U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

Smart Grid Activities by the US Department of Energy

Presentation at the EPA Smart Grid Webinar on Smart Grid and Clean Energy for Local Governments

Dan Ton

Program Manager, Smart Grid Research and Development

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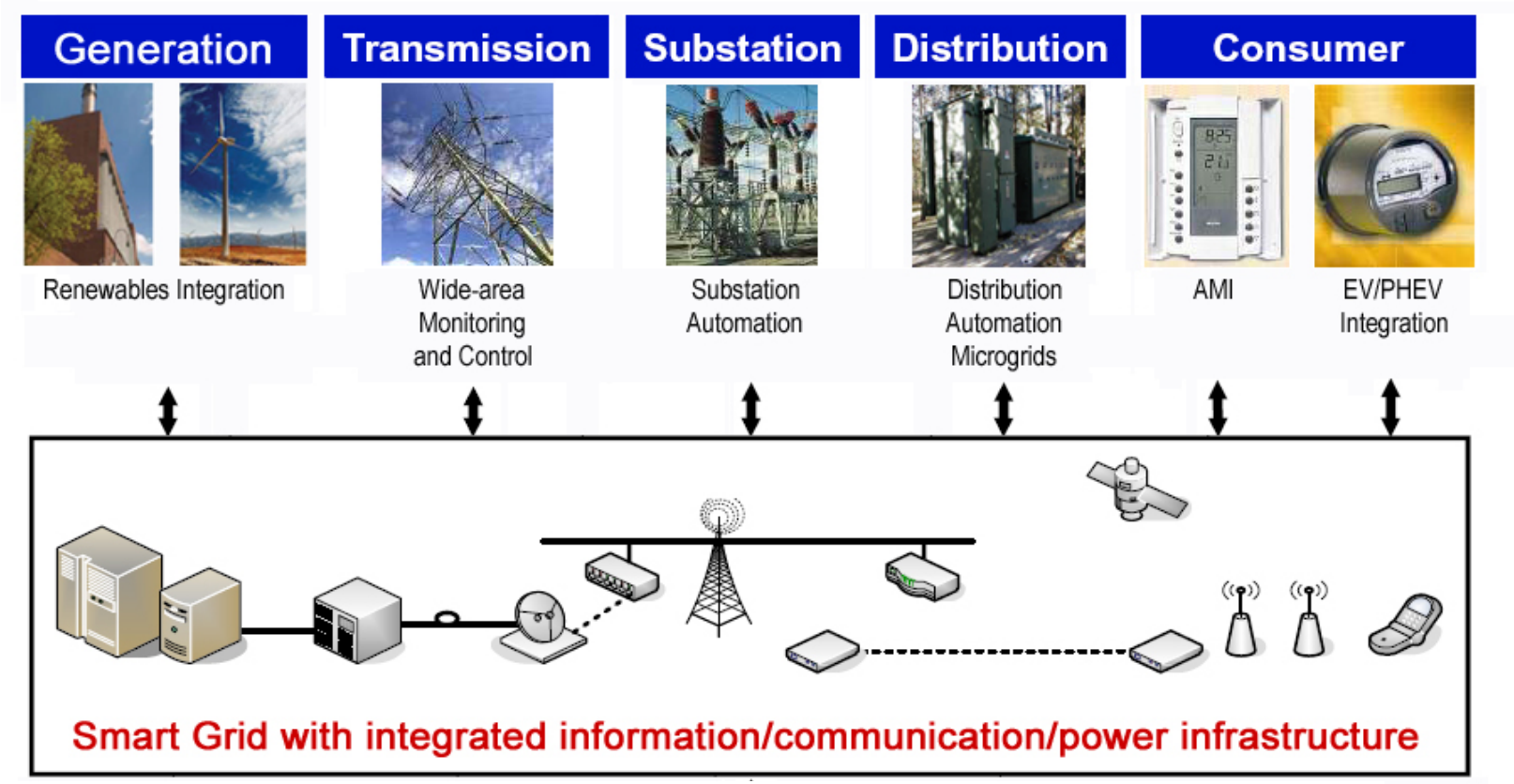
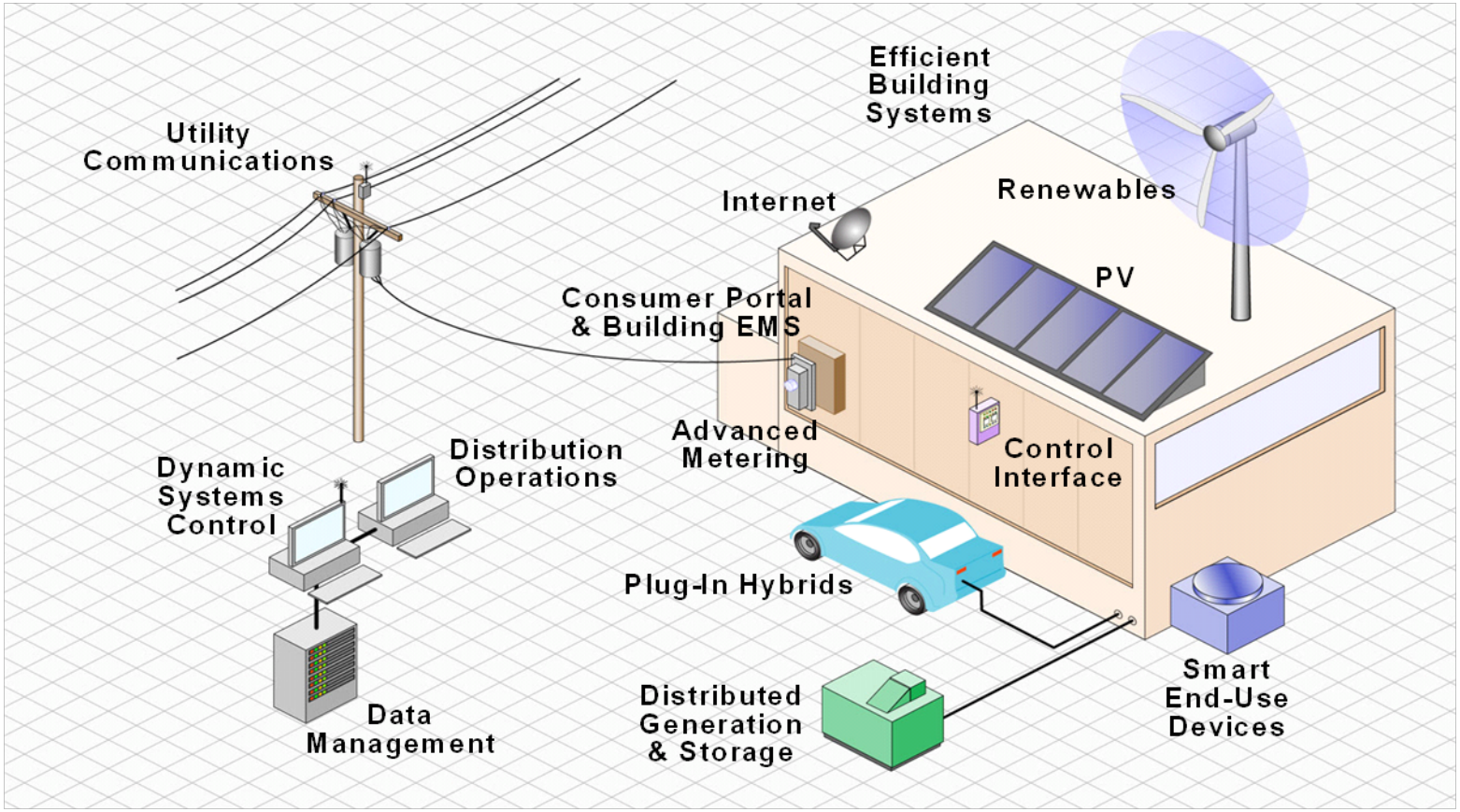
Presentation Outline

