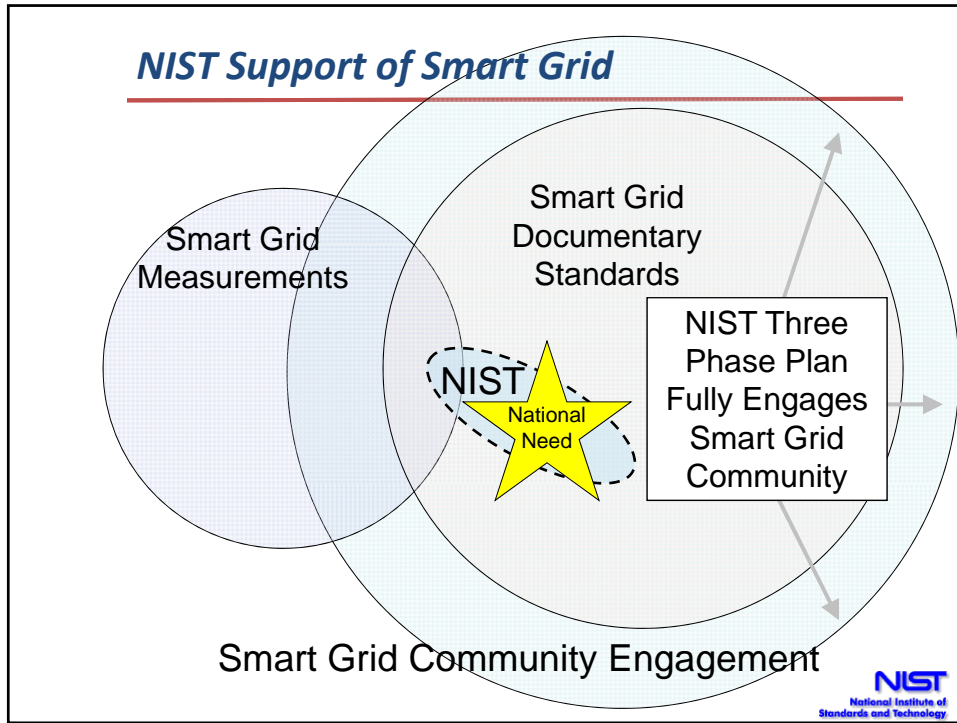
### NIST Support of Measurements and Standards

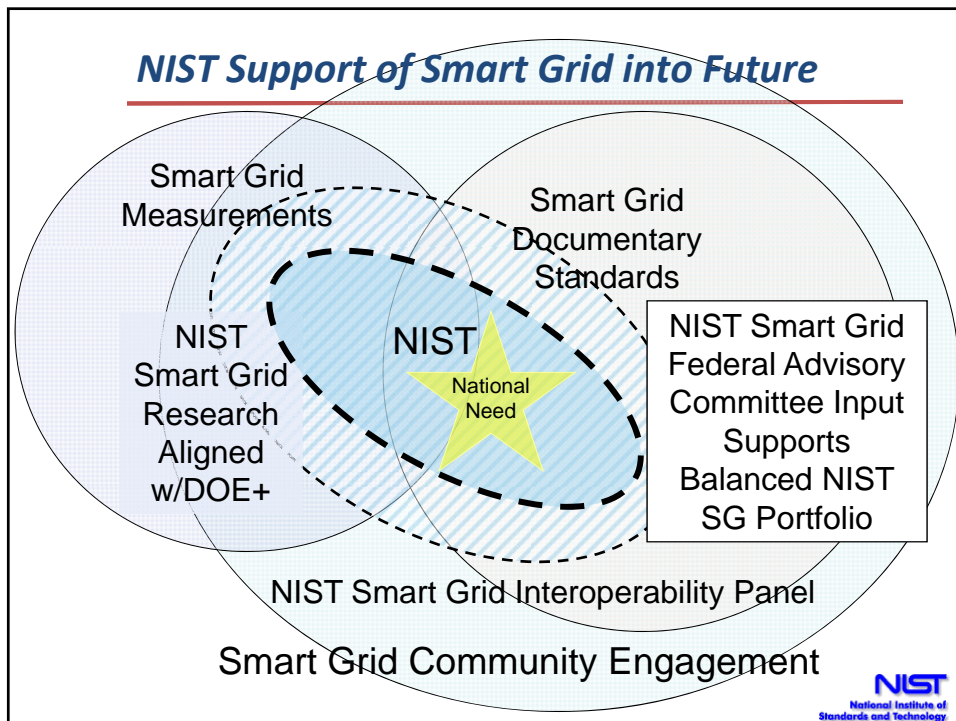
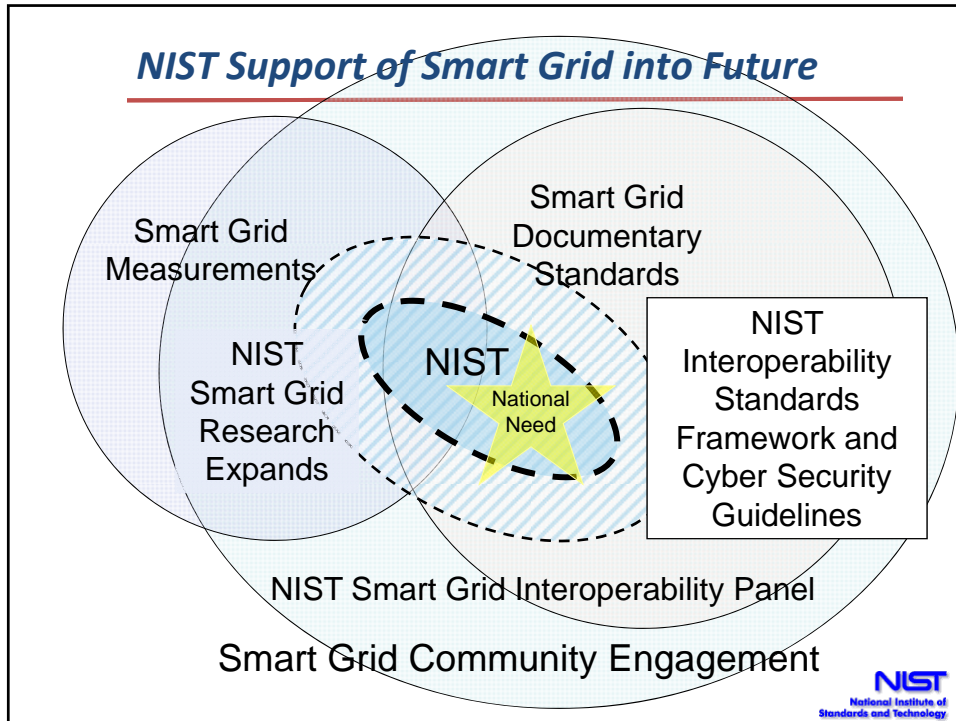


