

The Clean Energy Ministerial and ISGAN

U.S. Department of Energy Perspectives

Smart Grids Week – Linz 2011

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U.S. Department of Energy

Office of Climate Change Policy and Technology

25 May 2011



Outline

1

- DOE Perspective on Smart Grid

2

- Clean Energy Ministerial

3

- ISGAN

4

- DOE Activities and Tools

Smart Grid – A National Priority

- “It is the policy of the United States to support the modernization of the Nation’s electricity [system]...to achieve...a Smart Grid.”

U.S. Congress (Energy Independence and Security Act of 2007)

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

President Barack Obama

- “A smart electricity grid will revolutionize the way we use energy...”

Secretary of Commerce Gary Locke



Why Smart Grid?

The National Academy of Engineering (U.S.) called electrification the greatest engineering achievement of the 20th century...

BUT...

“To meet the energy challenge and create a 21st century energy economy, we need a 21st century electric grid...”
Secretary of Energy Steven Chu

What is a 21st Century Electric Grid?

20th Century Grid

- Production Follows Demand
- Largely Electromechanical
- High Carbon / Low Storage
- Blind to Distribution & Demand
- Very Little Information and Control
- Central Planning, Design and Operation



21st Century Smart Grid

- Information Rich
- Distributed Design and Operation
- Clean Tech Priority
- Ubiquitous Storage
- Automated Operations
- Highly Differentiated Energy Services



DOE Identifies Seven Core Smart Grid Characteristics...

Customer Participation

Integration of All Generation and Storage Options

New Markets and Operations

Power Quality for 21st Century

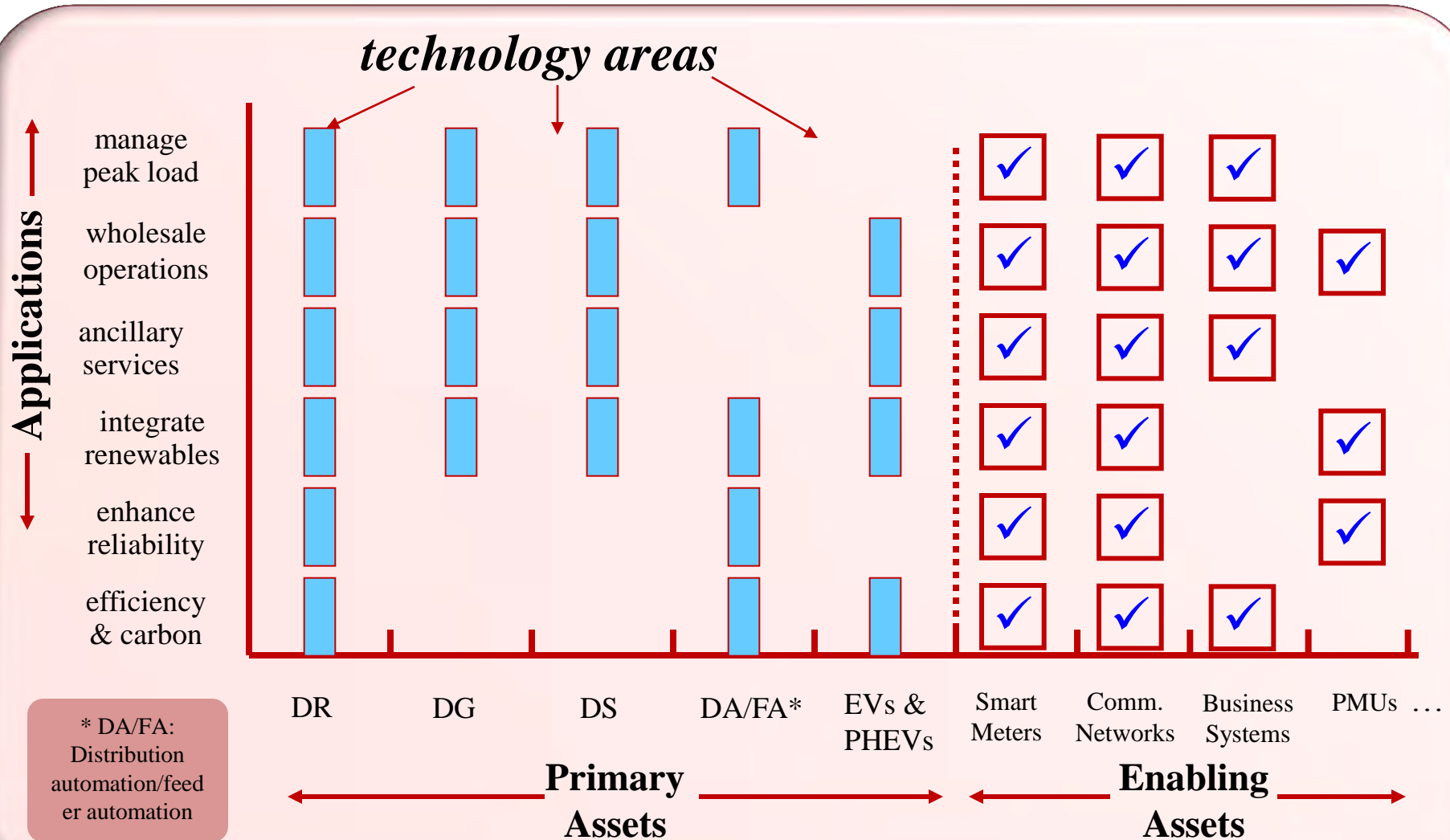
Asset Optimization and Operational Efficiency

Self-healing

Resilient Against Attacks and Disasters

... And develops and implements advanced information, communication, and control technologies, along with supportive policies, to achieve all seven.

