NIST
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Impact of Smart Grid, ICT on Environment and Climate Change

ITU Symposium on ICTs, the Environment and Climate Change

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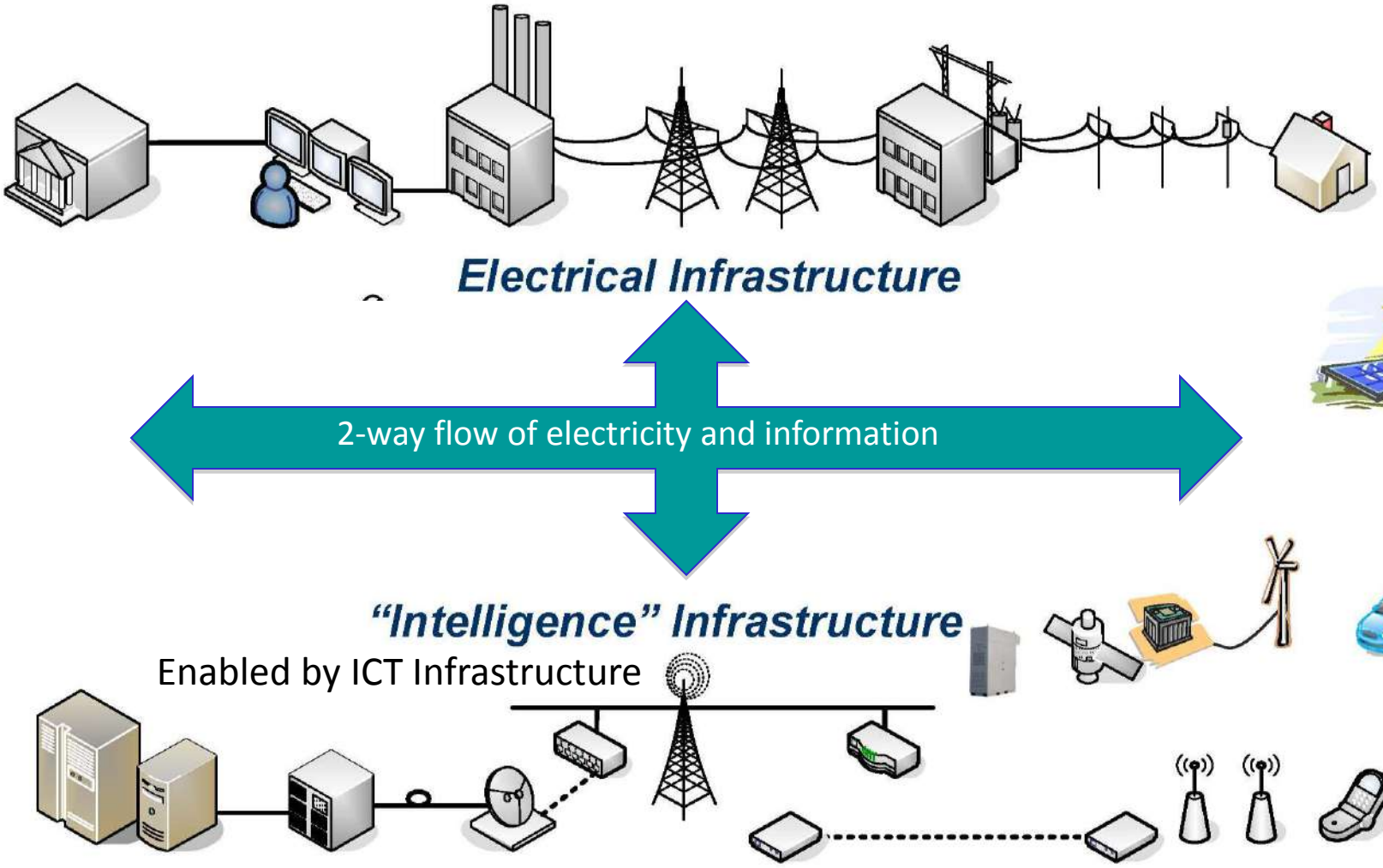
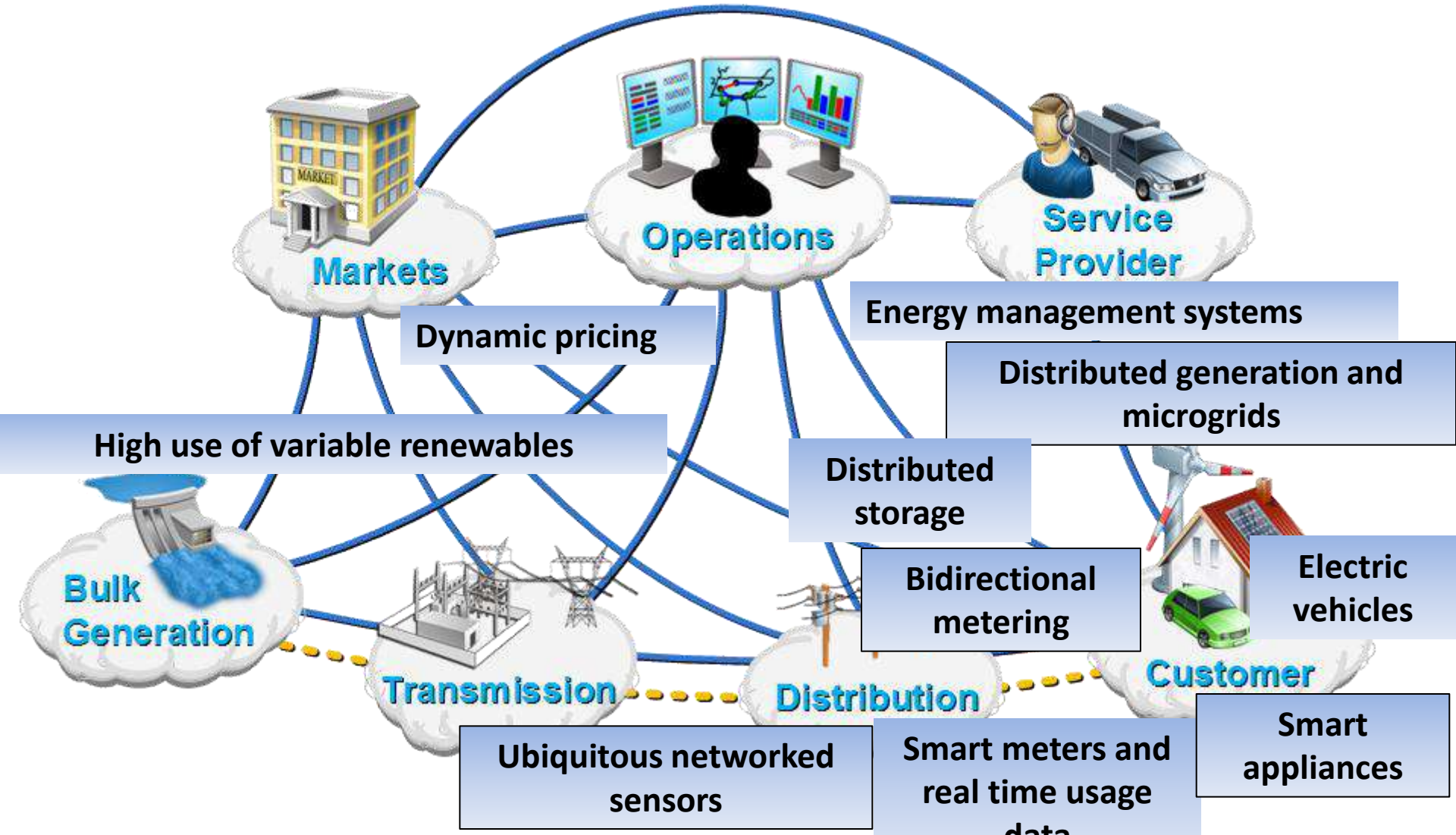
Smart Grid: The "Energy Internet"