### NIST Support of Smart Grid







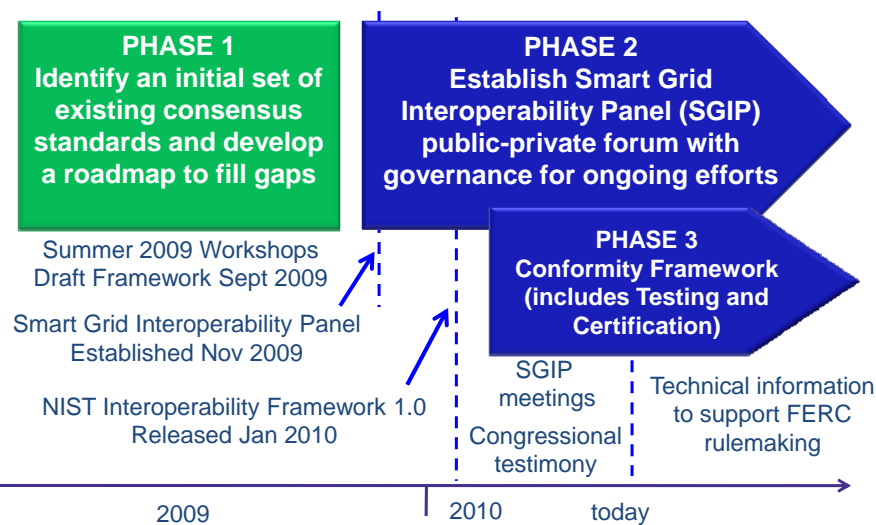


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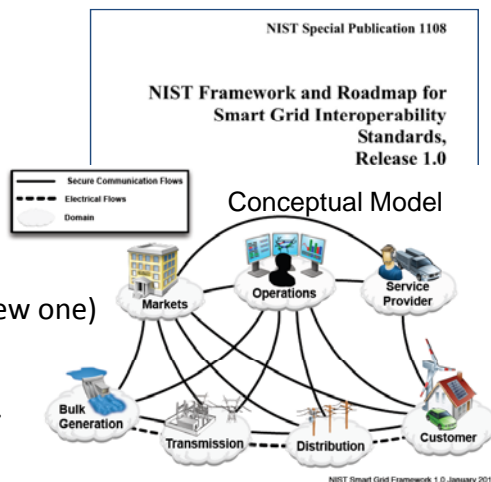


## NIST Three Phase Plan for Smart Grid Interoperability



## NIST Framework and Roadmap, Release 1.0


- Final version January 2010
  - Public comments on draft reviewed and addressed
- Smart Grid Vision / Model
- 75 key standards identified
  - IEC, IEEE, ...
- 16 Priority Action Plans to fill gaps (one completed, new one)
- Includes cyber security, companion document NISTIR 7628, Guidelines for Smart Grid Cyber Security recently published



