DOE Programs Addressing PV Integration into Utility Planning & Operations

Presentation at:

Utility-Scale PV Variability Workshop

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Smart Grid Research & Development

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PV Integration – A Collaborative Area between EERE/OE

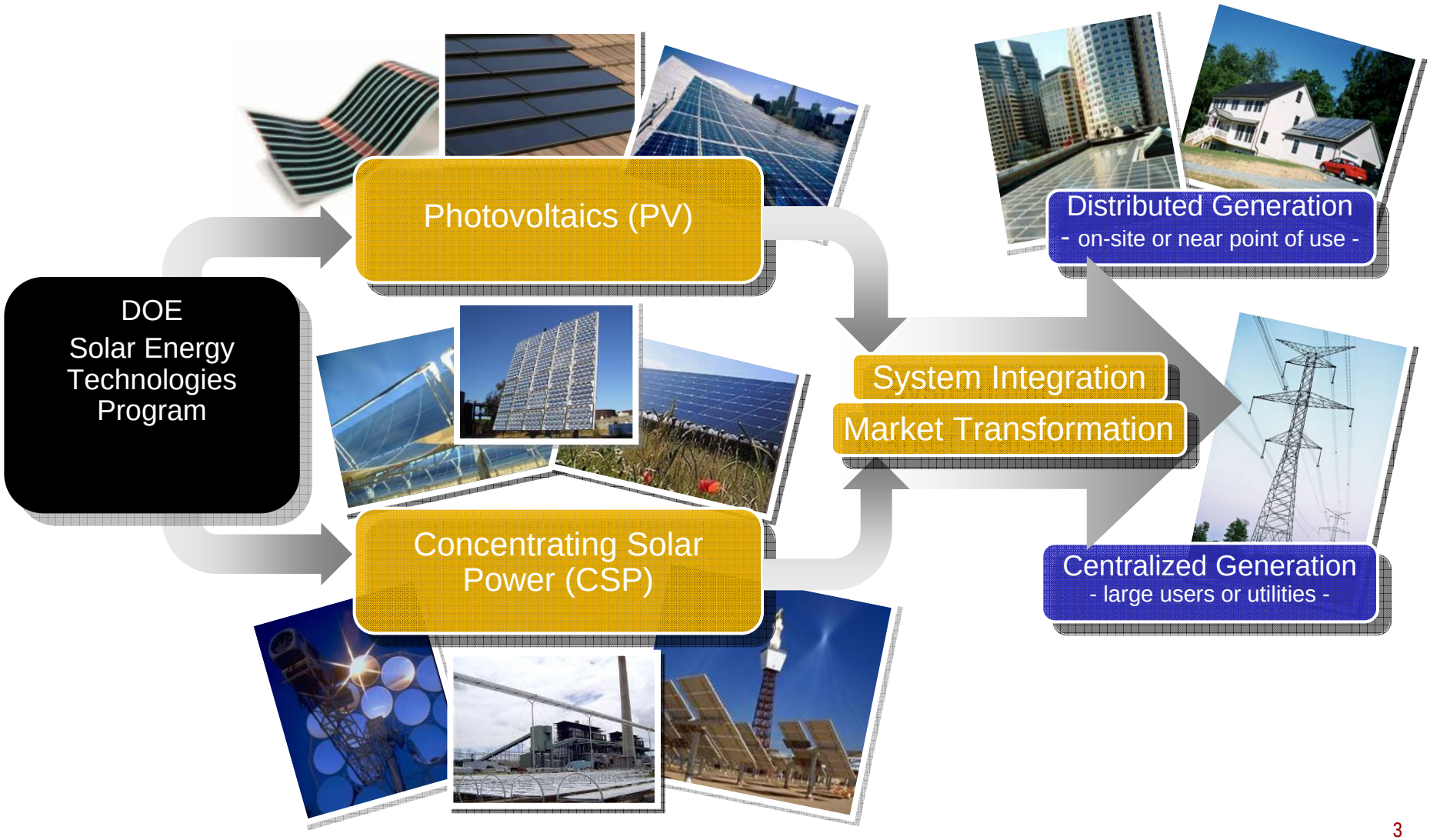
U.S. DEPARTMENT OF ENERGY | Electricity Delivery & Energy Reliability