Mapping of Smart Grid Assets (Components), Applications, and Technology Areas

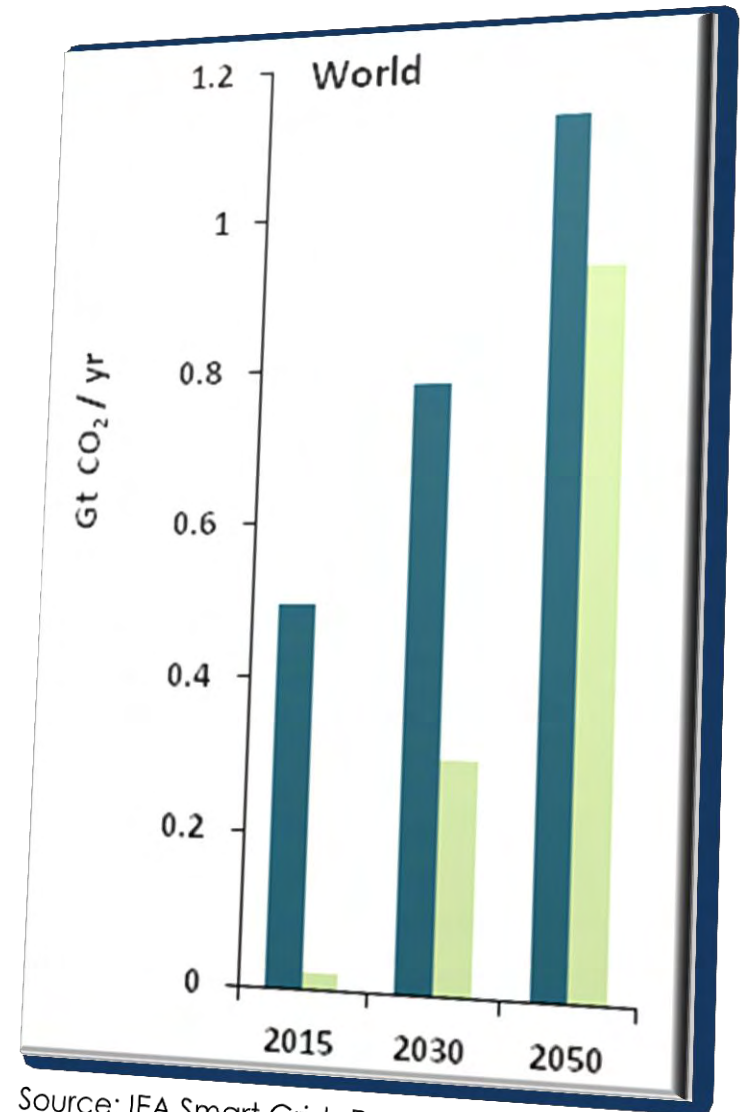


Two Gigatonnes of CO₂ Per Year!

Deployed globally, smart grids have the potential to help reduce global CO₂ emissions by over 2 gigatonnes per year by 2050

■ **Direct Reductions:** Energy savings from peak load management, continuous commissioning of service sector loads, accelerated deployment of energy efficiency programs, reduced line losses, and direct feedback on energy usage

■ **Enabled Reductions:** Greater integration of renewables and facilitation of EV and PHEV deployment



Source: IEA Smart Grids Roadmap Insights, 2011

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Growing International Engagement on Smart Grid

Worldwide efforts:

- e.g., *The International Smart Grid Action Network and the Clean Energy Ministerial*

Regional efforts:

- e.g., *APEC Smart Grid Initiative*

Bilateral agreements:

- e.g., *US-EU Energy Council Working Groups on Technology and Policy*

...and more

Path to the Clean Energy Ministerial (& ISGAN)

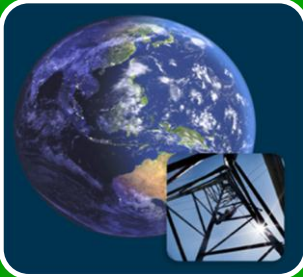
July 2009



L'Aquila (IT) – Major Economies Forum on Energy and Climate (MEF)

- Global Partnership for low-carbon and climate-friendly technologies
- Technology Action Plans: 10 technologies, 80% CO₂ reduction potential

December 2009



Copenhagen (DK) – Public release of Tech. Action Plan on Smart Grids

- Led by IT and KR (with support from U.S.)
- www.majoreconomiesforum.org
- Menu of options to accelerate deployment
- Promotes multilateral partnership on Smart Grids → ISGAN

July 2010



Washington, DC (USA) – First Clean Energy Ministerial (C.E.M)

- Energy Ministers from 23 Countries + EC
- Collaborate on policy and programs that accelerate the world's transition to clean energy technologies
- Goal is action – policy and program collaboration

The CEM's goal is action!

Policy and program collaboration, driven from the highest levels, to accelerate the world's transition to clean energy technologies

- “Distributed leadership” model.
- Concrete, transformative clean energy initiatives led by groups of like-minded and willing countries are the “deliverables.”
- No expectation that every government join every action.
- No communiqué or other negotiated text.

The first CEM took place on 19-20 July 2010 in Washington, DC, USA.

The second CEM took place on 6-7 April 2011 in Abu Dhabi, UAE.

The third, fourth, and fifth CEMs will take place in 2012, 2013, and 2014
in the UK, India, and Korea, respectively.

The First Clean Energy Ministerial (CEM1) – July 2010

>70% of global GDP

> 80% of global GHG emissions



Australia



Belgium



European
Commission



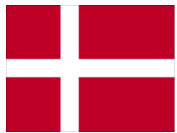
Brazil



Canada



China



Denmark



Finland



France



Germany



India



Indonesia



Italy



Japan



Korea



Mexico



Norway



Russia



South Africa



Sweden



Spain



United Arab Emirates



United Kingdom



United States

11 Clean Energy Initiatives Launched at CEM1

**Bioenergy
Working Group**

**Carbon Capture
Use and Storage
Action Group**

**Clean Energy
Education and
Empowerment
Women's Initiative**

**Clean Energy
Solutions Centers**

**Electric Vehicles
Initiative**

**Global Superior
Energy
Performance
Partnership**

**International
Smart Grid Action
Network**

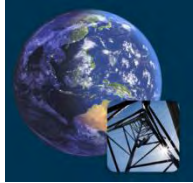
**Multilateral Solar
and Wind Working
Group**

**Solar and LED
Energy Access
Program**

**Super-Efficient
Equipment and
Appliance
Deployment
Initiative**

**Sustainable
Development of
Hydropower
Initiative**

Global Energy Efficiency Challenge



GRIDS

- International Smart Grid Action Network (ISGAN)



APPLIANCES

- Super-efficient Equipment and Appliances Deployment (SEAD)



BUILDINGS AND INDUSTRY

- Global Superior Energy Performance (GSEP)



ELECTRIC VEHICLES

- Electric Vehicles Initiative (EVI)



CAPACITY BUILDING

- Clean Energy Solutions Centers

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International Smart Grid Action Network (ISGAN)

A mechanism for bringing high-level government attention and action to accelerate the development and deployment of smarter electricity grids around the world.

ISGAN...

- Facilitates dynamic knowledge sharing, technical assistance, peer review and, where appropriate, project coordination
- Sponsors activities that accelerate smart grid deployment and address knowledge gaps
- Builds on the momentum of and knowledge created by the substantial investments being made in smarter grids globally
- Fulfills a key recommendation in the Smart Grids Tech. Action Plan
- Leverages cooperation with the International Energy Agency, Global Smart Grid Federation, and other relevant stakeholders



ISGAN Scope

- Five key topic areas
- Core emphasis on sharing of knowledge and lessons learned
- Projects may cover several topics areas



ISGAN Structure

As of April 2011, ISGAN is formally established as an **Implementing Agreement (IA)** under the IEA umbrella.

- First Executive Committee meeting in Seoul, Korea – June 2011
- Interim Secretariat at Korea Smart Grid Institute

ISGAN by the Numbers:

14 Countries

Have Signed the IA
(including all D-A-CH)

1 Other

Country
Eligible to
Sign

**5 Other
Countries**

Currently
Participate

**Plus Expressions
of Interest**

from Brazil, Greece,
Ireland, Turkey, etc.

