



U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

DOE Programs Addressing PV Integration into Utility Planning & Operations

Presentation at:

Utility-Scale PV Variability Workshop

**Dan Ton, Program Manager
Smart Grid Research & Development**

October 7, 2009

Cedar Rapids, Iowa

PV Integration – A Collaborative Area between EERE/OE



U.S. DEPARTMENT OF
ENERGY

Electricity Delivery
& Energy Reliability



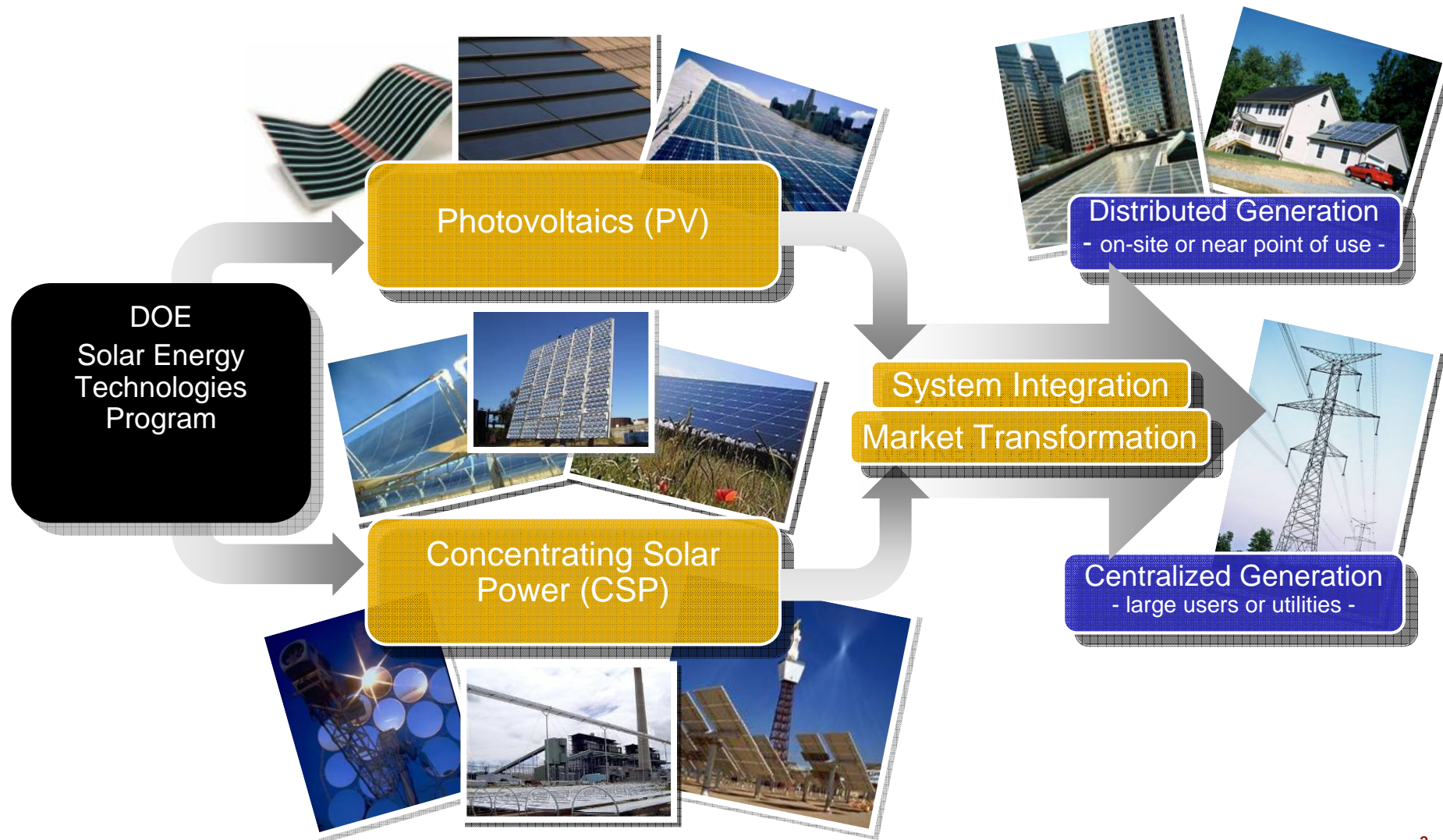
U.S. Department of Energy
Energy Efficiency and Renewable Energy

