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

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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

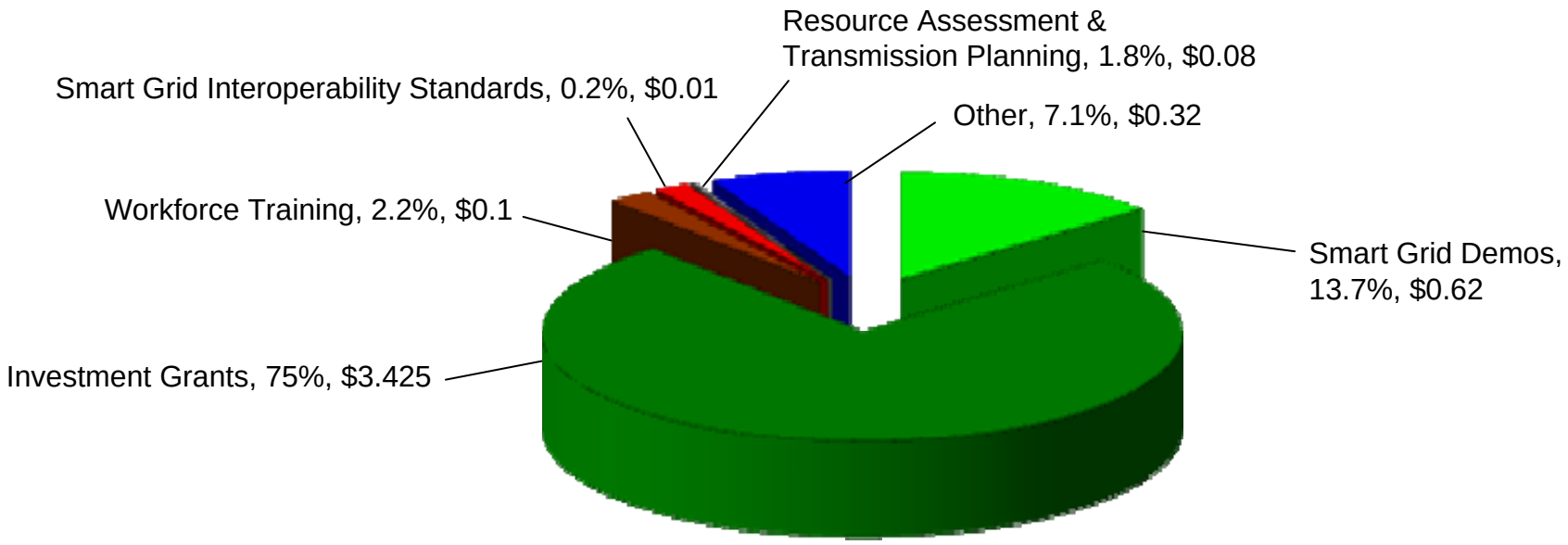
- Provides the Power Quality for the Range of Needs in the 21st Century
- Optimizes Asset Utilization and Operating Efficiently
- Addresses Disturbances – Automated Prevention, Containment, and Restoration
- Operates Resiliently Against Physical and Cyber Attacks and Natural Disasters

➔ 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



Amounts are in billion US Dollars

- 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

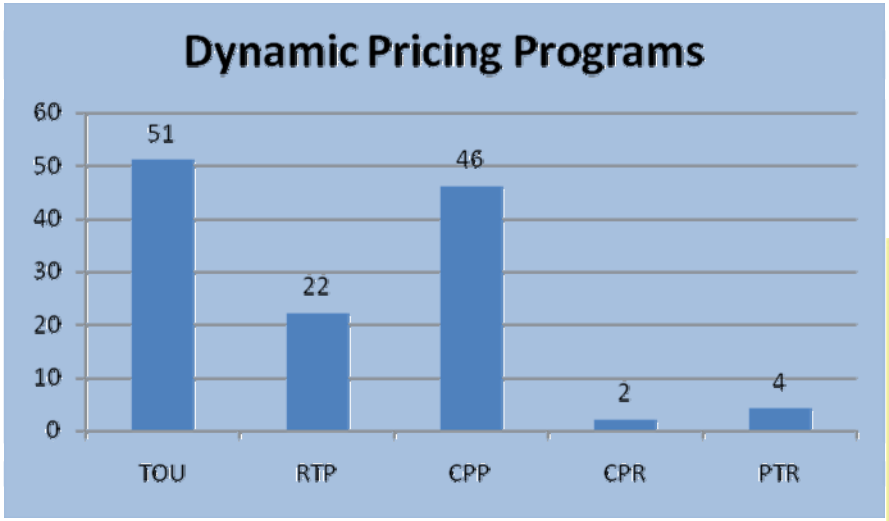
Recovery Act: Smart Grid Investment Grants

