Grid Modernization and Smart Grid

Paul Molitor, Assistant Vice President

Origins of Smart Grid in the U.S.

The Blackout of 1965

- 25 million people affected
- 80,000 square miles
- Congressional Hearings
  - Cites lack of R&D in Electric Power
  - Creation of Electric Power Research Institute (EPRI)

Origins of Smart Grid in the U.S.

The Blackout of 2003

- 55 million people affected
- 110,000 square miles
- Congressional Hearings
  - Environmental Protection Act of 2005
    - FERC charged with mandating reliability stds
  - Energy Independence and Security Act of 2007 (EISA)
    - Title XIII - Smart Grid

Origins of Smart Grid in the U.S.

Today we make a major step with the **Energy Independence and Security Act**. We make a major step toward reducing our dependence on oil, confronting global climate change, expanding the production of renewable fuels and giving future generations of our country a nation that is stronger, cleaner and more secure.

President George W. Bush, December 19, 2007

So that's why today, I'm pleased to announce that under the **Recovery Act**, we are making the largest-ever investment in a smarter, stronger, and more secure electric grid. This investment will come in the form of 100 grants totaling $3.4 billion -- grants that will go to private companies, utilities, cities, and other partners who have applied with plans to install smart grid technologies in their area.

President Barak Obama, October 27, 2009

Energy Independence & Security Act (EISA)

SEC.1301. "It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:"

1. Increase Use of Digital Controls
2. Dynamic Optimization
3. Integrate Distributed Resources
4. Demand Response
5. Smart Metering
6. Smart Appliances
7. Storage and Peak Shaving
8. Customer Control
9. Communications Standards
10. Reduce Market Barriers

Energy Independence & Security Act (EISA)

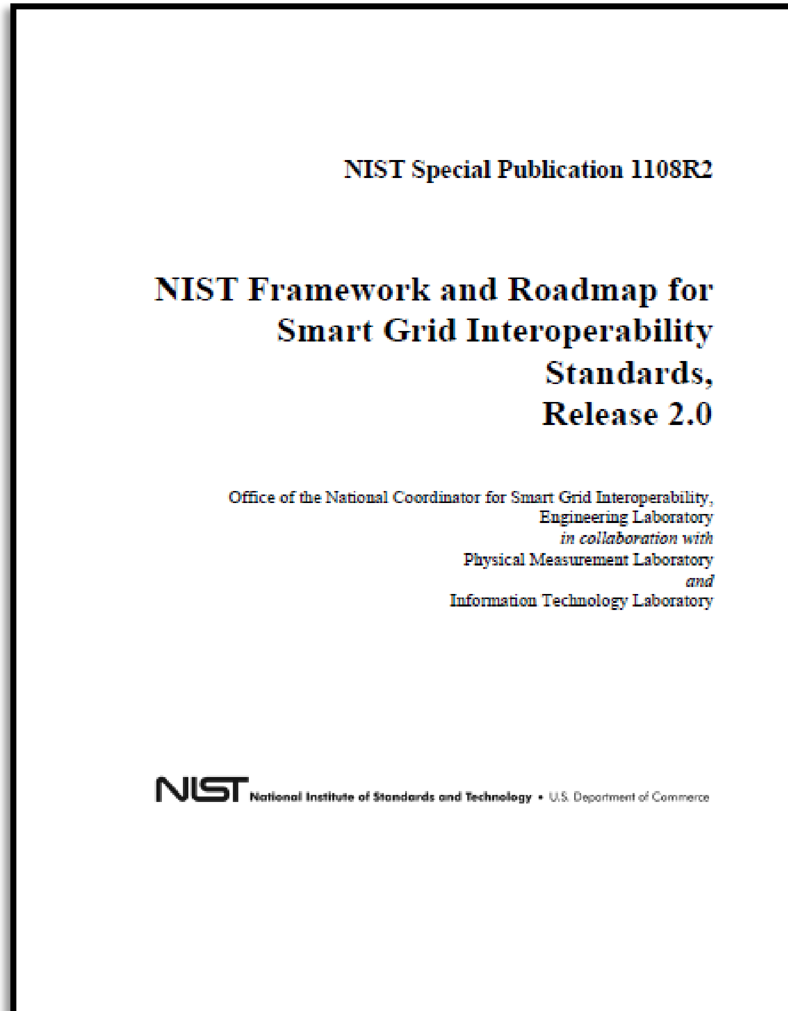
- The Federal Energy Regulatory Commission (FERC)
  - Smart Grid Policy, Final Rule (18 CFR Chapter 1)
  - Four key grid functionalities:
    - Wide Area Situational Awareness
    - Demand Response
    - Electric Storage
    - Electric Transportation

- The National Institute of Standards and Technology (NIST)
  - Framework and Roadmap (Special Publication 1108)
  - FERC List plus:
    - Advanced Metering Infrastructure
    - Distribution Grid Management
    - Cybersecurity
    - Network Communications

8 Application Areas for Smart Grid

NIST Special Publication 1108R2

- Release 2.0 March 2012
- 8 Application Areas
- 37 Standards identified for implementation
- 61 Standards designated for further review
- 19 Priority areas identified for new standards activity



