



U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

Federal Smart Grid Initiatives

**Presented at the North Carolina 8th Annual
Sustainable Energy Conference**

Eric Lightner

Director, Smart Grid Task Force

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www.oe.energy.gov

U.S. Department of Energy – 1000 Independence Ave., SW Washington, DC 20585

Presentation Outline

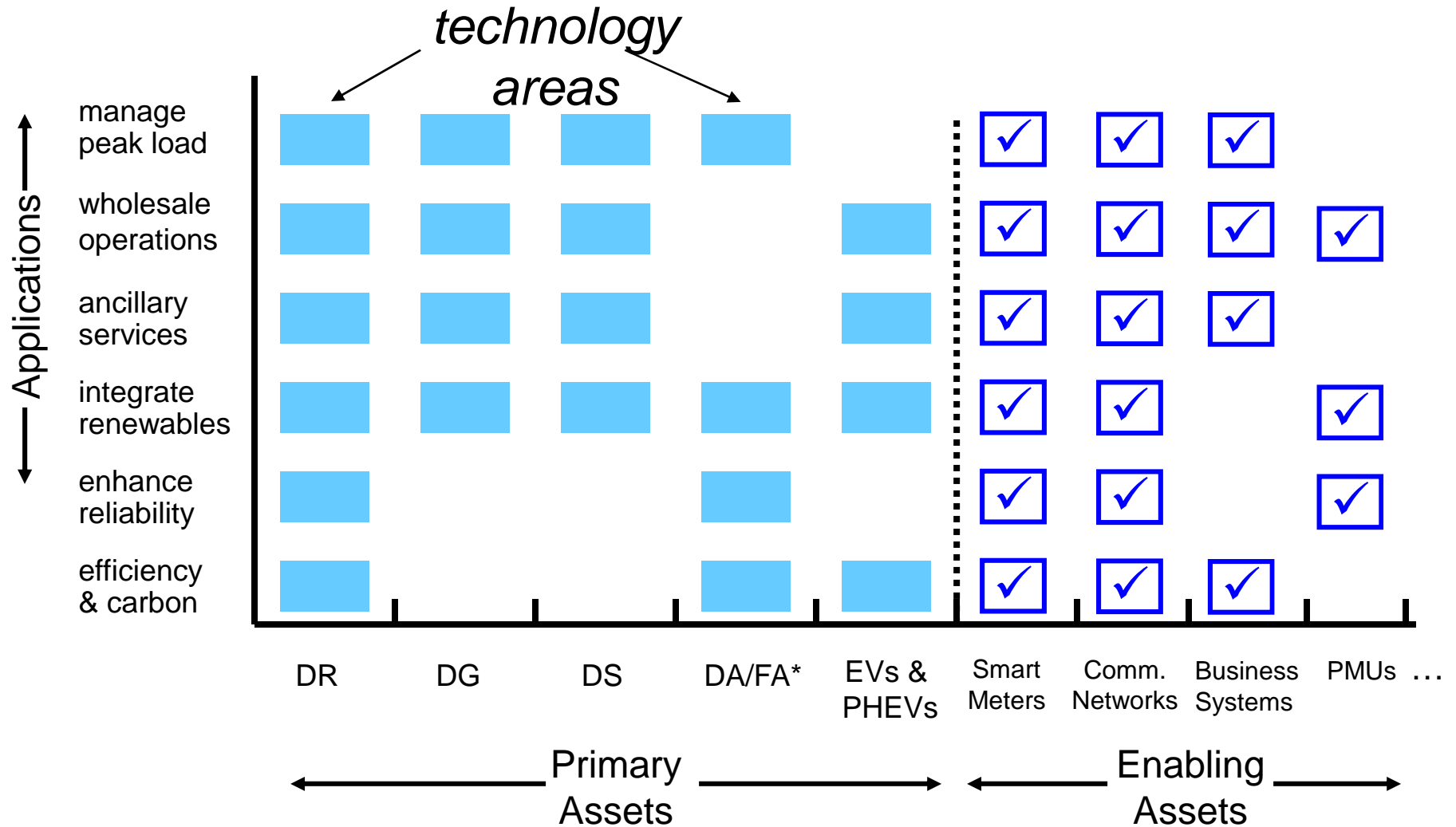
- Smart Grid & Role of Technology
- Impact of ARRA Smart Grid Development
- Key Smart Grid Activities
- Measuring Progress
- Information Resources

Scope of Smart Grid Development

Develop and implement advanced information, communication, and control technologies, along with supportive policies, to achieve all seven characteristics.