DOE EERE/OE jointly developed and identified five strategic areas for RSI to realize a significantly larger share of the nation's energy consumption from renewable energy (wind, solar, geothermal, tidal wave) and renewable fuels (biomass, biofuels)

- High-resolution renewable energy resource characterization
- Advanced operational strategies with integrated renewables, energy storage, and load management
- Advanced communications and controls for interconnection and interoperability
- Comprehensive regional infrastructure planning and coordination
- Education and workforce development



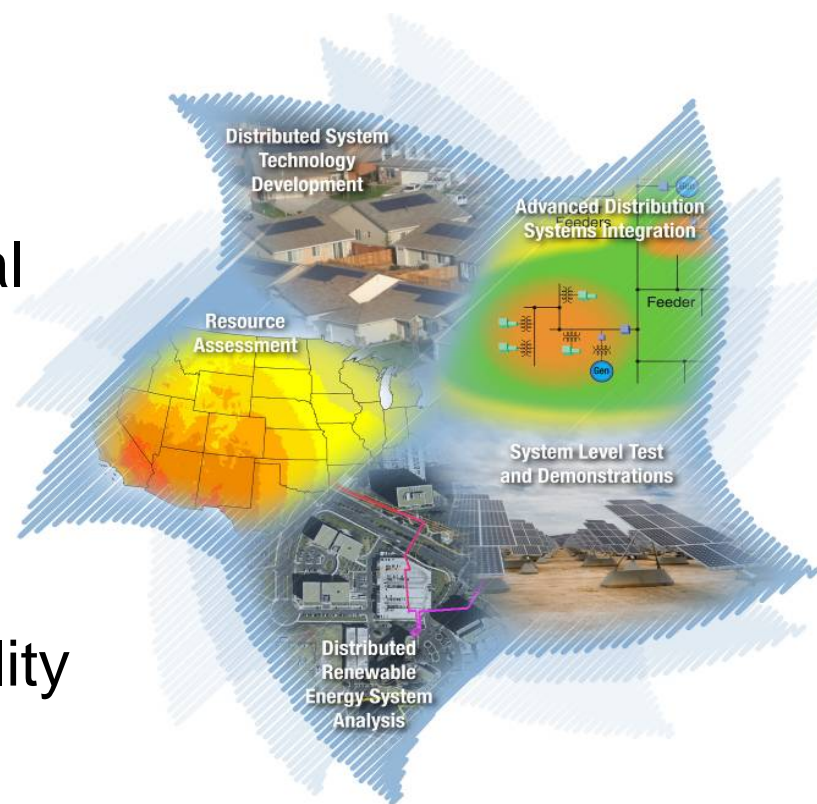
The Program is implementing four key activities to reduce technology cost and achieve high market penetration