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

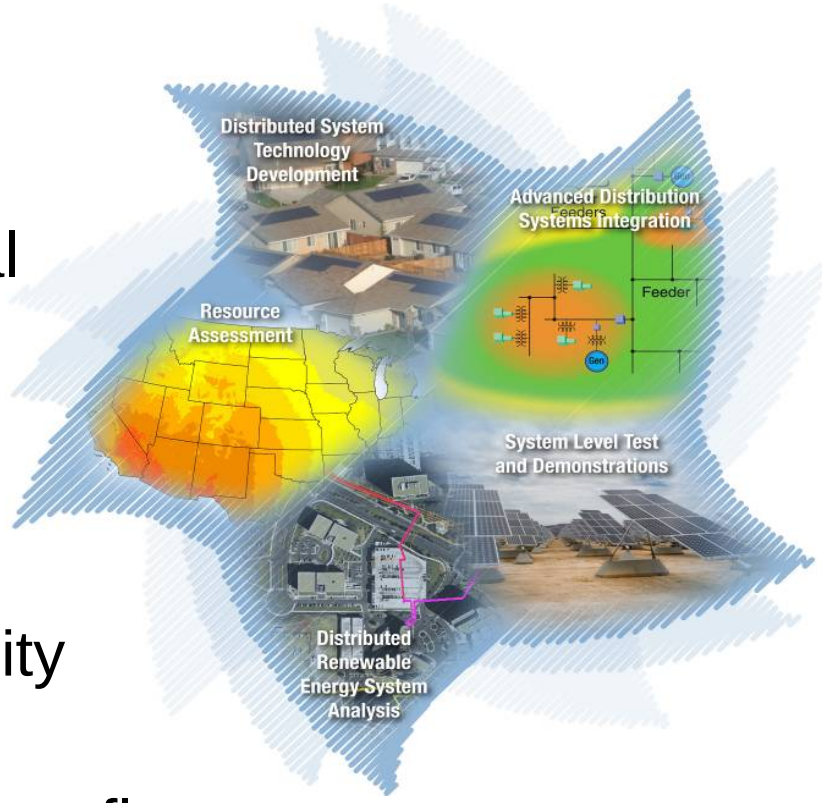
The Program is implementing four key activities to reduce technology cost and achieve high market penetration