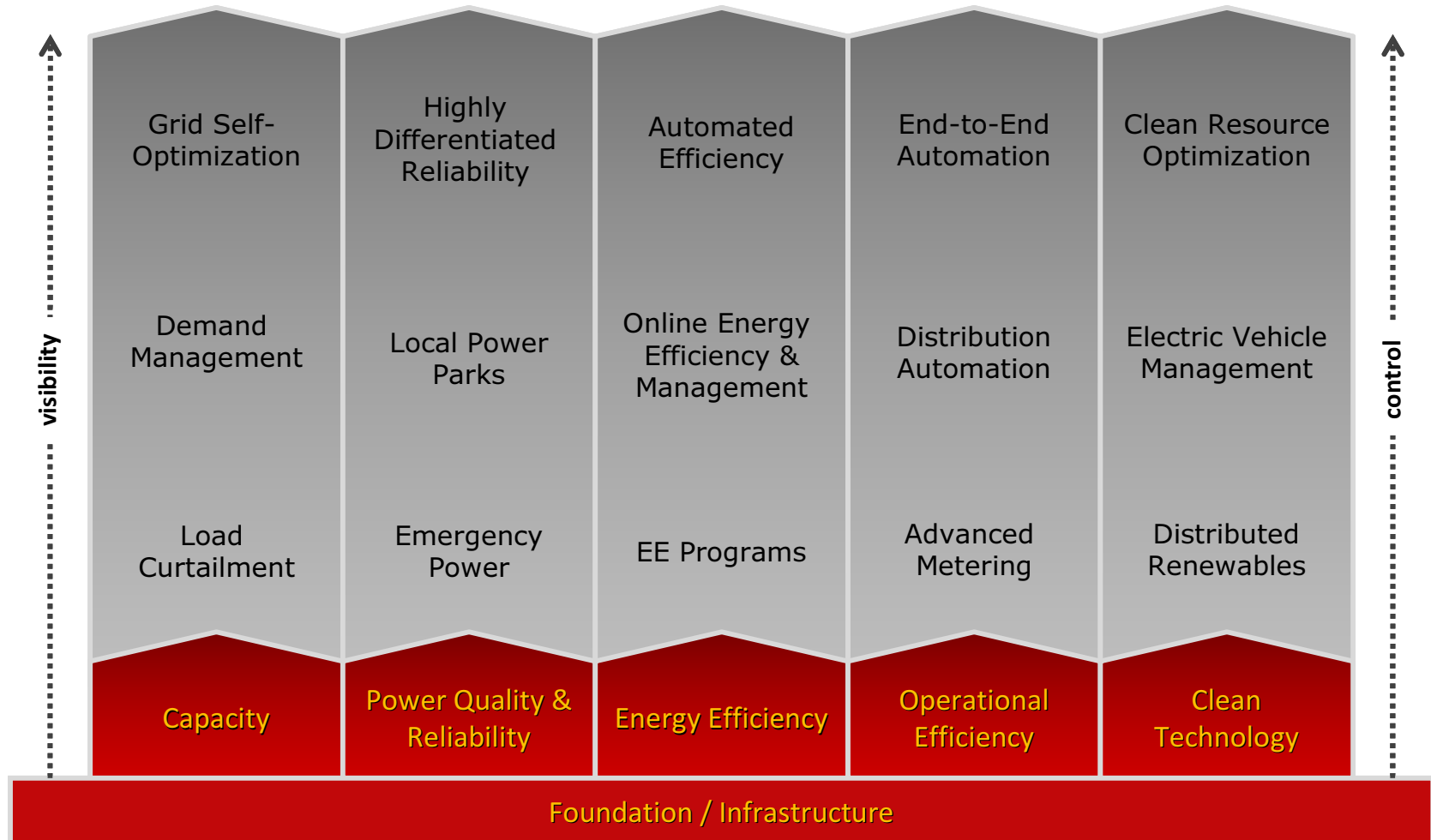
Mapping of Smart Grid Assets (Components), Applications, and Technology Areas



