NIST Smart Grid Program

Smart Grid/Green Button Update

NIST Smart Grid Federal Advisory Committee
June 3, 2014

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

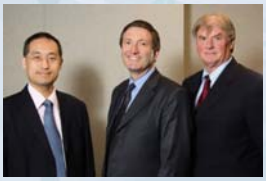
engineering laboratory

NIST Smart Grid Program Update

- **People, Planning Processes, Program Implementation …**
- **People**: Smart Grid & CPS staffing transitions
  - Chris Greer, director and Dave Wollman, deputy director
    → Dean Prochaska smart grid program manager
  - Chris Greer, SGIP Board elected member
  - George Arnold [retirement May 2014]
    → SGIP Board ex-officio member Dave Wollman
  - Marianne Swanson [retirement 2013]
    → Vicky Pillitteri, smart grid cybersecurity lead
  - Jeff Mazer [retirement May 2014]
    → Paul Boynton, smart grid testbed lead (internal transfer)
  - Jerry Castellucci, CPS public working group (internal transfer)
  - Additional new hires (including Allen Goldstein, PMU project)
  - New Presidential Innovation Fellows (next slide)

Presidential Innovation Fellows

- White House (OSTP) initiated program to bring in innovative private sector entrepreneurs to tackle high-profile priorities
  - Todd Park, US Chief Technology Officer
  - Includes Open Data and My Data projects
- NIST has hosted three "PIFs" in Round 2
  - John Teeter, Green Button/My Data (and Matt Theall, Green Button PIF at DOE)
  - Sokwoo Rhee and Geoff Mulligan, CPS
  - 1 year fellowship, June 2013 to June 2014



- PIF Round 3
  - Digital by default – Veterans
  - Data innovation (multiple agencies)
  - Crowdsourcing (multiple agencies)

Engineering Lab Program Planning Process

- Annual process – program development, program and project descriptions, presentations, decisions, funding allocation, …

EL Program: Smart Grid

Program Manager: David Wollman, Smart Grid and Cyber-Physical Systems Program Office, x2433

Associate Program Manager: Dean Prochaska, Smart Grid and Cyber-Physical Systems Program Office, x2214

Strategic Goal: Smart Manufacturing and Cyber-Physical Systems

Date Prepared: May 31, 2013 [updated August 23, 2013]

Summary: This program develops and demonstrates smart grid measurement science advances to improve the system efficiency, reliability, resiliency, and sustainability of the nation's electric grid. In response to a mandate given by Congress and the Administration, NIST's Engineering Laboratory-led Smart Grid program leads the coordination and acceleration of smart grid interoperability and security standards in collaboration with the private sector, including the private-public non-profit organization Smart Grid Interoperability Panel 2.0, Inc. (SGIP), and through publication of the NIST Framework and Roadmap for Smart Grid Interoperability. By utilizing expertise in NIST's Engineering, Information Technology, and Physical Measurement Laboratories, this program advances the measurement science that will increase asset utilization and efficiency, improve grid reliability and resiliency, and enable greater use of renewable energy sources in the grid through research, standardization, testing and implementation of the NIST Framework.

EL Project Title and Number(s): Smart Grid Communication Networks [7721294-000]

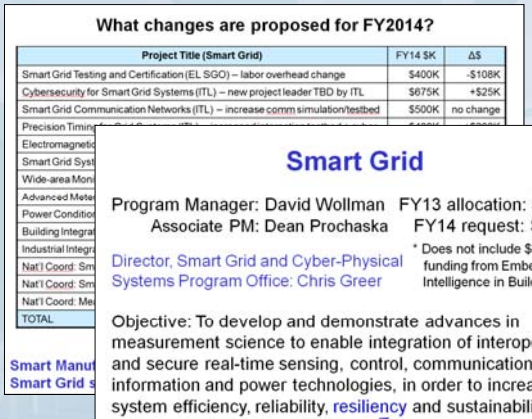
Program Title and Number: Smart Grid

Project Leader: Nada Golmie, Information Technology Lab (ITL), Advanced Network Technologies Division, x4190