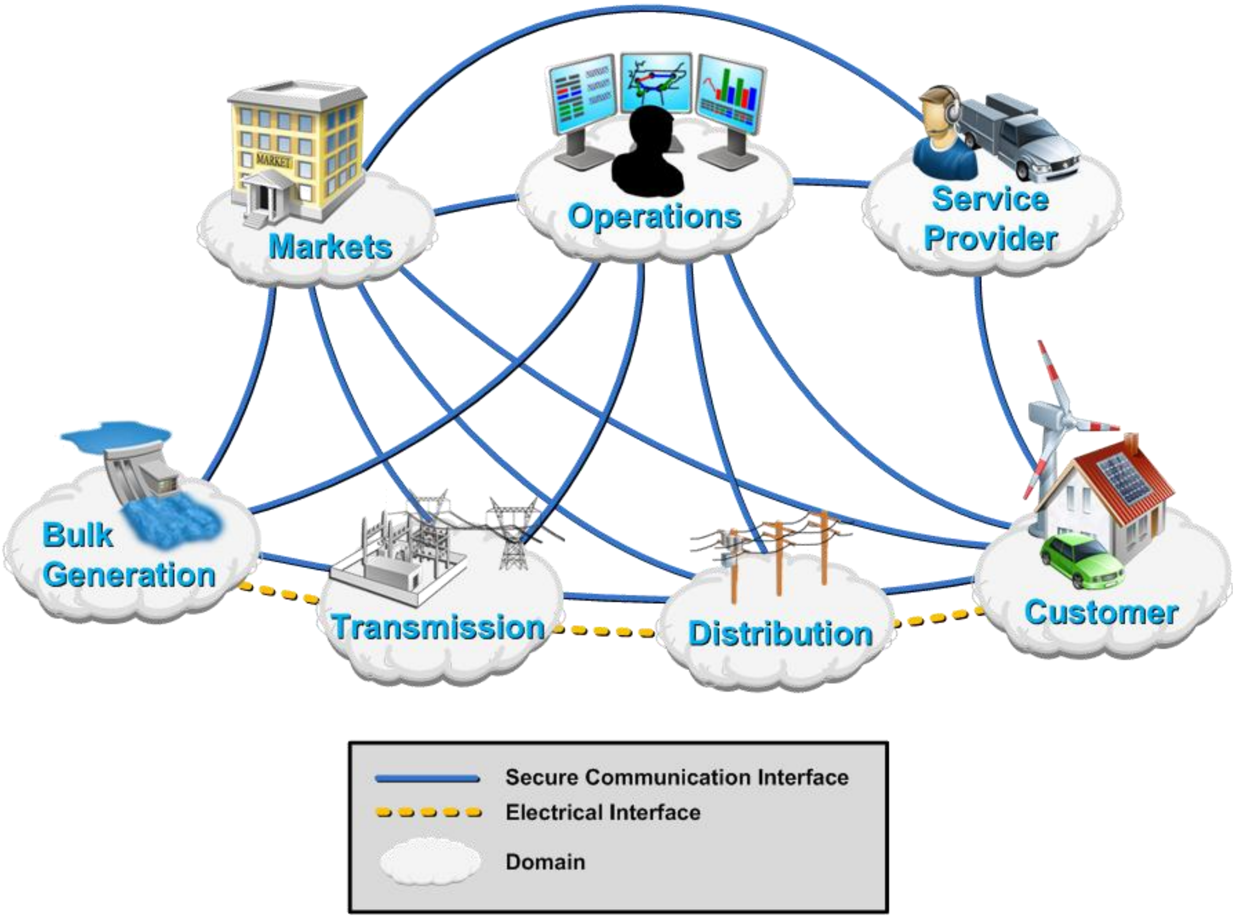
NIST Special Publication 1108R2

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 2.0

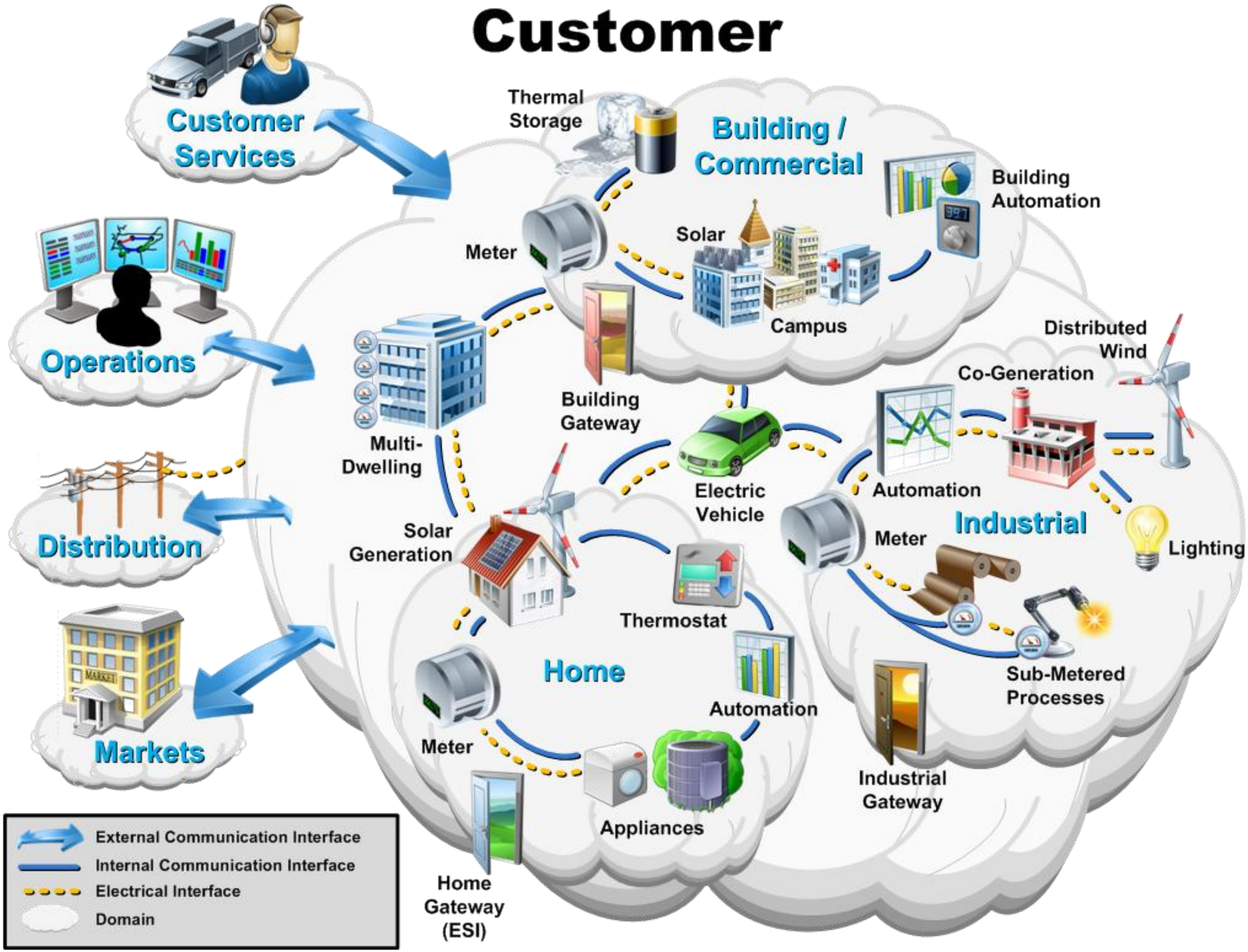
Office of the National Coordinator for Smart Grid Interoperability,
Engineering Laboratory
in collaboration with
Physical Measurement Laboratory
and
Information Technology Laboratory