## NIST Smart Grid Interoperability Panel


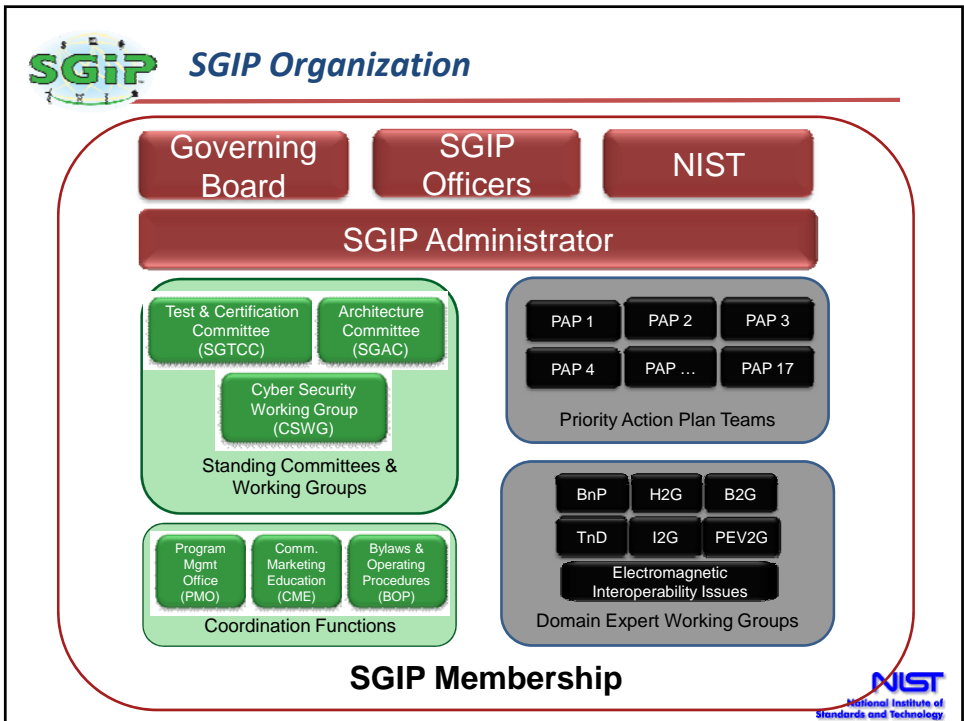
- Public-private partnership created by NIST in Nov. 2009
- Broad range of stakeholders in SGIP developing consensus about standards needed to build a smarter grid
  - Nearly 600 member organizations (with over 50 international organizations) & over 1700 participants from 22 stakeholder categories
  - Stakeholder category includes #14: R&D organizations and academia
- Supports NIST to coordinate the development of standards by Standards Development Organizations (SDOs)
  - Identifies Requirements
  - Prioritizes standards development programs
  - Works with over 20 SDOs including IEC, ISO, ITU, IEEE, ...
- Open, transparent & inclusive process
  - SGIP Twiki: <http://collaborate.nist.gov/twiki-ssgrid/bin/view/SmartGrid/SGIP>



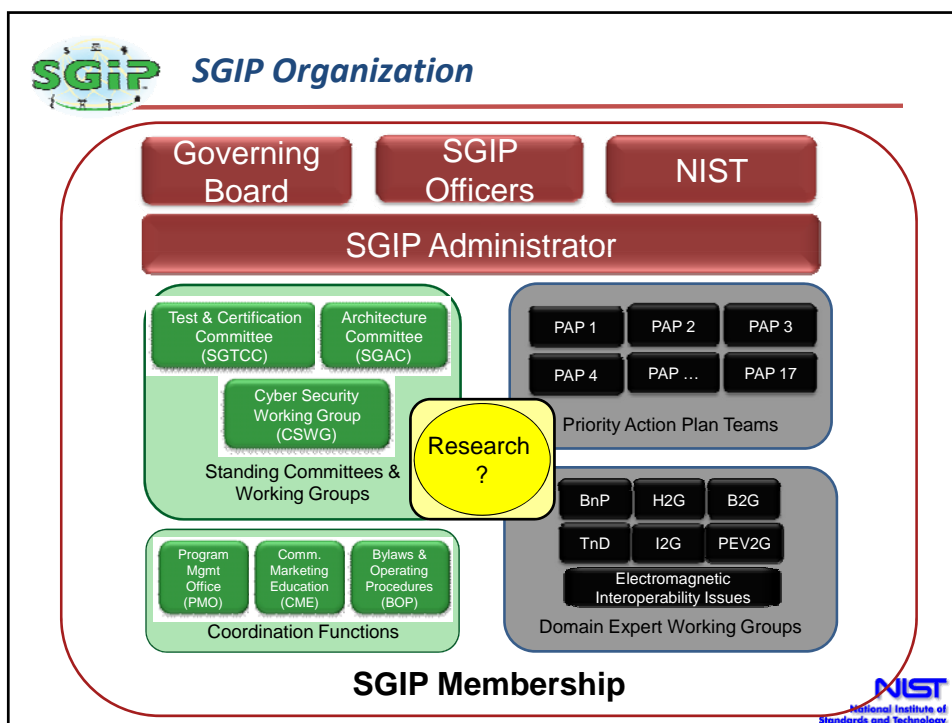


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### ***NIST Smart Grid Program Plan FY10-12***

- Program Management
  - Office of the National Coordinator for Smart Grid Interoperability
- Architecture and Standards
  - NIST Framework
  - Priority Action Plans
  - Smart Grid Interoperability Panel
- Testing and Certification
  - Initial Framework
  - Smart Grid Interoperability Panel
- Supporting Research
  - Power Systems
  - Building Interfaces
  - Industrial Interfaces
  - Cyber Security
  - Communications