How Will Smart Grid Help Environment

- Improve electrical power generation and distribution system
  - Integration of electric infrastructure and ICT infrastructure
  - More efficient and better management of power infrastructure
- Increase use of renewable energy sources
  - Alternate energy sources – Wind, solar generation, power storage
  - Integration of distributed energy sources into power infrastructure
    - Wind and solar generation by nature is variable
    - Matching or supply and demand to reduce traditional bulk generation
- Better management of energy usage
  - Use of smart meters and Demand Response systems to reduce and balance energy usage
  - Enable use of plug-in electrical vehicles – more friendly to environment, also as energy storage

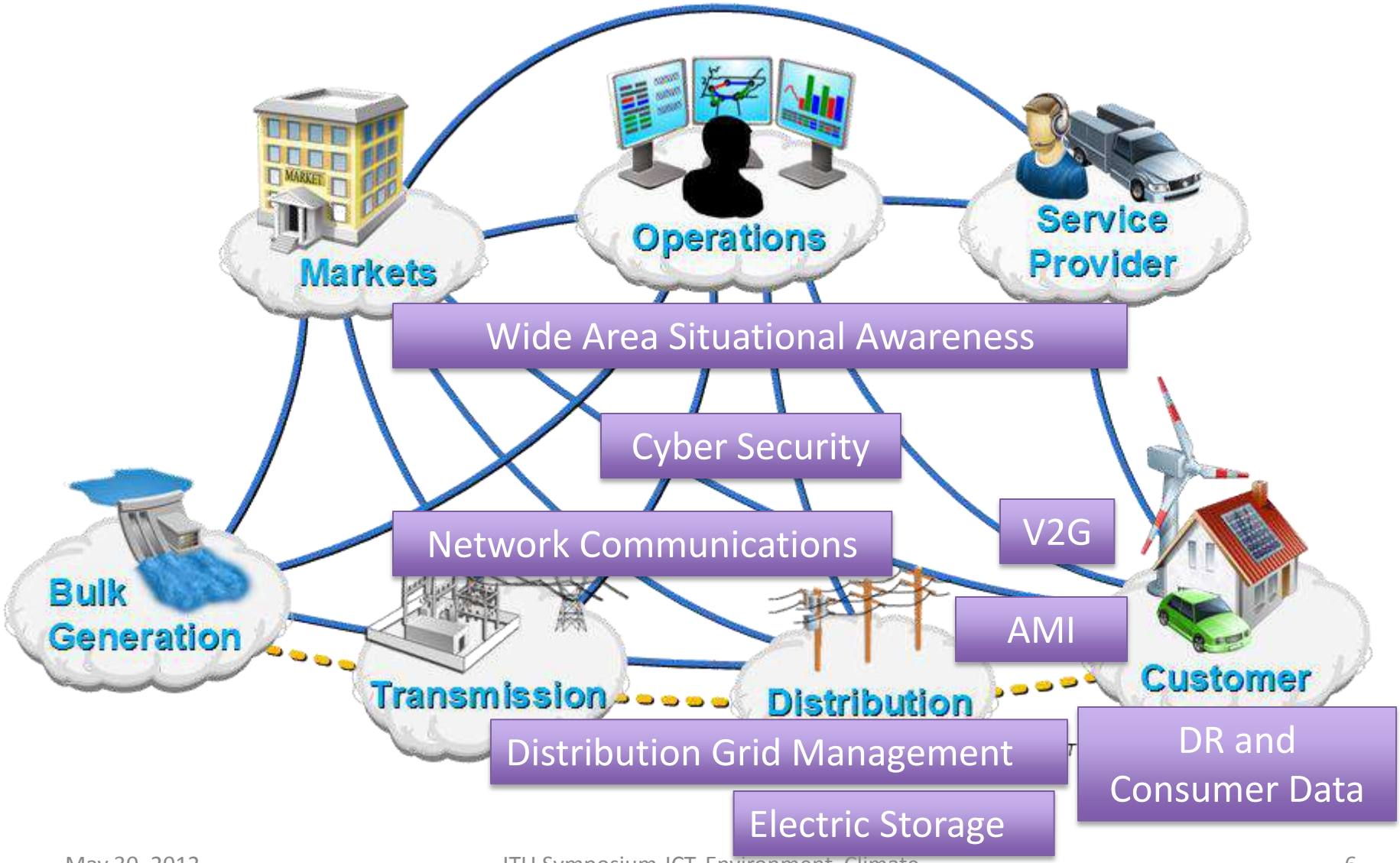
What Will the Smart Grid Look Like?



