



U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

Smart Grid Activities by the US Department of Energy

37th Meeting of the APEC Expert Group on Energy Efficiency & Conservation

Dan Ton

Program Manager, Smart Grid R&D

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Presentation Outline

- Smart Grid Functionalities
- DOE Programs Addressing Smart Grid Development & Deployment
- Challenge Ahead
- Smart Grid Resources

Smart Grid Functionalities

Development characterized by seven defining *functionalities (or characteristics)* of the smart grid

Demand response & customer participation goals



- Enables Informed Participation by Customers
- Accommodates All Generation and Storage Options
- Enables New Products, Services, and Markets

Dynamic optimization goals



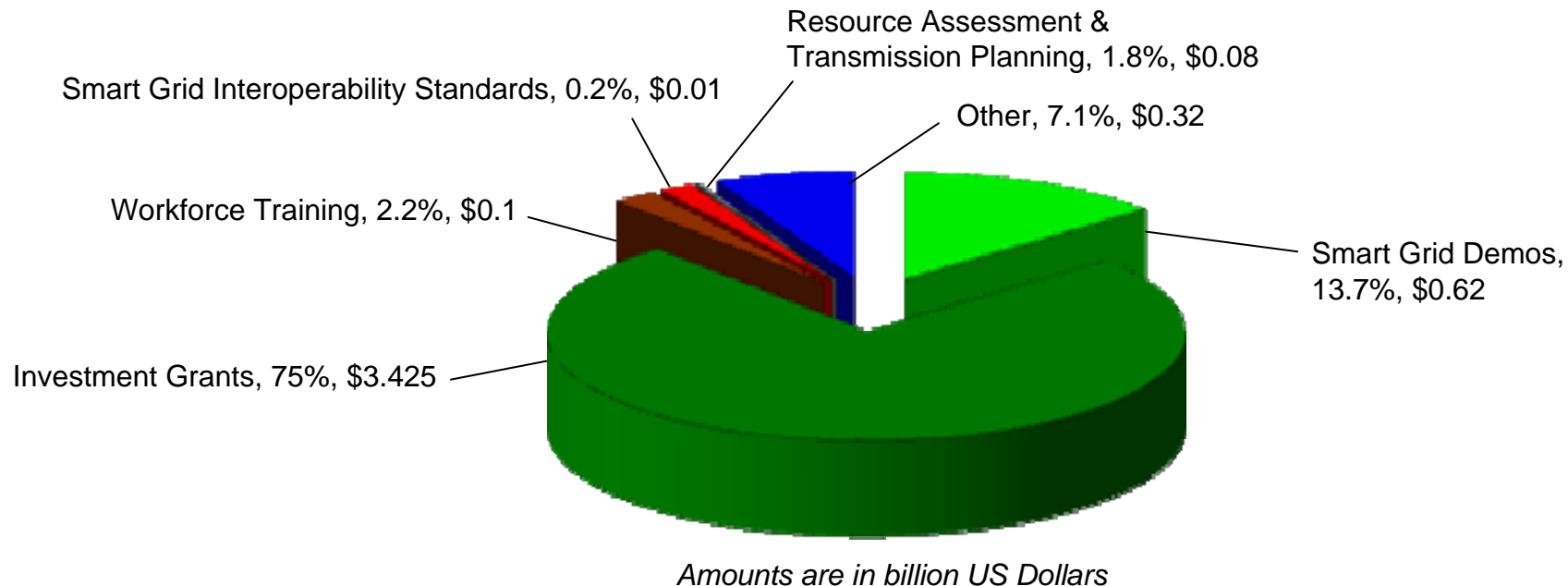
- Provides the Power Quality for the Range of Needs in the 21st Century
- Optimizes Asset Utilization and Operating Efficiently
- Addresses Disturbances – Automated Prevention, Containment, and Restoration
- Operates Resiliently Against Physical and Cyber Attacks and Natural Disasters

→ Denotes outcomes contributing to primary goals

DOE Programs Addressing Smart Grid Development & Deployment

- **Recovery Act**
Commercial applications and demonstrations of near-term technology
- **Smart Grid R&D Program**
R&D on longer-term technology
- **International Coordination**