- **Overview of Smart Grid**
  - **Enabling Applications**
  - **Value Streams**
  - **Implementation Challenges**
- **DOE Smart Grid Development Plan**
  - **Near-term Activities**
  - **Longer-term Technology R&D**
- **Opportunities for Local Governments**
- **Smart Grid Resources**

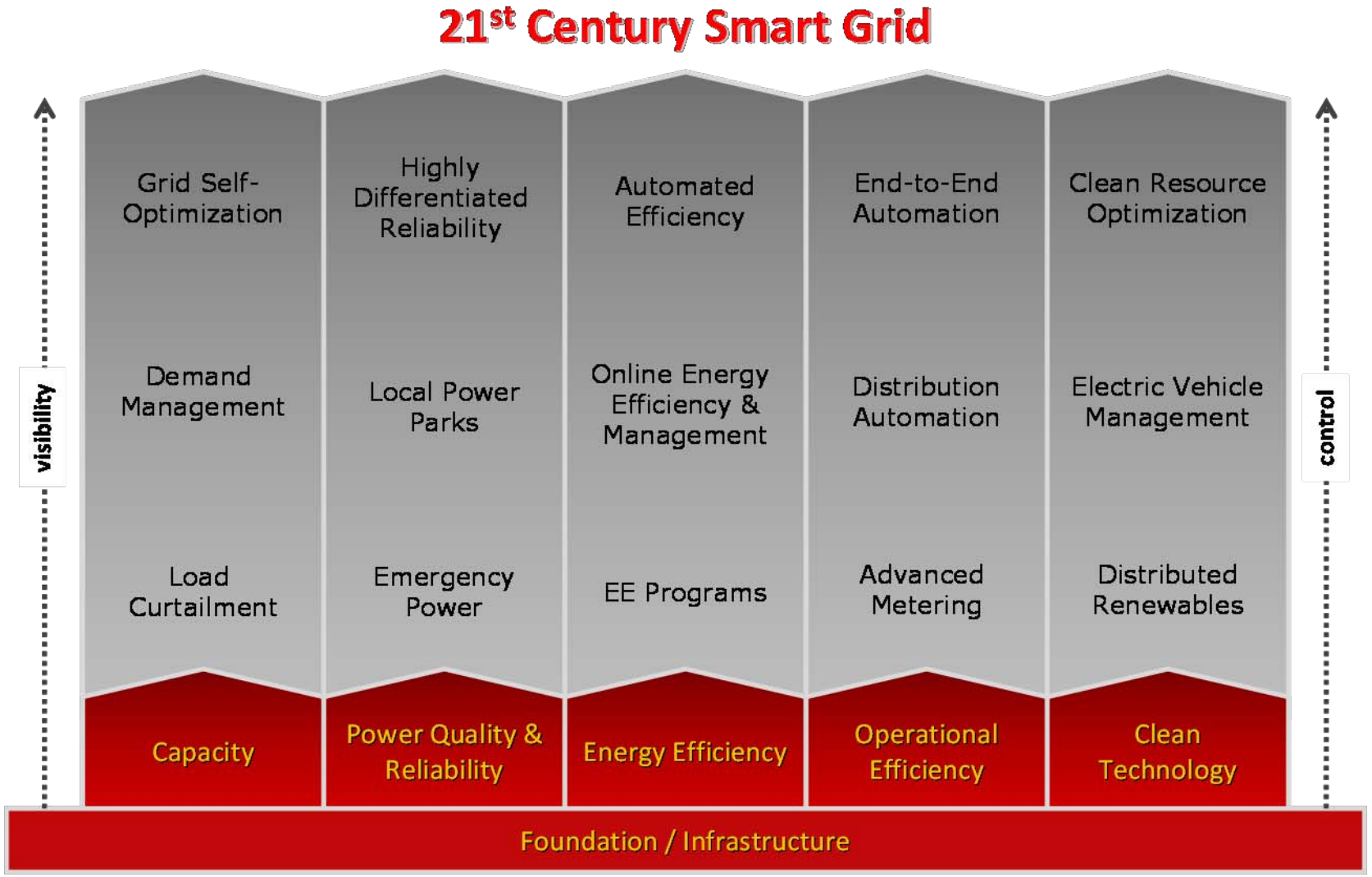
Smart Grid Enables Dynamic Optimization of Grid Resources and Operations