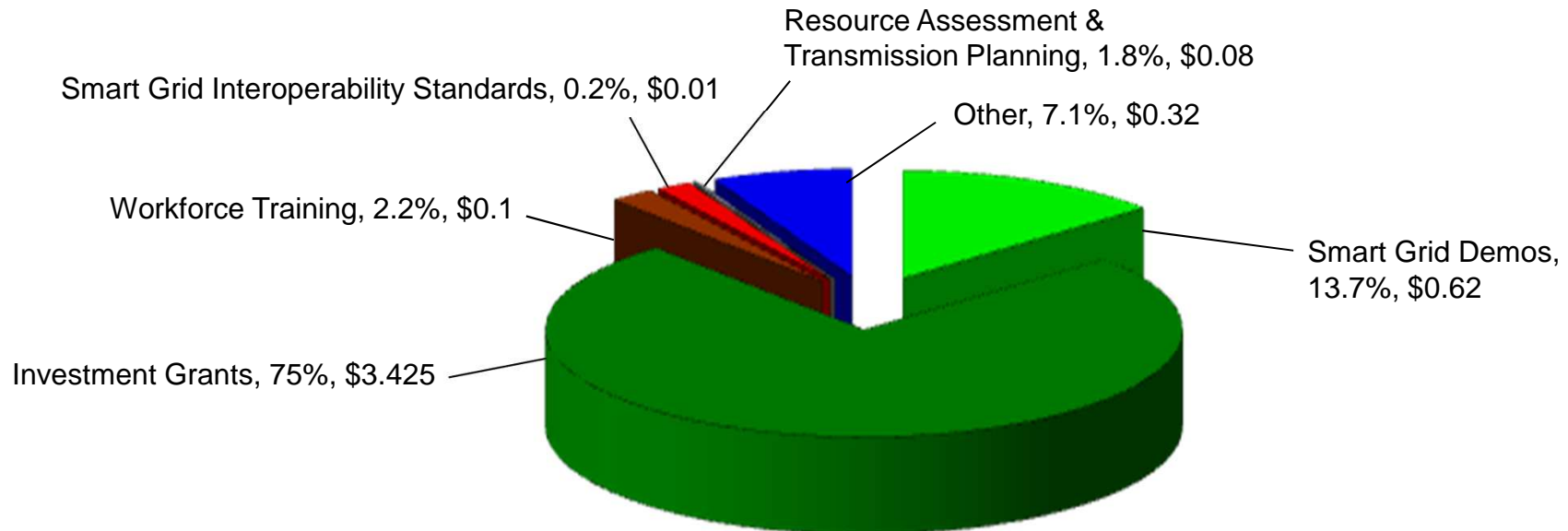
* DA/FA: Distribution automation/feeder automation

Assets + Applications → Value Creation

21st Century Smart Grid



\$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)

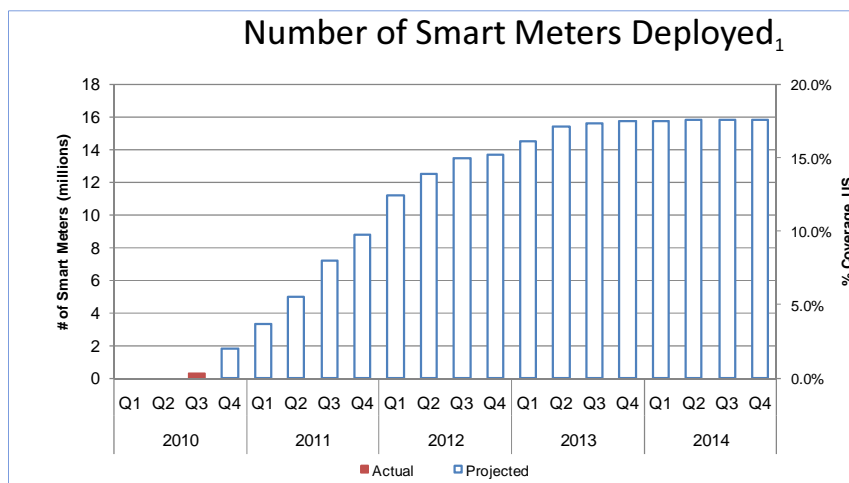
Smart Grid Systems and Equipment	Numbers of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	<ul style="list-style-type: none"> • Near-nationwide coverage • 6X the 166 existing networked PMUs 	<p><i>Enhanced situational awareness and electric system reliability and resiliency</i></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	210,814	<ul style="list-style-type: none"> • Enables peak demand reductions 	<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"> • 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><i>Transformational changes in consumer behavior and energy consumption</i></p>
In-Home Display Units	1,207,912	<ul style="list-style-type: none"> • Enables customer empowerment 	
PHEVs / Charging Stations	12 / 100	<ul style="list-style-type: none"> • Accelerates market entry 	<p><i>Begins the path toward energy independence</i></p>