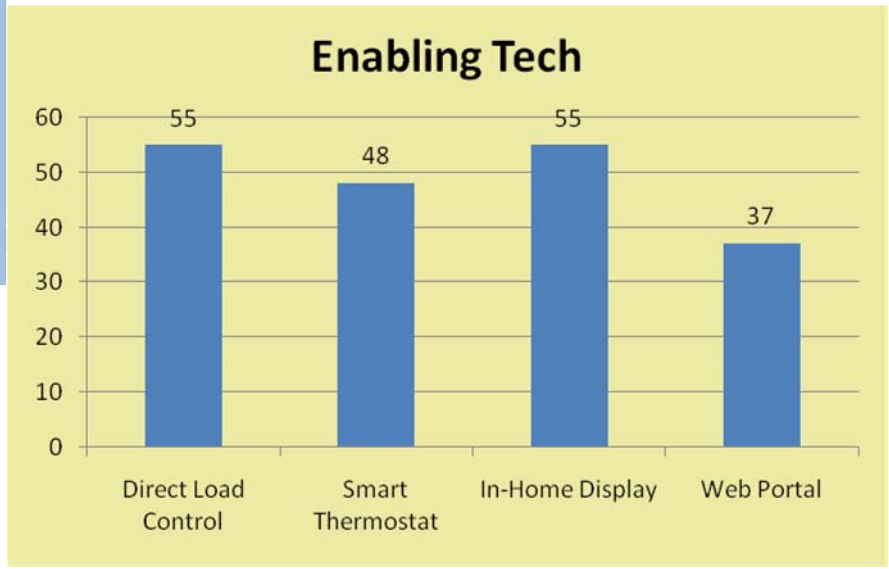
(99 projects: $3.4B Federal; $4.4B non-Federal)

Smart Grid Systems and Equipment	Numbers of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	• *Near-nationwide coverage* • *6X the 166 existing networked PMUs*	*Enhanced situational awareness and electric system reliability and resiliency*
Smart Transformers	205,983	• *Enables preventative maintenance*	
Automated Substations	671	• *5% of 12,466 transmission and distribution substations in U.S.*	
Load Control Devices	210,814	• *Enables peak demand reductions*	*1484 MWs of peak demand reduction per year (self-reported estimates)*
Smart Thermostats	170,218	• *Enables peak demand reductions*	
Smart Meters	18,179,912	• *13% of the 142 million customers in the U.S.*	*Transformational changes in consumer behavior and energy consumption*
In-Home Display Units	1,207,912	• *Enables customer empowerment*	
PHEVs / Charging Stations	12 / 100	• *Accelerates market entry*	*Begins the path toward energy independence*