\$4.5 Billion for Grid Modernization in Recovery Act Funding



- Title XIII—Smart Grid, Energy Independence and Security Act of 2007
 - \$620M for demonstration projects (Section 1304)
 - \$3.425B for matching for deployment (Section 1306)

SEE: <http://www.energy.gov/recovery>

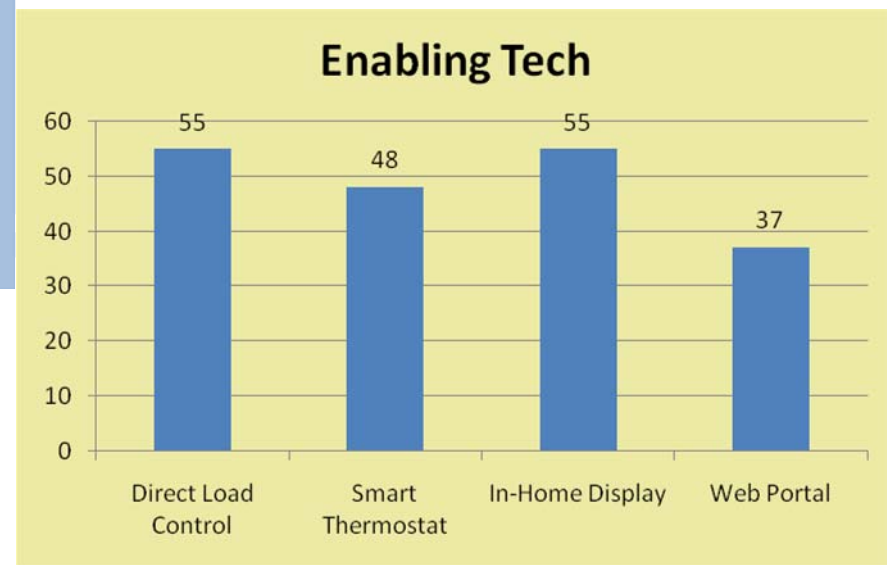
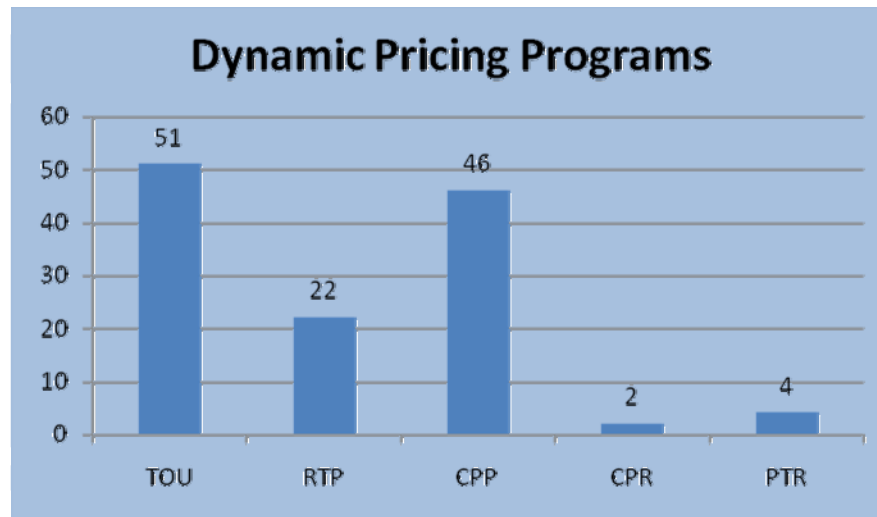
Recovery Act: Smart Grid Investment Grants

(99 projects: \$3.4B Federal; \$4.4B non-Federal)