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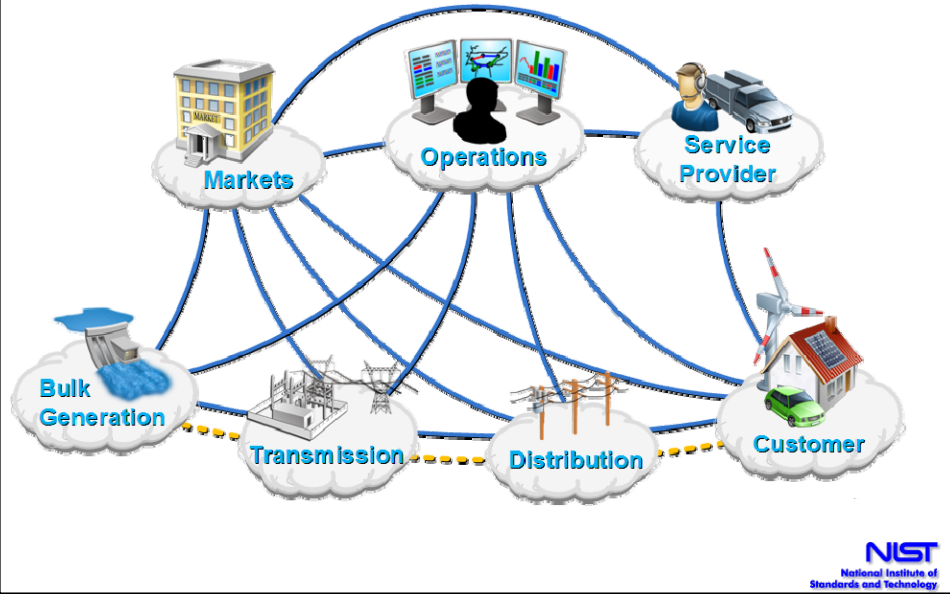
## ***NIST Smart Grid Program Plan FY10-12***

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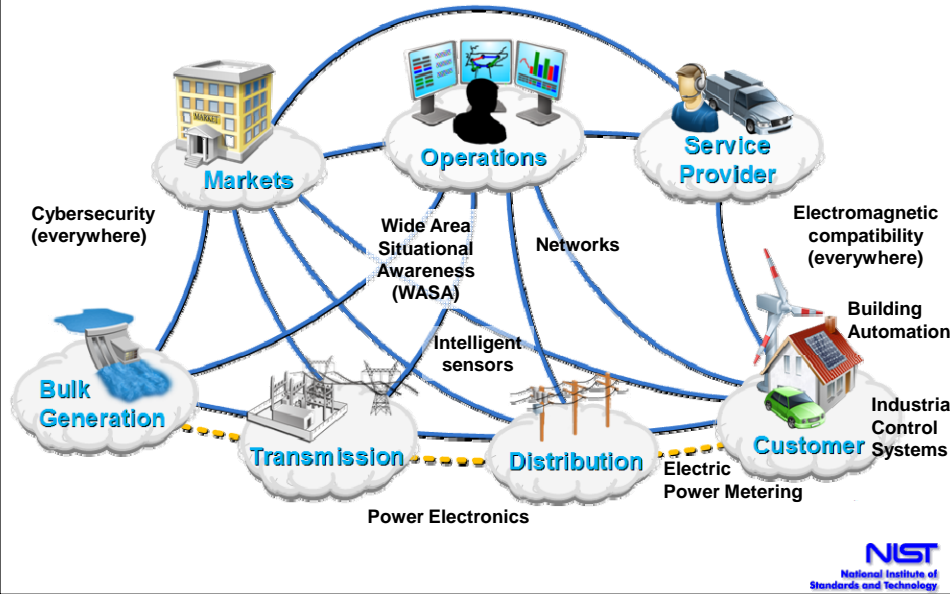
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- Supporting Research
  - Power Systems    Metering, PMUs, Power Conditioning Systems, Energy Efficiency, EMC, EV/Storage...
  - Building Interfaces    Building to Grid Connections, Building Automation Systems, ...
  - Industrial Interfaces    Industrial to Grid, SCADAs, UML Modeling, ...
  - Cyber Security    Cyber R&D strategy, security requirements and profiles, ...
  - Communications    IPv6, network architectures, ...



### NIST Smart Grid Conceptual Model



### NIST Smart Grid Conceptual Model



## NIST Research: Advanced Metering

- Metering
  - Power and energy calibrations
  - “Quantum Watt” - link to quantum-based standards
  - Measurement and calibration development including three phase power, bidirectional power
  - ANSI C12 metering standards
  - New metering testbeds, including integration with security work
- Future research concepts
  - Waveform distortion measurement, mitigation
  - Device-based energy usage monitoring
  - Micro-energy metering (nano-devices), ...



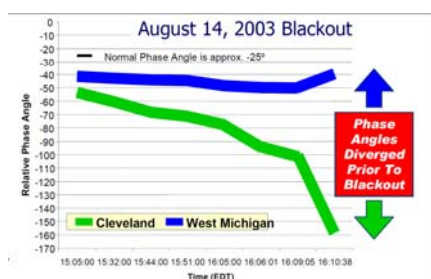
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## NIST Research: SynchroMetrology Laboratory

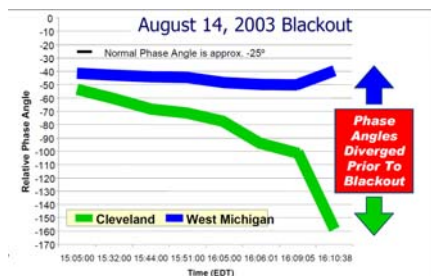
- Phasor Measurement Units (PMUs) provide situational awareness and advance warning for grid operations
- NIST has unique PMU calibration special test service
- NIST has provided measurement assistance to manufacturers and utilities on design, testing and use of PMUs, and has helped to evaluate and improve standards.
- Example: Mandatory testing of PMUs to be used in Brazil



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National Institute of  
Standards and Technology