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



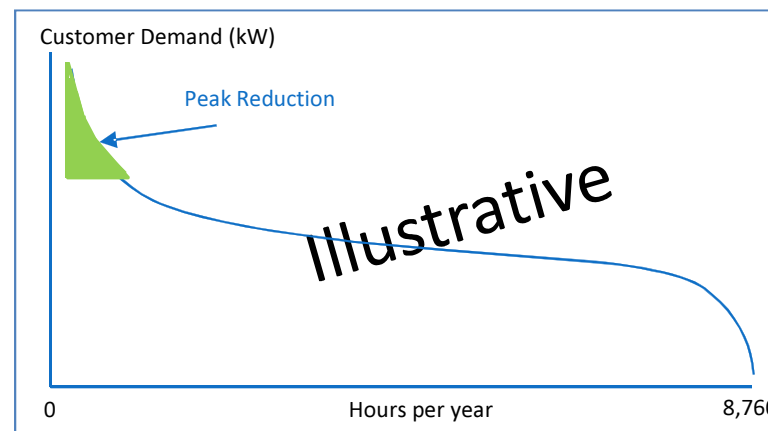
21 ARRA Smart Grid Projects reported build metrics for the Q3 reporting period.(cumulative)

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

	Technology Option			
Pricing Strategy	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)

Smart Grid Task Force: Federal Coordination

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
- ✓ Reviews Congressional Reports
- ✓ Collaborates on interoperability framework
- ✓ Coordinates ARRA investments in smart grid and related areas
- ✓ Ensures awareness of Federal smart grid activities
- ✓ Collaborates with and supports the WH NSTC Smart Grid Subcommittee

Member Organizations

Department of Energy
Federal Energy Regulatory Commission
Department of Commerce
 National Institute and Standards and Technology
 International Trade Agency
Environmental Protection Agency
Department of Homeland Security
US Department of Agriculture
Department of Defense
Federal Communications Commission
State Department

Smart Grid R&D Program

R&D Areas Guided by MYPP

- Standards & Best Practices
- Technology Development
 - Renewable and distributed systems integration
 - Microgrids
 - Advanced communications & controls
- Modeling
- Analysis
- Evaluation & Demonstrations

