

Update on Smart Grid Implementation in the USA

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About NEMA

- 💡 Trade Association and Standards Development Organization (SDO)
 - Headquarters in Rosslyn, VA
 - 430+ Member Companies
 - Mission
 - To help members expand the market for their products, technologies, and services by developing appropriate product and testing standards, advocating for beneficial public policies, providing valuable business information, and otherwise promoting member competitiveness.
 - Government Services (advocacy), Technical Services (standards), and Business Information Services (statistics)
 - www.nema.org

About NEMA

Insulating Materials Division

- 6IM Insulating Materials
- 6LD Decorative Laminate
- 6MW Magnet Wire

Wire and Cable Division

- 7HW High Performance Wire and Cable
- 7MO Modular Wire
- 7WC-1 Building Wire
- 7WC-2 Power & Control Cable
- 7WC-3 Flexible Cords

Power Equipment Division

- 8CC Electrical Connector
- 8CP Capacitor
- 8EI-1 Electricity Metering Group
- 8EI-3 Meter Mounting/Test Equipment
- 8HV High Voltage Insulator
- 8LA Surge Arrester
- 8SG Switchgear
- 8TP-1 Dry Type/Specialty Transformers
- 8TP-2 Transformer

Medical Imaging and Technology Alliance

- 9MII Medical Imaging Informatics
- 9MS Magnetic Resonance
- 9MO Molecular Imaging
- 9RT Radiation Therapy
- 9UD Ultrasound Imaging
- 9XR X-Ray Imaging Products

Councils

- Energy Storage Council
- High Performance Buildings Council
- Smart Grid Council
- Port Electrification Council

Origins of Smart Grid in the USA, part 1

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 USA, part 2

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



Energy Independence & Security Act of 2007

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. Communication Standards
10. Reduce market barriers

NIST Special Publication 1108

- 💡 Release 1.0 dated January 25, 2010
- 💡 25 Standards identified for implementation
- 💡 50 Standards designated for further review
- 💡 15 Priority areas identified for new standards activity
 - Later expanded to 17
- 💡 Draft Release 2.0 issued in November 2011

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

NIST Special Publication 1108R2

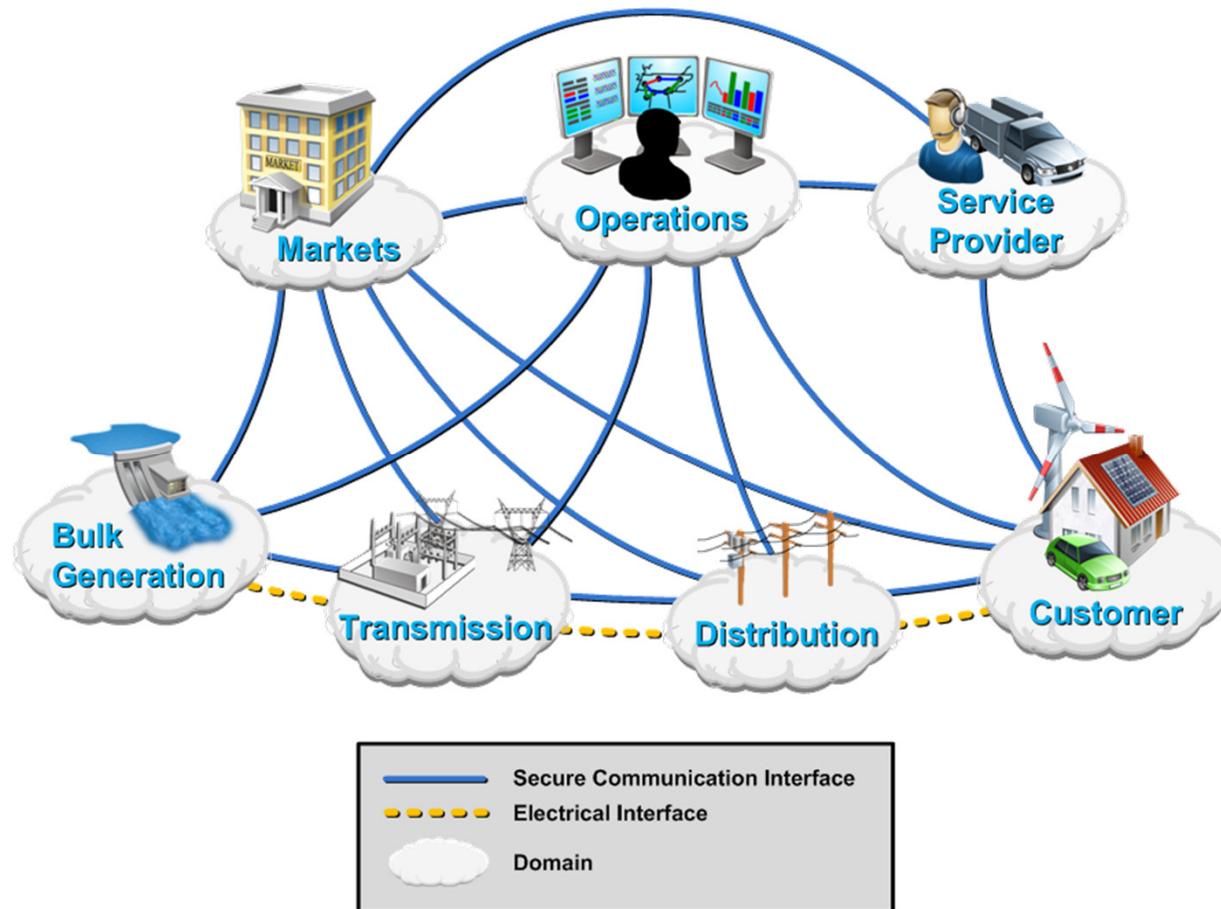
- 💡 Release 2.0 dated February 28, 2012
- 💡 34 Standards identified for implementation
- 💡 58 Standards designated for further review
- 💡 19 Priority areas identified for new standards activity

