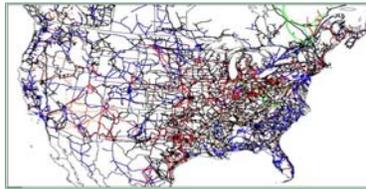




*Leading the Modernization of the Electricity Grid through
Transformational Research and Partnerships*



Clean Energy Transmission and Reliability (CETR)

Substantial expansion of renewable power presents the Nation's electric sector with two major challenges: judicious expansion of the Nation's transmission infrastructure; and integration of variable renewable generation into the routine operation of the power system.

CETR addresses the strong need for additional transmission capacity by supporting activities in next-generation technologies that reduce the need for new rights-of-way; and prepares for potentially dramatic changes in the way the system is planned and operated by enhancing understanding of power system interactions and market behavior, and improving situational awareness and operator response.

FY 2010 Key Activities

- Advanced models and visualization tools using wide area, time-synchronized system data
- Enhanced analysis capabilities from transmission-level sensor (phasor) networks
- Algorithm development and computational research for real-time power system analysis
- Property improvements for High Temperature Superconductivity "2G" wires and cables
- HTS direct current cable configuration studies





Smart Grid Research and Development (SG R&D)

SG R&D supports grid modernization through research projects to allow interoperability of advanced digital systems for measurement, monitoring, communication, and control of electricity delivery for enhanced operational intelligence; adapt and integrate distribution-level renewables and clean distributed energy, storage, and demand response resources, including end-use efficiency and plug-in electric vehicles; and optimized system performance for greater reliability, asset utilization, and environmental performance.

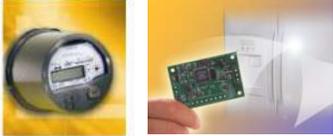
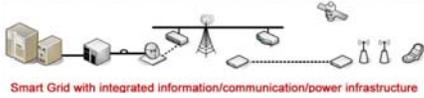
FY 2010 Key Activities

Smart Grid

- Advanced Control Methods – *SG functionality for distributed resources*
- Improved Interfaces and Decision Support - *accurate and timely human decision making at all grid levels*
- Advanced Components – *cost effective, high voltage energy conversion and flow control for fast response*
- Integrated Communications – *standards and deployment monitoring*

Grid Materials, Devices and Systems Hub

- Power Electronics
- Smart Materials - *Advanced Sensors*

Smart Grid with integrated information/communication/power infrastructure

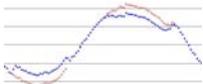


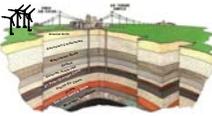
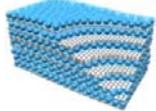
Energy Storage (ES)

ES supports grid modernization through the development and demonstration of advanced storage systems in utility-scale power applications including advanced battery, flywheel, ultra-capacitor, and compressed air systems for load leveling, voltage and VAR support, back up power, and balancing of variable renewable generation in conjunction with utilities, states, equipment manufacturers , and the Office of Science for advanced and novel concepts.

FY 2010 Key Activities

- Assessment of large-scale bulk-power storage for high penetration of variable renewable generation, e.g., compressed air energy storage (CAES)
- System design, monitoring, and evaluation of advance storage devices in bench tests and utility field tests
- Research on advanced materials for novel storage concepts with improved cycle life, reliability, and cost





Cyber Security for Energy Delivery Systems (CS-EDS)

CS-EDS supports grid modernization by engaging multidisciplinary expertise in computer science, systems engineering, cyber security, and risk analysis to assess vulnerabilities and develop proactive solutions through the National SCADA Test Bed including cyber security assessments of SCADA systems, development of tools and applications to harden control systems across the grid and enhance resiliency to cyber attack.

FY 2010 Key Activities

- Analysis of threats, vulnerabilities, and consequences
- Test bed assessments of SCADA/EMS
- Development of survivable networks, intrusion detection systems, and real-time visualization of cyber attacks
- Focused cyber security research on smart grid systems such as advanced metering infrastructure and home area networks