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

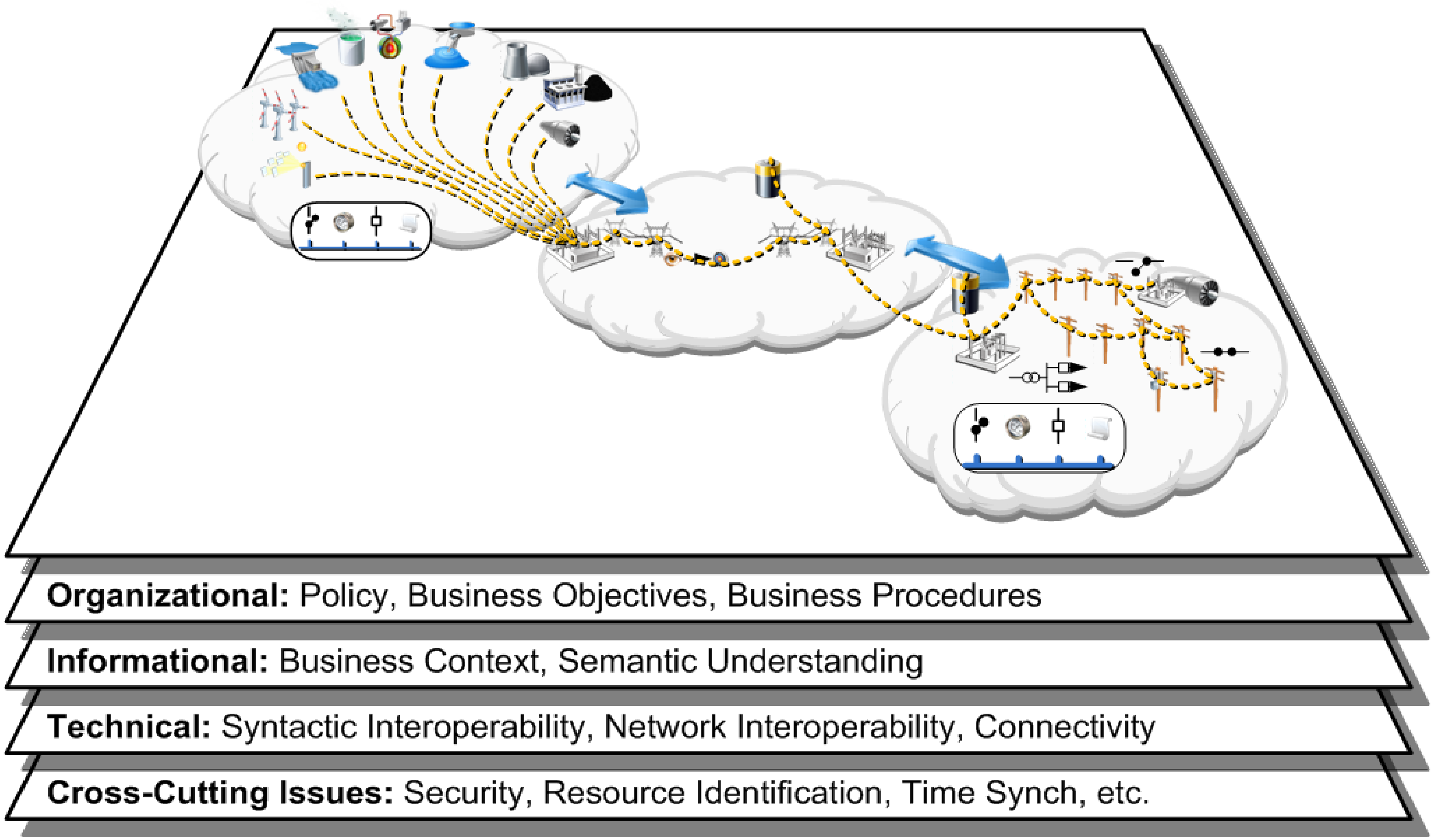
NIST Conceptual Model for Smart Grid



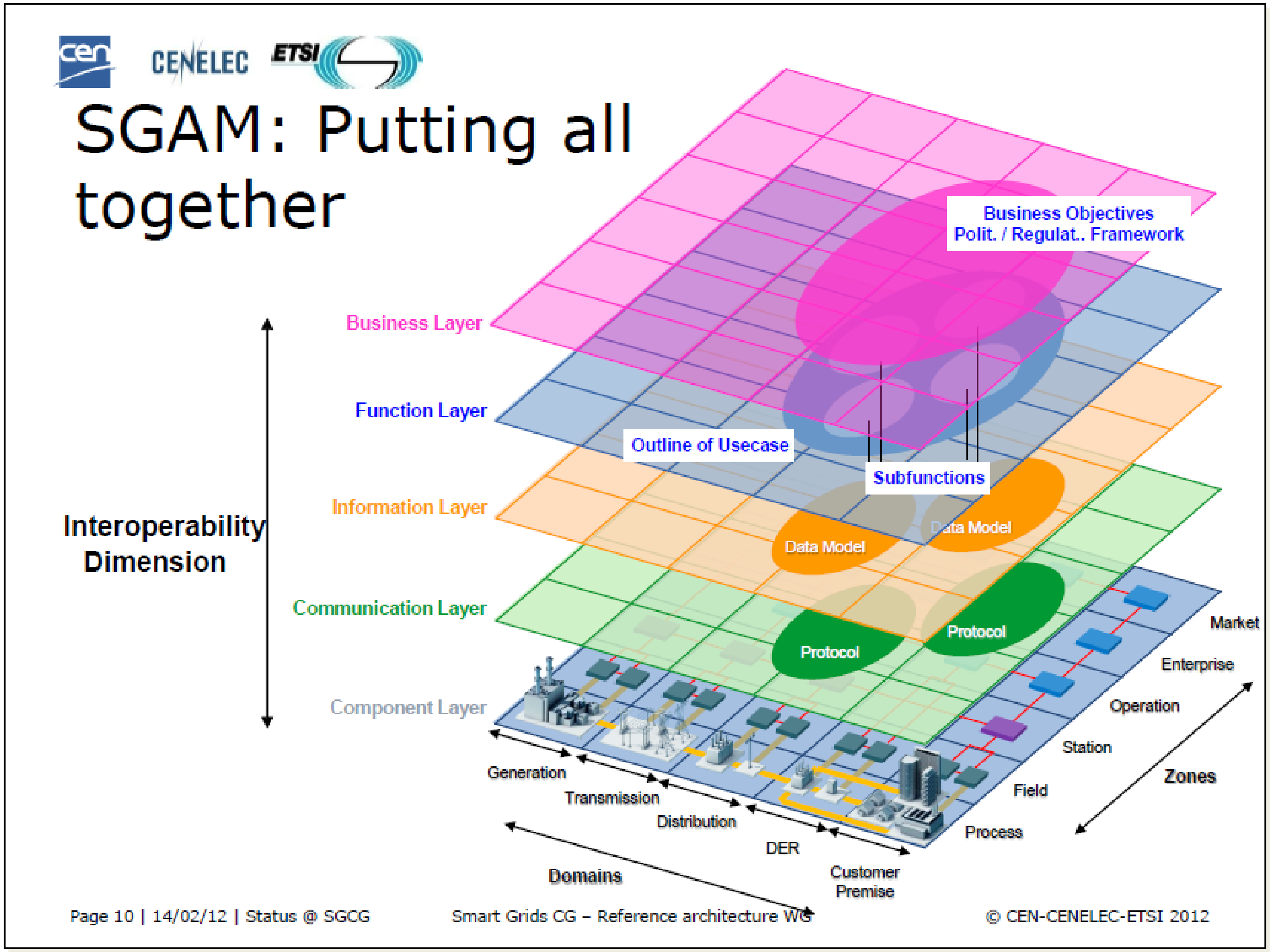
Customer


Customer Services
Operations
Distribution
Markets
Thermal Storage
Building / Commercial
Building Automation
Meter
Solar
Campus
Multi-Dwelling
Building Gateway
Distributed Wind
Co-Generation
Electric Vehicle
Automation
Industrial
Meter
Lighting
Solar Generation
Thermostat
Sub-Metered Processes
Home
Automation
Meter
Appliances
Industrial Gateway
Home Gateway (ESI)
External Communication Interface
Internal Communication Interface
Electrical Interface
Domain

