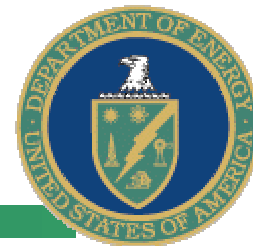


Electric Reliability: A National Priority

March 1, 2004

***Jimmy Glotfelty
Office of Electric Transmission and Distribution
U.S. Department of Energy***





Strategic Importance

“...it's clear that the power grid needs an overhaul. It needs to be modernized... we want the most modern electricity grid for our people... we need more investment; we need research and development...”

President George W. Bush
September 2003



“When the lights go out, modern life as we know it grinds to a sudden halt... communications fail, water systems shut down, factory work is disrupted, food spoils, businesses lose money...”

Spencer Abraham
September 2003



August 14th Blackout *By-The-Numbers*

1 Canadian Province
3 deaths
8 U.S. states
12 airports closed
23 cases of looting in Ottawa
250+ power plants
9,266 square miles
61,800 MW of power lost
1.5 million Cleveland residents without water
50 million people affected
\$4.5-10 billion in economic activity lost

U.S.-Canada Power System Outage Task Force



- Interim Report released
November 18, 2003
- Final Report to be
released in March 2004
- Recommendations
 - Technical
 - Policy

U.S.-Canada Power System Outage Task Force

Interim Report:
Causes of the
August 14th Blackout
in the
United States and Canada



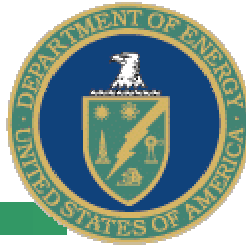
Canada

November 2003



Initial Blackout Responses

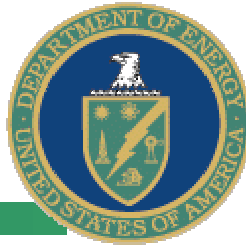
- **October 10, 2003 - NERC's Board of Trustees issued letter for near-term actions to protect reliability**
- **December 24, 2003 - FERC directed FirstEnergy to implement remedial actions by June 30, 2004**
- **February 10, 2004 - NERC issued fourteen requirements**
- **MISO plan to address deficiencies in tools and procedures; new joint operating agreement with PJM**
- **Heightened general awareness by all control areas and reliability coordinators**



Further Steps Needed

Common Themes From the Blackout Meetings

- Better training for operators with special attention to emergency preparedness
- Clearer roles, responsibilities, and authorities for control areas and reliability coordinators under wide range of operating conditions
- Stronger NERC monitoring capability
- Better vegetation management
- Minimum requirements for real-time tools and operators
- Broaden use of under voltage load-shedding



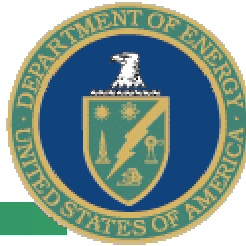
Potential Policy Actions

- Enact comprehensive energy legislation that requires mandatory reliability standards
- Establish a mechanism for funding NERC or a future reliability organization and the regional reliability councils that are independent of the entities they oversee
- Clarify that prudent expenditures and investments to maintain or improve reliability will be recoverable through transmission rates

Potential Policy Actions (cont.)



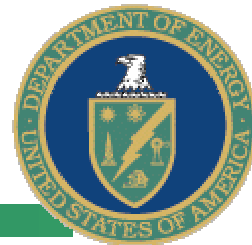
- **Require all entities operating as part of the bulk power system to be members of the regional reliability council(s) for the region in which they operate**
- **Develop accountability measures for NERC and its Board**
- **Ensure that the highest levels of corporate governance support and sign off on reliability plans and audits**



Policy Considerations

A Few of the Key Issues

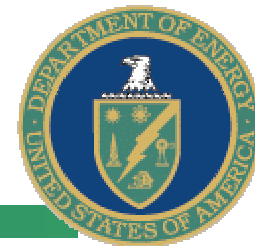
- **Load Shedding**
 - Policies needed?
 - If so, what, when, and why
 - Is the system ready?
- **Operator Training**
 - Policies needed?
 - Who is responsible?
 - What simulators are best?



U.S. DOE Actions

- **National Interest Transmission Bottleneck Rulemaking**
- **Demand Response Initiatives (various regions)**
- **Regional Planning Exercise**
- **Technology Testing – WAPA/BPA**
- **Eastern Interconnection Phasor Project**

Legislation - Electricity Title



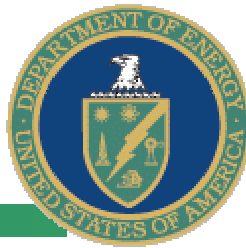
- **Mandatory Reliability**
- **Incentive Rates for Transmission**
- **Transmission Siting/Corridors**
- **Transmission and other Tax Incentives**
- **R&D Authorization Title**
- **PUHCA Repeal**

Creates Industry Certainty



Next Steps

- **Clarify state and federal jurisdictions**
 - We must work together, but how?
- **Improve reliability infrastructure**
 - Refine auditing and monitoring process at NERC
- **Determine what information should be made public**
- **Continue developing international relationships**
- **Encourage investments in new infrastructure**
- **Determine how markets and reliability can work together**

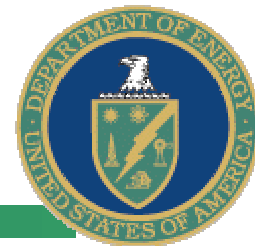


Conclusions

“Consumers and businesses need reliable supplies of energy to make our economy run -- so I urge you to pass legislation to modernize our electricity system, promote conservation, and make America less dependent on foreign sources of energy”.