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 Conceptual Model for Smart Grid



25 Recommended Standards - examples:

BACNET (ASHRAE 135-
2008/ISO 16484-5)

ANSI/NEMA C12 Suite: .1, .18,
.19, .20, .21 Meters

ANSI/CEA 709 and CEA 852.1
LON Protocol Suite

DNP3 Substations

IEC 608760 / TASE.2

IEC 61850 Suite

IEC 61968/61970 Suites

IEEE C37.118

IEEE 1547 Suite

IEEE 1588

Internet Protocol Suite

Multispeak

Open ADR

OPC-UA Industrial

Open Geospatial Consortium

Geography Markup Language
(GML)

Zigbee/Homeplug Smart Energy
Profile 2.0

25 Recommended Standards, continued

Open HAN

AEIC Guidelines version 2.0

Security Profile for Advanced
Metering Infrastructure v.1.0

DHS National Cyber Security
Catalog of Control Systems
Security

DHS Cyber Security
Procurement Language for
Control Systems Security

IEC 62530 Parts 1-8

IEEE 1686-2007

NERC CIP 002-009

NIST Special Publication (SP)
800-53, NIST SP 800-82

Selected Additional Standards - examples:

ANSI C12.22, .23, .24
GPS & SPS
Homeplug AV & Homeplug C&C
IEEE 61400-25 Communication
and Control of Windpower
Plants
G.Hn
IEEE P1901 - PLC
ISO/IEC 8824 & 12139-1
IEEE 802 Family
3GPP (2G, 3G, 4G Cellular)
Wireless
IEEE P2030

EV

SAE J1772 Electrical Connector
SAE J2836/1-3 Use Cases for
PEV Interactions
SAE J2847/1-3 Communications
for PEV

W3C

US Dept. of Transportation
NTCIP 1213 - Intelligent
Transportation Systems

Cyber Security

ISA SP99, ISO 27000, NIST
FIPS 140-2, OASIS WS Suite

What happens next?

NIST Governance for Smart Grid

- Smart Grid Interoperability Panel (SGIP)
 - 600+ member companies
 - 1,700+ individual participants
 - Governing Board Structure
 - Charter & Elected Representation
 - Open to International Participation
- www.SGIPweb.org



Types of Electrical Utilities in the USA

- 💡 **Investor owned: 150 companies, on stock exchanges such as New York Stock Exchange**
 - **Edison Electric Institute**
- 💡 **Community owned: 2,000 companies (ex. Los Angeles, Portland, OR, Sacramento, etc.)**
 - **American Public Power Association**
- 💡 **Cooperatives: 3,000 companies, owned by the customers.**
 - **National Rural Electric Cooperative Association**

Investment Considerations in Smart Grid Technology in the USA

Economic evaluation

Regulatory evaluation: financial -

- Who will pay for the new equipment? Utility or customers?
- How will the technology impact reliability? Goal is typically 99+ % or less than 4 hours per year outage.

Regulatory evaluation: environmental -

- How will this project improve or hurt the environment?