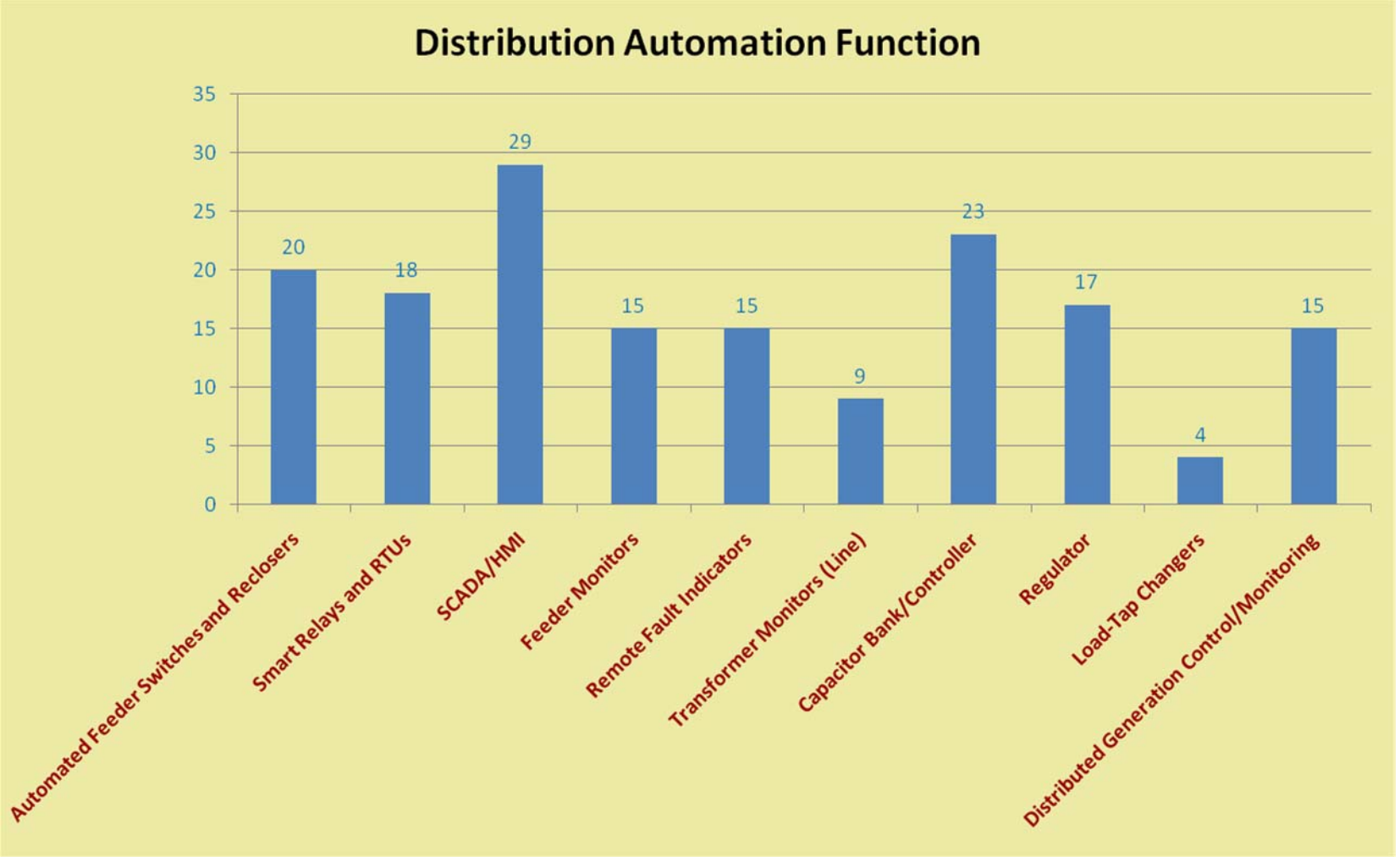
SGIG: AMI & Customer Systems

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





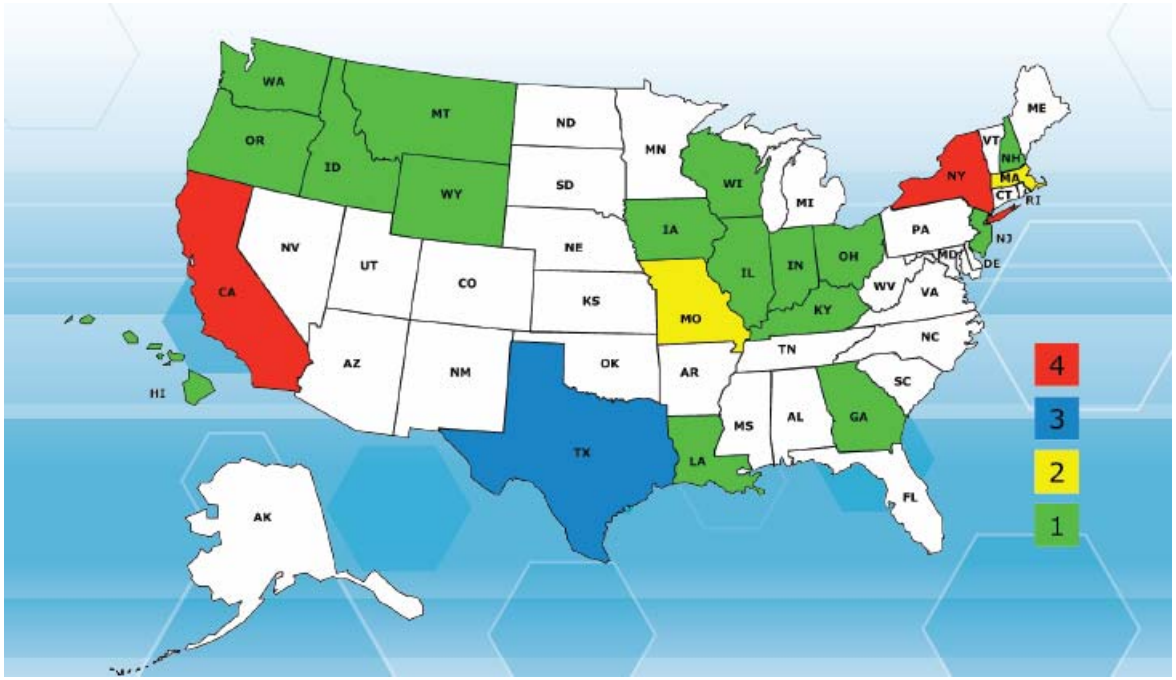
SGIG: Distribution Automation



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:

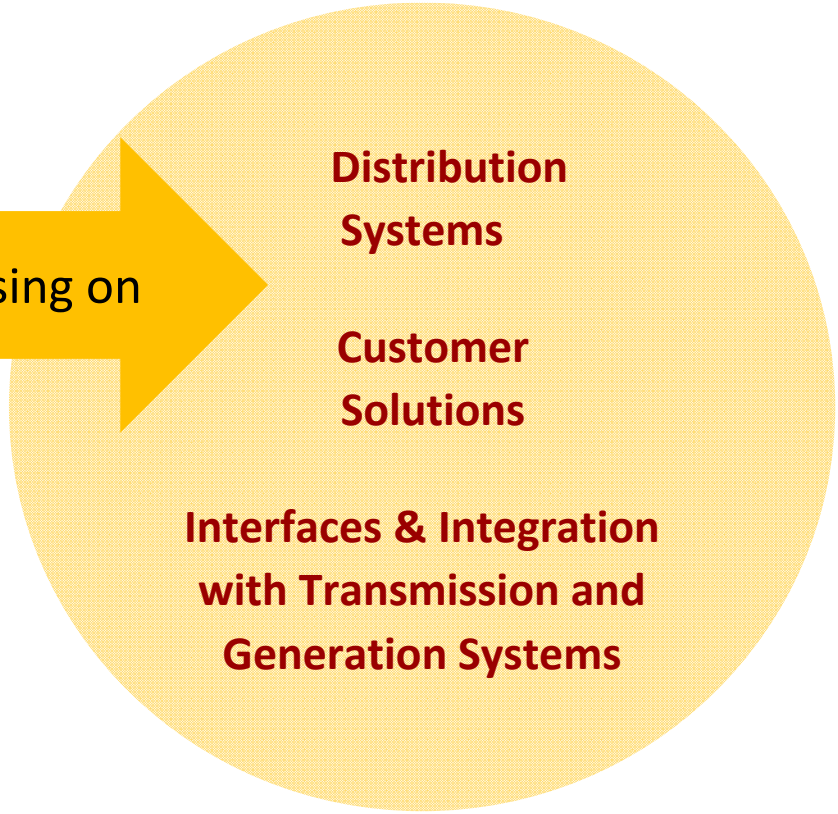
- Released **NIST Framework and Roadmap** for Smart Grid Interoperability Standards, Release 1.0
- Released Guidelines for **Smart Grid Cyber Security**
- Launched **Smart Grid Interoperability Panel** (SGIP) to provide a forum for collaboration with the private sector