Applied Domain Diagrams

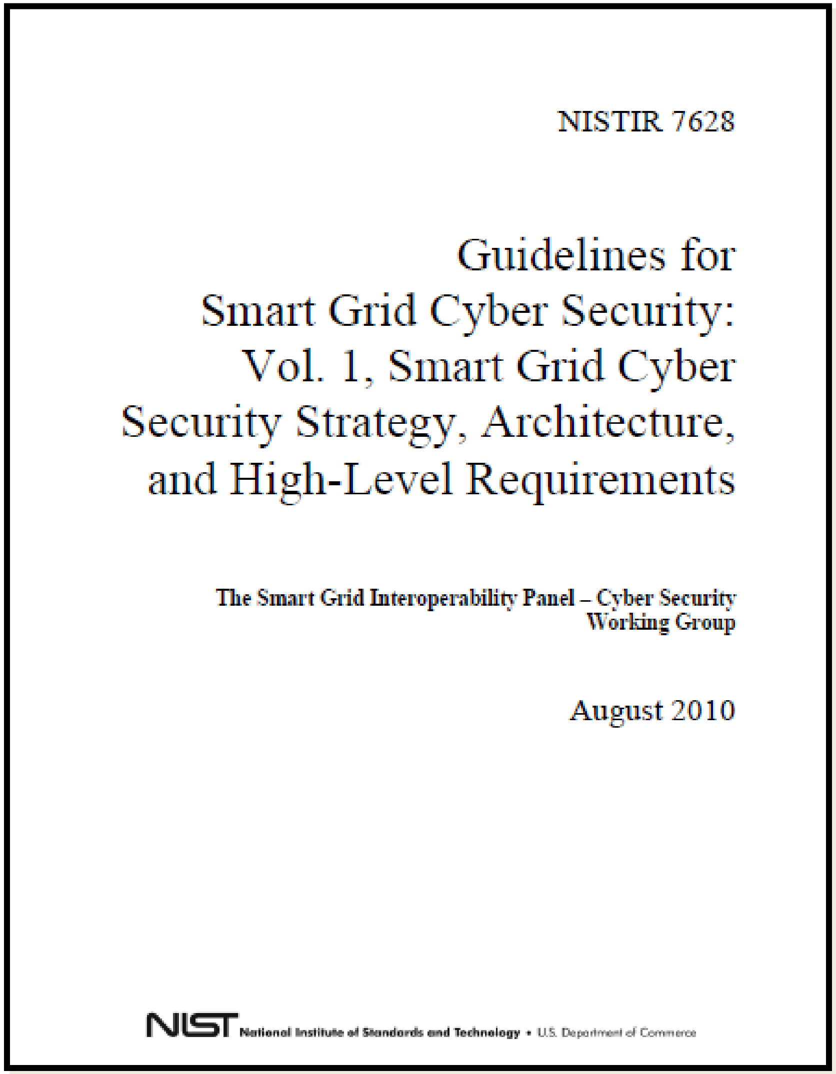


EU Smart Grid Coordinating Committee



Cyber Security Guidelines

- Three Volumes
- High-Level Requirements
  - A Design Tool
  - Evaluation Framework
  - Guidance for crafting cyber security strategies
    - Prevention
    - Detection
    - Response
    - Recovery


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

Evaluation Framework

- Select of Use Cases
- Perform Risk Assessment
- Set Boundaries
  - First Step for a Security Architecture
- High-Level Security Requirements
  - Identify Information Requirements
- Testing & Certification

Risk Assessment Model

THREAT	X	VULNERABILITY	X	CONSEQUENCE	=	RISK
Event, actor, or action with potential to harm		*Weakness*		*Impact*		*Operational, economic, safety, environmental*

- What threats are we concerned about?
- Evaluate effects of cyber vulnerabilities.
- What are the physical impacts ?
- How do failures cascade?
- Assess and quantify the risk.

Interoperability Process Reference Manual

- IPRM Version 2.0, January 2012
  - Applies ISO Guidance for Testing Programs
    - IAF - International Accreditation Forum
    - ISO Guide 65
    - ISO Guide 17025
  - Leverages the industry history in safety testing
- Interoperability Testing & Certification Authority (ITCA)

SGiP

SMART GRID INTEROPERABILITY PANEL

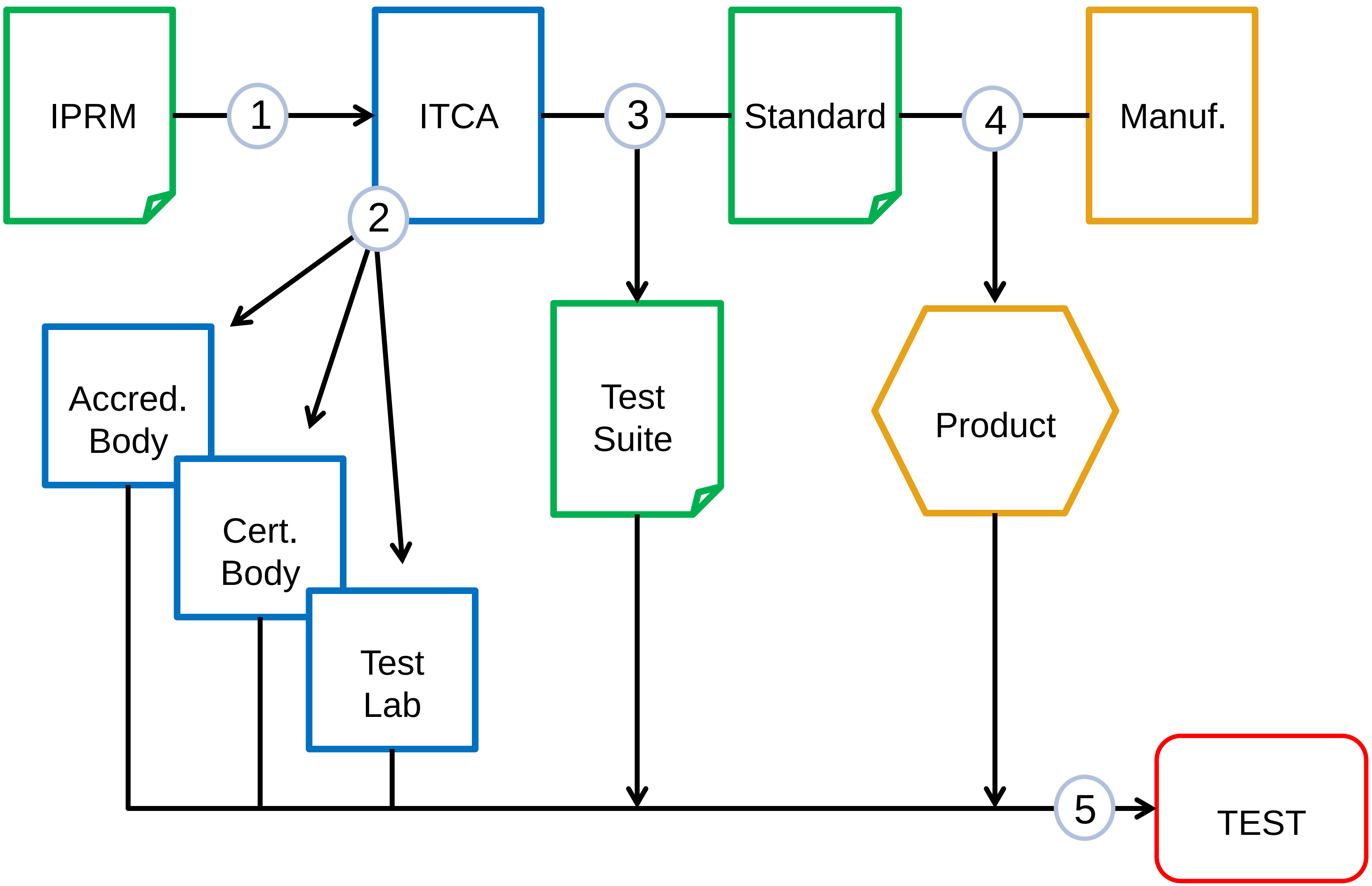
Smart Grid Testing & Certification Committee (SGTCC)