Challenges: System Integration

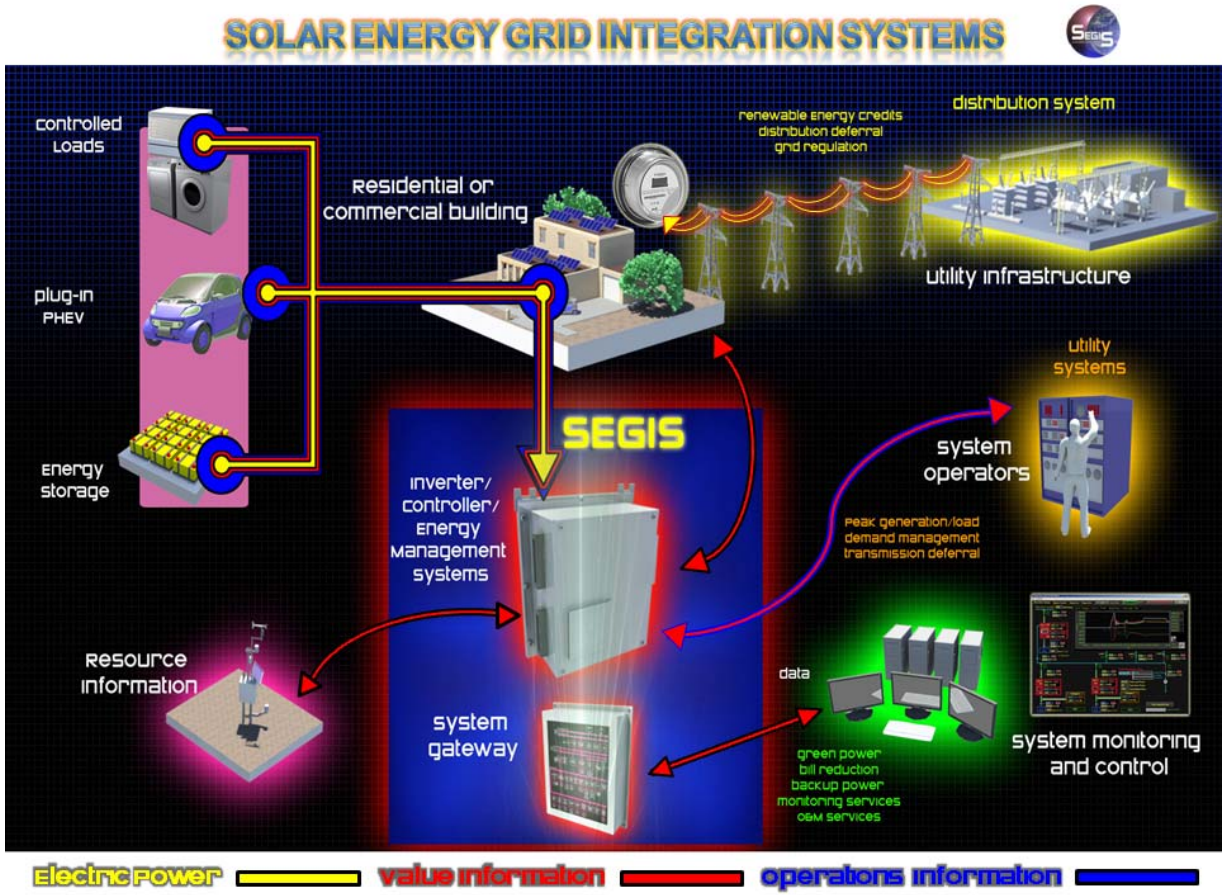
High-penetration solar electricity into the grid affected by variability of solar resources & outdated electric delivery infrastructure

- 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



Addressing System Integration Challenges

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



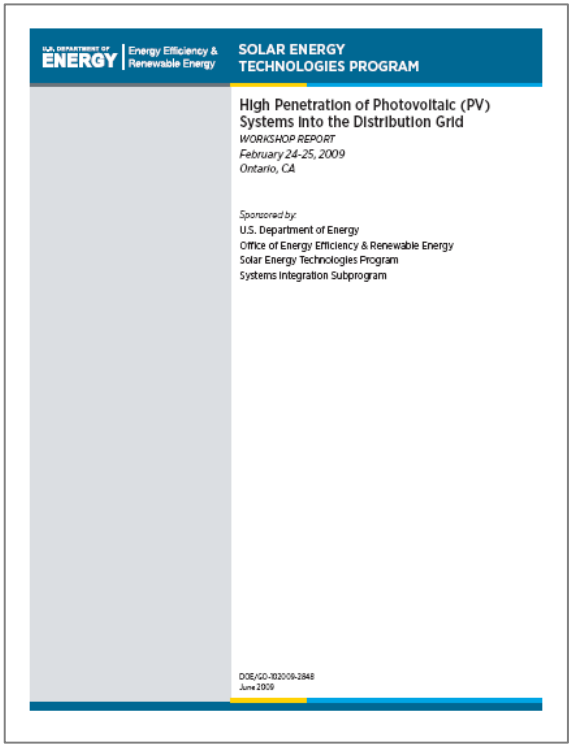
Addresses integration application needs for:

- ✓Communication portals
- ✓micro-grids
- ✓demand response
- ✓zero-energy buildings
- ✓PHEV integration
- ✓PV system sizes, <1kW to >100kW

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

- Corporate Business Operations

Research & Development (R&D)*

- Clean Energy Transmission and Reliability
- Smart Grid Research and Development
- Energy Storage
- Cyber Security for Energy Delivery Systems

Permitting, Siting, & Analysis (PSA)

- Modeling and Analysis
- Electric Markets Technical Assistance
- Electricity Exports/ Presidential Permits
- Power Marketing Administration Liaison