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

R&D Areas

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

Focusing on



Smart Grid R&D MYPP Development & Implementation

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

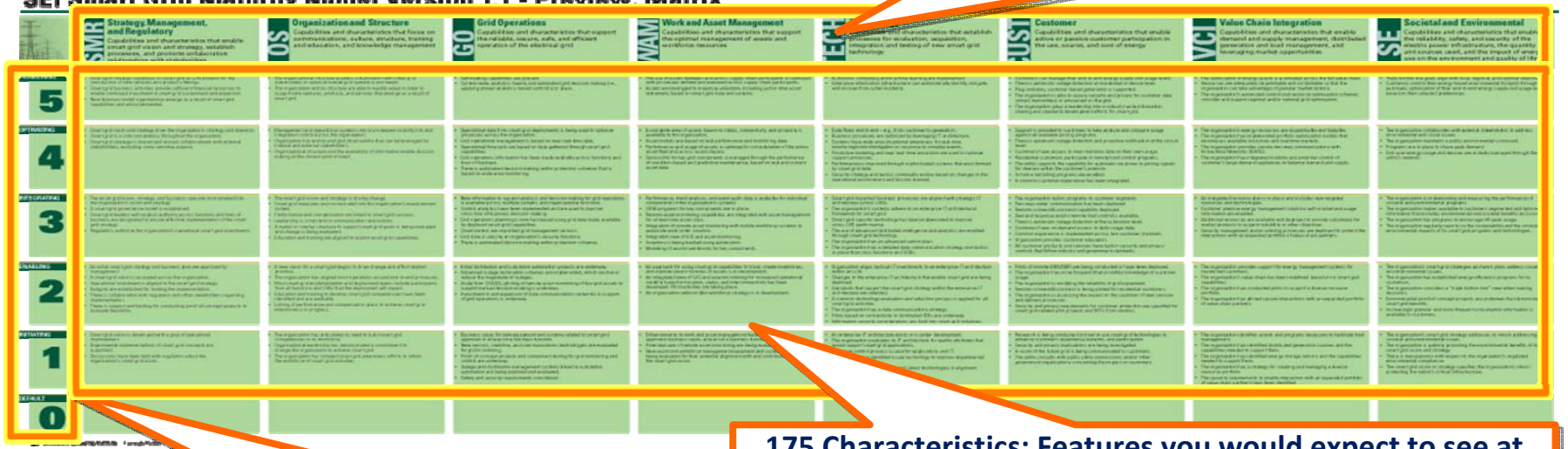
- Meeting in October 2009 involving national labs
- Stakeholder Roundtable Meeting in December 2009
- Public comment in March-April 2010

MYPP implementation

- Funding opportunity announcement for private sector-led projects (5 awards expected in March2011 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