Interoperability Process Reference Manual
(IPRM)

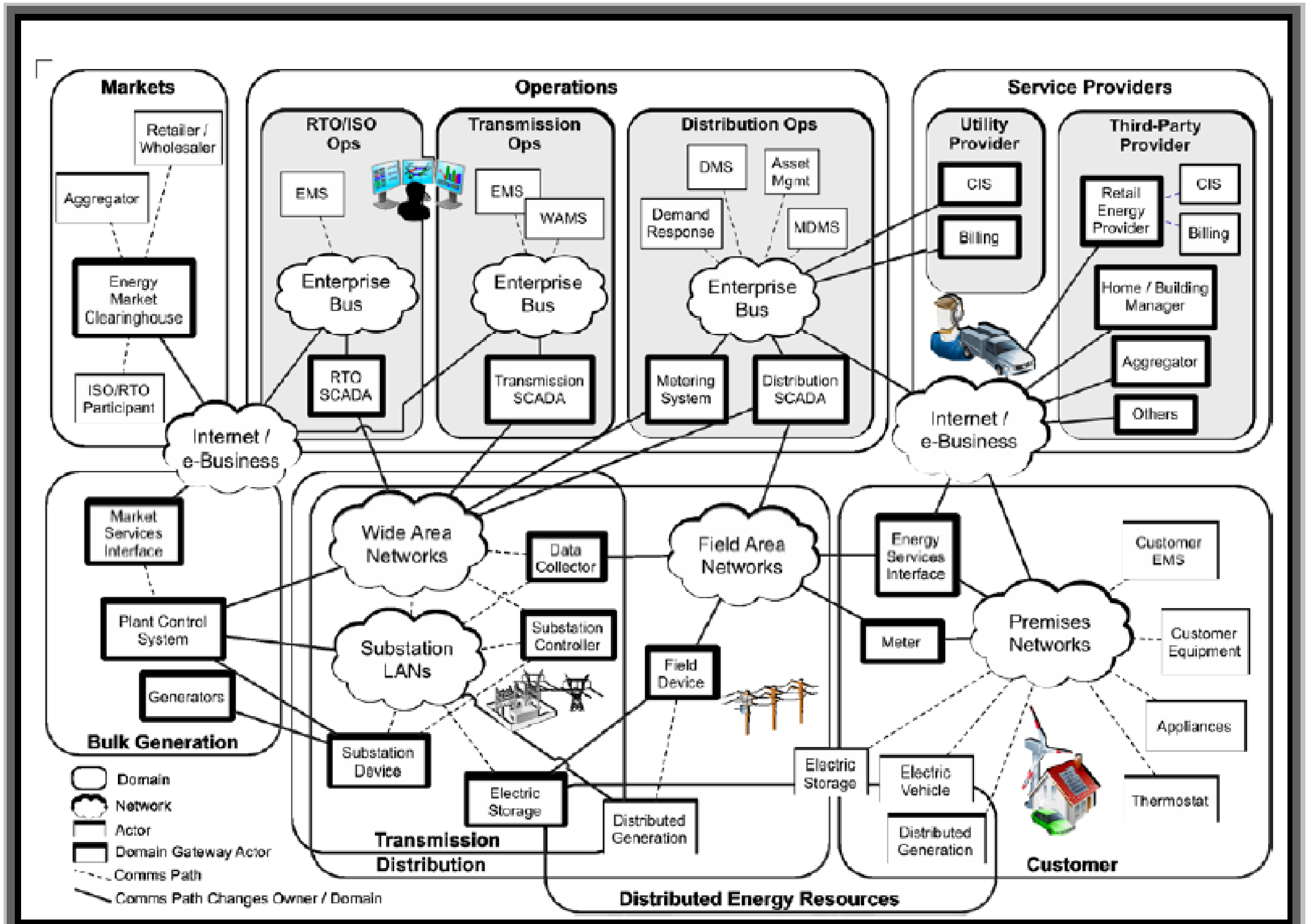
Version 2.0

January 2012

NEMA/ANSI Smart Grid Testing Standard



What Gets Tested?



Other Key Concepts in Smart Grid

“Green Button” Initiative

- Consumer Energy Dashboard

Executive Order 13636

- Improving Critical Infrastructure Cybersecurity
- NIST Cybersecurity Framework
- DHS Voluntary Program for Critical Infrastructure

Storm Reconstruction

Jack Lyons, Northeastern Field Representative

Overview
Smart Grid Solutions
Microgrids, Energy Storage, and Decentralized Generation
Backup Generation
Wiring, Cabling, and Components
Replacing and Relocating Equipment
Disaster Recovery
Contributors
Storm FAQs
Points of Contact
Useful Links

Minimizing the damage caused by major storms can start by ensuring that our electrical grid is resilient and reliable before disaster strikes, and by rebuilding smart after a major weather event. In the NEMA Storm Recovery Guide, find out how smart technologies available today can provide power systems that are safer, more reliable and resilient, and that can be restored more quickly following a disaster.
[Overview]