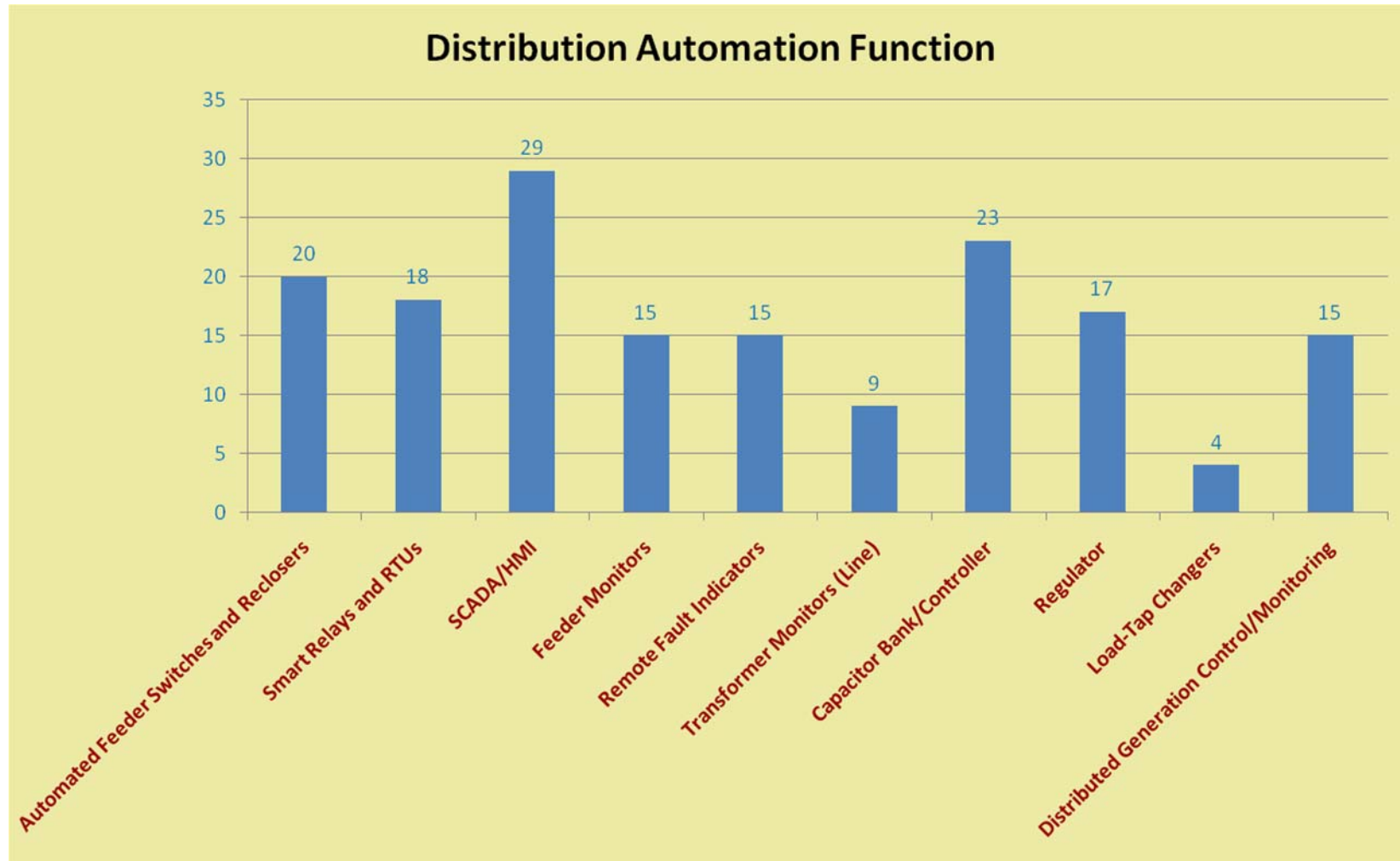
Smart Grid Systems and Equipment	Numbers of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	<ul style="list-style-type: none"> • <i>Near-nationwide coverage</i> • <i>6X the 166 existing networked PMUs</i> 	<p><i>Enhanced situational awareness and electric system reliability and resiliency</i></p>
Smart Transformers	205,983	<ul style="list-style-type: none"> • <i>Enables preventative maintenance</i> 	
Automated Substations	671	<ul style="list-style-type: none"> • <i>5% of 12,466 transmission and distribution substations in U.S.</i> 	
Load Control Devices	210,814	<ul style="list-style-type: none"> • <i>Enables peak demand reductions</i> 	<p><i>1484 MWs of peak demand reduction per year (self-reported estimates)</i></p>
Smart Thermostats	170,218	<ul style="list-style-type: none"> • <i>Enables peak demand reductions</i> 	
Smart Meters	18,179,912	<ul style="list-style-type: none"> • <i>13% of the 142 million customers in the U.S.</i> 	<p><i>Transformational changes in consumer behavior and energy consumption</i></p>
In-Home Display Units	1,207,912	<ul style="list-style-type: none"> • <i>Enables customer empowerment</i> 	
PHEVs / Charging Stations	12 / 100	<ul style="list-style-type: none"> • <i>Accelerates market entry</i> 	<p><i>Begins the path toward energy independence</i></p>

