NIST Smart Grid Activities

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National Institute of Standards and Technology
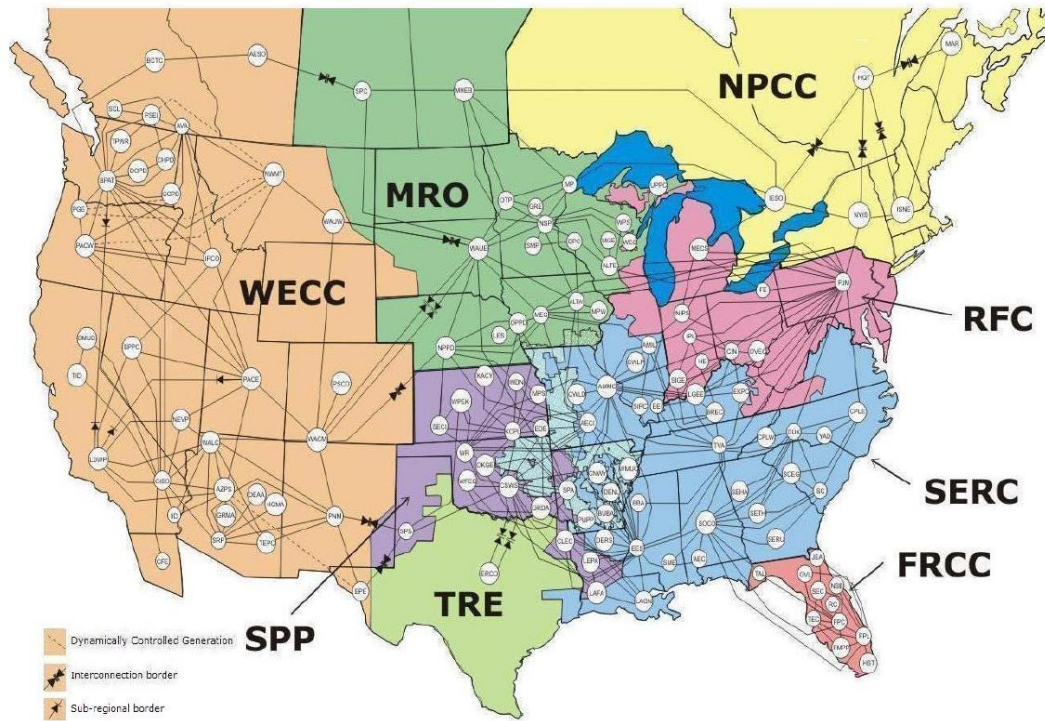
ANSI/ESO Public Conference

October 12, 2011

# *Example: North American Electric Grid*

US figures:

- 22% of world consumption

- 3,200 electric utility companies
- 17,000 power plants
- 800 gigawatt peak demand
- 165,000 miles of high-voltage lines
- 6 million miles of distribution lines
- 140 million meters
- $1 trillion in assets
- $350 billion annual revenues
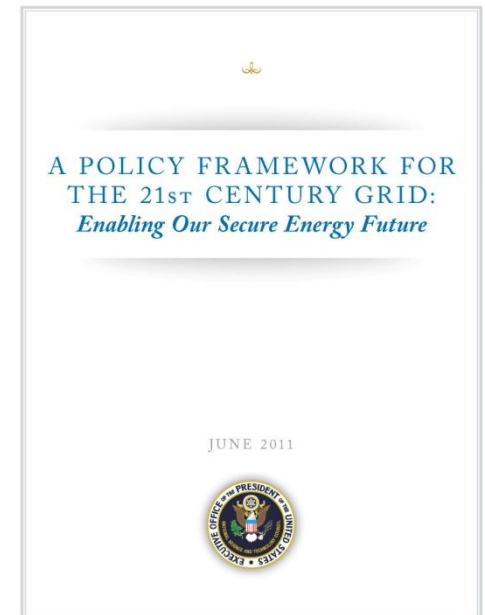
Worldwide Investment in the Grid

- **International Energy Agency estimates:**
  - $10 trillion over next 20 years
  - 50% in generation
  - 50% in transmission and distribution
  - Does not count customer-side investments
- Laws of physics do not change from country to country – international collaboration is critical