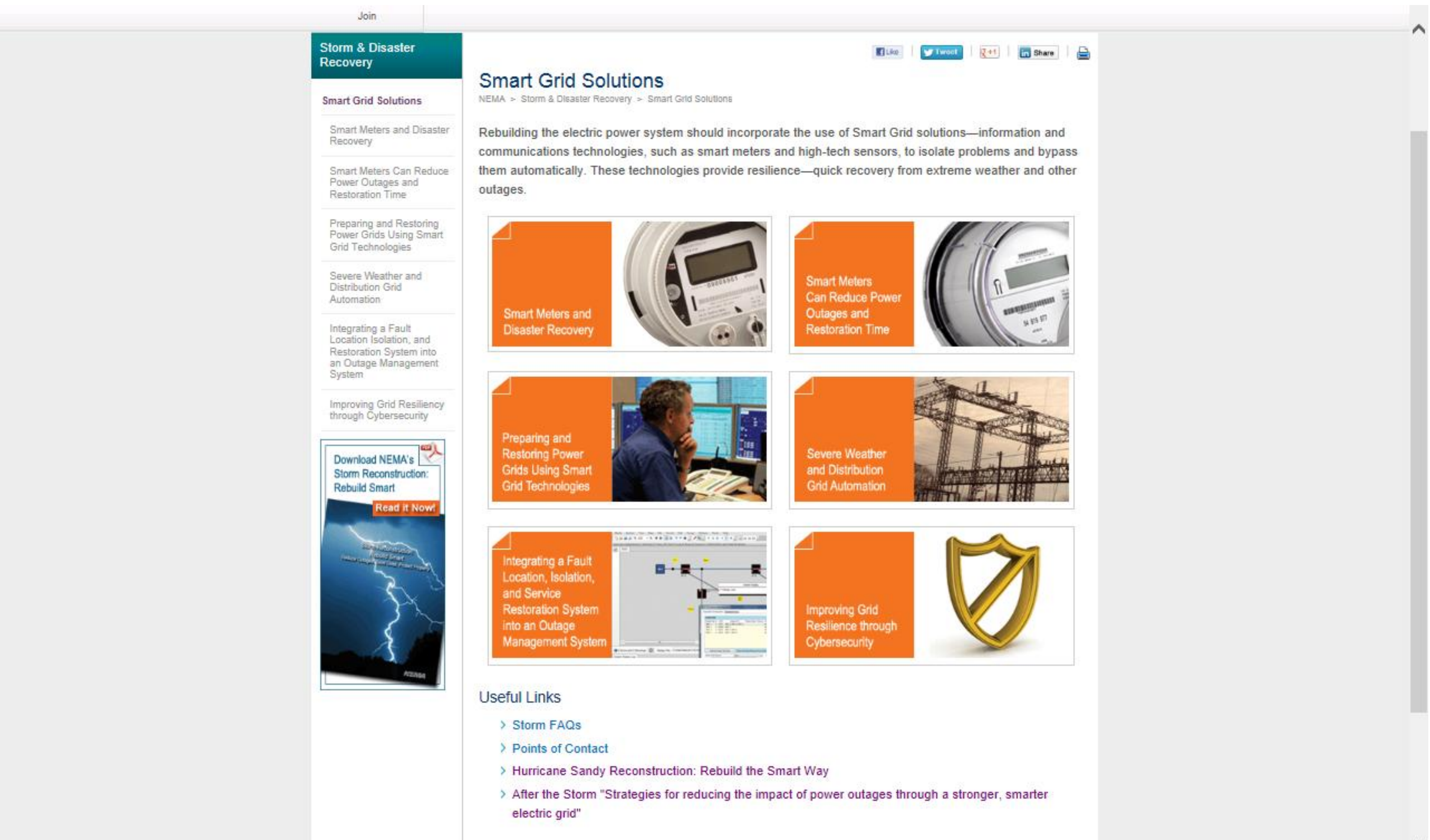
- Information for Policymakers
- Information for Consumers

Contributors:

ABB, ALSTOM, elster, GE, HUBBELL Power Systems, Inc., LEVITON, S&C, Schneider Electric, SIEMENS, Cummins Power Generation, EATON Powering Business Worldwide, Honeywell, PHILIPS, Southwire

NEMA

The Association of Electrical and
Medical Imaging Equipment Manufacturers



Join

Storm & Disaster Recovery

- Smart Grid Solutions
- Smart Meters and Disaster Recovery
- Smart Meters Can Reduce Power Outages and Restoration Time
- Preparing and Restoring Power Grids Using Smart Grid Technologies
- Severe Weather and Distribution Grid Automation
- Integrating a Fault Location Isolation, and Restoration System into an Outage Management System
- Improving Grid Resiliency through Cybersecurity

Download NEMA's Storm Reconstruction: Rebuild Smart

Read it Now!

Like | Tweet | +1 | Share

Smart Grid Solutions

NEMA > Storm & Disaster Recovery > Smart Grid Solutions

Rebuilding the electric power system should incorporate the use of Smart Grid solutions—information and communications technologies, such as smart meters and high-tech sensors, to isolate problems and bypass them automatically. These technologies provide resilience—quick recovery from extreme weather and other outages.

- Smart Meters and Disaster Recovery
- Smart Meters Can Reduce Power Outages and Restoration Time
- Preparing and Restoring Power Grids Using Smart Grid Technologies
- Severe Weather and Distribution Grid Automation
- Integrating a Fault Location, Isolation, and Service Restoration System into an Outage Management System
- Improving Grid Resilience through Cybersecurity

Useful Links

- Storm FAQs
- Points of Contact
- Hurricane Sandy Reconstruction: Rebuild the Smart Way
- After the Storm "Strategies for reducing the impact of power outages through a stronger, smarter electric grid"

Standards

All Standards
All Standards by Product
All Standards by Title
About NEMA Standards
Code Alerts
Codes and Standards Committee
Engineering Bulletins
International Activities
International and Regional Standardization Committee (IRSC)
NTCIP
NEMA Policies and Strategies
Normas en Español
Patent Disclosure Policy
Popular Acronyms
Technical
ANSI Z535 Safety Alerting Standards
Whitepapers

Evaluating Water-Damaged Electrical Equipment

NEMA > Standards

Status: Active

[No Document Number] [DOWNLOAD]

Provides advice on the safe handling of electrical equipment that has been exposed to water. Outlines items that will require complete replacement or that can be reconditioned by a trained professional. Equipment covered includes electrical distribution equipment, motor circuits, power equipment, transformers, wire, cable and flexible cords, wiring devices, GFCIs and surge protectors, lighting fixtures and ballasts, motors and electronic products.

Published Date: Oct.13.2004

Related Standards:

- Evaluating Fire- and Heat-Damaged Electrical Equipment

Staff Contact:

- Baclawski, Vince

Download Publication:

Terms & Conditions
To display, copy and/or download a copy of the document you have requested, NEMA's permission is subject to the following terms and conditions, which you must agree to by clicking on the "I Accept" button below:

1. I agree not to alter the publication in any way and agree not to change its electronic format.
2. I agree not to sell or offer for sale the publication for a price or any other consideration.
3. I agree not to display the publication on a public website or distribute the publication from a public website.
4. I acknowledge that the copyright to this document belongs to the National Electrical Manufacturers Association (NEMA), and that said copyright owner may revoke its permission or modify any of the foregoing terms and conditions at any time.