Standard is the Key

- Information is the foundation
  - Better management of power infrastructure requires accurate, real-time or near real-time data.
  - Capacity management, and energy market trading need data for projection and prediction of demand and supply
  - Common data format and semantic for interoperability
- Communications is the glue
  - Reliable network for meter and sensor data, control and command
  - Standards for device communications, networking and management of smart grid networks
- NIST established Smart Grid Interoperability Panel (SGIP) to determine the need for standards and to coordinate standardization activities

Smart Grid Standardization



NIST Smart Grid Interoperability Panel

- Public-private partnership created in Nov. 2009
- Approx. 750 member organizations, 1900+ participants
- Open, public process with international participation
- Coordinates and accelerates standards development
  - Identifies Requirements
  - Prioritizes standards development programs
  - Works with over 20 SDOs including IEC, ISO, ITU, IEEE, …
- Web-based participation

SGIP Twiki:
http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIP

Sample Results

- Energy usage data and the Green Button Program
- Guidelines for Smart Grid Communications and Networking
- Guidelines for Smart Grid Cyber Security

Energy Usage Data

- Smart Meters enables readings of customers electricity usage in a timely manner, but how to make this information useful?
- SGIP's Priority Action Plan 10 (PAP10) was formed to facilitate the standardization of Energy Usage Information, resulted in
  - NAESB (North American Energy Standards Board) REQ18/WEQ19 PAP10 EUI standard, an information model standard
  - NAESB REQ21 Energy Services Provider Interface
    - How to represent EUI in XML, and,
    - How to exchange it between utilities and third parties on behalf of consumers
- Together these define a flexible file format for Green Button based on ratified standards from NAESB
- The implementations of standards resulting in the Green Button supported by the U.S. White House and Utility industry

What is Green Button?

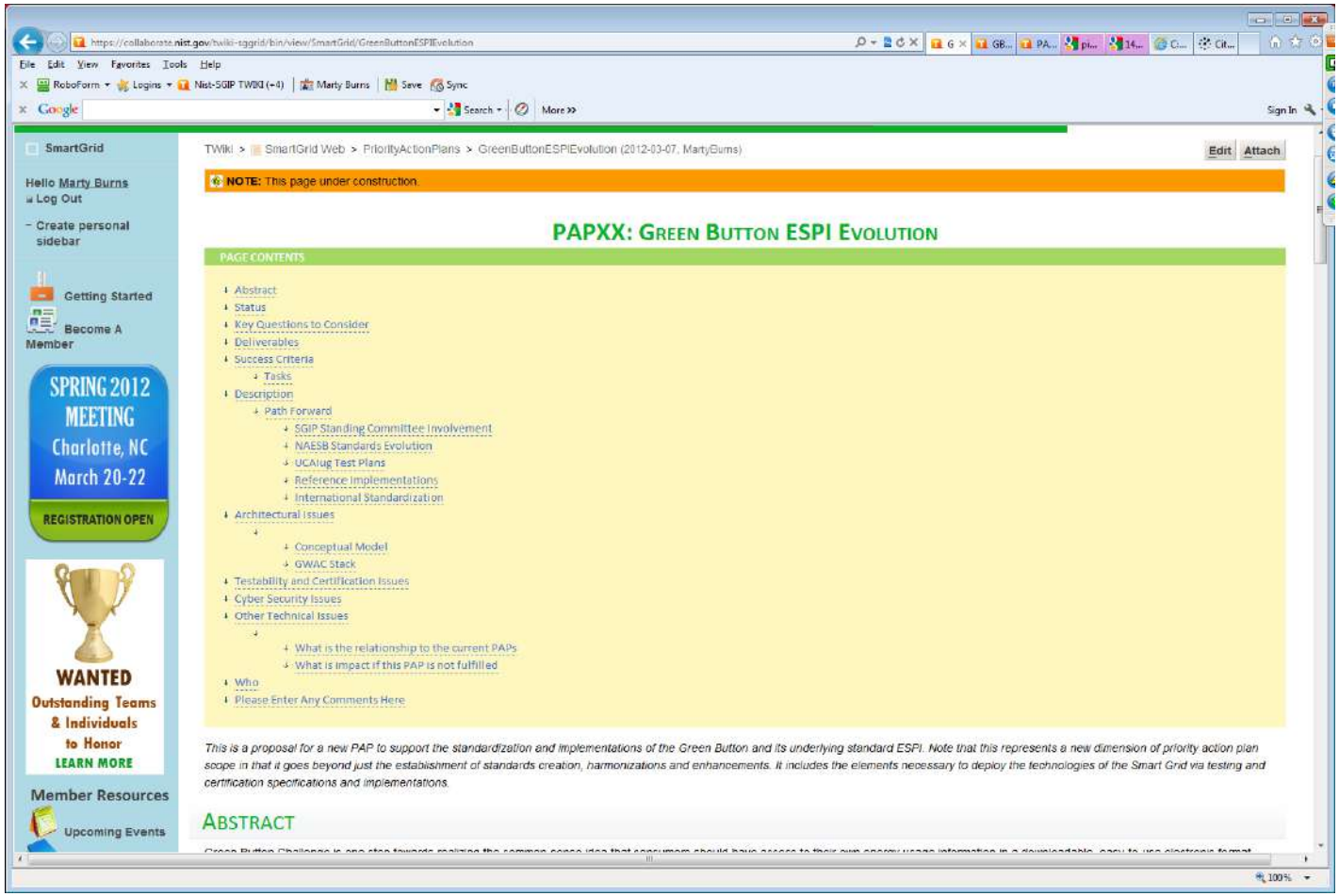
- *Common-sense idea that electricity customers should be able to download their own energy usage information in consumer- and computer-friendly format.*