Four Foundational Projects

1

- **“Global Smart Grid Inventory”**
of enabling programs and policies

2

- **Smart Grid Case Studies**
using a common framework and metrics

3

- **Benefit/Cost Methodologies**
(bottom-up & top-down) and related policy toolkits
to assess smart grid investments

4

- **Synthesis of Insights for High-level Decision Makers**
(e.g., CEM Ministers) from ISGAN and other
related projects

- Recognized that ISGAN is not the only entity developing an “inventory”
- Several such efforts underway regionally
 - ENARD Annex V
 - ASGI
 - EEGI
 - EC – JRC (Setis)
 - Etc.
- Although different drivers for each, there are opportunities for cooperation
 - Met earlier this week at BMVIT in Vienna

Others Projects and Collaboration Proposed or Under Consideration

**Smart Grid International
Research Facility Network
(SIRFN)**

Coordination with the ENARD IA
(Electricity Networks, Analysis, Research &
Development)

**Continuing dialogue
with private sector and other
stakeholders**
(eg, Global Smart Grid Federation, ADB, SGIP)

**Engagement with other
international efforts**
(eg, the US-EU Energy Council and
APEC Smart Grid Initiative)

Joint Projects with the DSM IA

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- **DOE Activities and Tools**

Department of Energy Action at Home

American Recovery and Reinvestment Act

- One-time public investment in commercial applications and demonstrations of near-term technology

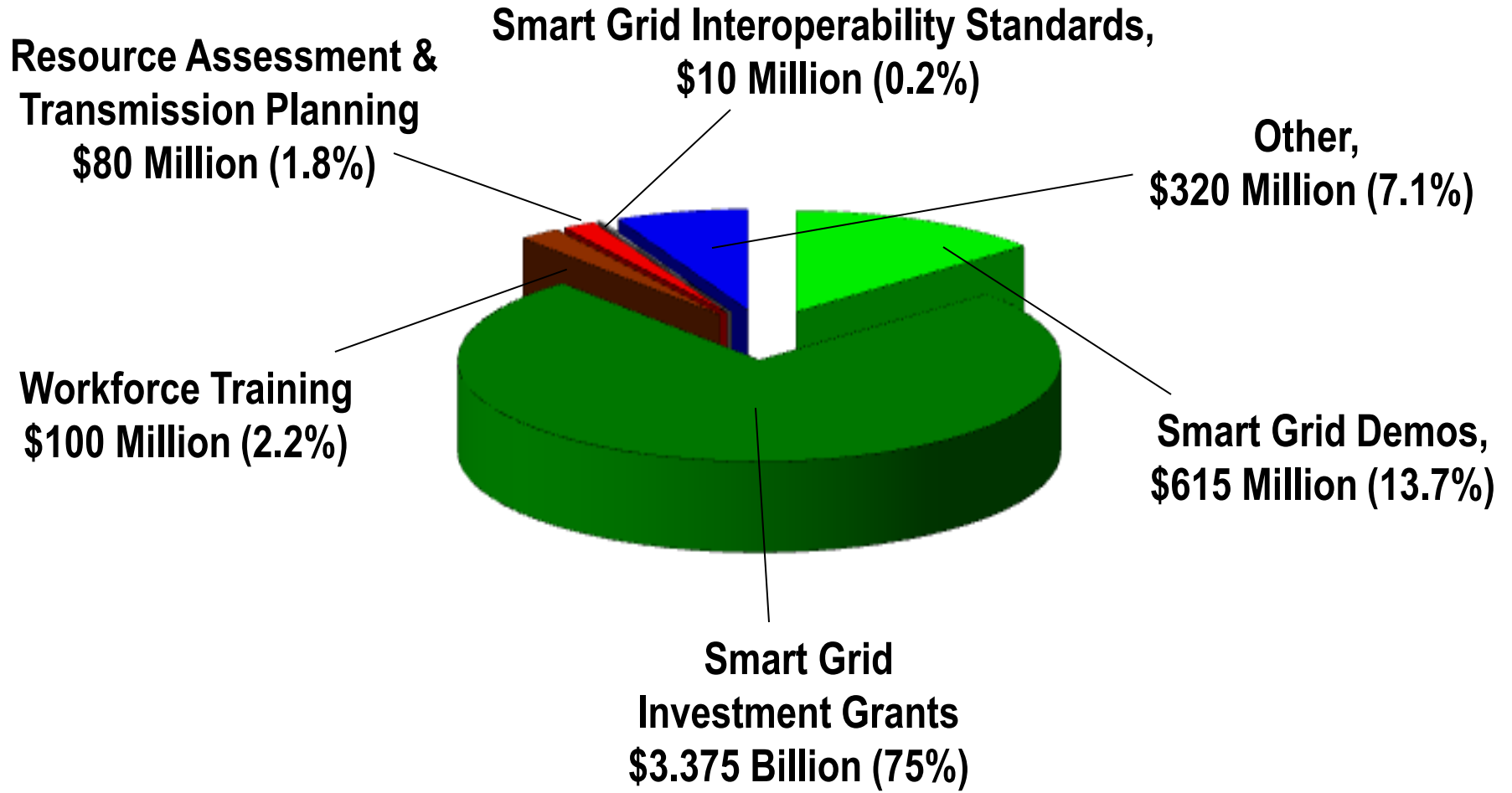
On-going Smart Grid R&D Program

- Sustained public investment in smart grid innovations

Inter-agency Coordination

- Smart Grid Subcommittee and Task Force

Recovery Act: \$4.5 Billion in One-time Funding for Grid Modernization



Source: www.energy.gov/recovery

Recovery Act: Smart Grid Investment Grants

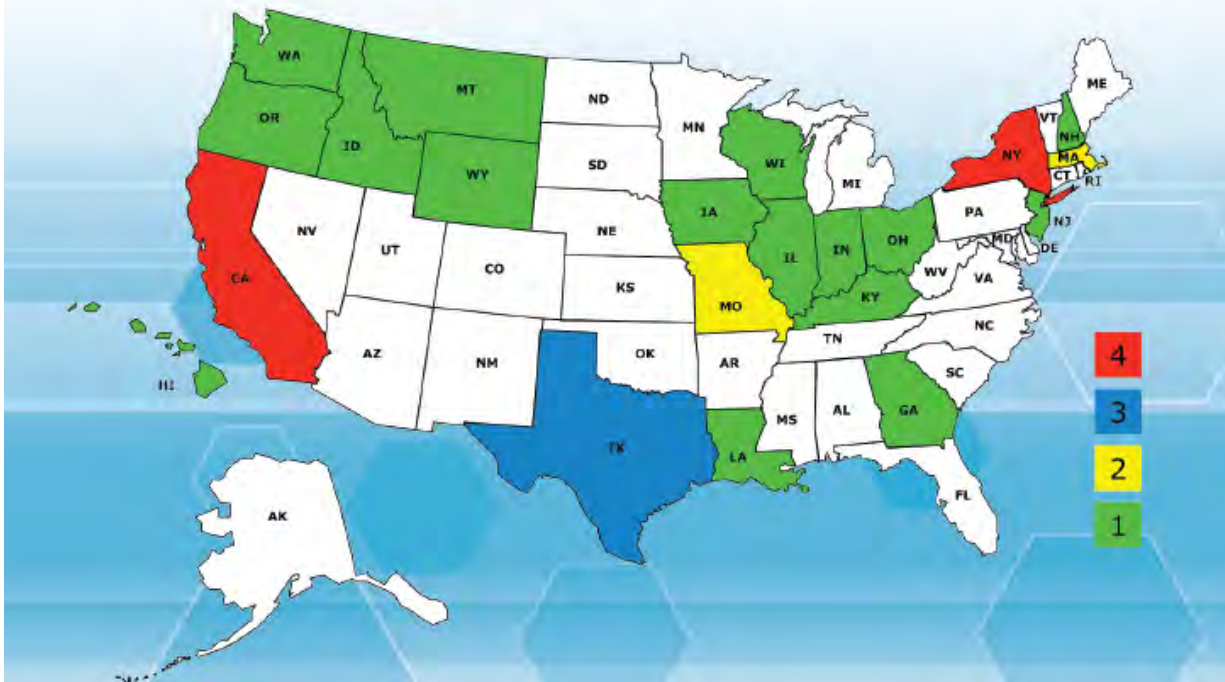
(99 projects: \$3.4B Federal; \$4.4B non-Federal)