Smart Grid Enables Consumer Participation and Demand Response

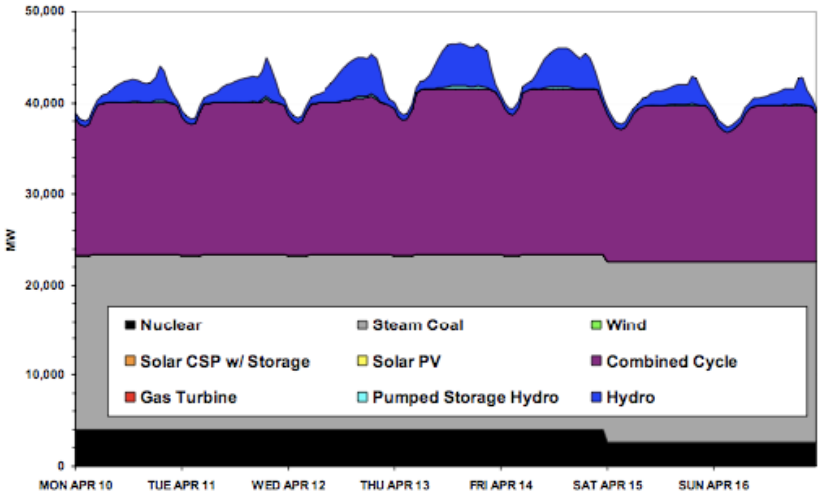


Smart Grid Value Streams

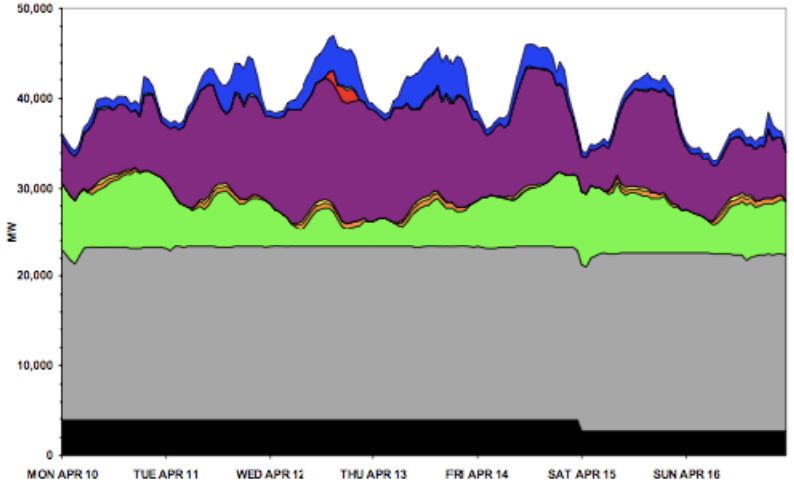


Smart Grid Technologies Needed to Address Variable Generation Effects on Grid Operations