Some examples of Green Button Data

- Hourly load profile for past billing period plus current period to date
- Fifteen minute load profile for most recent 15 days
- Daily load profile for past month or year
- Summary only data
- Energy usage and energy demand readings
- Gas, Water usage profiles
- Yearly summary data with monthly parts

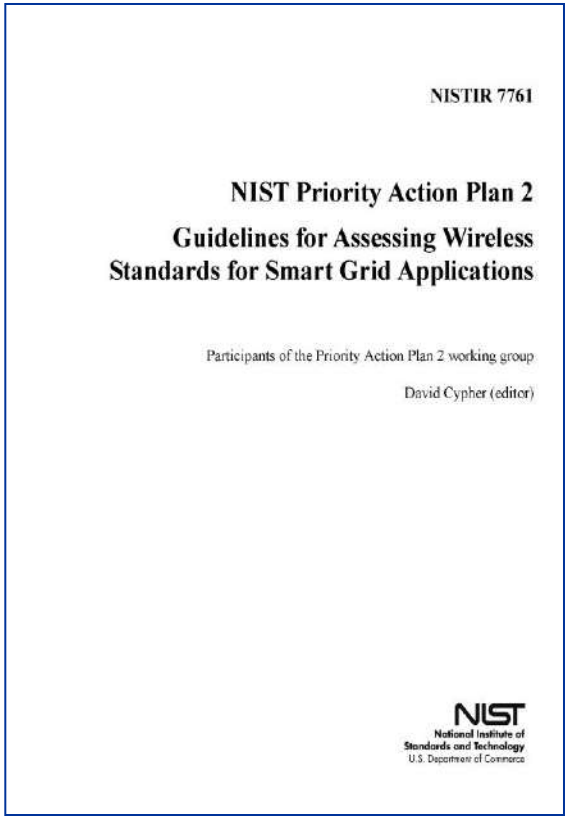
Green Button Enabling Vision

https://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonESPIEvolution



Guidelines for Smart Grid Communications and Networking

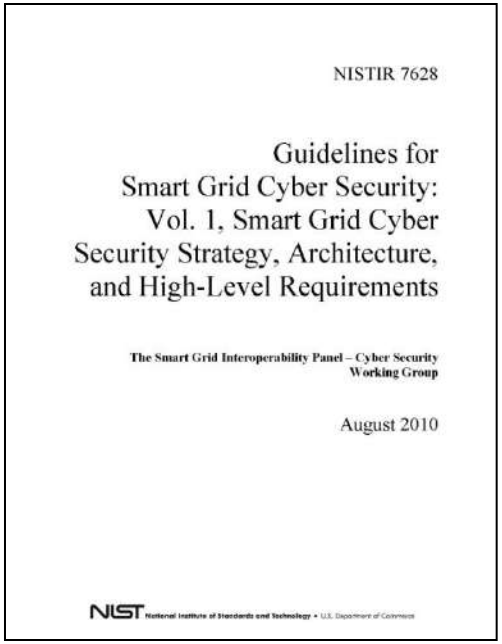
- RFC 6272, *Internet Protocols for the Smart Grid* – Guideline for setting up IP network for Smart Grid (PAP01)
- NISTIR 7764, *Guidelines for Accessing Wireless Standards for Smart Grid Applications*
- NISTIR 911198, *Guideline for the Implementation of Coexistence for Broadband Power Line Communication Standards*



Guidelines for Smart Grid Cyber Security

(Cyber Security Working Group)

- Building cyber security in from the start has been a paramount concern
- Permanent Working Group
  - Over 575 public and private sector participants
- NIST IR 7624 *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

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