Associate Project Leaders: Hamid Ghanvi, David Griffith, David Cypher

Date Prepared: May 31, 2013 [updated August 23, 2013]

Summary: While there is a clear need for communication networks supporting reliable information transfer between the various entities in the electric grid, there are many issues related to network performance, suitability, interoperability, and security that need to be resolved. This project will focus on identifying opportunities to tailor existing communication protocols to support the specific needs of smart grid applications. By creating collaborative links between the stakeholders, users, and standard developing organizations (SDOs) working on telecommunications, this project will promote the use and deployment of interoperable communication protocols for smart grid. In addition, the analytical and simulation tools and the published research findings that will be produced by this project will foster the development of new areas of inquiry into smart grid specific communication technologies.



What changes are proposed for FY2014?

Project Title (Smart Grid)	FY14 $K	Δ$
Smart Grid Testing and Certification (EL SGO) – labor overhead change	$400K	-$108K
Cybersecurity for Smart Grid Systems (ITL) – new project leader TBD by ITL	$675K	+$25K
Smart Grid Communication Networks (ITL) – increase comm simulation/testbed	$500K	no change
Precision Timing		
Electromagnetic		
Smart Grid Syst		
Wide-area Moni		
Advanced Meter		
Power Condition		
Building Integra		
Industrial Integra		
Nat'l Coord: Sm		
Nat'l Coord: Sm		
Nat'l Coord: Me		
TOTAL		

Smart Manuf
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Smart Grid

Program Manager: David Wollman FY13 allocation: $8,885K*
Associate PM: Dean Prochaska FY14 request: $8,535K*

Director, Smart Grid and Cyber-Physical Systems Program Office: Chris Greer

* Does not include $300K funding from Embedded Intelligence in Buildings

Objective: To develop and demonstrate advances in measurement science to enable integration of interoperable and secure real-time sensing, control, communications, information and power technologies, in order to increase the system efficiency, reliability, resiliency and sustainability of the nation's electric grid, by 2016.

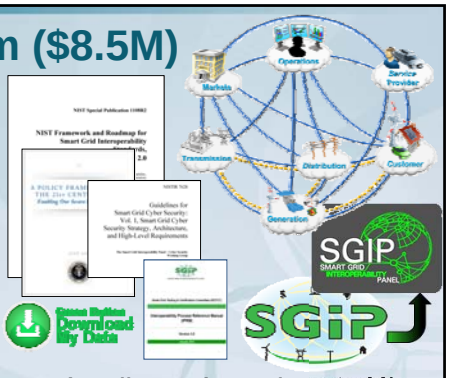
NEW

Smart Manufacturing and Cyber-Physical Systems: Smart Grid

FY 14 EL STRS Program Review

NIST Smart Grid Program ($8.5M)

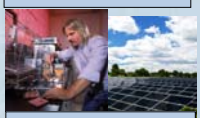
- **Standards coordination:**
  - EISA: NIST coordinates and accelerates development of SG interop standards
  - NIST Framework and Roadmap
  - NIST established the Smart Grid Interoperability Panel (SGIP), now an industry-led private-public partnership
- **Measurement science:**
  - NIST Engineering Laboratory leads a multi-Lab smart grid research program:
  - System performance (testbed, EMC, cybersecurity, networking and testing)
  - Transmission and distribution grid operations (PMUs, metering)
  - Distributed energy resources (power conditioning systems)
  - End-user interoperation (building controls, energy usage)



