



U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

Cyber Security and the Smart Grid

American Recovery and Reinvestment Act (ARRA)

Revitalizing America's Power Grid

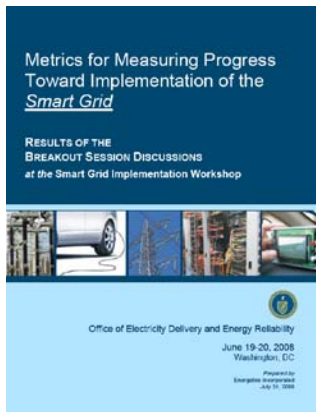
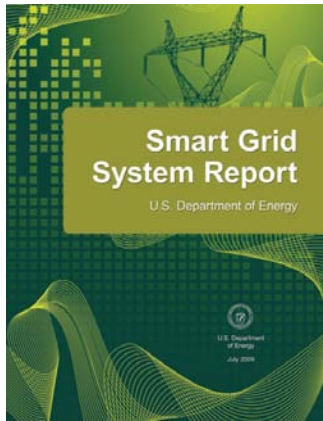
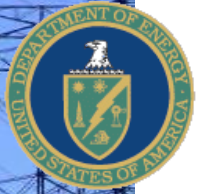
U.S. Department of Energy

Hank Kenchington

Deputy Assistant Secretary – R&D

Office of Electricity Delivery and Energy Reliability

Smart Grid Enabling Activities



- Smart Grid System Report (2009)
- Smart Grid Metrics for Measuring Progress
- Smart Grid – Introduction and Stakeholder books
- Smart Grid Maturity Model
- Smart Grid Information Clearinghouse
- SmartGrid.gov





“We’ll fund a better,
smarter electricity grid and
train workers to build it...”

President Barack Obama

“To meet the energy challenge and
create a 21st century energy economy,
we need a 21st century electric grid”

DOE Secretary Chu
GridWeek, September 2009





American Recovery and Reinvestment Act (\$4.5 B)

Jumpstarts Smart Grid

Office of Electricity Delivery and Energy Reliability	\$ Millions
Smart Grid Investment Grant Program; ≤ 3 years	\$3,400
Smart Grid Demonstrations; 3-5 years	\$615
Interoperability Framework Development by NIST	\$10
Resource Assessment and Interconnection-Level Transmission Analysis and Planning	\$80
State Electricity Regulators Assistance	\$50
Enhancing State Government Energy Assurance Capabilities and Planning for Smart Grid Resiliency	\$55
Workforce Development	\$100



ARRA Smart Grid Investment Grants

Transforms Electricity Delivery

Smart Grid Systems and Equipment	Numbers of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	<ul style="list-style-type: none"> • Near-nationwide coverage • 6X the 166 existing networked PMUs 	<i>Enhanced situational awareness and electric system reliability and resiliency</i>
Smart Transformers	205,983	<ul style="list-style-type: none"> • Enables preventative maintenance 	
Automated Substations	671	<ul style="list-style-type: none"> • 5% of 12,466 transmission and distribution substations in the U.S. 	
Load Control Devices	176,814	<ul style="list-style-type: none"> • Enables peak demand reductions 	<i>1444 MWs of peak demand reduction per year (self-reported estimates)</i>
Smart Thermostats	170,218	<ul style="list-style-type: none"> • Enables peak demand reductions 	
Smart Meters	18,179,912	<ul style="list-style-type: none"> • 13% of the 142 million customers in the U.S. 	<i>Transformational changes in consumer behavior and energy consumption</i>
In-Home Display Units	1,183, 265	<ul style="list-style-type: none"> • Enables customer empowerment 	
PHEVs/Charging Stations	12/100	<ul style="list-style-type: none"> • Accelerates market entry 	<i>Begins the path toward energy independence</i>



ARRA SG Demonstration Program

Regional Smart Grid & Energy Storage

Demo Program Type	No.	Impacts	DOE Funding
Regional Demonstrations	16	• <i>Integrate existing SG technologies in regional applications that can be replicated across the US</i>	\$435M
Battery Storage for Utility Load Shifting or for Wind Farm Diurnal Operations and Ramping Control	3	• <i>Smooth, ramp control, & shift peaks of wind with Li ion, flow batteries & other advanced systems in 8-25 MW range</i>	\$61M
Frequency Regulation Ancillary Services	1	• <i>Test flywheels or batteries in 1-2 MW range</i> • <i>Demo fast 20 MW flywheel storage device for grid scale frequency regulation</i>	\$24M
Distributed Energy Storage for Grid Support	5	• <i>Demo frequency regulation, demand management, community energy storage, & peak shifting with lead carbon, Li ion, flow batteries & others in 1-3 MW range</i>	\$20M
Compressed Air Energy Storage	2	• <i>Use off-peak electricity to compress air into storage to serve on-loads with Compressed Air Energy Storage in 150-300 MW range</i>	\$55M
Demo of Promising Energy Storage Technologies	5	• <i>Bring lab concepts to functioning prototype: advanced batteries, flow batteries, flywheels, & compressed air</i>	\$25M
Total Demo Projects	32	Gather data & show benefits	\$620M