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

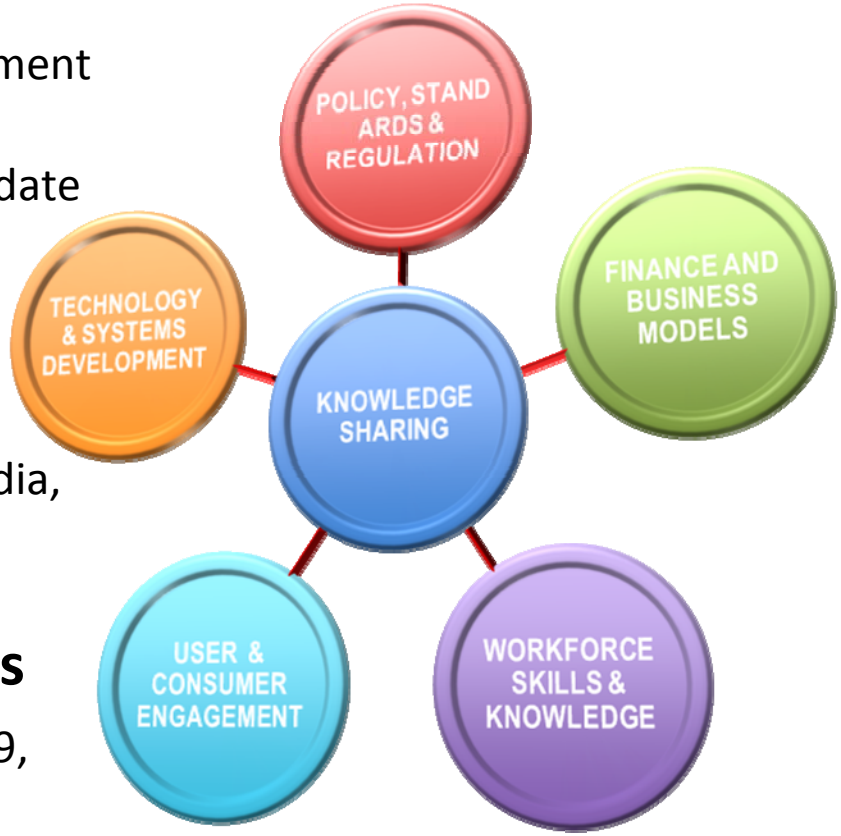
6 Maturity Levels: Defined sets of characteristics and outcomes

Smart Grid Challenge for the Year Ahead

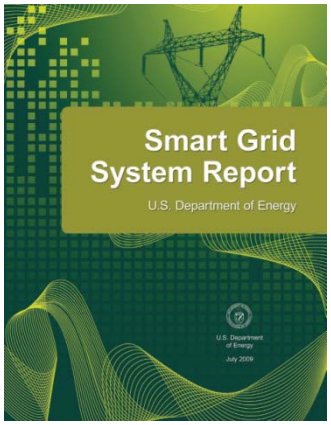
- **Educate consumers about the benefits of a smart grid and understand consumer behavior**
  - Plan under way to develop a broad-based consumer communications program to increase awareness, communicate SG costs and benefits, and disseminate tools for energy savings
  - 12 smart grid pilots under consumer 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**

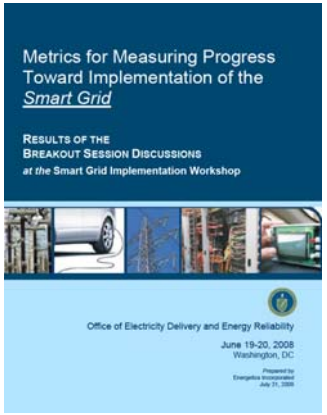
International Collaboration

- **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

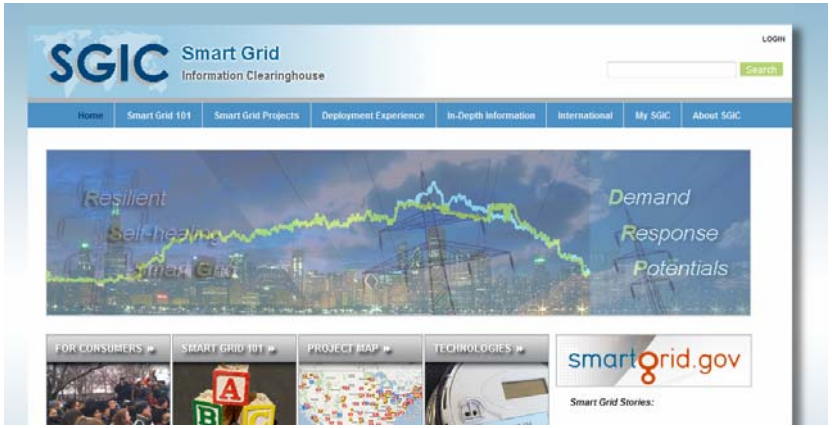




- Smart Grid System Report (2009)
- Smart Grid Metrics for Measuring Progress
- Smart Grid – Introduction and Stakeholder books
- Smart Grid Maturity Model
- Smart Grid Information Clearinghouse
- SmartGrid.gov

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.sgiclearinghouse.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

Contact Information

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OE: www.oe.energy.gov

Smart Grid: smartgrid.gov