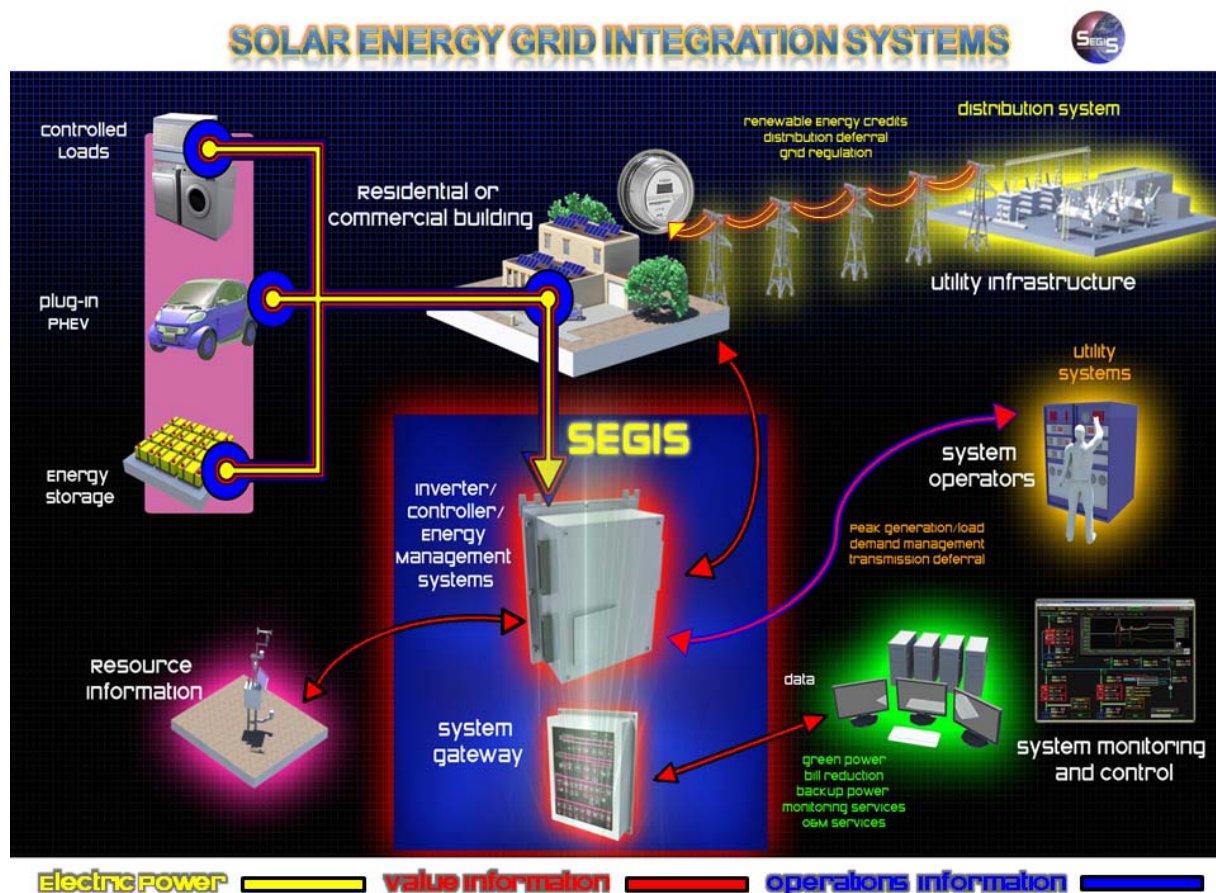
High-penetration solar electricity into the grid affected by variability of solar resources & outdated electric delivery infrastructure

- Resources characterization with inadequate temporal and spatial resolutions
- System planning and operational tools inadequate to manage uncertainty from renewable energy generation
- Lack of system flexibility to accommodate additional variability introduced by renewables
- Limited capacity for two-way power flow





SEGIS focuses on developing intelligent hardware that interconnects PV to evolving “Smarter” electrical grid



Addresses integration application needs for:

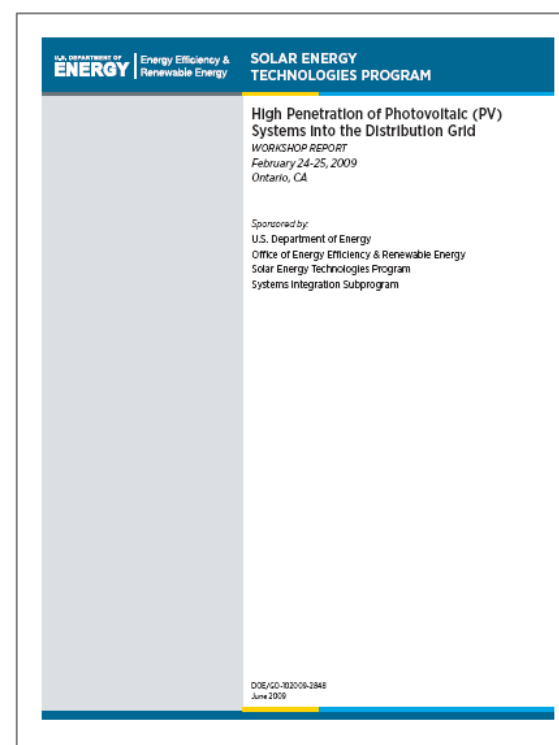
- ✓ Communication portals
- ✓ micro-grids
- ✓ demand response
- ✓ zero-energy buildings
- ✓ PHEV integration
- ✓ PV system sizes, <math><1\text{kW}</math> to $>100\text{kW}$