Example "cyber-focused" SGDP Projects

- **Los Angeles Department of Water and Power Smart Grid Regional Demonstration Project** – Deploy SG systems at partners' university campus properties & tech transfer labs - gather data on how consumers use energy in a variety of systems, test next-gen cybersecurity technologies, & how to integrate plug-in hybrid electric vehicles into the grid. (ARRA DOE funding: \$60.2M)
- **Southern Cal Edison - Irvine Smart Grid Demonstration** - Demonstrate integrated, scalable SG system that includes all interlocking pieces of an end-to-end Smart Grid system. Focus on interoperability and interactions between technologies and systems working at the same time - such as communications networks, cyber-security requirements, & interoperability standards, such as NIST & NERC cyber security standards. (ARRA DOE funding: \$40.1M)
- **Battelle - Pacific Northwest Smart Grid Demonstration Project** - Spanning five states & affecting more than 60,000 consumers, demo & validate new SG technologies & inform business cases; provide two-way communication between distributed generation, storage, & demand assets & the existing grid infrastructure; quantify smart grid costs & benefits; & advance interoperability standards & cyber security approaches. (ARRA DOE funding - \$88.8M)





Cybersecurity ARRA Activities *Critical* to Smart Grid Success

- Organized interagency group (DOE, NIST, FERC, DHS, CIA) for development of cybersecurity requirements for RFP
- Cybersecurity - major factor in Technical Merit Review
- Utilized technical merit review team and cybersecurity SME team to provide independent reviews
- DOE will work with grantees to ensure cybersecurity plans are adequate

“DOE may not make an award to an otherwise meritorious application if that application cannot provide reasonable assurance that their approach to cyber security will prevent broad based systemic failures in the electric grid in the event of a cyber security breach.”

Smart Grid FOA

Ongoing Cybersecurity Support

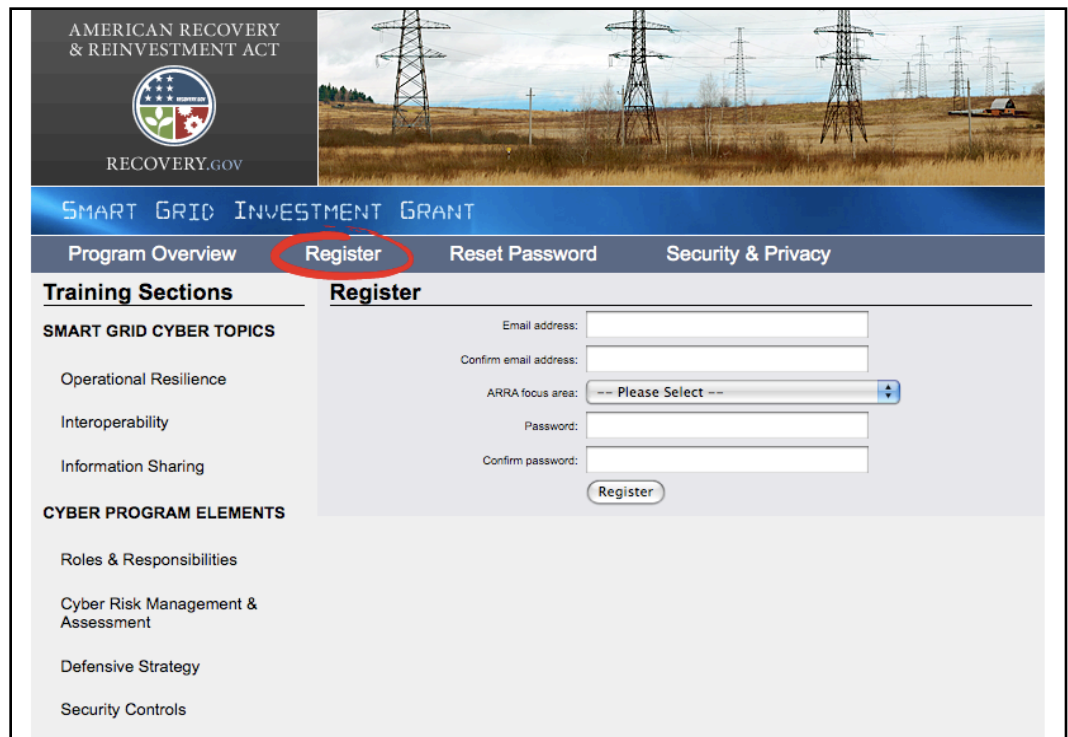
ARRA Cybersecurity Webinar January 12, 2009

www.ARRAsmartgridcyber.net

Who should participate? Smart Grid Investment Grant Awardees

Why?