Smart Grid Systems and Equipment	Numbers of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	<ul style="list-style-type: none"> • Near-nationwide coverage • 6X the 166 existing networked PMUs 	<p>Enhanced situational awareness and electric system reliability and resiliency</p>
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 U.S. 	
Load Control Devices	176,814	<ul style="list-style-type: none"> • Enables peak demand reductions 	<p>1444 MWs of peak demand reduction per year (self-reported estimates)</p>
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. 	<p>Transformational changes in consumer behavior and energy consumption</p>
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 	<p>Begins the path toward energy independence</p>

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 Workforce Training

(\$100M Federal; \$95M non-Federal)

- Training and development programs to help prepare the next generation of workers for smart grid-related jobs.
- Almost \$100 million for 54 projects.
- Leverages more than \$95 million in funding from community colleges, universities, utilities, and manufacturers
- Will both develop curricula and training programs and help train approximately 30,000 Americans to transform the nation's electrical grid and implement smarter grid technologies in communities across the country.



Recovery Act: Accelerating SG Interoperability

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 the Smart Grid Interoperability Panel (SGIP) to provide a forum for collaboration with the private sector – now 1,750 members from 634 organizations



NIST

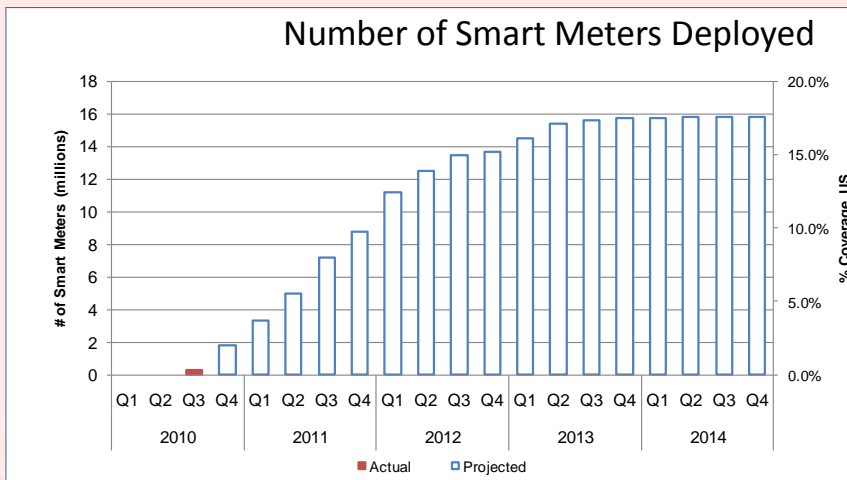


Tracking Performance and Determining Impacts

DOE will report deployment metrics quarterly:

- Number of smart meters deployed
- Number of distribution circuits with automated equipment
- The portion of the transmission system visible with synchrophasor technology

Program-Level Reporting



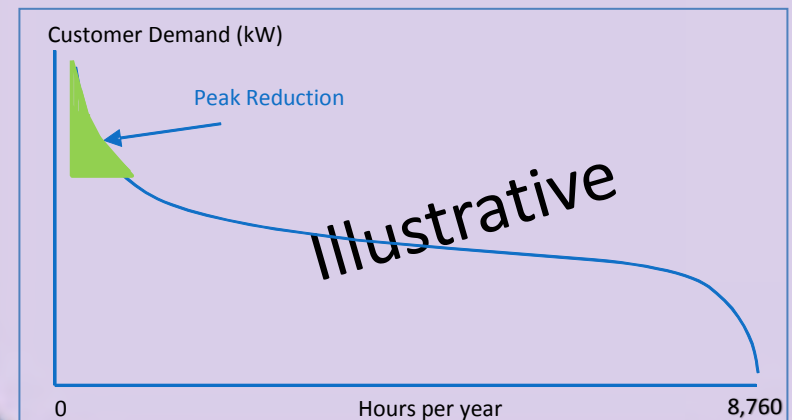
21 ARRA Smart Grid Projects reported build metrics for the Q3 reporting period (cumulative)

DOE will report impacts semi-annually with emphasis on:

- Peak demand reduction
- O&M cost reductions
- Reliability improvements (T&D)
- System efficiency improvements (T&D)
- Possible greenhouse gas reductions

And developing a business case framework with stakeholders

Peak Demand Reduction



Understanding the Impact of AMI and Dynamic Prices on Consumer Behavior

Ten statistically rigorous studies will be conducted to:

- Identify factors influencing customer acceptance of dynamic electricity rates and AMI technology
- Quantify effect of dynamic rates on electricity consumption (peak and overall load reduction)
- Understand relative and combined contributions of pricing, information feedback, and control technology on consumer behavior
- Provide statistically relevant data with analysis to researchers and decision-makers

Pricing Strategy	Technology Option			
	Web Portal	In-Home Display (IHD)	Programmable Communicating Thermostat (PCT)	All Technology Options
Variable Peak Price (VPP)	Treatment 1	Treatment 2	Treatment 3	Treatment 4
TOU Critical Peak Price (CPP)	Treatment 5	Treatment 6	Treatment 7	Treatment 8
Control Group	Control Group			

Oklahoma Gas and Electric (OG&E) is undertaking a 2-yr study with 4,600 residences and 650 small businesses to determine load reduction resulting from combinations of dynamic rates and enabling technologies

OG&E expects to avoid building two 165 MW peaking units based on achieving a 20% customer participation rate (on opt-in basis)

DOE Smart Grid R&D Program: Vision

(from Multi-Year Program Plan, 2010-2014)

- By 2030, the power grid has evolved into an **intelligent energy delivery system** that supports **plug-and-play integration** of dispatchable and intermittent low-carbon energy sources, and provides a **platform for consumer engagement** in load management, national energy independence, innovation, entrepreneurship, and economic security.
- This smart grid supports the **best and most secure electric services available** in the world and connects everyone to abundant, affordable, high quality, environmentally conscious, efficient, and reliable electric power.

http://www.smartgrid.gov/sites/default/files/oe_mypp.pdf

DOE Smart Grid R&D Program

On-going support for smart grid innovation

R&D Areas:

- Standards & Best Practices
- Technology Development
 - renewable and distributed systems integration
 - microgrids
 - advanced communications & controls
- Modeling
- Analysis
- Evaluations & Demonstrations