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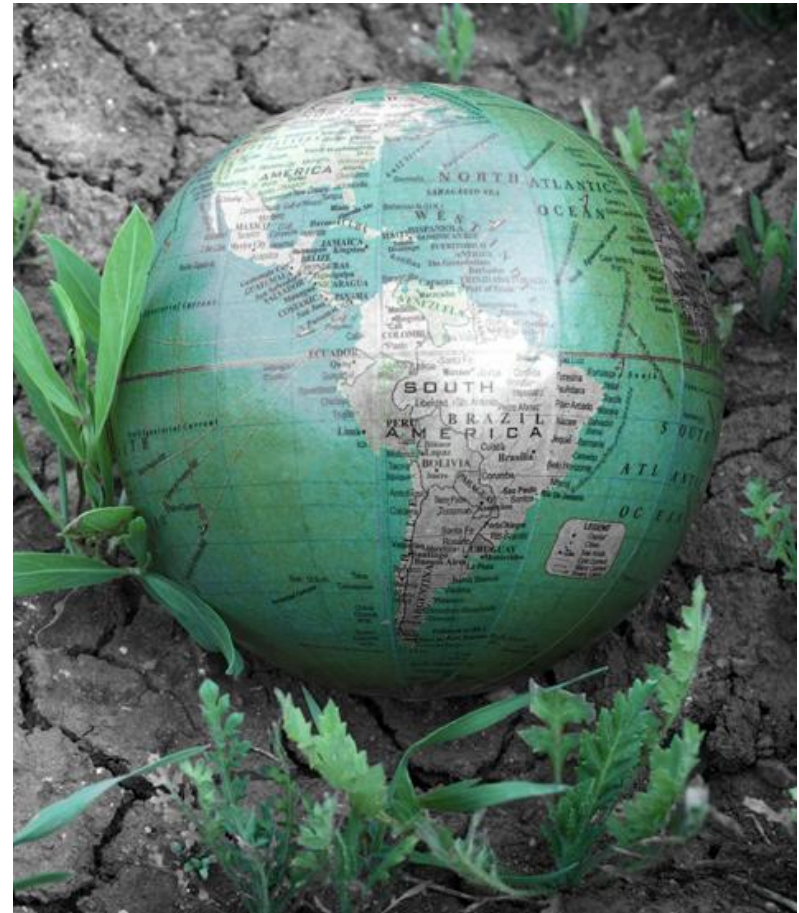
Smart Grid – A U.S. National Policy

- The 2007 Energy Independence and Security Act (EISA) lays out a national policy for the Smart Grid in the U.S.

- White House National Science and Technology Council Smart Grid Subcommittee
  - Report released June 2011 – Administration's strategy for Smart Grid

- Key Federal recommendations:
  - Enable cost-effective smart grid investments
  - Unlock innovation
  - Empower and inform consumers
  - Secure the grid

A POLICY FRAMEWORK FOR THE 21st CENTURY GRID: *Enabling Our Secure Energy Future*

JUNE 2011

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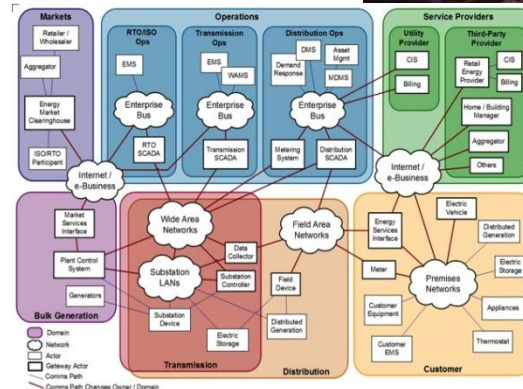
Standards – Key Aspect of US Policy

The Energy Independence and Security Act gives NIST

"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 federal Smart Grid Investment Grants

- Input to federal and state regulators

NIST Roles in the Smart Grid

- ## Measurement research
  - Metering
  - Wide area monitoring (synchrophasors)
  - Power conditioning
  - Building energy management
  - Electricity storage
- ## Standards (EISA role)
  - Interoperability
  - Cybersecurity

NIST Three Phase Plan

PHASE 1
Identify an initial set of existing consensus standards and develop a roadmap to fill gaps