Five industry awards downselected for prototyping, testing, and pilot production

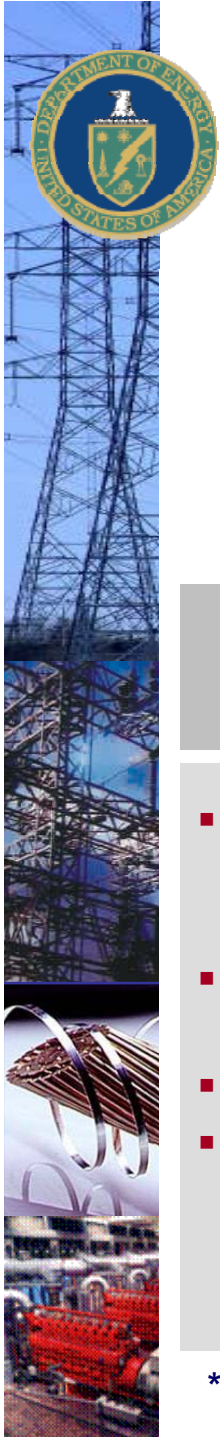


High Penetration PV Development

- Industry workshop held in February 2009 with over 120 participants
- Workshop report documenting high-priority needs, RD&D activities, and performance requirements
- Up to \$37.5M DOE investment over 5 years (FY10-14), selection for award announced in September 2009:
 - Modeling tools development
 - Field verification of high-penetration levels
 - Modular power architecture
 - Demonstration of PV and energy storage for smart grids