Focusing on

Distribution Systems

Customer Solutions

Interfaces &
Integration with
Transmission &
Generation Systems

Plus, additional DOE investments in energy storage, cyber security, and clean energy transmission and reliability

Inter-agency Coordination: Federal Smart Grid Task Force

To ensure awareness, coordination, and integration of the diverse smart grid activities in the Federal Government

Functions

- ✓ Serves as Federal focal point on all things “smart grid”
- ✓ Coordinates and integrates inter-governmental activities
- ✓ Oversees report production for submission to Congress
- ✓ Collaborates on interoperability framework
- ✓ Guides ARRA investments in smart grid
- ✓ Ensures awareness of Federal smart grid activities
- ✓ Collaborates with and supports the Electricity Advisory Committee

Member Organizations



Website

www.oe.energy.gov/smartgrid_taskforce.htm

- ✓ Charter
- ✓ Presentations
- ✓ Publications
- ✓ Events

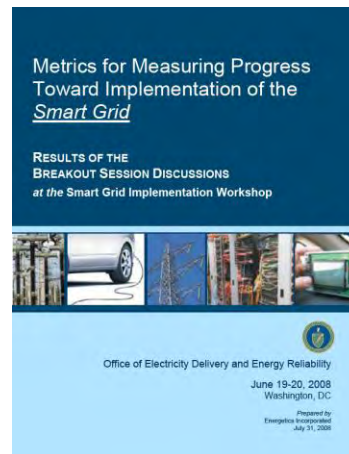
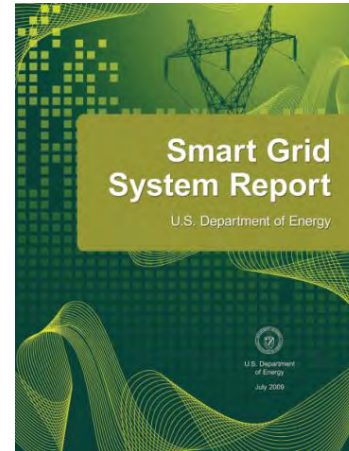
Inter-agency Coordination: Smart Grid Subcommittee

In July 2010, the (U.S.) National Science and Technology Council established the **Smart Grid Subcommittee**, which will:

- Articulate a vision for smart grid technology and the core priorities and opportunities for development of the smart grid
- Facilitate a strong, coordinated effort across federal agencies to develop smart grid policy
- Develop a framework for administration policy related to the smart grid that will be described in a public report
- Complement the existing Federal Smart Grid Task Force, which coordinates existing federal smart grid activities

U.S. Smart Grid Information Resources and Tools

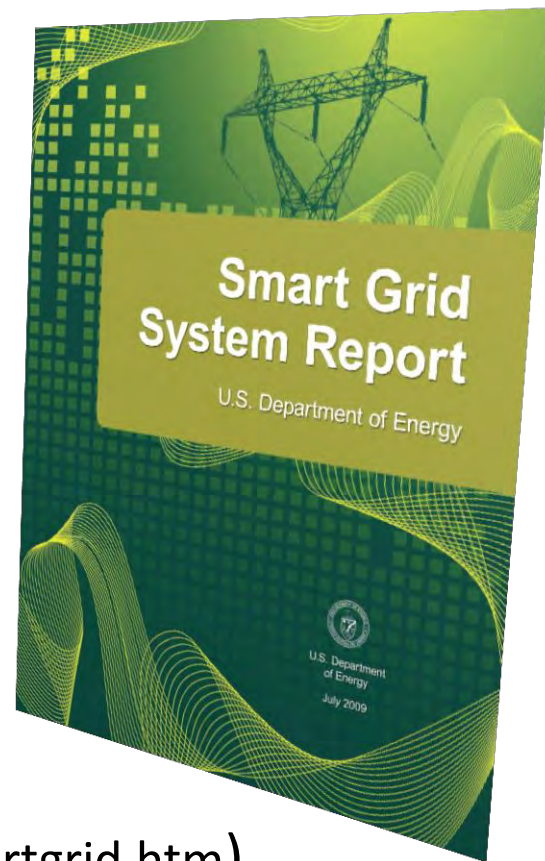
- Smart Grid System Report
- Smart Grid Metrics for Measuring Progress
- Smart Grid Maturity Model
- Smart Grid Information Clearinghouse
- SmartGrid.gov
- Smart Grid – Introduction and Stakeholder books



Applying Metrics to Indicate Smart Grid Progress

Smart Grid System Report, a DOE report to Congress

- Biennial updates of deployment progress for each metric
 - Penetration levels: nascent, low, moderate, high (for build metrics)
 - Maturity: nascent, mature, and trend (for value metrics)
 - Trending: declining, flat, growing at nascent, low, moderate or high levels
- First report published July 2009
(report available at <http://www.oe.energy.gov/smartgrid.htm>)
- Second report under development