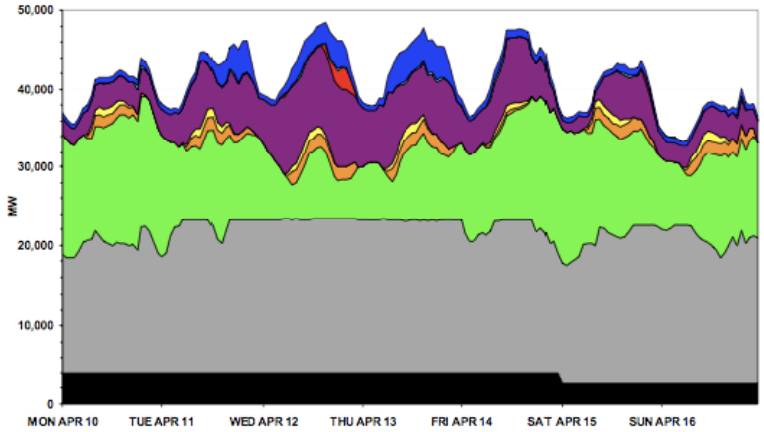
No wind



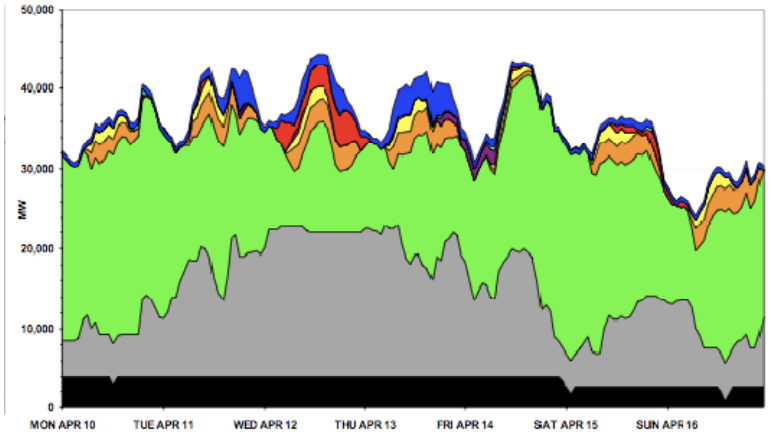
11% renewables



23% renewables



35% renewables

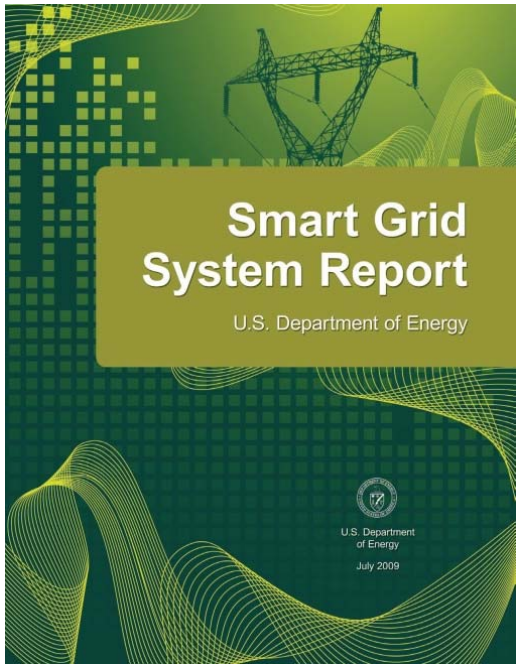


Lew et al. "How do Wind and Solar Power Affect Grid Operations: The Western Wind and Solar Integration Study," National Renewable Energy Laboratory, (September 2009), p. 6

Smart Grid Challenges

Smart Grid System Report (July 2009)* identifies challenges to smart grid deployments in 4 broad categories

- Costs and their recovery
- Interoperability standards
- Technical barriers
- Changing technologies and policies



* Report available at http://www.oe.energy.gov/DocumentsandMedia/SGSRMain_090707_lowres.pdf

Regional Differences Affecting Smart Grid Deployments

Regional Differences

- Generation resources
- Business economy
- Climate
- Topography
- Environmental concerns
- Public policy

- Value streams
- Incentives
- Obstacles

ARRA Smart Grid Development

- Encompassing technical, operational, business-model development in all regions:
  - 8 NERC regions,
  - 27 eGrid subregions
  - co-ops or publicly owned utilities in the (sub)regions