## NIST Research: SynchroMetrology Laboratory

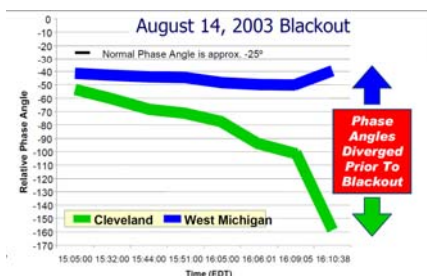
- Technical input to IEEE C37.118 standard
- North American SynchroPhasor Initiative (NASPInet)
- Priority Action Plan (PAP 13 Time Synchronization, IEC 61850 Objects/ IEEE C37.118 Harmonization)
- NIST ARRA Contract to support PAP13 and further developments; ARRA Grant supporting PMU calibrators
- Future research: Additional dynamic measurements, sensors



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**NIST**  
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## NIST Research: Building Automation Control

- Addressing the role of the building in the smart grid:
  - 72% of all electricity is consumed by building system loads.
  - NIST building smart grid research is focused on grid-aware energy management in complex facilities.
  - Research leads to information models that enable communication standards for the Smart Grid
  - Building systems control strategies for load, generation and storage management
  - Net-zero residential building testbed
  - Islanding strategies for graceful degradation of building system performance during grid outages



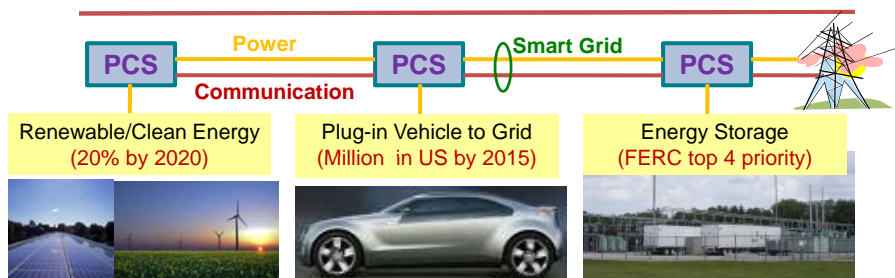
NIST Virtual Cybernetic  
Building Testbed

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## High Penetration of Renewables and PEVs



- Power Conditioning Systems (PCS) convert to/from 60 Hz AC for interconnection of renewable energy, electric storage, and PEVs
- Energy Storage technologies:
  - Pumped hydro, compressed air storage, batteries, flywheels, supercapacitors, ...
  - Electric vehicles as distributed storage

### ***NIST Smart Grid Research Opportunities***

---

- Metering
  - Bidirectional metering, testbeds...
- Sensors and automated control
  - PMUs, time synchronization, distributed sensors...
- Smart Grid architecture and operations
  - Research/modeling of grid stability (load/generation)
  - Microgrids, ...
- Power Electronics
- Electromagnetic Compatibility/Interference
- Energy Efficiency
- Integration with Net-Zero Buildings
- Cybersecurity
- Electric Vehicles/Storage
- Communication protocols
- Testing and certification activities, many others ...



### ***NIST Smart Grid Research Opportunities***

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## ***Outreach and Engagement***

---

- DOE R&D Strategic Plan
  - Office of Electricity Delivery and Energy Reliability (OE)
  - Office of Energy Efficiency and Renewable Energy (EERE)
  - PNNL, Sandia, INL, NREL, Brookhaven ...
- Other Federal Agencies (EPA, DOD, GSA, NSF, FERC, ...)
- Academia
  - Texas A&M, Virginia Tech, Georgia Tech, MIT, UCLA, CU-Boulder, CMU, U. Illinois, NC State, USF, UT-Austin, U.Minn, PSU, ...
  - Smart Grid Research Centers
- Industry
  - Utilities (including testing labs), EPRI, ...
  - Wide range, including SGIP members, consortia, ...
- International
  - European Electricity Grids Initiative, ...
  - Other National Metrology Institutes (NRC Canada, NPL, ...)



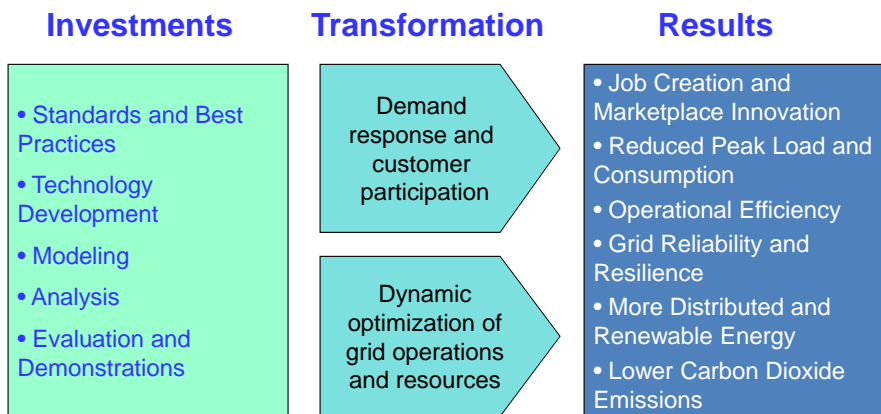
## ***Outreach and Partnerships***

---

- DOE
- Other Federal Agencies
- Academia
- Industry
- International
- Mechanisms for interaction
  - Advisory committees
  - Collaborative research, grants, postdocs, students ....
  - Joint centers? (Examples: CU-Boulder; U. Maryland/John Hopkins Univ.; ...)
  - Engagement with demo projects, .... ?