PHASE 2
Establish public/private Interoperability Panel to provide ongoing recommendations for new/revised standards

PHASE 3
Testing and Certification Framework

2009   2010   2011
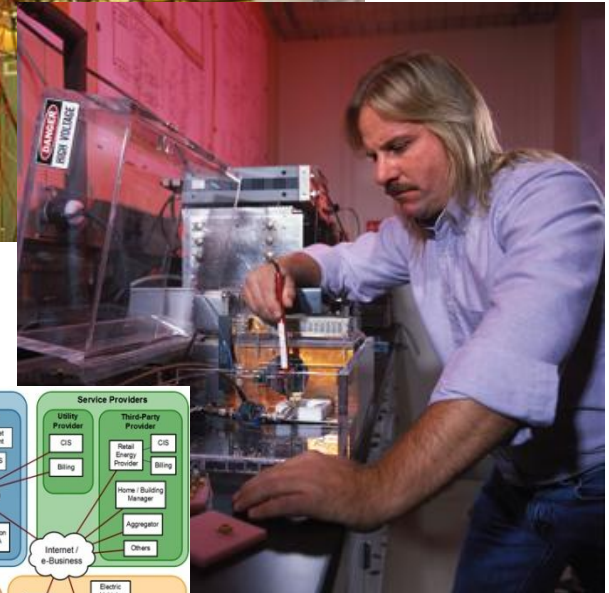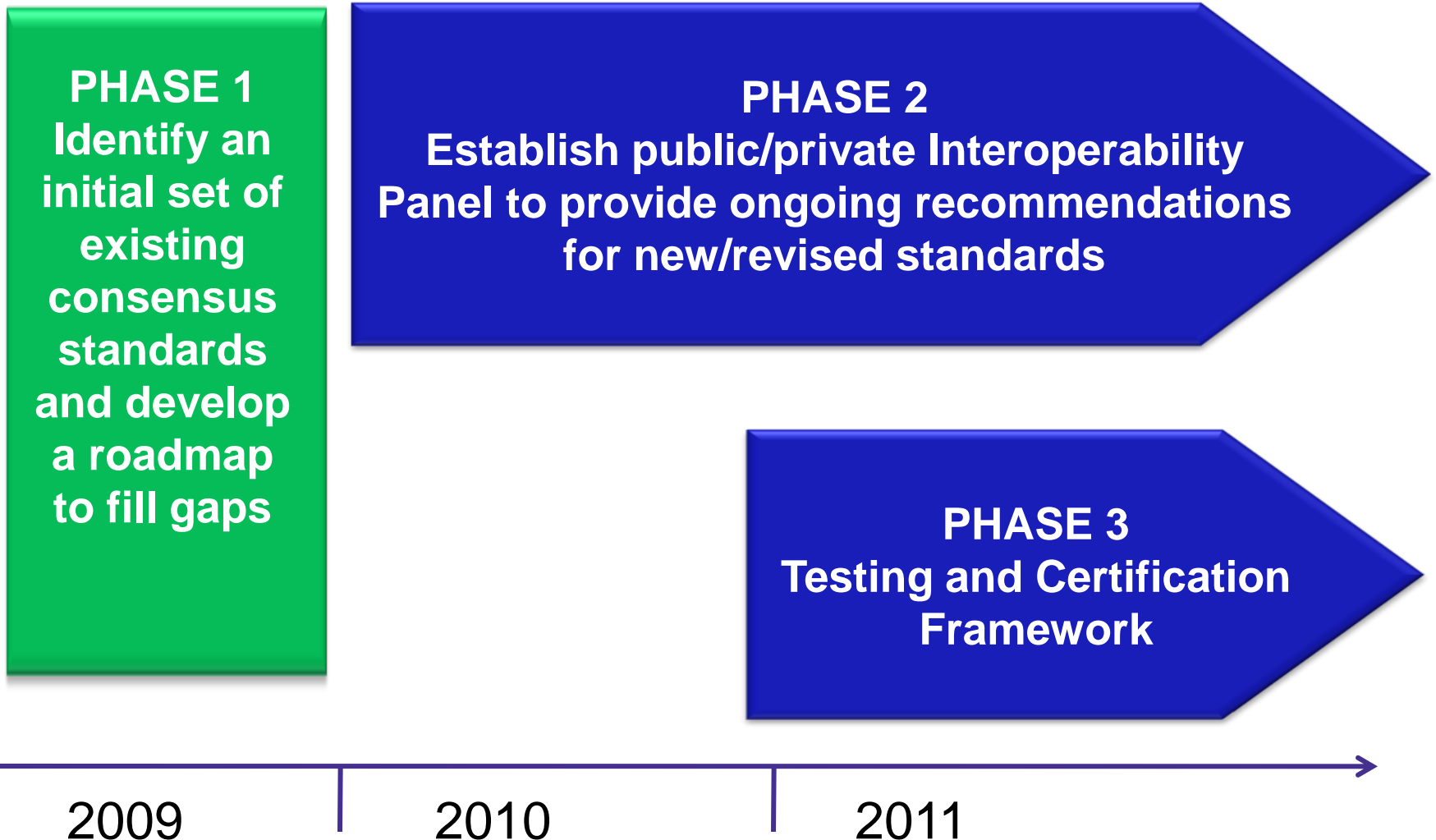
Standards Come from Many Developers