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

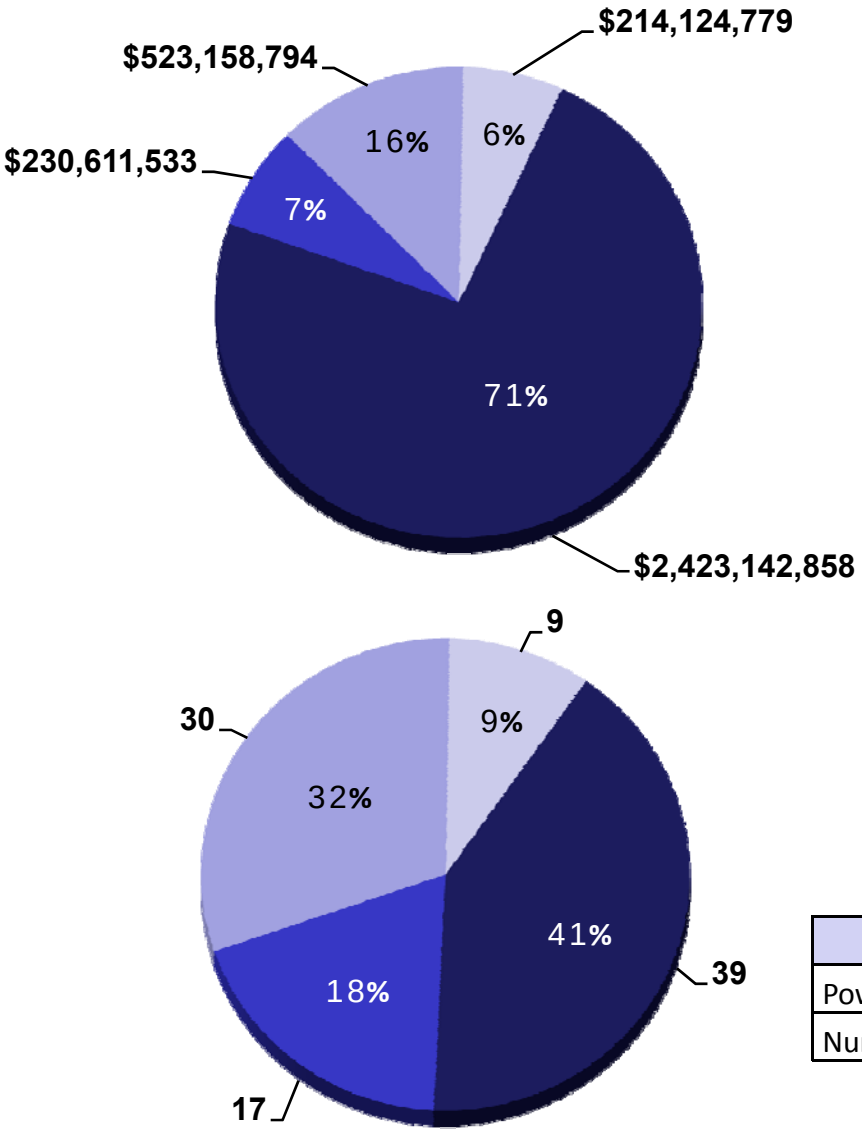



Recovery Act: Smart Grid Investment Grants

(100 projects: $3.4B Federal; $4.7B non-Federal)

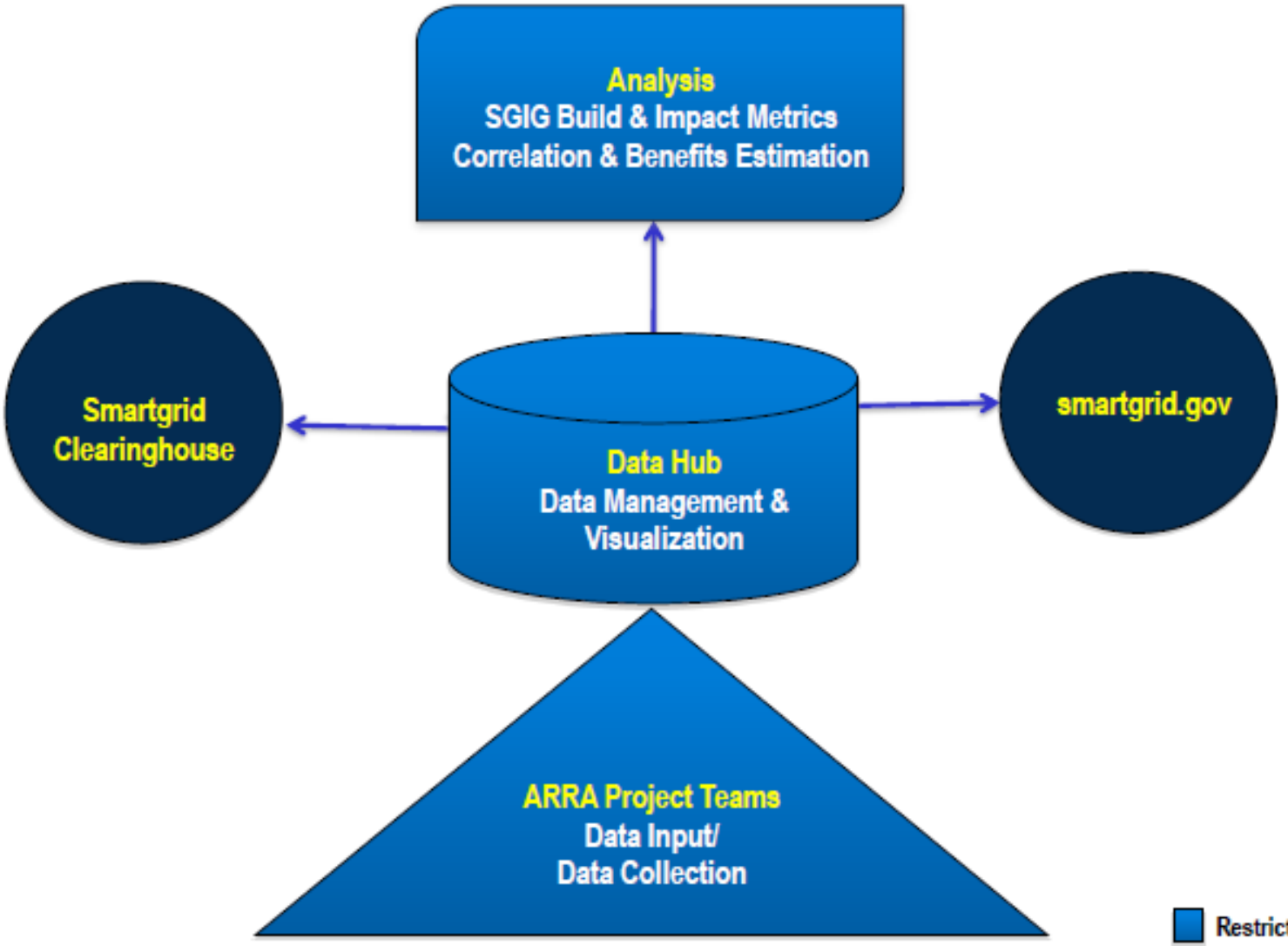
Smart Grid Systems and Equipment	Number of Units (self-reported estimates)	Improvements	Impacts
Networked Phasor Measurement Units	877	• *Near-nationwide coverage* • *6X the 166 existing networked PMUs*	*Enhanced situational awareness and electric system reliability and resiliency*
Smart Transformers	205,983	• *Enables preventative maintenance*	
Automated Substations	671	• *5% of 12,466 transmission and distribution substations in the U.S.*	
Load Control Devices	176,814	• *Enables peak demand reductions*	*1444 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	1,183, 265	• *Enables customer empowerment*	
PHEVs / Charging Stations	12 / 100	• *Accelerates market entry*	*Begins the path toward energy independence*