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

NIST Virtual Cybernetic Building Testbed

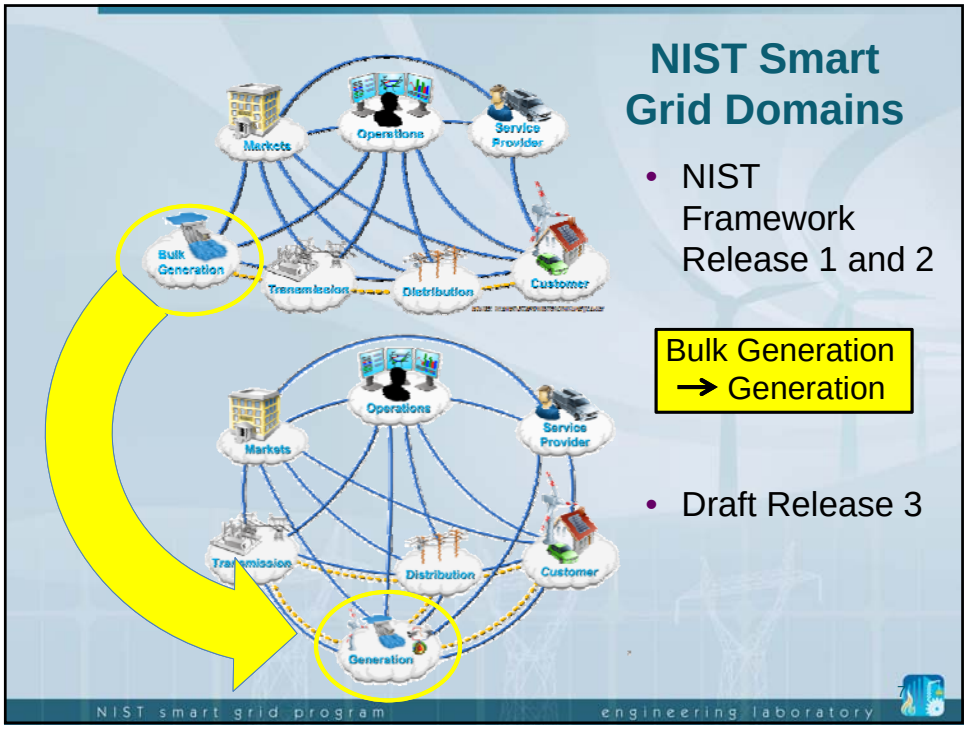
PMU sensor testbed



Power electronics

NIST Smart Grid Framework History

Release 1	Release 2	Draft Release 3
NIST Special Publication 1108 NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 Jan 2010	NIST Special Publication 1108R2 NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 2.0 Feb 2012	NIST Special Publication 1108R3 PRELIMINARY DISCUSSION DRAFT NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0 Mid/late-2014
Key concepts: Identified 75 standards, 16 Priority Action Plans, cyber, architecture conceptual model, energy services interface	Key concepts: Identified 98 standards, 19 PAPs and progress, Smart Grid Interoperability Panel structure/ops, Testing&Certification framework	Public comments closed May 30, 2014 Key concepts: SGIP transition to non-profit organization, architecture harmonization