International

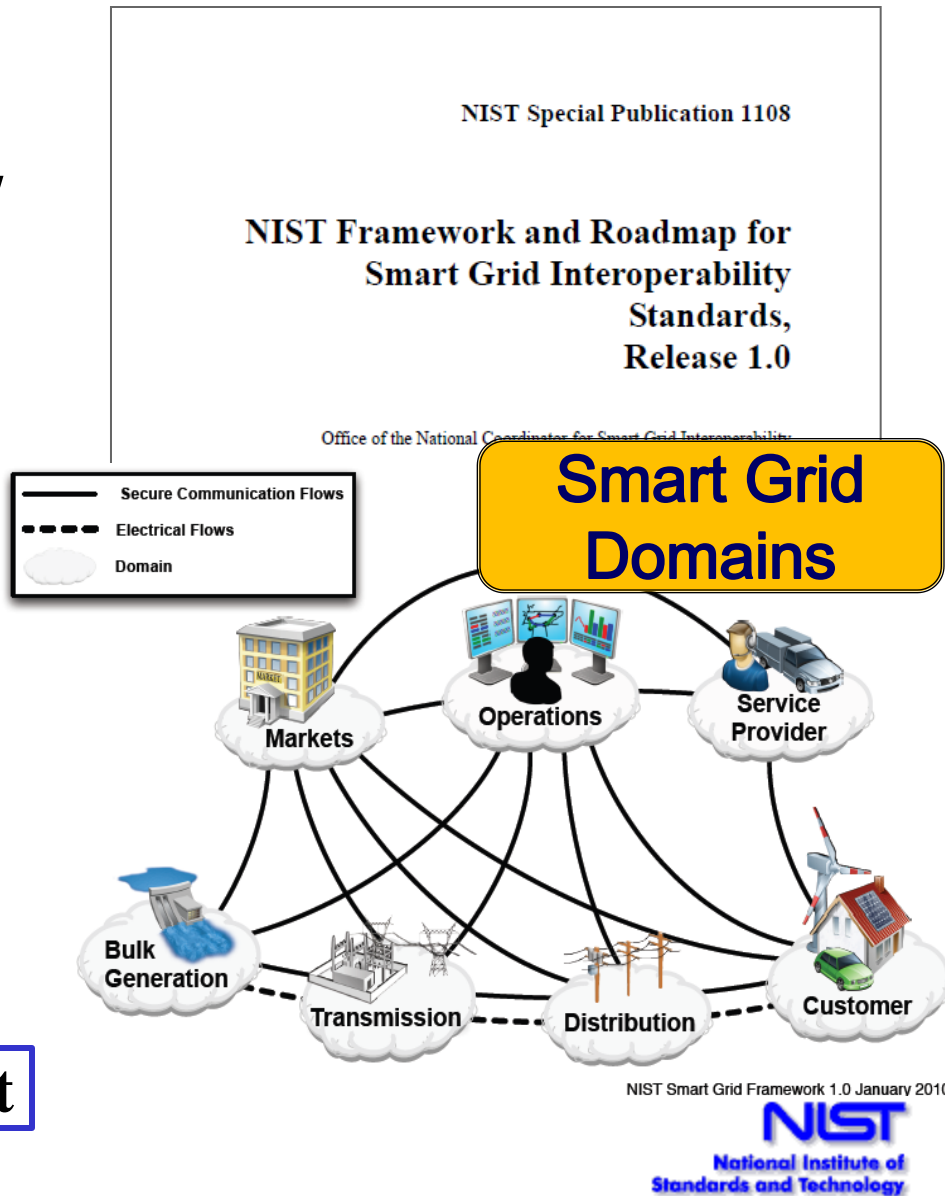Global
Consortia

Regional and
National

NIST 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/

Release 2.0 is Under Development

NIST Special Publication 1108

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

Office of the National Coordinator for Smart Grid Interoperability

Secure Communication Flows
Electrical Flows
Domain

Smart Grid Domains

Markets
Operations
Service Provider