Focusing on

Distribution
Systems

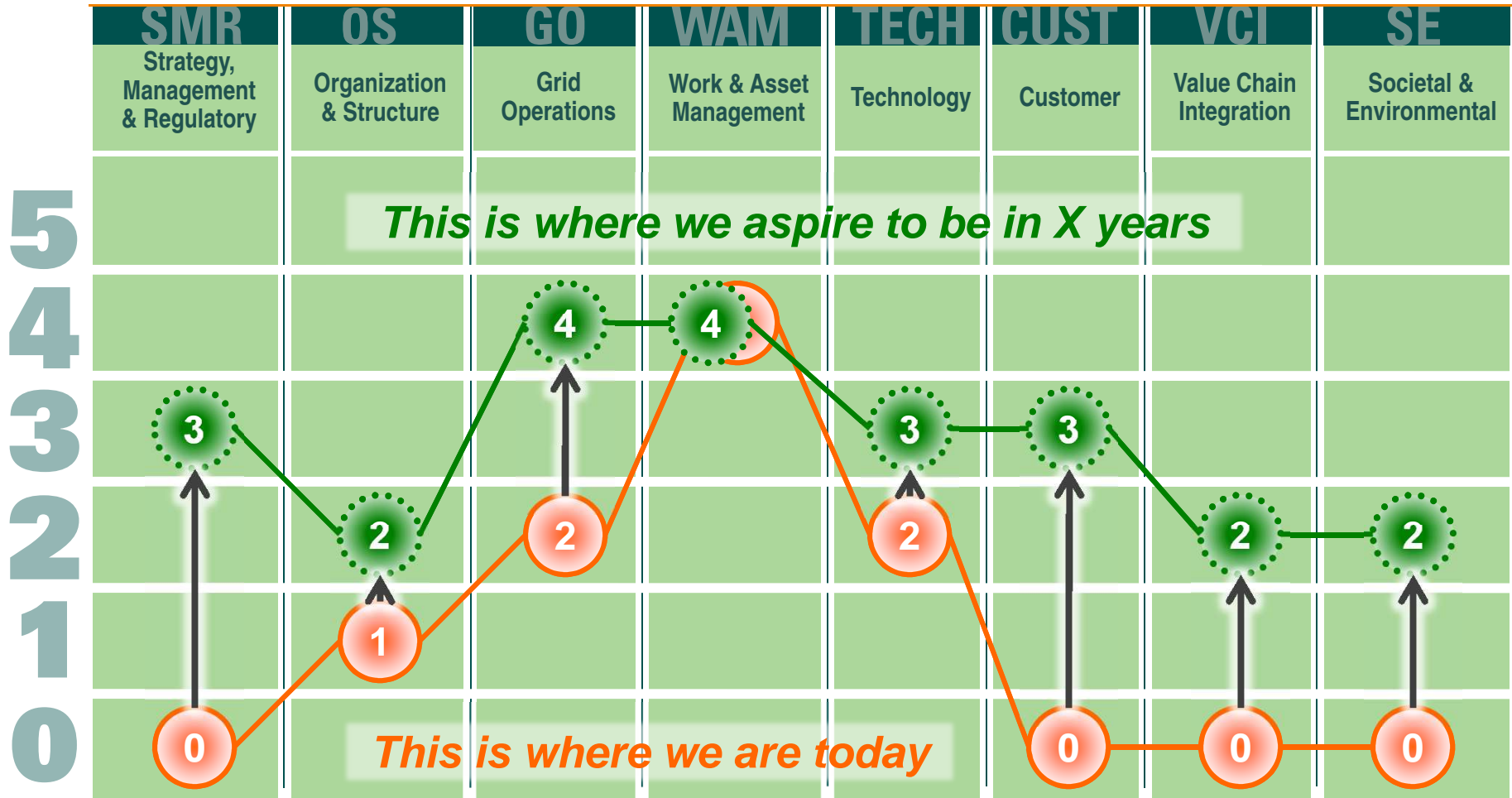
Customer
Solutions

Interfaces & Integration
with Transmission and
Generation Systems

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

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

Workshop 2 sets **strategic aspirations** by domain, for example:



Impact on Smart Grid Standards Development

Through close work with DOE, the NIST Smart Grid Interoperability Standards Program has:

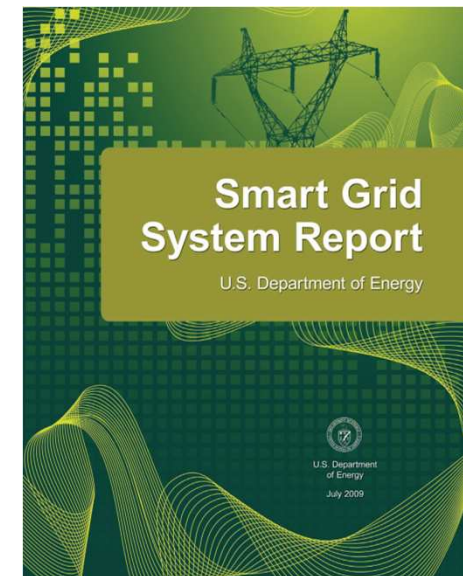
- Released **NIST Framework and Roadmap** for Smart Grid Interoperability Standards, Release 1.0
- Released Guidelines for **Smart Grid Cyber Security**
- Launched **Smart Grid Interoperability Panel (SGIP)** to provide a forum for collaboration with the private sector – now 1,750 members from 634 organizations