Mapping Metrics to Smart Grid Characteristics

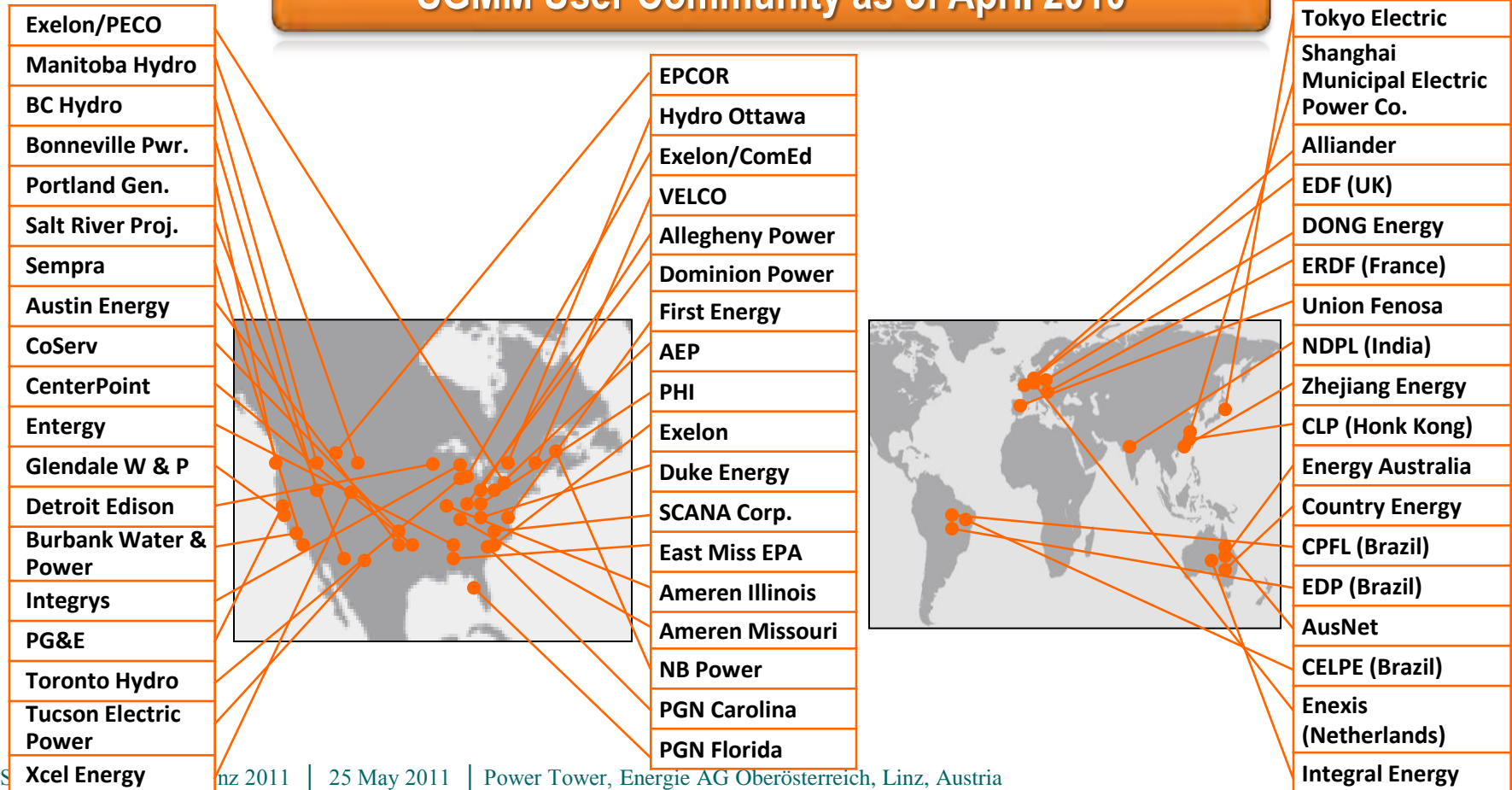
Metric Name	Customer Participation	All Generation & Storage Options	New Products, Services, & Markets	Power Quality for the Range of Needs	Asset Optimization & Efficient Operation	Resiliency to Disturbances, Attacks, & Natural Disasters
Dynamic Pricing	Primary Emphasis	Importance	Importance	Importance	Importance	Importance
Real-Time Data Sharing	Importance	Importance	Importance	Importance	Primary Emphasis	Primary Emphasis
DER Interconnection	Importance	Primary Emphasis	Importance	Importance	Importance	Importance
Regulatory Policy	Importance	Importance	Primary Emphasis	Importance	Importance	Importance
Load Participation	Primary Emphasis	Importance	Importance	Importance	Importance	Importance
Microgrids	Importance	Importance	Importance	Primary Emphasis	Importance	Importance
DG & Storage	Importance	Primary Emphasis	Importance	Importance	Importance	Importance
Electric Vehicles	Importance	Importance	Primary Emphasis	Importance	Importance	Importance
Grid-responsive Load	Importance	Importance	Importance	Importance	Importance	Primary Emphasis
T&D Reliability	Importance	Importance	Importance	Importance	Importance	Primary Emphasis
T&D Automation	Importance	Importance	Importance	Importance	Primary Emphasis	Importance
Advanced Meters	Primary Emphasis	Importance	Importance	Importance	Importance	Importance
Advanced Sensors	Importance	Importance	Importance	Importance	Importance	Primary Emphasis
Capacity Factors	Importance	Importance	Importance	Importance	Primary Emphasis	Importance
G, T, & D Efficiency	Importance	Importance	Importance	Importance	Primary Emphasis	Importance
Dynamic Line Rating	Importance	Importance	Importance	Importance	Primary Emphasis	Importance
Power Quality	Importance	Importance	Importance	Primary Emphasis	Importance	Importance
Cyber Security	Importance	Importance	Importance	Importance	Importance	Primary Emphasis
Open Architecture/Std	Importance	Importance	Primary Emphasis	Importance	Importance	Importance
Venture Capital	Importance	Importance	Primary Emphasis	Importance	Importance	Importance

 Primary Emphasis
 Importance

Smart Grid Maturity Model (SGMM)

A management tool to help utilities benchmark smart grid development and share best practices

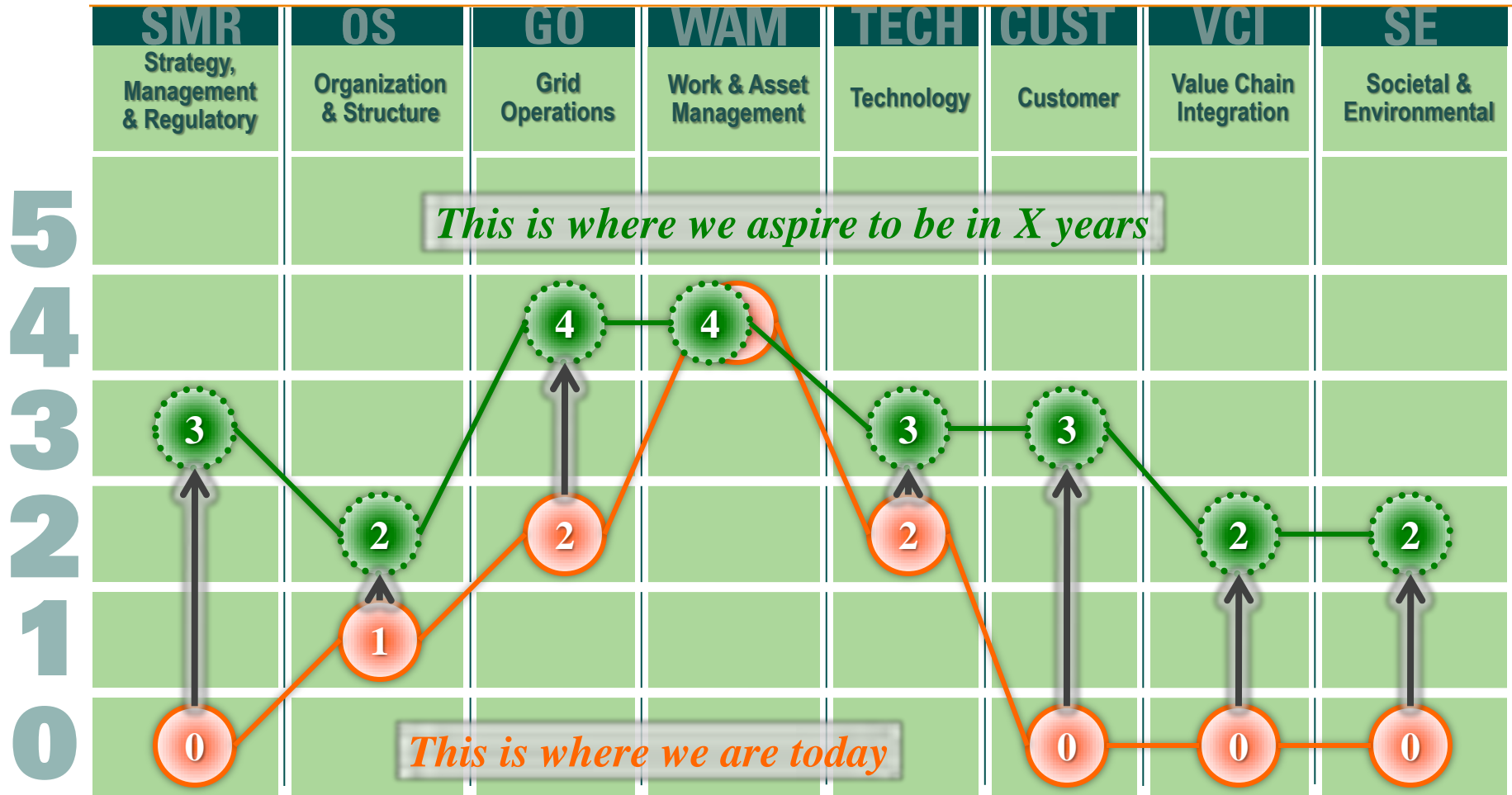
SGMM User Community as of April 2010



SGMM targets

NOTE: There is no “correct” target profile implied in the model; the optimal profile will vary by utility.