Bulk Generation
Transmission
Distribution
Customer

NIST Smart Grid Framework 1.0 January 2010

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Smart Grid Will Use International Standards

Source of Standards in NIST Roadmap

US Government 10%

Domestic SDO 13%

International 77%

- ISO/IEC/ITU
- IETF
- IEEE/SAE/ISA
- Global consortia
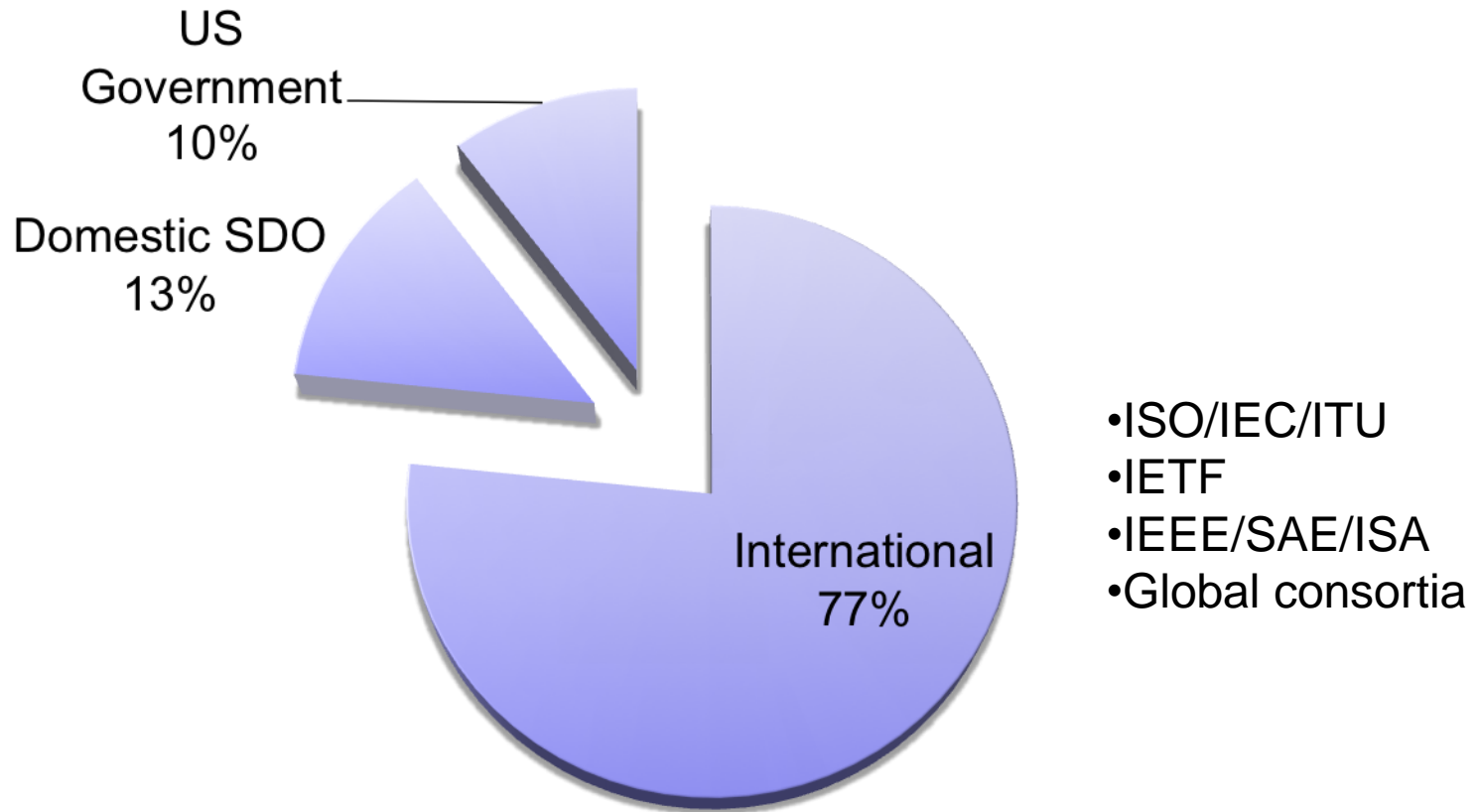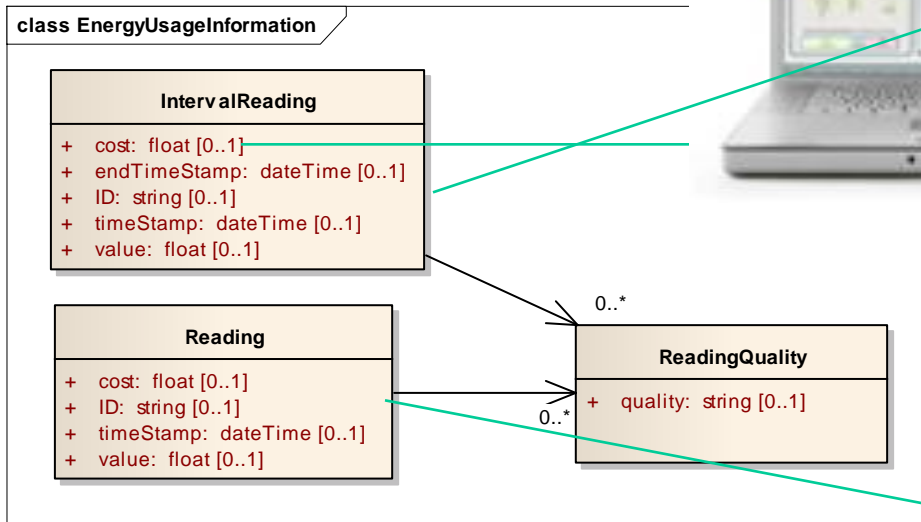
Energy Usage Information Standard