SGIG: AMI & Customer Systems

Number of SGIG projects offering individual dynamic pricing programs and enabling technologies



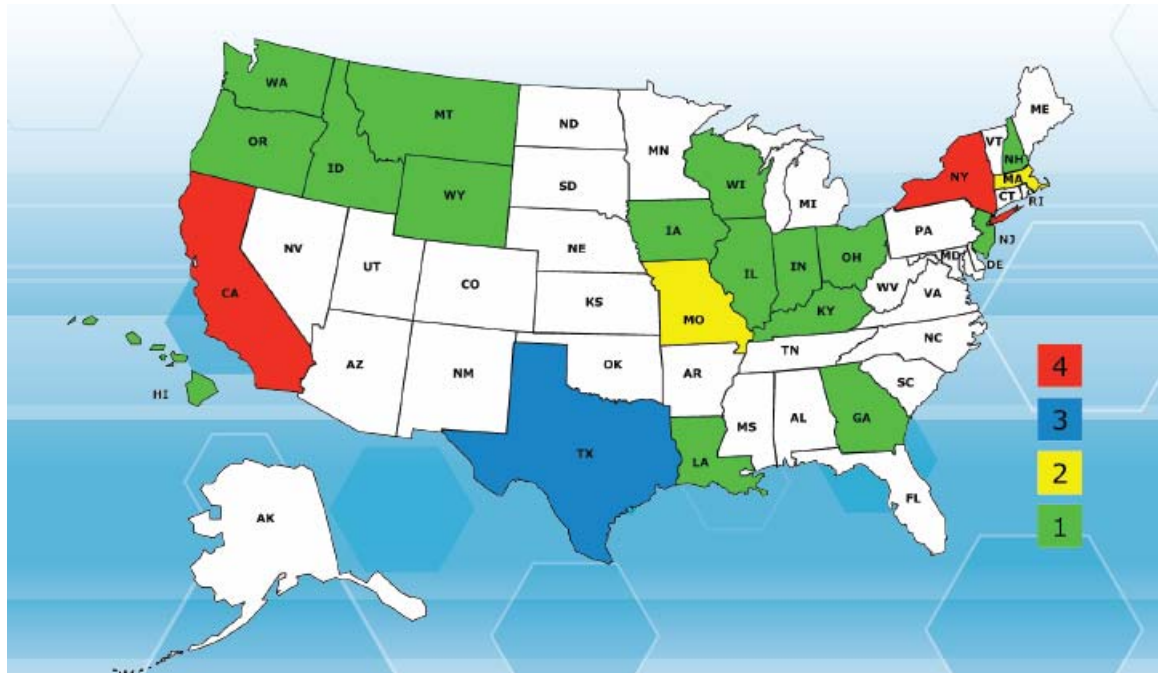
SGIG: Distribution Automation



Recovery Act: Smart Grid Regional Demonstrations

(\$435M Federal; \$877M non-Federal)

16 Awards Support Projects in 21 States



- *Demonstrate* cutting edge SG technology (including integration of renewables)
- Prove ability/ease to replicate
- Show benefits (with actual data)
- Validate business models
- Address regulatory and scalability issues

Recovery Act: Smart Grid Progress to Date

Smart Grid



ARRA assistance:

- Over 2 million smart meters
- 800+ phasors to be deployed, beginning this fall
- Created 1,400+ jobs, training 30,000 workers in 33 states
- Leveraged \$4.5 billion in federal funds into \$10.1 billion

Accelerating Smart Grid Interoperability Standards Development

Through close work with DOE and over 600 stakeholders, the NIST Smart Grid Interoperability Standards Program has:

- Released **NIST Framework and Roadmap** for Smart Grid Interoperability Standards, Release 1.0
- Released Guidelines for **Smart Grid Cyber Security**
- Launched **Smart Grid Interoperability Panel (SGIP)** to provide a forum for collaboration with the private sector



NIST



Smart Grid R&D: Multi-Year Program Plan (FY10-14)