## DOE: Benefits from Smart Grid R&D Investments

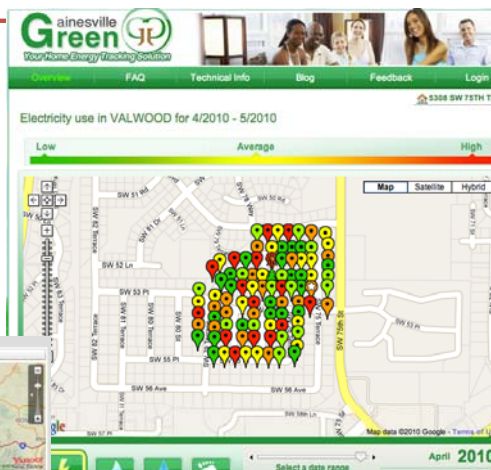
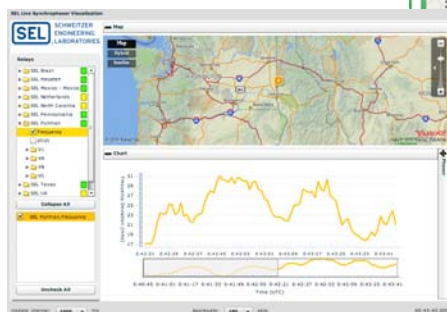


• Figure 2.1 from DOE's Smart Grid R&D: 2010-2014 Multiyear Program Plan



## Real-time Data Management Needs

- Smart Meters
- Synchro Phasors
- Embedded Sensors
- Distributed Generation Output



## ***Computational Applications for Today's Grid***

---

- Forecasting load
  - Short, mid and long-term
  - Used for capacity planning, market operations, dispatching, demand response
  - Based on historical patterns and variables such as weather
  - Well understood
- Forecasting variable generation
  - Utility-owned wind and solar PV
  - Localized weather models
- Situational awareness
  - Phasor Measurement Units
- Control
  - Visualization and decision support tools



## ***New Computational Applications for the Smart Grid***

---

- Forecasting load
  - New models needed to reflect effects of dynamic prices, smart appliances, customer energy management systems, electric vehicles
- Forecasting variable generation
  - Distributed generation sources owned by customers
- Situational awareness and data management
  - Management and utilization of data from networked Phasor Measurement Units, smart meters, and embedded sensors in transmission and distribution networks
- Control
  - Automated control systems utilizing real time data



### ***Smart Grid Research and Gaps – Questions?***

---

- Measurements and Documentary Standards Introduction
- NIST Three Phase Plan
- NIST Smart Grid Research
- Smart Grid Research Opportunities
- Contact info:
  - David Wollman
  - david.wollman@nist.gov
  - 301-975-2433
- Questions?

# Smart Grid Research Needs

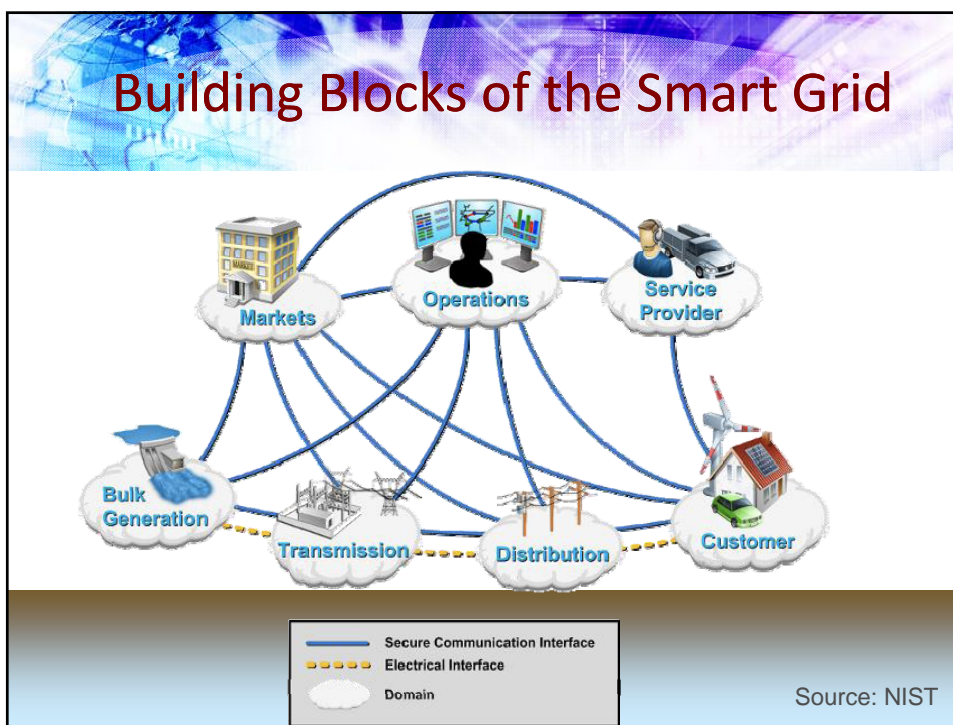
NIST Smart Grid Advisory Committee Meeting