Utilities sets strategic aspirations by domain, for example:



Smart Grid Information Clearinghouse

<http://www.sgiclearinghouse.org/>

- Platform for direct sharing and dissemination of relevant smart grid information around the world
- Smart grid project summaries (with focus on non-ARRA projects), use cases, and business cases for the U.S. and internationally
 - >200 smart grid projects in the U.S.
 - >50 smart grid projects overseas
 - >1,000 smart grid-related documents and multimedia



Smartgrid.gov

- ARRA smart grid project summaries and other Federal program activities
- Reporting of ARRA SGIG & SGDP projects (progress, metrics and benefits, consumer behavior studies) and provision of analysis results to the public

The screenshot shows the SmartGrid.gov website homepage. At the top, there is a navigation bar with links for "What is the Smart Grid?", "Recovery Act Smart Grid Programs", "Federal Smart Grid Initiatives", and "Smart Grid Information Clearinghouse". Below this is the main header with the "SMARTGRID.GOV" logo, a search bar, and a brief description of the site's purpose. The main content area is divided into four large, colorful panels: "What is the Smart Grid?" (orange), "Recovery Act Smart Grid Programs" (green), "Federal Smart Grid Initiatives" (dark green), and "Smart Grid Information Clearinghouse" (blue). Each panel includes an icon and a brief description of the content. Below the main content area, there are two sections: "THE SMART GRID LIBRARY" featuring a book titled "Smart Grid Stakeholder Books" and "NEWS" with a list of recent updates and dates.

Smart Grid Challenge for the Year Ahead

- **Educate consumers, regulators, and other stakeholders on the need for and benefits of a smarter, modern grid**
- **Innovate to lower costs**
 - Through investments in developing new and advanced technologies
- **Integrate resiliency and security**
 - Enhanced system flexibility, T&D automation, and cybersecurity
- **Stimulate and implement partnerships**
- **Work with international partners to share best practices and learn from others**

Thank you!

For more information on the Clean Energy Ministerial and ISGAN:

- www.cleanenergyministerial.org

For more information on DOE smart grid activities:

- **DOE Office of Electricity:** www.oe.energy.gov
- **Smart Grid:** www.smartgrid.gov

Russ Conklin

Office of Climate Change Policy and Technology

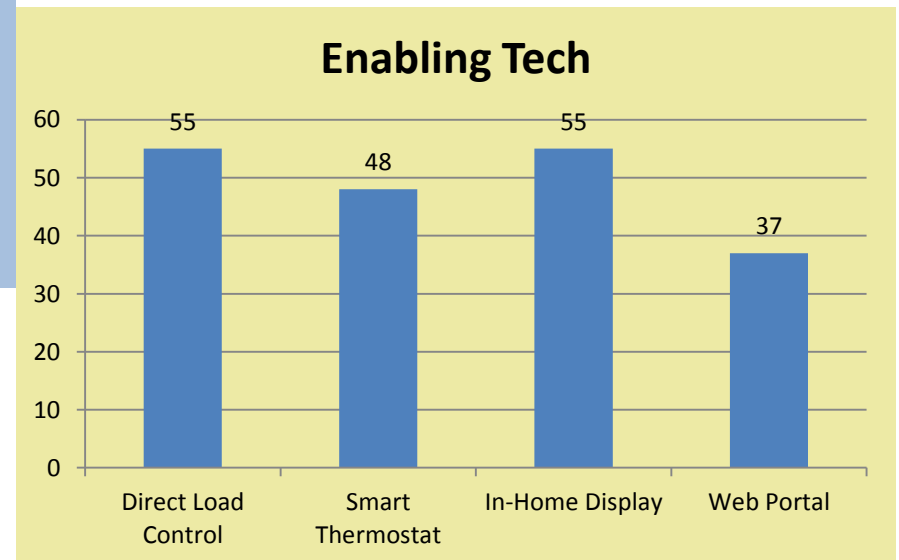
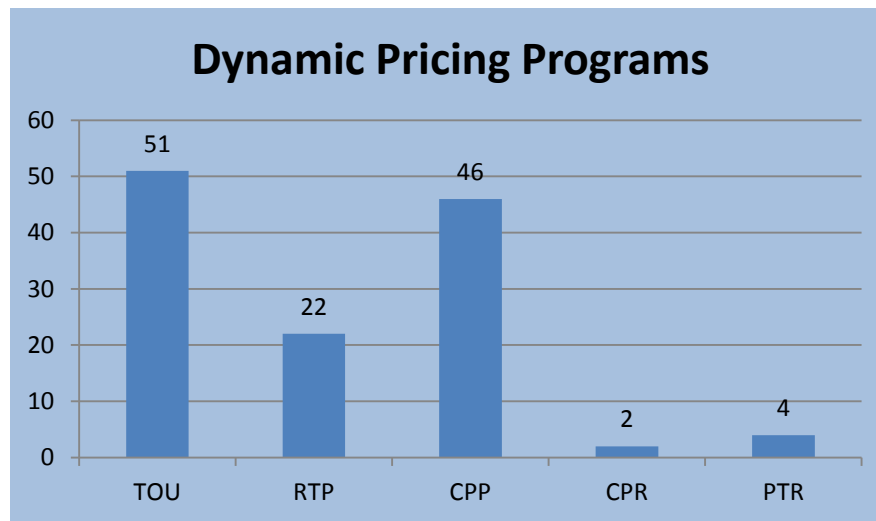
U.S. Department of Energy