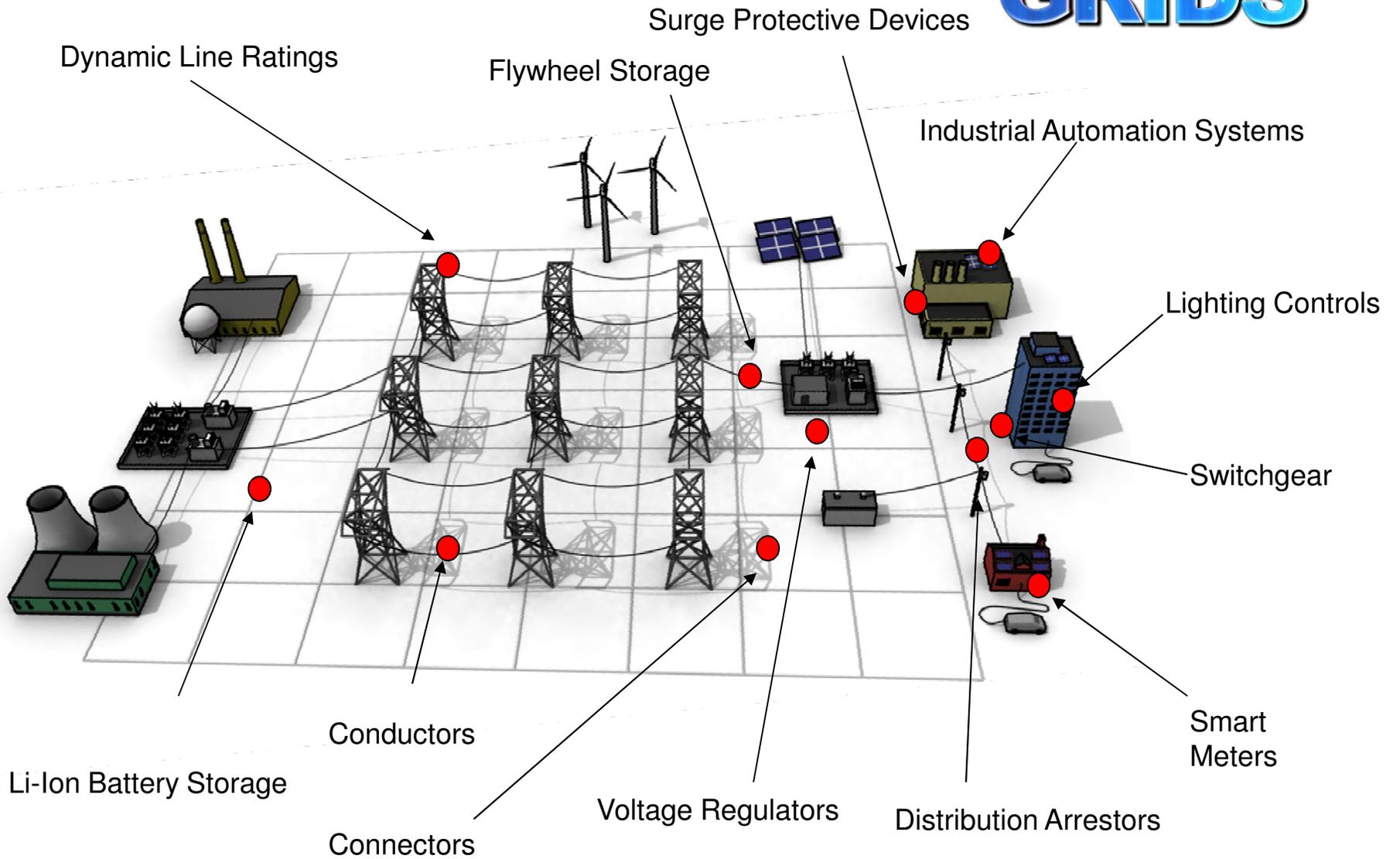
Enabling Technology

- 💡 Various technologies that enable smart grid operation can be grouped into five key technology areas. These categories are:
 - 💡 advanced components,
 - 💡 advanced control methods,
 - 💡 sensing and measurement,
 - 💡 improved interfaces and decision support, and
 - 💡 integrated communications.

Enabling Technology: Advanced Components

Examples:

-  Advanced On-load Tap-changer (OLTC)
-  One Cycle Control Controller
-  Advanced Protective Relays
-  Controllable Network Transformer (CNT)
-  Real-Time Demand Response and DER Control Device
-  Convertible Static Compensator (CSC)
-  Short Circuit Current Limiter (SCCL)
-  Current Limiting Conductor (CLiC)
-  Smart Meter
-  D-VAR or DSTATCOM
-  FACTS
-  Solid State Transfer Switch (SSTS)



Important Links

- 💡 www.nema.org/smartgrid
- 💡 www.nist.gov/smartgrid
- 💡 www.energy.gov
- 💡 www.sgiclearinghouse.org
- 💡 www.YouTube.com/vids4grids
- 💡 Questions?

Thank you