Standardizes data elements available to consumers or authorized 3rd party application providers

class EnergyUsageInformation

IntervalReading

+ cost: float [0..1]
+ endTimeStamp: dateTime [0..1]
+ ID: string [0..1]
+ timeStamp: dateTime [0..1]
+ value: float [0..1]

Reading

+ cost: float [0..1]
+ ID: string [0..1]
+ timeStamp: dateTime [0..1]
+ value: float [0..1]

0..*

ReadingQuality

+ quality: string [0..1]

0..*

- Work initiated (SGIP PAP10) - July 2009
- Requirements finalized - June 2010
- Standard developed and published by NAESB - December 2010

NAESB PAP10 Kickoff: Straw Model
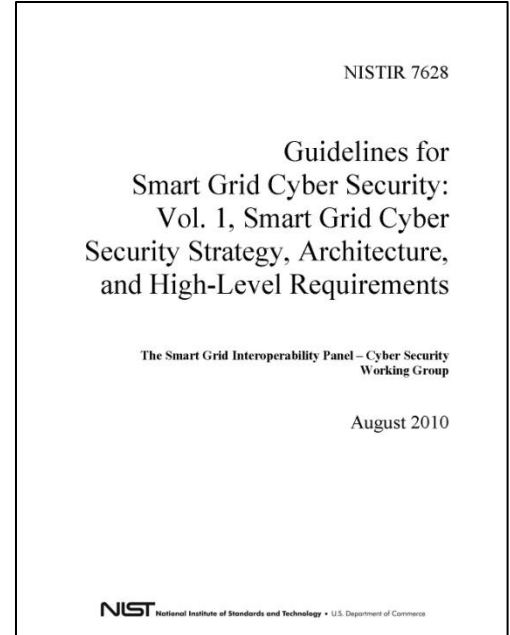
Smart Grid Interoperability Panel