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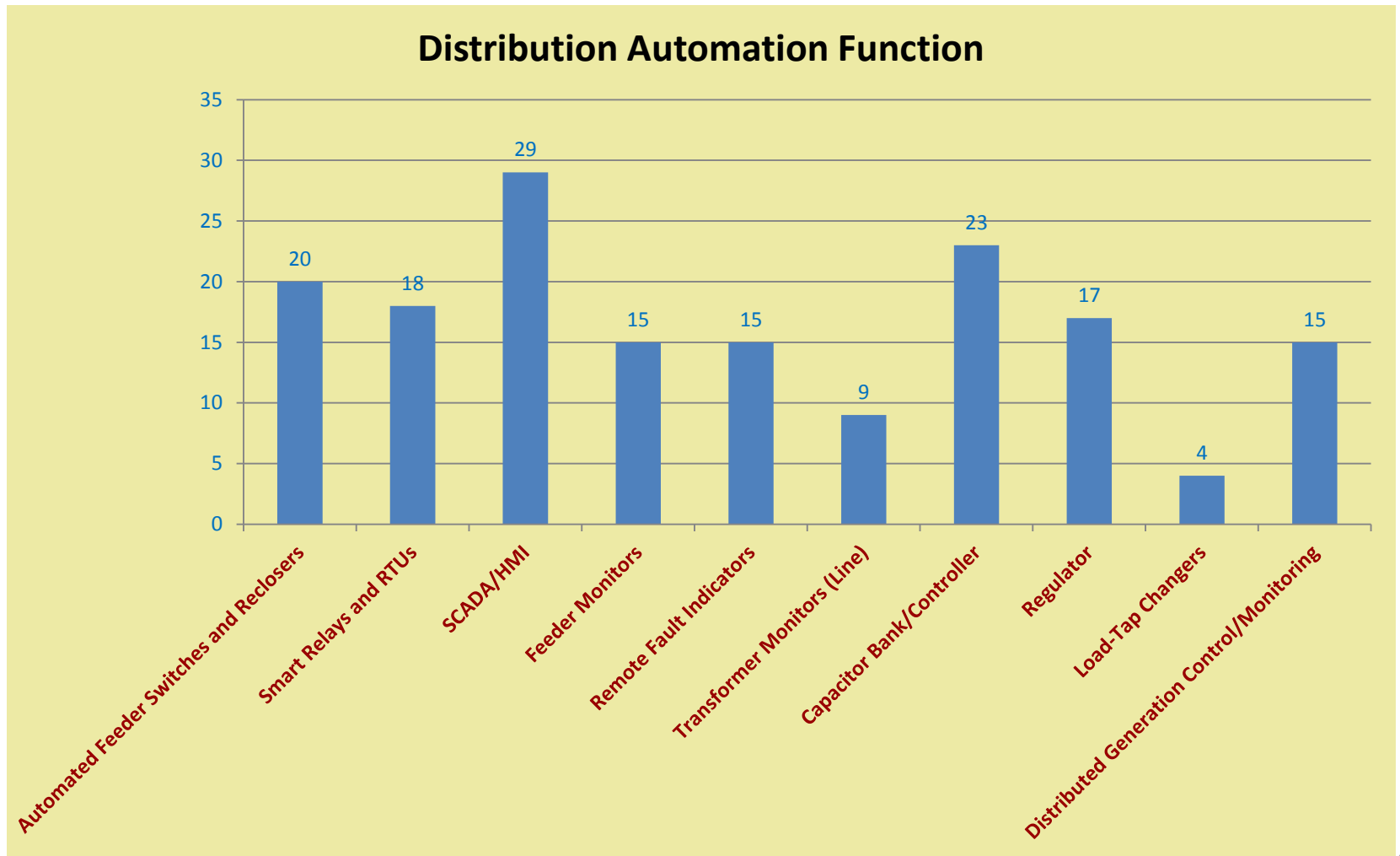
Additional Info

SGIG: AMI & Customer Systems

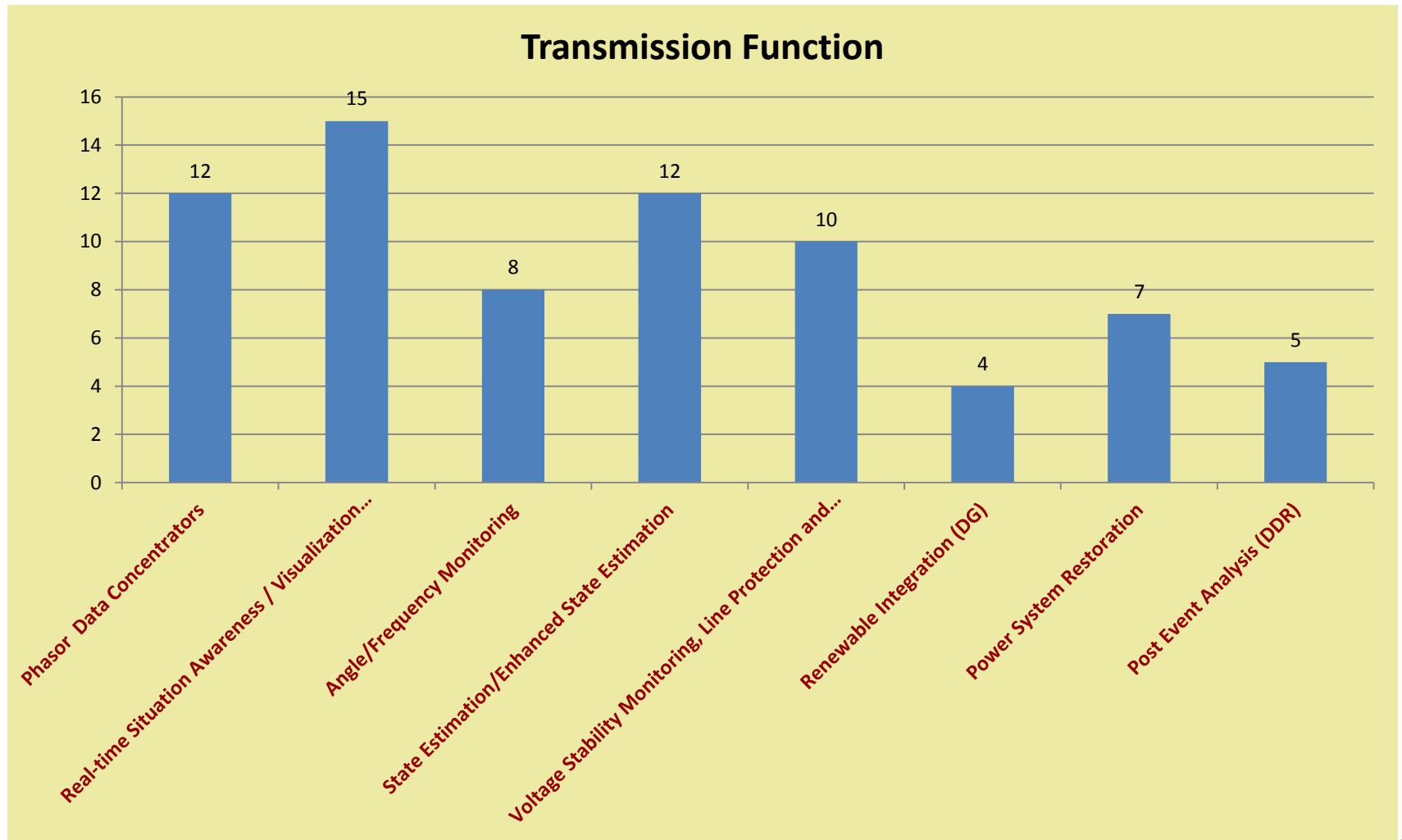
Number of SGIG projects offering individual dynamic pricing programs and enabling technologies



SGIG: Distribution Automation



SGIG: Transmission System



Why an ISGAN Implementing Agreement?

1

- Provides proven model for engagement

2

- Facilitates cooperation with the IEA Secretariat and other Implementing Agreements (reduce overlap and increase synergies)

3

- Allows direct private sector participation if desired

4

- Offers clear rules for engagement...

5

- ... But also flexibility to adjust to evolving needs and interests of the Participants