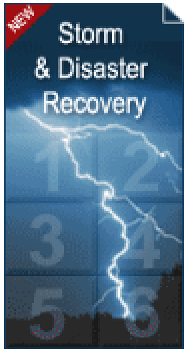
If you choose not to accept these terms and conditions, please exit this page.

I Agree

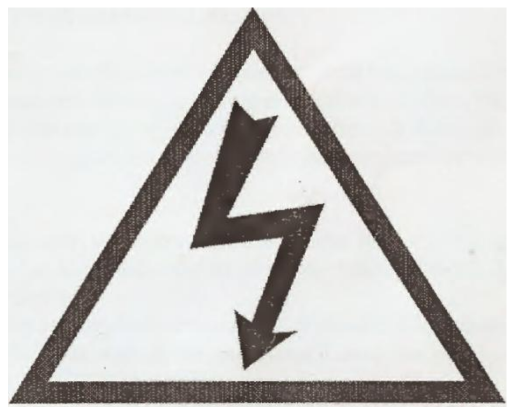
Search Standards

Search Standa

Related

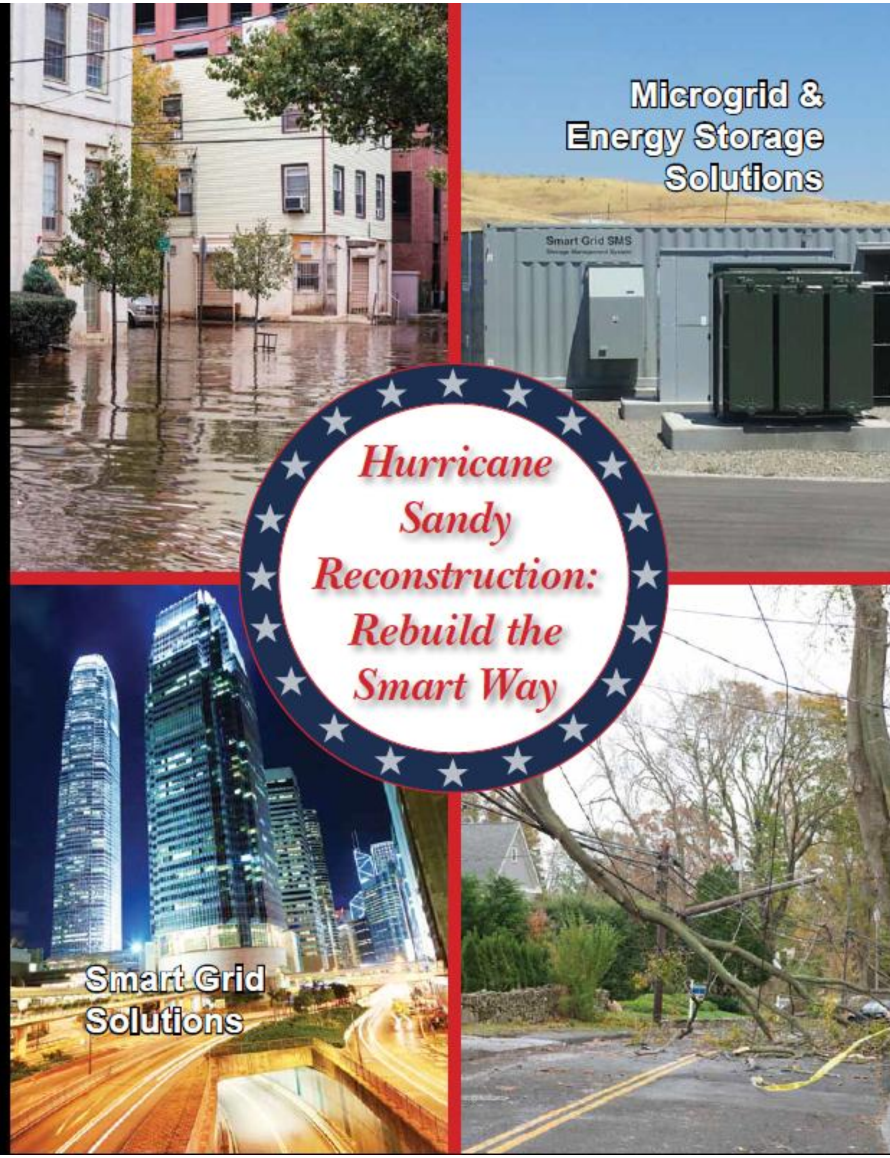


Evaluating Water-Damaged
Electrical Equipment
Storm Damage Recovery



NEMA

Boardwalk Fire (9/13/13)


Microgrid &
Energy Storage
Solutions
Smart Grid SMS
Hurricane
Sandy
Reconstruction:
Rebuild the
Smart Way
Smart Grid
Solutions

When smart technologies are in place, power outages can be avoided and lives, homes & businesses protected.

The 400-plus member companies of the National Electrical Manufacturers Association and our staff of experienced engineers and electroindustry experts, spanning more than 50 industry sectors, stand ready to assist industry and government officials at all levels involved in rebuilding "after the storm."

Contacts

- Government Relations: kyle.pitsor@nema.org, 703-841-3274
- Operations and Technical Services: john.caskey@nema.org, 703-841-3233
- Policy and Communications: chuck.konigsberg@nema.org, 703-841-3292
- Press Contact: joseph.higbee@nema.org, 703-841-3241

Useful Links:

- Administration request for emergency funds: *www.whitehouse.gov/sites/default/files/supplemental__december_7_2012_hurricane_sandy_funding_needs.pdf.pdf*
- Electricity Restoration: *www.nema.org/afterthestorm*
- Energy Efficiency and Economic Growth: *www.nema.org/Energy-Efficiency-and-Economic-Growth*
- Smart Grid Return on Investment (ROI): *www.nema.org/Smart-Grid-ROI*
- NEMA's Policy Initiatives: *www.nema.org/Saving-Energy-and-Saving-Lives*

About NEMA

NEMA is the association of electrical equipment and medical imaging manufacturers, founded in 1926 and headquartered in Arlington, Virginia. Its member companies manufacture a diverse set of products including power transmission and distribution equipment, lighting systems, factory automation and control systems, and medical diagnostic imaging systems. Worldwide annual sales of NEMA-scope products exceed $120 billion.

NEMA National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752, Rosslyn, VA 22209
703.841.3200 • www.NEMA.org

REBUILD SMART: RELIABILITY, RESILIENCE, RECOVERY

Executive Summary

Severe weather events seem to be happening more frequently in the United States. Historic floods, tornadoes, hurricanes, and last year's Superstorm Sandy have led to record levels of devastation and rebuilding. As we become more reliant on electricity to power our homes, businesses, industry, communications, and first responders, a more robust approach to electrical preparedness and recovery is critical to minimizing the personal and economic damage caused by these events.