- Public-private partnership created in Nov. 2009
- 680 member organizations
- Open, public process with international participation
- Coordinates standards developed by Standards Development Organizations (SDOs)
  - Identifies Requirements
  - Prioritizes standards development programs
  - Works with over 20 SDOs including IEC, ISO, ITU, IEEE, …
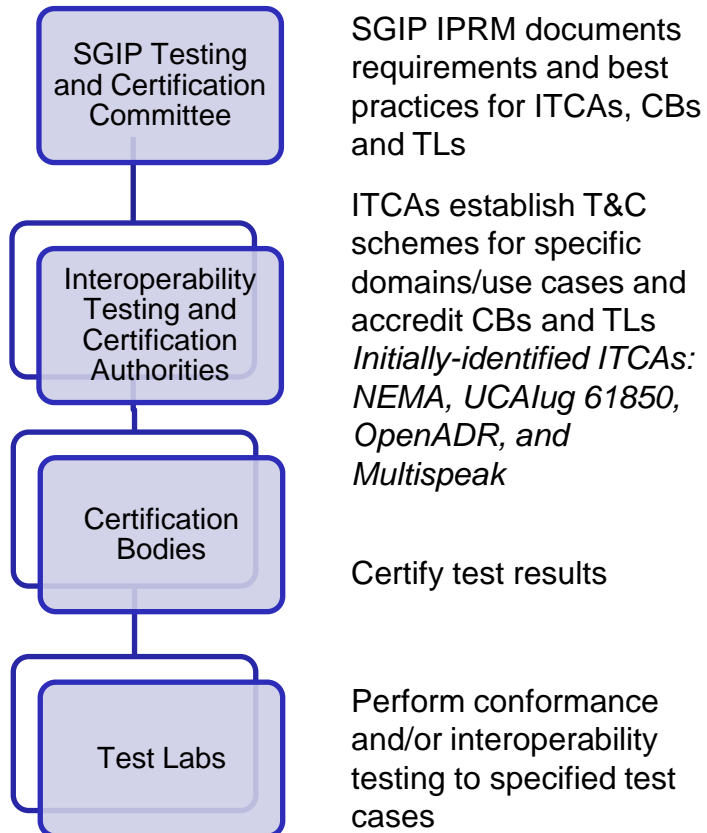- Web-based participation (via link from nist.gov/smartgrid)

Cyber Security Working Group

- Building cyber security in from the start has been a paramount concern

- Permanent Working Group
  - Over 650 public and private sector participants

- August 2010 NIST publishes: *Guidelines for Smart Grid Cyber Security*

- Guideline includes:
  - Risk assessment guidance for implementers
  - Recommended security requirements
  - Privacy recommendations

NISTIR 7628

Guidelines for
Smart Grid Cyber Security:
Vol. 1, Smart Grid Cyber
Security Strategy, Architecture,
and High-Level Requirements

The Smart Grid Interoperability Panel – Cyber Security
Working Group

August 2010

NIST National Institute of Standards and Technology • U.S. Department of Commerce

Testing and Certification Framework

- Defined in SGIP Interoperability Process Reference Manual (IPRM)

SGIP Testing and Certification Committee

SGIP IPRM documents requirements and best practices for ITCAs, CBs and TLs

Interoperability Testing and Certification Authorities

ITCAs establish T&C schemes for specific domains/use cases and accredit CBs and TLs
Initially-identified ITCAs: NEMA, UCAIug 61850, OpenADR, and Multispeak

Certification Bodies

Certify test results

Test Labs

Perform conformance and/or interoperability testing to specified test cases

Smart Grid Testing & Certification Committee (SGTCC)

Interoperability Process Reference Manual (IPRM)

Version 1.0

November 18, 2010

National Institute of Standards and Technology

US – EU Collaboration

White paper on standardization of Smart Grids

published by

NIST &

Smart Grid Co-ordination Group