NIST Smart Grid Domains
Markets
Operations
Service Provider
Bulk Generation
Transmission
Distribution
Customer
Generation
• NIST Framework Release 1 and 2
Bulk Generation → Generation
• Draft Release 3
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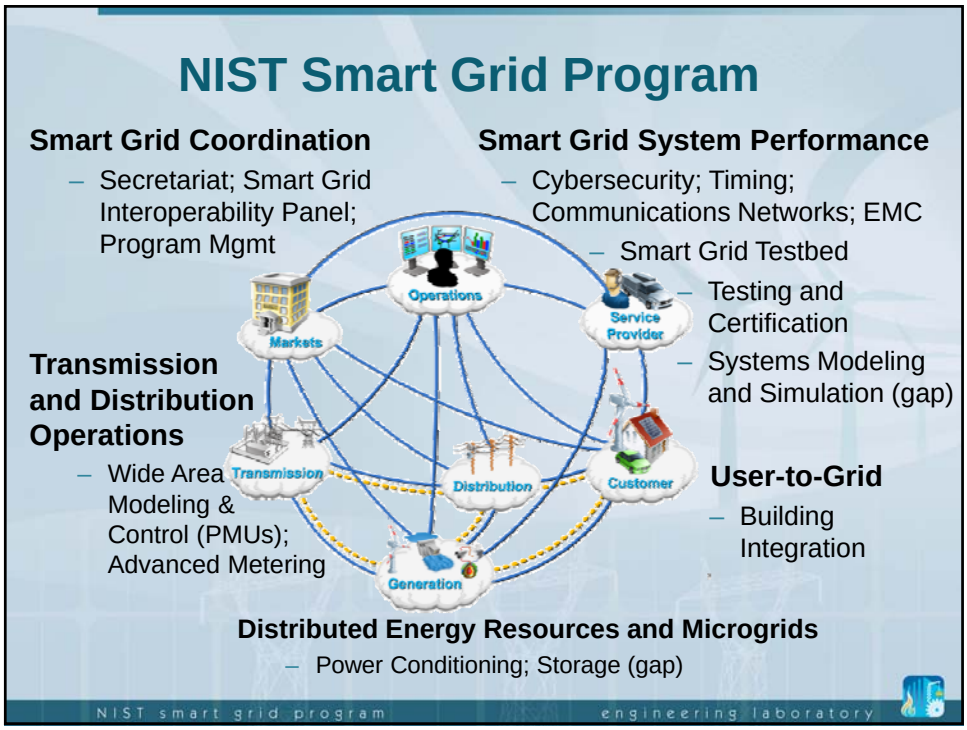
NIST Smart Grid Program
Smart Grid Coordination
– Secretariat; Smart Grid Interoperability Panel; Program Mgmt
Smart Grid System Performance
– Cybersecurity; Timing; Communications Networks; EMC
– Smart Grid Testbed
– Testing and Certification
– Systems Modeling and Simulation (gap)
Transmission and Distribution Operations
– Wide Area Modeling & Control (PMUs); Advanced Metering
User-to-Grid
– Building Integration
Distributed Energy Resources and Microgrids
– Power Conditioning; Storage (gap)
Markets
Operations
Service Provider
Transmission
Distribution
Customer
Generation
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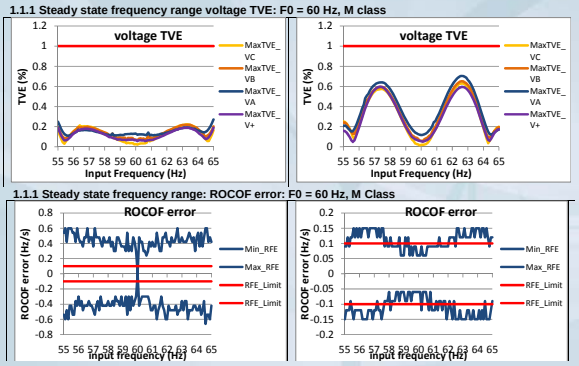
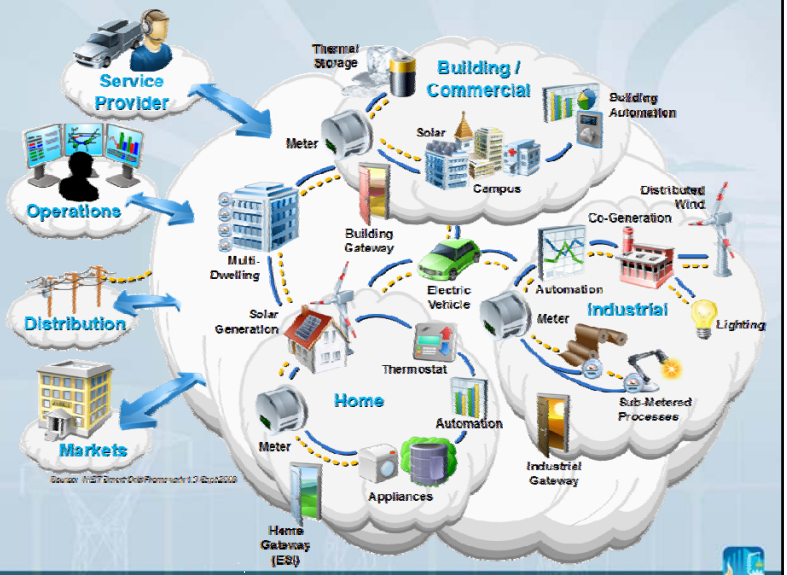
NIST Synchrometrology Lab (PMUs)