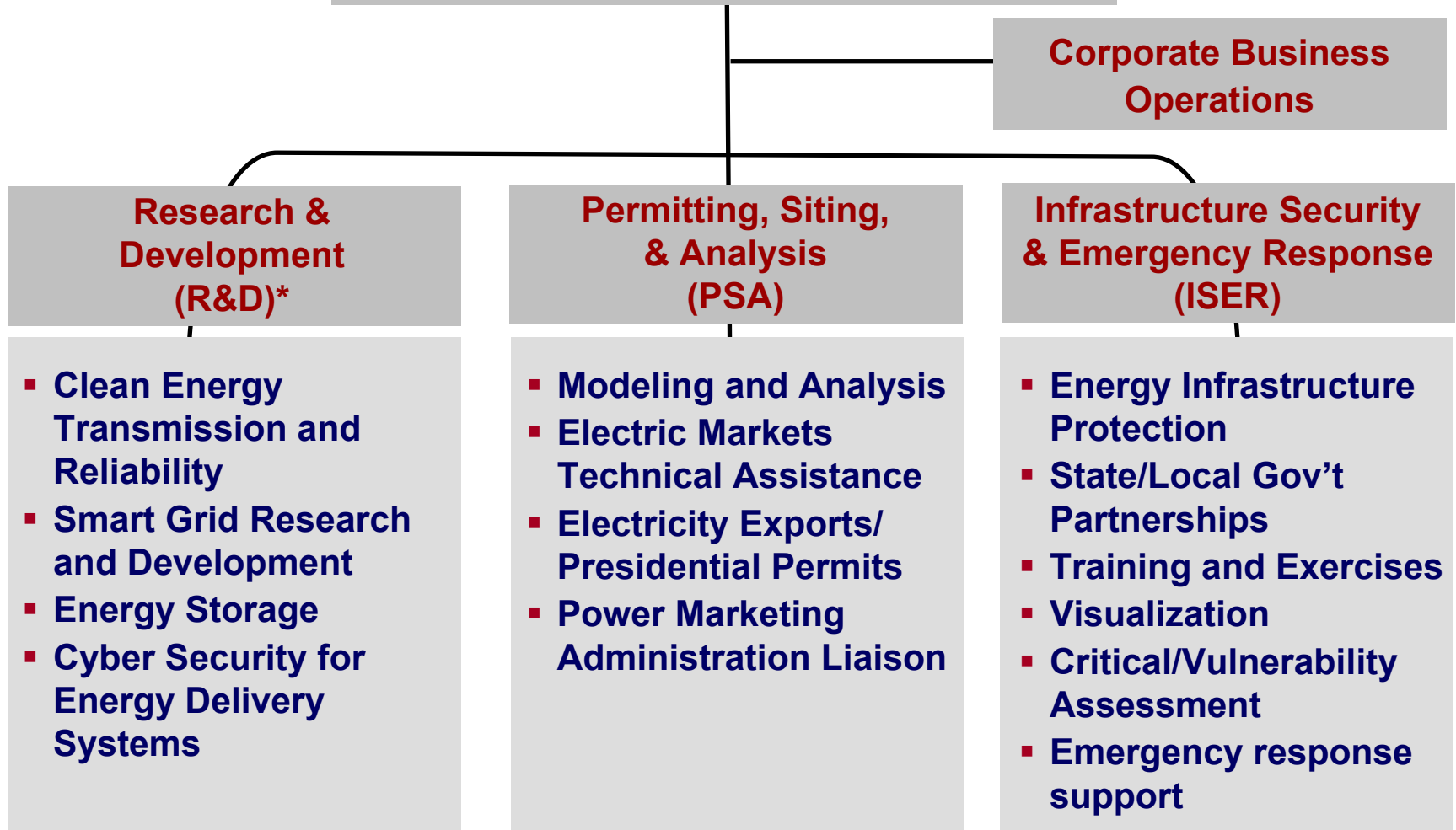


http://www1.eere.energy.gov/solar/pdfs/pv_grid_penetration.pdf

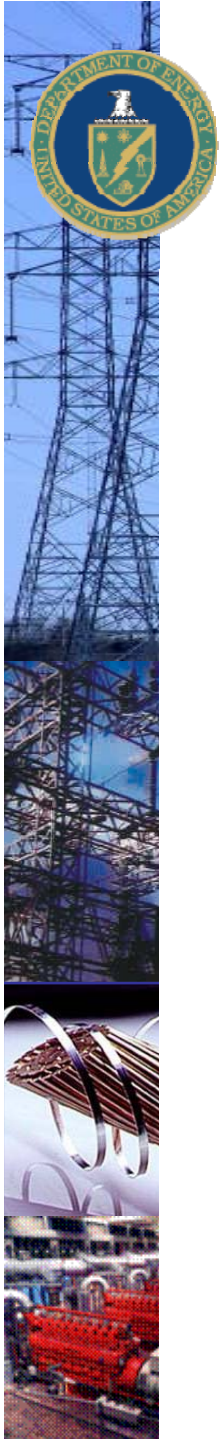


Office of Electricity Delivery and Energy Reliability

Office of the Assistant Secretary

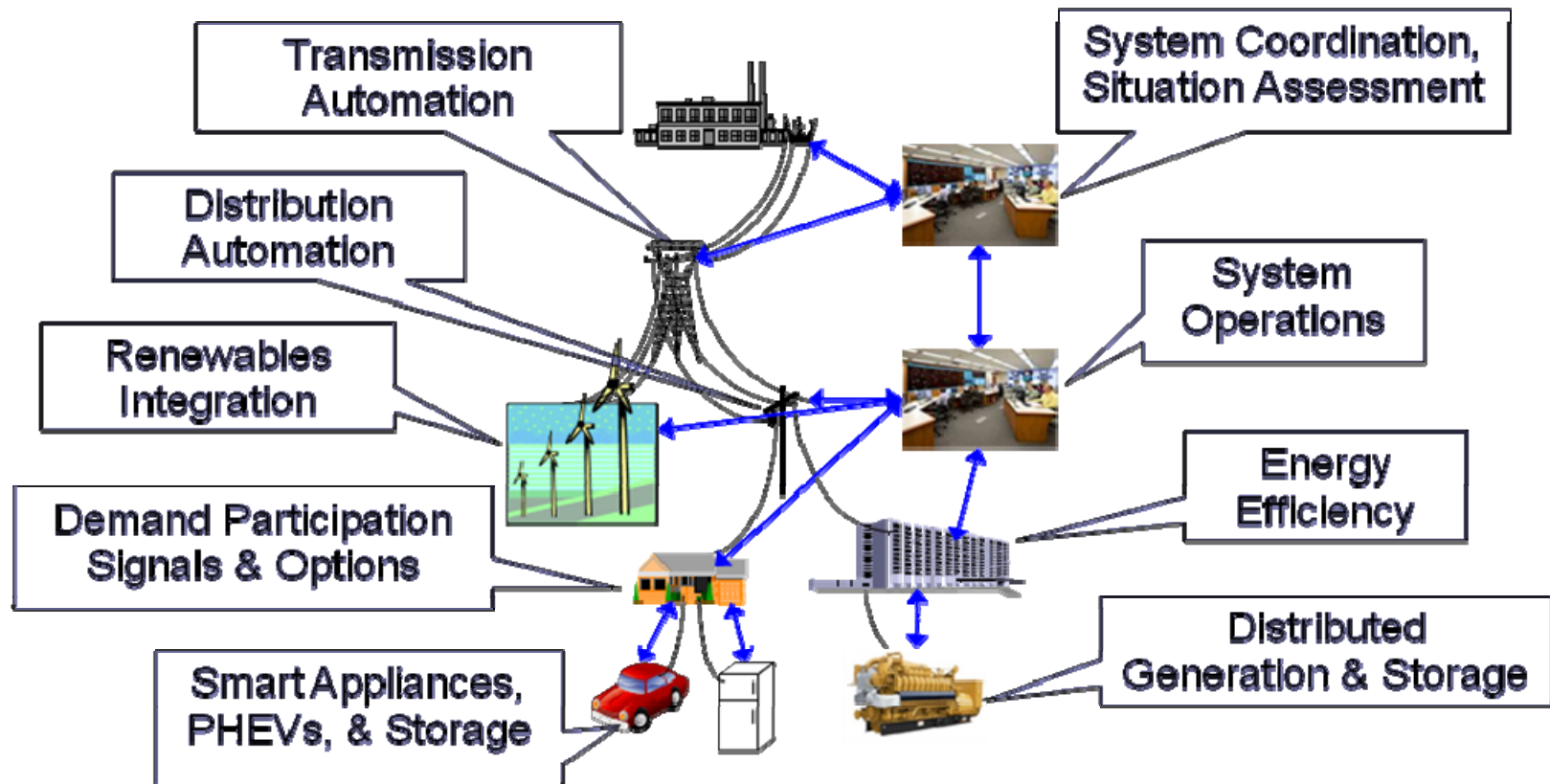


* FY10 Budget Line Items

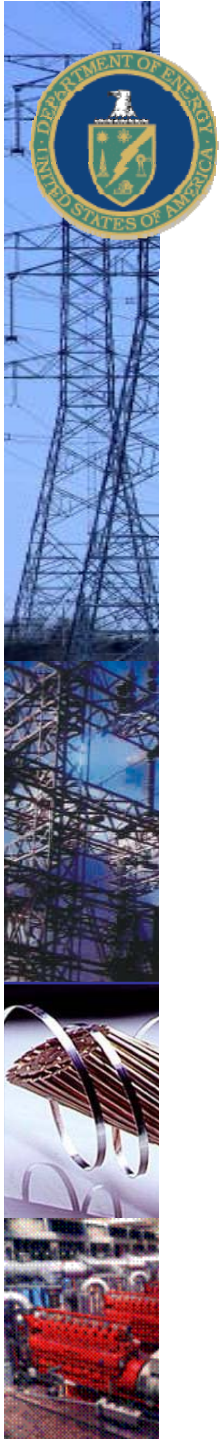


Smart Grid Research and Development