R&D Areas

- Standards & Best Practices
- Technology Development
- Modeling
- Analysis
- Evaluation & Demonstrations

Focusing on

Distribution
Systems

Customer
Solutions

Interfaces & Integration
with Transmission and
Generation Systems

Smart Grid R&D MYPP

Development & Implementation

MYPP to guide Smart Grid R&D investments with staged development process

- Meeting in October 2009 involving national labs
- Stakeholder Roundtable Meeting in December 2009
- Public comment in March-April 2010

MYPP implementation

- Funding opportunity announcement for private sector-led projects (5 awards expected in March 2011 with estimated \$20M DOE funding over 5 years)
- Program review of national lab R&D in June
- Peer review of all R&D projects in November

Smart Grid Maturity Model (SGMM)

A management tool to help utilities plan, implement, and manage a smart grid transformation



8 Domains: Logical groupings of smart grid related capabilities and characteristics

SEI Smart Grid Maturity Model Version 1.1 - Preview: Matrix

	SMMS Strategy Management and Regulatory	OS Organizational Structure	GO Grid Operations	WAM Work and Asset Management	TECH Technology	JUST Customer	VCI Value Chain Integration	SE Societal and Environmental
5
4
3
2
1
0

6 Maturity Levels: Defined sets of characteristics and outcomes

175 Characteristics: Features you would expect to see at each stage of the smart grid journey

Smart Grid Challenge for the Year Ahead

- **Educate consumers about the benefits of a smart grid and understand consumer behavior**
 - Plan under way to develop a broad-based consumer communications program to increase awareness, communicate SG costs and benefits, and disseminate tools for energy savings
 - 12 smart grid pilots under consumer behavior study plan meeting academic rigor in experimental design, statistical significance, consistency in analysis methodology, validity of extrapolation
- **Innovate to lower costs**
 - Through investments in developing new and advanced technologies (ARPA-E, Smart Grid R&D)
- **Integrate resiliency and security**
 - Enhanced system flexibility, T&D automation, and cybersecurity (establishment of the **National Electric Sector Cybersecurity Organization**)
- **Stimulate and implement partnerships**
- **Work with international partners to share best practices and learn from others**

International Collaboration

- **International Smart Grid Action Network (ISGAN)**

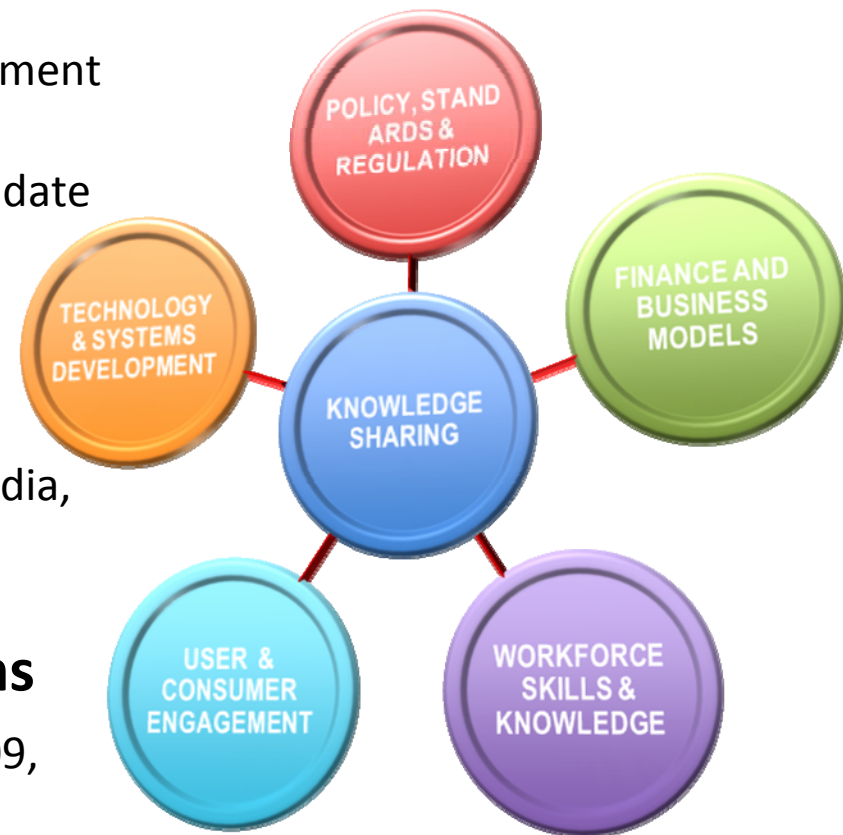
- Accelerating development and deployment of smarter electric grids
- 16 nations and the EC participating to date
- Projects across five focus areas