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: draft being reviewed, targeting finalization by December 2010

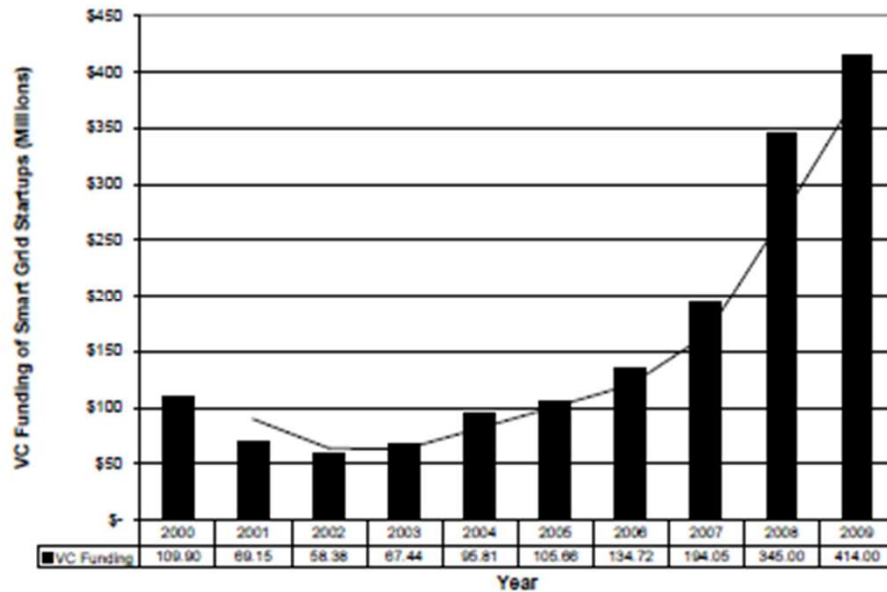


Mapping Metrics to Smart Grid Characteristics

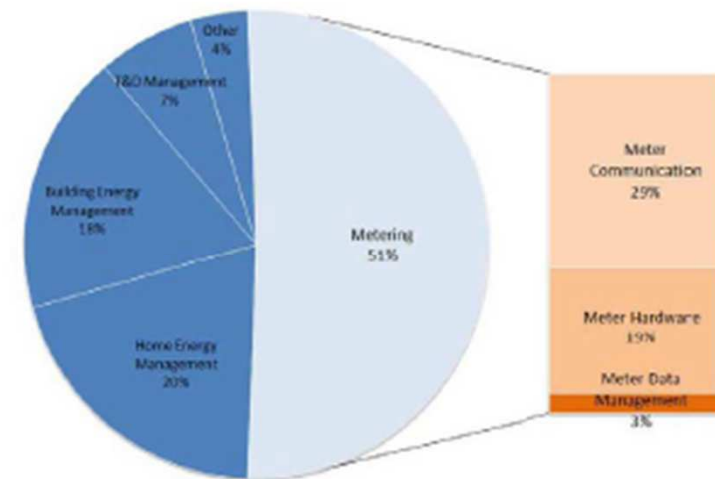
Metric Name	Customer Participation	All Generation & Storage Options	New Products, Services, & Markets	Power Quality for the Range of Needs	Asset Optimization & Efficient Operation	Resiliency to Disturbances, Attacks, & Natural Disasters
Dynamic Pricing	Primary Emphasis	Importance	Importance	Importance	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	Primary Emphasis	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	Primary Emphasis	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

Economic Impact – Tracked by Venture Capital Funding



**Venture Capital Funding of Smart Grid Startups
(2002-2009)**



**Venture Capital Spending by
Company Type (2007-2010)**

Source: Smart Grid System Report (Draft: December 2010)

Information Resources

Smart Grid Information Clearinghouse

- Smart grid project summaries (with focus on non-ARRA projects), use cases, and business cases for the U.S. and internationally
- >200 & >50 smart grid projects in the U.S. and overseas; >1,000 smart grid-related documents and multimedia (use cases, c/b analyses, business cases, legislation & regulation, standards, and technologies)



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



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**

Contact Information

Eric M. Lightner
Director, Smart Grid Task Force
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
(202) 586-8130
eric.lightner@hq.doe.gov

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