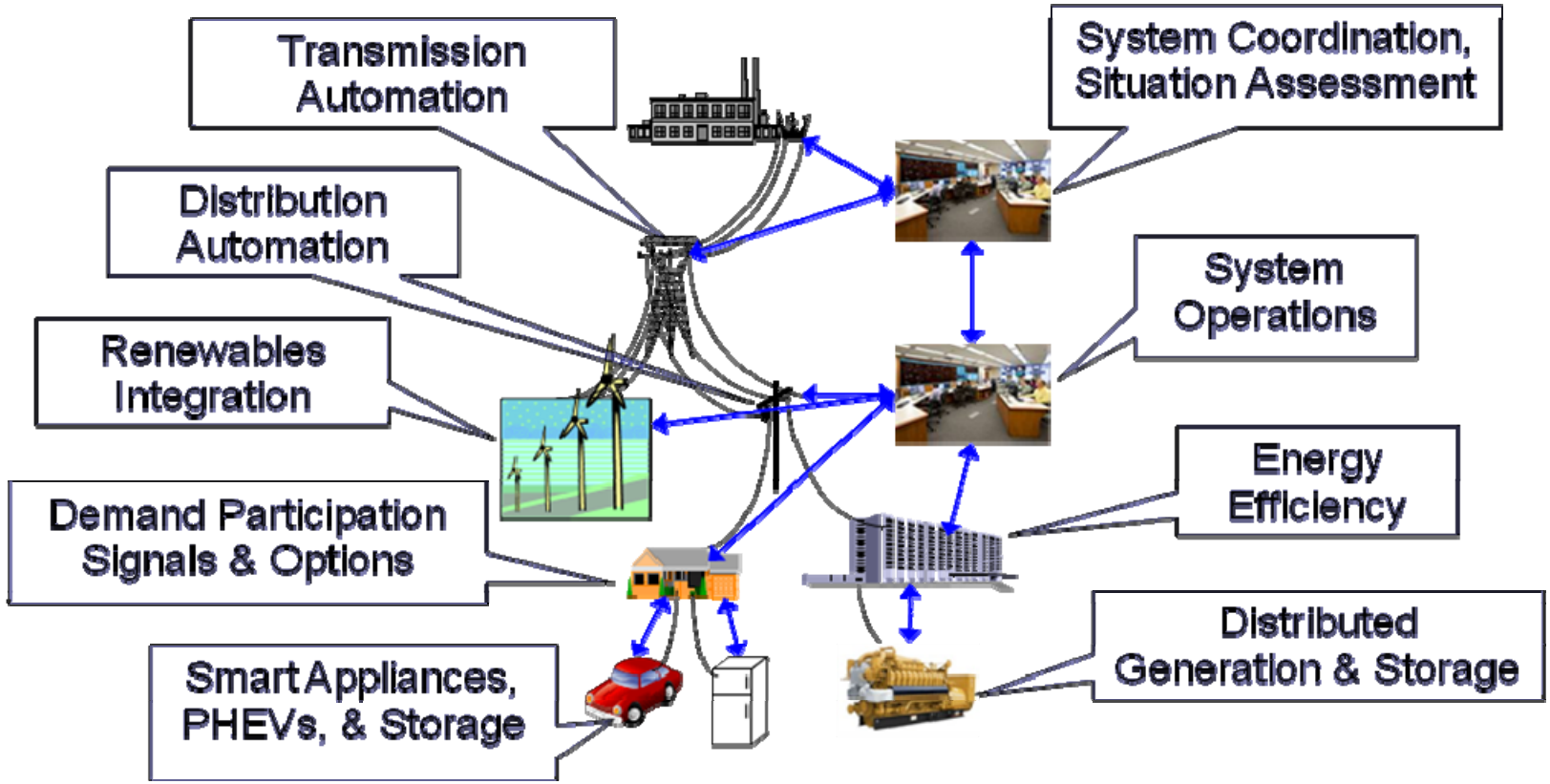
Infrastructure Security & Emergency Response (ISER)

- Energy Infrastructure Protection
- State/Local Gov't Partnerships
- Training and Exercises
- Visualization
- Critical/Vulnerability Assessment
- Emergency response support

** 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

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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