29 September 2010  
Gaithersburg, Maryland

Prof. Saifur Rahman



Advanced Research Institute, Virginia Tech, USA



## This is the Electric Power Grid

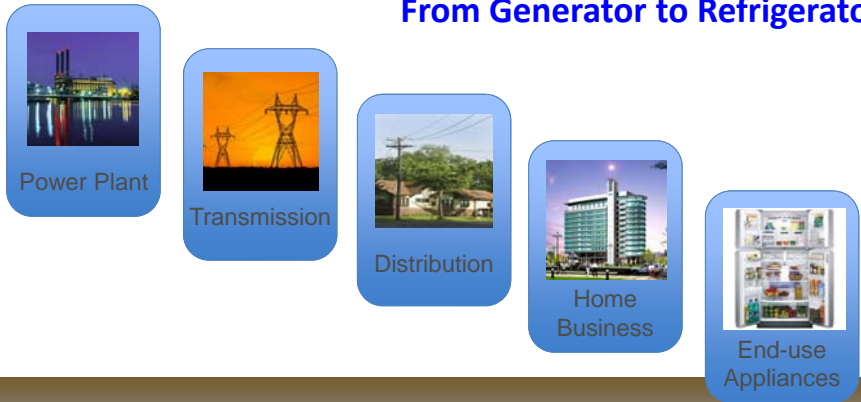


Source: [www.sxc.hu](http://www.sxc.hu)

3

## Starting and End Points of a Smart Grid

### From Generator to Refrigerator



Power Plant

Transmission

Distribution

Home Business

End-use Appliances



## Operation of a Smart Grid

A smart grid must allow bi-directional flow of electricity based on available intelligence and user preferences

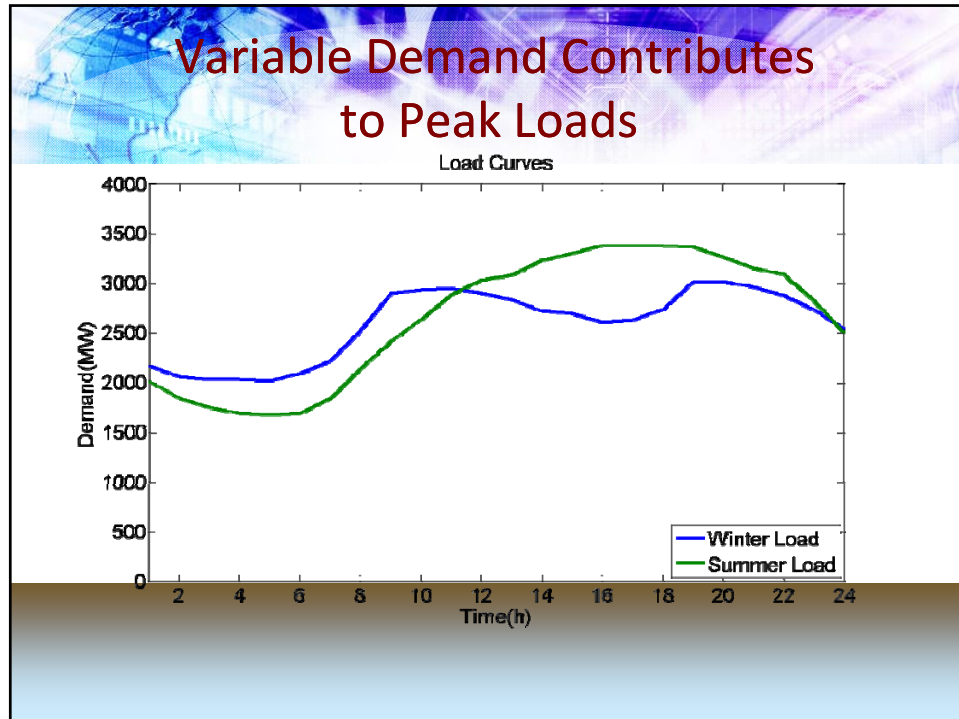


## Role of the Customer

Peak load reduction, generator efficiency improvements and DER integration are major benefits of the smart grid

Load control at the customer level can provide significant peak load reductions

A smooth load shape allows better asset utilization



## Demand Response

This is a broad term to encompass many customer level actions that can help to smooth the electric power load shape, and reduce energy consumption

Demand Response has a load (kW) component and an energy (kWhr) component

8



## Defining demand response – US FERC\*

### Demand response:

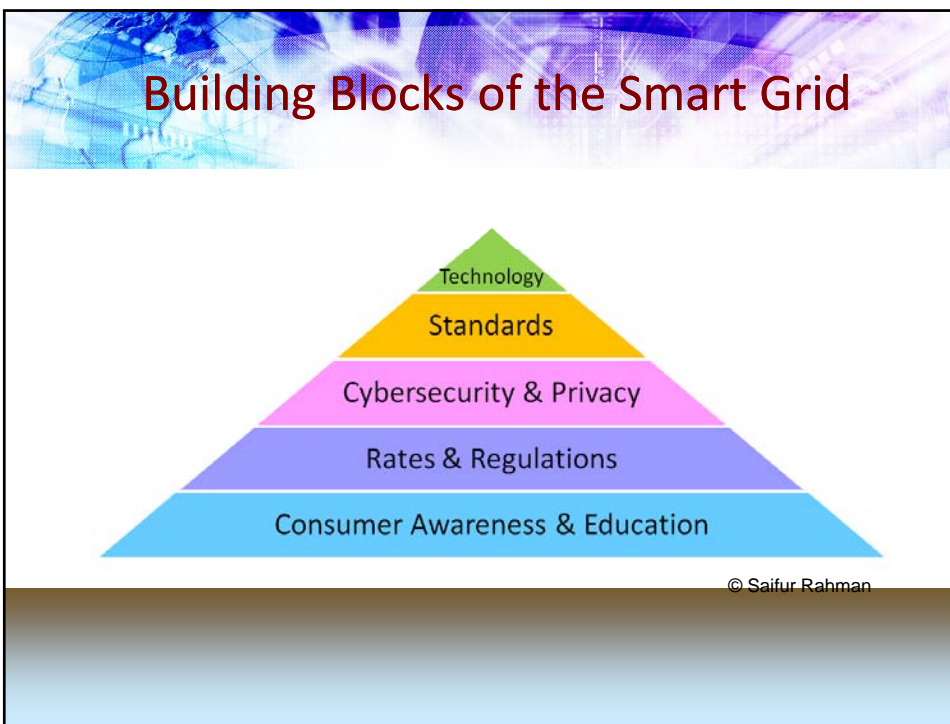
A reduction in the consumption of electric energy by customers from their expected consumption in response to an increase in the price of electric energy, or to incentive payments designed to induce lower consumption of electric energy