To better understand the baseline principles & practices necessary to implement cybersecurity into the Smart Grid.



The screenshot shows the registration page for the Smart Grid Investment Grant. At the top left is the American Recovery & Reinvestment Act logo with the text "RECOVERY.GOV". The main header is "SMART GRID INVESTMENT GRANT". Below this is a navigation bar with "Program Overview", "Register" (circled in red), "Reset Password", and "Security & Privacy". The page is divided into two columns. The left column, titled "Training Sections", lists "SMART GRID CYBER TOPICS" (Operational Resilience, Interoperability, Information Sharing) and "CYBER PROGRAM ELEMENTS" (Roles & Responsibilities, Cyber Risk Management & Assessment, Defensive Strategy, Security Controls). The right column, titled "Register", contains a registration form with fields for "Email address:", "Confirm email address:", "ARRA focus area:" (a dropdown menu with "-- Please Select --"), "Password:", and "Confirm password:". A "Register" button is at the bottom of the form.



Upcoming Cybersecurity Activities for the Smart Grid

Jan



Issued Notice of Intent for “National Energy Sector Cyber Organization”

March



Release “revised” *Roadmap to Secure Control Systems in the Energy Sector*

March



Issue RFP for industry-led R&D projects to enhance cybersecurity of electric grid – including Smart Grid

March



Issue National Laboratory call for R&D projects to enhance cybersecurity of electric grid – including Smart Grid

July



Conduct Peer Review of OE Grid Cybersecurity R&D

Ongoing



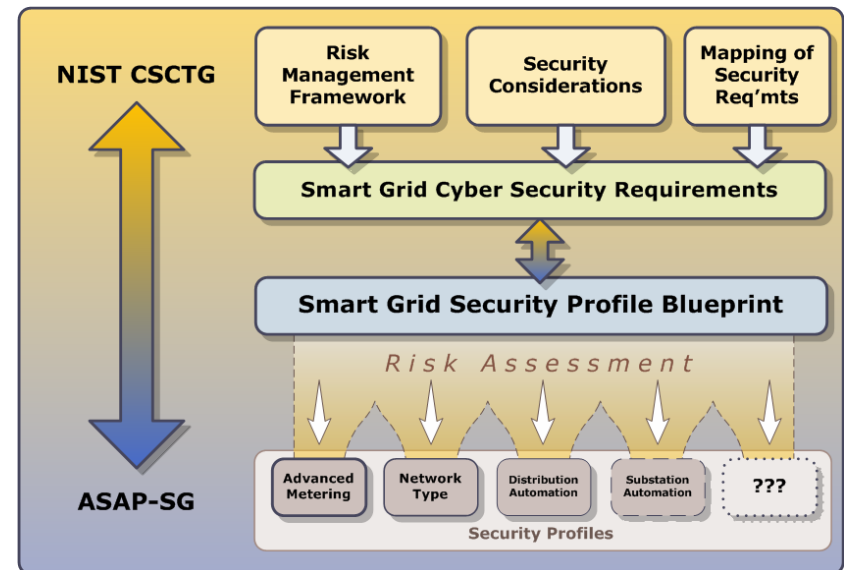
Continue to upgrade ARRA smartgridcyber.net
Work with NIST on interoperability/cyber standards
Continue acceleration of ASAP-SG



ASAP-SG

Advanced Security Acceleration Project - Smart Grid

- Industry-government collaboration (50-50 cost share) to accelerate security standards development for Smart Grid (May 2009 – May 2010)
- Successor to ASAP which developed "Security Profile for Advanced Metering Infrastructure, v 1.0" - incorporated in NISTIR 7628
- DOE funding Software Engineering Institute and Oak Ridge National Laboratory working with Enernex
- Current industry sponsors:
 - American Electric Power
 - Con Edison
 - Consumers Energy
 - Florida Power & Light
 - Southern California Edison
- Partners are invited
- Contact Bobby Brown at Enernex





Contact Information

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For more Smart Grid Information:

OE: www.oe.energy.gov

Smart Grid: www.smartgrid.gov

Smart Grid Task Force: www.oe.energy.gov/smartgrid_taskforce.htm