To mitigate the impact of future weather events, the 400-plus members of the **National Electrical Manufacturers Association (NEMA)** and its staff of electroindustry experts have compiled recommendations in a new guide titled, ***Storm Reconstruction: Rebuild Smart.***

Federal, State, and Local Policies

Minimizing the damage caused by major storms requires an electrical grid that is built to be resilient and reliable before disaster strikes. As *Storm Reconstruction: Rebuild Smart* explains, deployment of smart technologies can make America's power systems safer, more reliable and resilient, and designed in such a way that they can be restored more quickly following a disaster. NEMA supports policies that encourage investment in smarter energy technologies to better protect lives, infrastructure, and communities:

- Review current public programs to ensure technologies that are reliable, resilient, and efficient are promoted;
- Promote policies to stimulate greater public and private sector investments in smart energy technologies such as incentives for U.S. industrial sector and the use of energy saving performance contracts (ESPCs) for state, federal, and local agencies;
- Authorize all federal storm reconstruction aid to be used for deployment of technologies that mitigate future power outages;
- Encourage routine adoption of the most current electrical safety codes in all states; and
- Promote adoption of an industry standard for equipment and structures in vulnerable areas.

Risk Management Planning

Risk management planning should include deployment of smart technologies to mitigate future power outages:

- Engage experts in smart energy solutions to perform pre-crisis risk mitigation assessments;
- Create a unified emergency storm response plan to develop a cohesive blueprint for action that accounts for loss of power and damaged or fallen communication lines;
- Ensure that storm response plans are updated to utilize smart technologies for power restoration; and
- Invest in reliability testing and training for energy management systems.

Technologies and Practices

The NEMA guide contains best practices, recommendations in energy systems design, development, and technology deployment that can reduce outages, save lives, and protect property:

- Smart Grid solutions, microgrids, energy storage, and distributed generation systems;
- Alternative and backup generation technologies; and
- Advances in wiring, cabling, and components.

The guide can be found online at www.nema.org/rebuild-smart.

[1] In 2012, 3,527 monthly extreme weather records were broken for heat, rain and snow in the U.S., according to National Climatic Data Center (NCDC) information, beating 2011's record of 3,251. International insurance giant MunichRe found that from 1980 through 2011, the frequency of extreme weather events in North America nearly quintupled, rising more rapidly than anywhere else in the world.

NEMA

Build and Rebuild Smart—Consumer Tips

Experts at NEMA work with industry and government to recommend standards and best practices to improve the efficiency and safety of the nation's electrical services to public facilities, businesses, industries, and of course, homes.

The following is suggested guidance from *Storm Reconstruction: Rebuild Smart*, a NEMA publication that can help consumers be better prepared for storm-related outages by making electricity service to homes and businesses more reliable and resilient, and therefore better positioned to recover more quickly.

- **Advanced, wet-rated wiring.** Most wiring in homes and small businesses consists of what is called dry-rated product, such as NM-B, that does not withstand flood conditions. If a home or business is susceptible to flooding, owners should consider replacing wiring in threatened areas with a wet-rated product, such as UF-B, to improve resilience and speed recovery.
- **Underground line installation.** Overhead power line connections are more vulnerable to high winds, downed trees, or flying debris. To reduce the potential of power loss as a result of a downed line, owners should consider underground installation, including protective conduits to prevent water intrusion.
- **Backup power generation.** If the maintenance of electrical service at a home or business is of vital importance (e.g., keeping refrigerated food from spoiling), owners should consider installing backup generators that use alternate fuels such as natural gas, diesel, gasoline, or propane to provide essential functions during a prolonged power outage.
- **Smart meters.** Local utility smart meter programs are increasingly available and are perhaps best known for their cost- and energy-saving features. Smart meters also are smart sensors, with capabilities to assist the local utility in quickly identifying and responding to small-scale and wide-area outages, as well as verifying power restoration. Signing up for a smart meter program is well worth considering.
- **Low-power lighting.** The newest LED lighting technology is more energy and cost efficient for home and business lighting. It is also beneficial as part of a backup generation option because its low-power draw and native direct current (dc) integrates readily with alternate sources of dc power during outages.
- **Trees and landscaping.** It is always a best practice to ensure that trees and other landscaping on home or business properties are regularly trimmed and maintained to eliminate the dangers to buildings or power lines from weakened or diseased limbs.

The Association of Electrical and Medical Imaging Equipment Manufacturers
1300 North 17th Street, Suite 900, Rosslyn, Virginia 22209 • www.nema.org/storm-reconstruction

Disaster Recovery

- Evaluating Damaged Equipment
  - Water and Fire Damaged
- Generators
  - Location, Transfer, and Fuel
- Equipment Relocation
  - Above Grade?
- Harden Equipment
  - Wire, Cable, and components
- Disaster Preparation
  - Recovery, Response, and Rebuild planning

www.nema.org
www.nist.gov/smartgrid
www.sgip.org

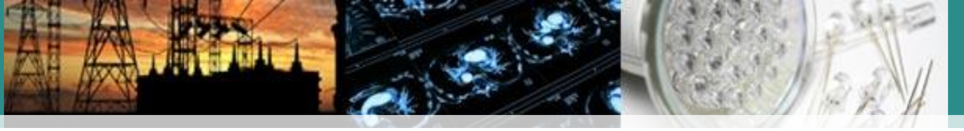
Jack.Lyons@NEMA.org
Paul.Molitor@NEMA.org
(703) 841-3262

Abstract

This session will provide a baseline understanding of Smart Grid and the activities that it encompasses including interoperability standards, testing & certification, and cybersecurity. It will further explore how Smart Grid affects disaster recovery operations for grid operators and the rebuilding efforts in the wake of Hurricane Irene and Superstorm Sandy in the northeastern United States.

Biography – Jack Lyons

- Jack Lyons is the Northeast Field Representative for the National Electrical Manufacturers Association, NEMA. Jack works closely with the Electrical Inspectors from Maine to Pennsylvania. His work involves education on Electrical Products and Codes, (i.e. National Electrical Code, I-Codes, energy codes, and NFPA 70E). Jack is a liason between End-Users, Inspectors, and manufacturers to ensure code compliant installations of electrical products. Jack's background is Electrical Contracting, Electrical Inspections, Electrical Education, and Engineering.



Biography – Paul Molitor

- Paul Molitor is an established figure in Smart Grid, holding numerous national and international leadership positions in the industry. He was the first Plenary Secretary of the NIST Smart Grid Interoperability Panel (SGIP), and served as the founding director for SGIP's industry-operated successor SGIP 2.0, Inc. He's also served as secretary of multiple U.S. Technical Advisory Groups for Smart Grid in the International Electrotechnical Commission (IEC) and was named to the Canadian Task Force on Smart Grid Technologies and Standards. In 2013, Paul was named as a "Smart Grid Pioneer" by *Smart Grid Today* along with U.S. Energy Secretary Ernest Moniz.