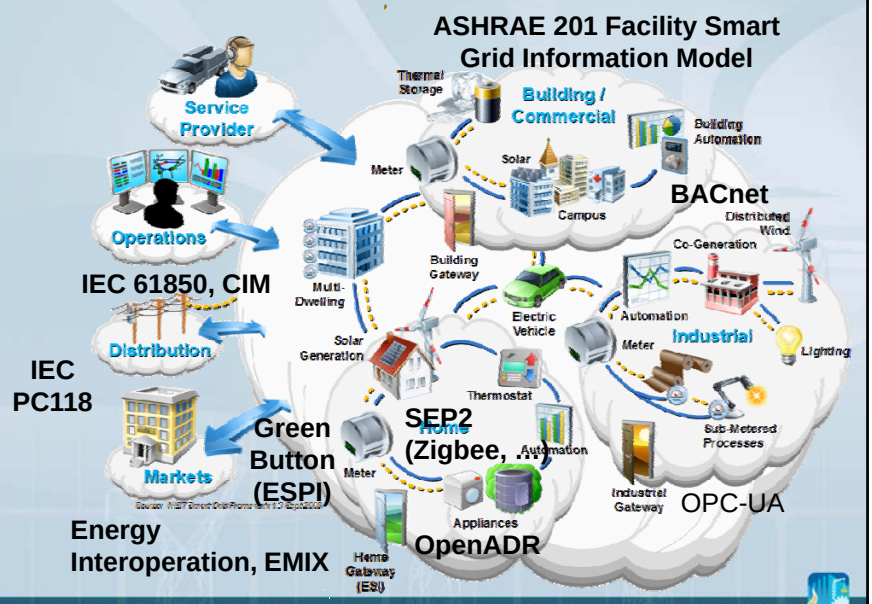
- Performed thousands of automated tests on 12 commercial PMUs to verify compliance with new dynamic performance of IEEE C37.118.1-2011 - **almost all failed!**
- Made recommendations to IEEE PMU WG on new requirements and worked with manufacturers to improve performance
- Recommendations adopted in IEEE C37.118.1a-2014
  - Some PMU results are improved due to some relaxed requirements
  - Some PMU vendors have revised firmware and now passing or close to passing amended std
  - More PMUs now passing test
- IEEE Conformity Assessment Program (ICAP)
  - Developed Test Suite Specification for ICAP
  - Chair ICAP's Synchrophasor Conformity Assessment Steering Committee
  - Developing a portable PMU test system for calibrating other test systems



Consumer Domain

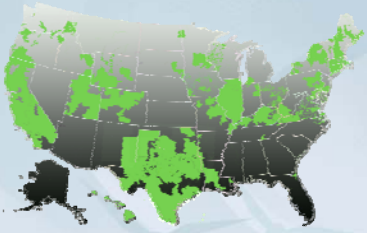


Consumer Domain – Standards



Green Button Initiative

- Enables electronic consumer access to energy data and supports development of ecosystem (apps)
- US: Available to 42+ million customers now and 59+ million in the future based on utility commitments
  CANADA: 2.6 million+
- Result of collaboration among White House, NIST, DOE, state regulators, utilities, vendors, SGIP, and North American Energy Standards Board
- Green Button Download My Data and Green Button Connect My Data



Map of US Green Button Commitments

Green Button Connect My Data

Green Button Download My Data

Green Button PIFs: Goals

- Grow (x2) Green Button ecosystem
  - Outreach to Utilities; Utility Vendors; Third Parties
  - Support Technical Development Teams
- Improve Green Button data
  - Collaborate to Create Certification Process (UCAIug/UL)
  - Download My Data Certification
  - Connect My Data Certification
- Leverage Green Button in Federal Agencies
  - Support Green Button activities in key Agencies (DoE/GSA/EPA)
  - Provide Technical Guidance to Federal Energy Managers
- Stretch Goals
  - Reference Open Source Green Button Implementation
  - American Energy Data Challenge

US Federal Government Commitment

Climate Action Plan

"The Administration will leverage the 'Green Button' standard – which aggregates energy data in a secure, easy to use format – within federal facilities to increase their ability to manage energy consumption, reduce greenhouse gas emissions, and meet sustainability goals." The President's Climate Action Plan, June 25, 2013