Smart Grid R&D focuses on developing next generation smart grid technologies for integration into the nation's electric delivery network to enhance operational intelligence and connectivity throughout all application areas .



Key SG Application Areas

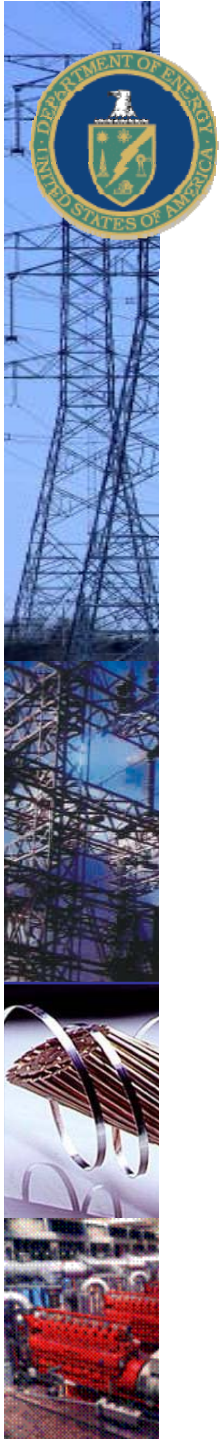


Defining Smart Grid Characteristics

Electricity delivery network modernized using latest digital/information technologies to meet key defining functions