Selected SGIG Projects – Breakout By Type of Power Company



Selected Power Company Projects	
Power Company Federal Funding	$3,390,562,615
Number of Power Company Projects	95

Tracking & Reporting of ARRA Project Results



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

Development & Implementation

- **MYPP to guide Smart Grid R&D investments with staged development process**
  - Meeting in October involving national labs
  - Stakeholder Roundtable Meeting in December
  - Public comment in March-April 2010
- **MYPP implementation**
  - Funding Opportunity Announcement in April, with awards in September 2010
  - Estimated budget:
    $30M in Federal funds over 5 years

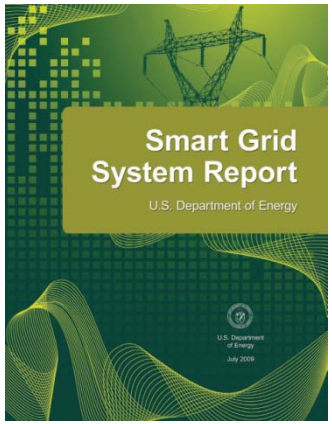
Opportunities for Local Governments

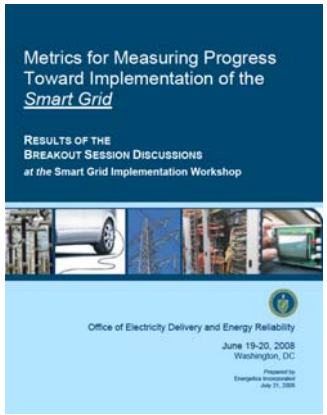
- **Smart Grid R&D FY10 Funding Opportunity Announcement**
  - Teaming is encouraged to carry out smart grid technology RD&D, along with viable commercialization strategy
- **International City-to-City Collaborative Mechanism**
  - Identified as one of the five activities in the DOE International Smart Grid Implementation Plan for 2010-2014, pending budget availability
  - To focus on zero-carbon communities development through smart grid integration with energy efficient buildings, clean energy generation, and electric transportation
  - To showcase development of a sustainable community in each participating nation by applying technologies from all collaborating nations

Examples of DOE Projects Involving Municipal Utilities and Local Governments

- **City of Fort Collins**
  - RDSI: Develop a zero energy district to substantially increase the use of renewables and distributed energy resources for supplying power during peak load periods
  - SGIG: Install 79,000 smart meters and in-home demand response systems including in-home displays, smart thermostats and air conditioning and water heater control switches, automate transmission and distribution systems, and enhance grid security.
- **SMUD**
  - SGIG: Install a comprehensive regional smart grid system from transmission to the customer that includes 600,000 smart meters, dynamic pricing, 100 electric vehicle charging stations and 50,000 demand response controls including programmable smart thermostats, home energy management systems.

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

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