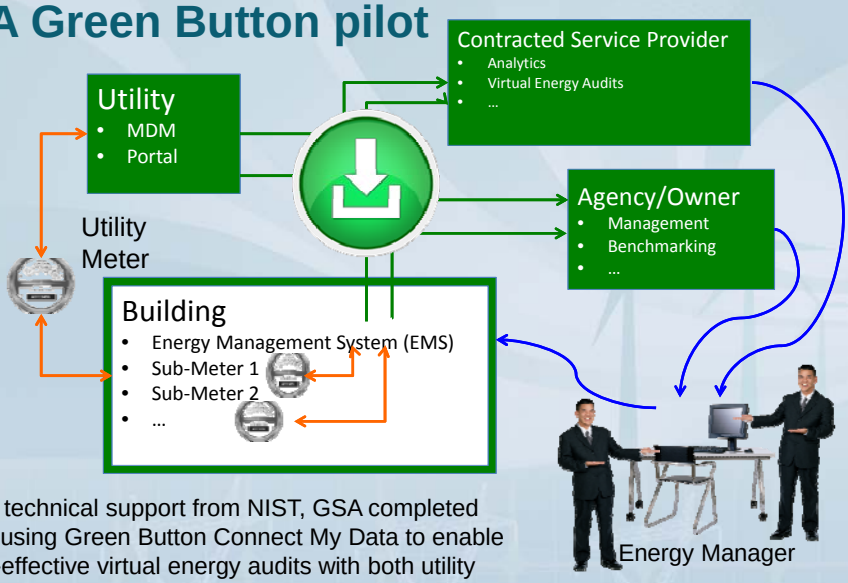
Presidential Memorandum (to all Federal agencies)

"Sec. 3. Building Performance and Energy Management .. each agency shall: … incorporate Green Button into reporting, data analytics and automation, and processes, in consultation with local utilities …" [.. GSA, EPA pilots …] Presidential Memorandum on Federal Leadership in Energy Management, December 5, 2013

Department of Energy American Energy Data Challenge

Challenge 2: Apps for Energy II (Jan-Mar2014), $100,000 total prizes, focus on best use of DOE APIs, best use of customer Green Button data, and best app addressing the "killer ideas" in Challenge 2. Details at http://energychallenge.energy.gov

GSA Green Button pilot



- With technical support from NIST, GSA completed pilot using Green Button Connect My Data to enable cost-effective virtual energy audits with both utility meter data (Pepco) and GSA vendor (Schneider Electric) sub-meter data streams ported via GBCMD into GSA vendor building analytics (FirstFuel)

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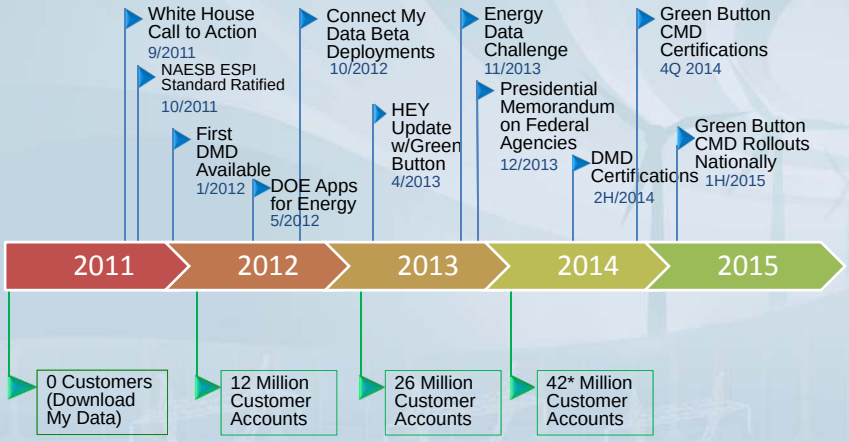
Green Button Evolution



* Represents Customer Accounts with Access to Green Button Data – Primarily Download My Data (DMD)

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