- **Bilateral collaborations**

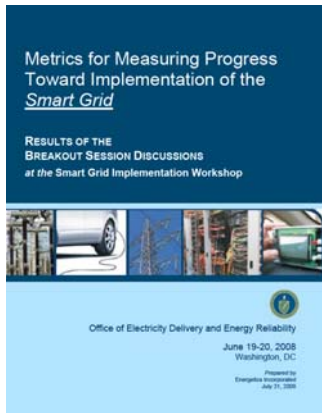
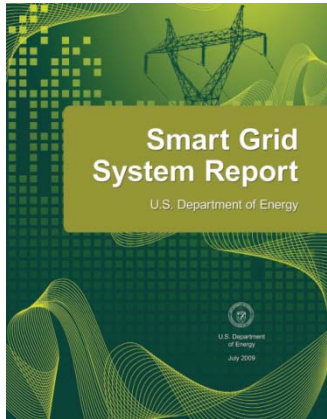
- ENARD, EU, Canada, Mexico, Japan, India, China, Korea, Brazil, Argentina

- **International Smart Grid Forums**

- Summits held at GridWeeks 2010, 2009, and 2008
- GridWise® Global Forum, September 2010



Smart Grid Resources



- 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



Smart Grid Information Clearinghouse

Designed to serve as the **first stop-shop** for smart grid related information and the **essential gateway** to connect the community to various information sources

- Released SGIC web portal <http://www.sgicclearinghouse.org> by Virginia Tech in September
 - >200 smart grid projects in the U.S.
 - >50 smart grid projects overseas
 - >1,000 smart grid-related documents and multimedia (use cases, c/b analyses, business cases, legislation/regulation, standards, and technologies and vendors)
- Platform for direct sharing and dissemination of relevant smart grid information around the world



Smartgrid.gov Website

- Serve as the central source of ARRA smart grid project summaries and other Federal program activities
- Convey the results of ARRA smart grid projects to the public
- Educate and inform the public and other key audiences about the benefits and components of the future smart grid
- Engage the public in smart-grid related conversations by providing ample opportunities for interaction and feedback

The screenshot shows the smartgrid.gov website homepage. At the top left is the logo "smartgrid.gov" with a stylized "g". To the right of the logo are links for "Bookmark & Share" and "Search Help". Below the logo is a navigation menu with links: "About SmartGrid.gov", "Basics", "Technologies", "Standards", "Projects", "News", "Resources", and "Contacts". The main content area features a large background image of a city at night with glowing power lines. Below this image is a text block: "SmartGrid.gov is a resource for information about the Smart Grid and government-sponsored Smart Grid projects." There are three main content sections: "National Broadband Plan" with a sub-section "Connecting America" and "Goal 6: To ensure that America leads the clean energy economy, every American should be able to use broadband to track and manage their real-time energy consumption."; "Smart Grid Projects" with a sub-section "Government-sponsored Smart Grid projects are transforming electric power systems in communities across the country. See how the American Reinvestment and Recovery Act is fostering smarter grids."; and "Breaking News" with two news items: "April 8, 2010 Obama Administration Announces Nearly \$100 Million for Smart Grid Workforce Training and Development" and "March 10, 2010 Treasury, Energy Announce Guidance for Tax Treatment of Smart Grid Investment Grants". At the bottom, there are links for "Manage Your Projects Online" and "RECOVERY ACT SMART GRID PROJECT TEAMS". The footer contains: "SmartGrid.gov Home | Contacts | Web Site Policies | Security & Privacy | FOIA | USA.gov", "SmartGrid.gov is a product of the Federal Smart Grid Task Force.", and "Content Last Updated: 05/03/10".

Contact Information

Dan T. Ton
Program Manager, Smart Grid R&D
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
(202) 586-4618
Dan.ton@hq.doe.gov

For more information:

OE: www.oe.energy.gov

Smart Grid: smartgrid.gov