- Enabling Informed Participation by Customers
- Accommodating All Generation and Storage Options
- Enabling New Products, Services, and Markets
- Providing the Power Quality for the Range of Needs in the 21st Century
- Optimizing Asset Utilization and Operating Efficiently
- Addressing Disturbances – Automated Prevention, Containment, and Restoration
- Operating Resiliently Against Physical and Cyber Attacks and Natural Disasters

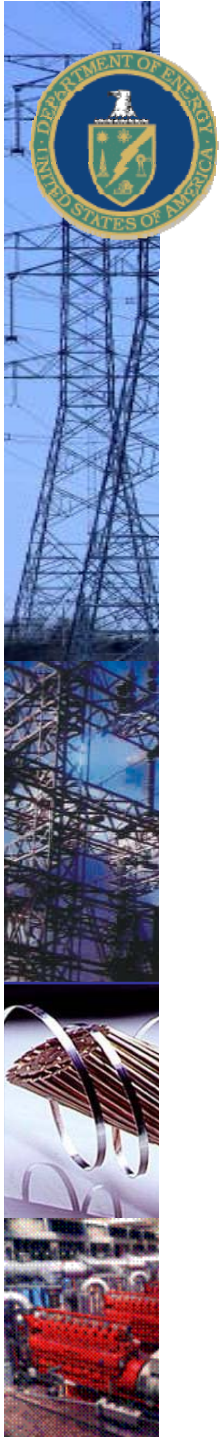
7 smart grid characteristics reaffirmed through the Smart Grid Implementation Workshop held June 2008



Smart Grid R&D Planned Activities for FY10

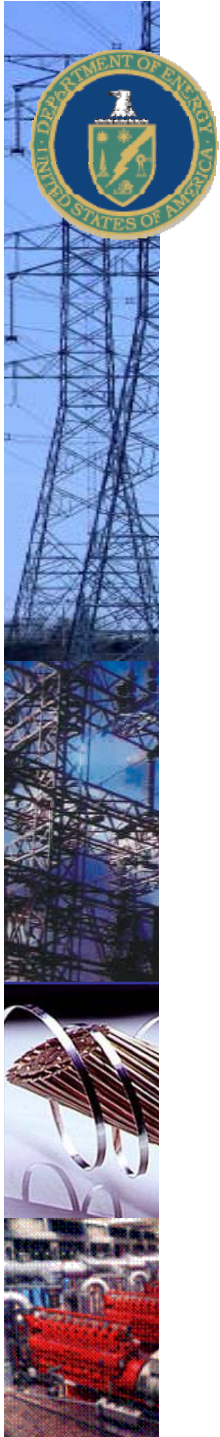
Smart Grid R&D Multi-Year Program Plan (FY10-14)

- Working groups being assembled to plan for development of each of the defined R&D areas to include the goal, objectives, challenges, tasks, and milestones
- Two-stage development process
 - Meeting in October involving all WGs
 - Industry Workshop in December
- MYPP to guide Smart Grid R&D investments, including a planned FY10 solicitation in February 2010



Recovery Act Smart Grid Funds: \$4.5 Billion

Office of Electricity Delivery and Energy Reliability	\$ Millions
Smart Grid Investment Grant Program; ≤3 years	\$3,400
Smaller projects, \$300K-\$20M; 40% of funding	
Larger projects, \$20M-\$200M; 60% of funding	
Smart Grid Demonstrations; 3-5 years	\$615
Regional Demonstrations, up to \$100M per project	
Grid-scale Energy Storage Demonstrations	
Interoperability Framework Development by NIST	\$10
Resource Assessment and Interconnection-Level Transmission Analysis and Planning	\$60
State Electricity Regulators Assistance	\$46
Enhancing State Government Energy Assurance Capabilities and Planning for Smart Grid Resiliency	\$39.5
Local Energy Assurance Planning (LEAP) Initiative	\$10.5



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: www.oe.energy.gov/smartgrid.htm

Systems Integration:

www1.eere.energy.gov/solar/systems_integration_program.html