\* Federal Energy Regulatory Commission

## Demand Response A broader definition

“Demand Response is a customer action to control load to meet a certain target. Here the customer chooses what load to control and for how long”.

This is different from Demand Side Management (DSM) where the load is controlled by the electric utility and the customer has no control beyond the initial consent.



## Research Needs

## Technology

**Power System related:**

- Demand Response
- Ancillary services
- Integration of renewables
- Two-way power flow (V2G, B2G)

**Sensing and communication related:**

- Home (premise) area network
- Two-way communication
- Secure and redundant communication

## Cybersecurity & Privacy

**Cybersecurity related:**

- Patchwork of solutions in place
- Needs robust communication channels
- Needs to communication real-time pricing information



**Privacy related:**

- Electric utility control of end-use appliances?
- Is customer usage profile visible to the utility?
- Customer choice for what needs be controlled and when



## Rates & Regulations

### Dynamic and Time-of-Use rates:

- Impact of dynamic pricing on customer behavior
- Provision for real-time pricing information
- Need for easily understandable and actionable information

### Voluntary programs:

- Microsoft Hohm Network
- Google Power Meter
- Energy and load reduction – geographical and seasonal impacts

## Consumer Awareness & Education

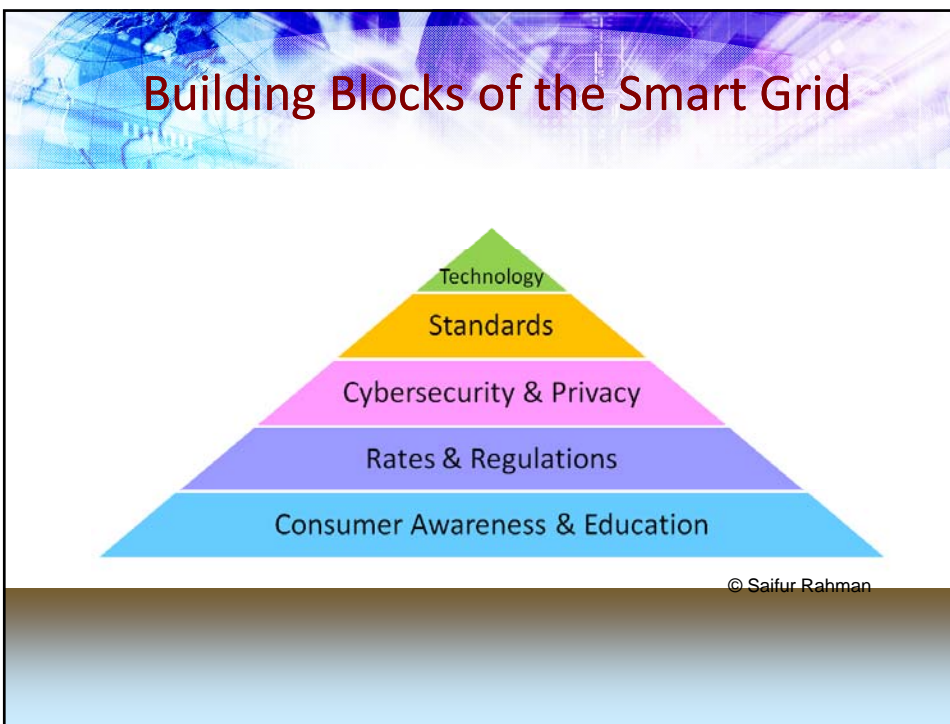
### Consumer Awareness:

How will the smart grid reduce my electric bill?  
**Answer:** Without the smart grid your electric bill will be higher  
Smart grid brings new value (difference between the POTS and smart phone)

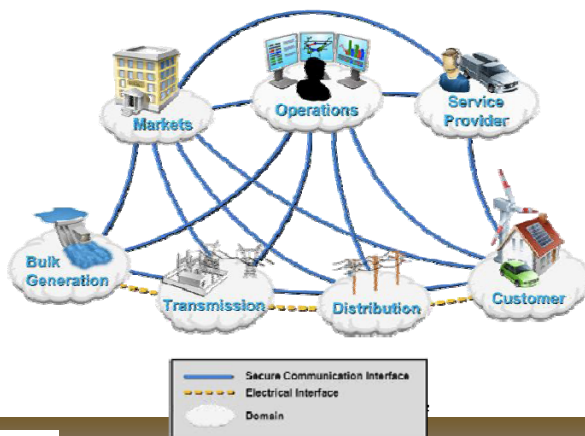


### Public Education:

- Electricity is a commodity with multi-tiered pricing
- Electricity is a community resource
- Possible to optimize electricity usage without sacrificing comfort



Thank you



Prof. Saifur Rahman  
[www.ceage.vt.edu](http://www.ceage.vt.edu)