**State-of-the-Union Address
January 20, 2004**



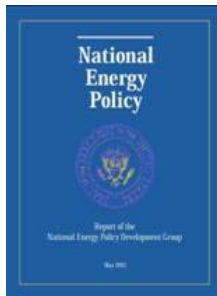
Back-ups

Leadership from all Levels

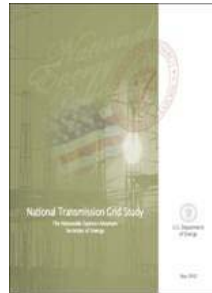


“...It is a plan to modernize our electricity delivery system. It is a plan which is needed now. It is needed for economic security. It is needed for national security...”

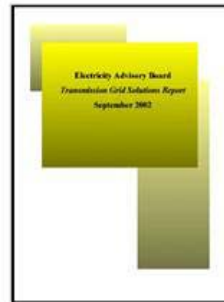
George W. Bush February 2003



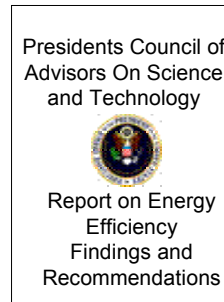
May 2001



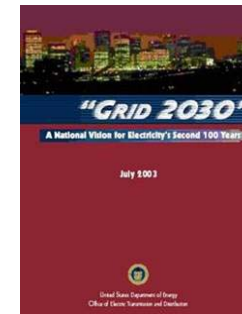
May 2002



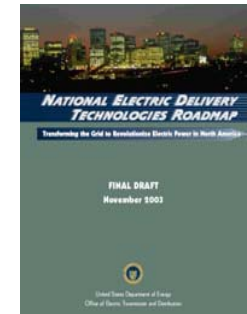
Sept 2002



April 2003



July 2003

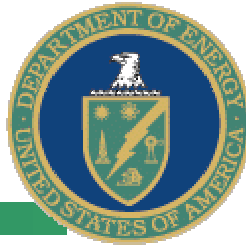


Jan 2004

“We will work to unleash innovation and strengthen our markets to allow entrepreneurs to develop a more advanced and robust transmission system that meets growing energy demand in the years ahead.”

Spencer Abraham May 2002

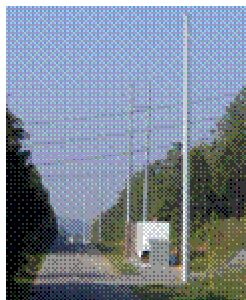
Office of Electric Transmission and Distribution



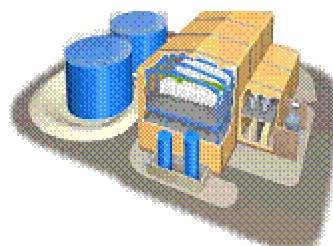
Mission

To lead a national effort to help modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security

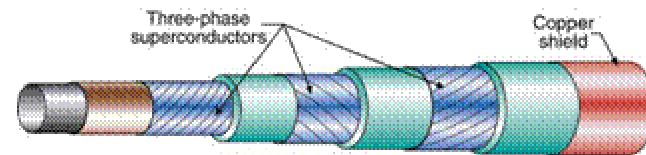
Portfolio of RD&D



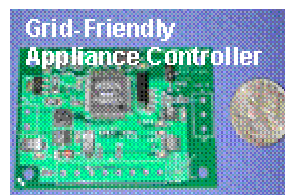
**Advanced
Conductors**



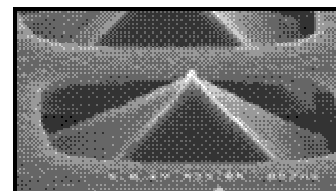
**Novel storage
concept**



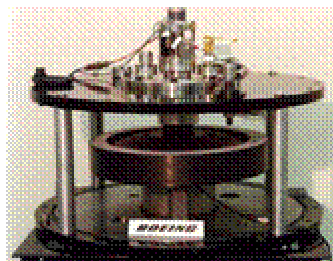
HTS tape to HTS cable



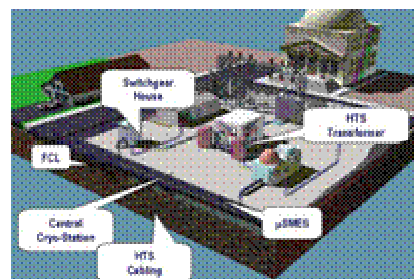
**Grid-Friendly
Appliance Controller**



**Diamond
Sensor**

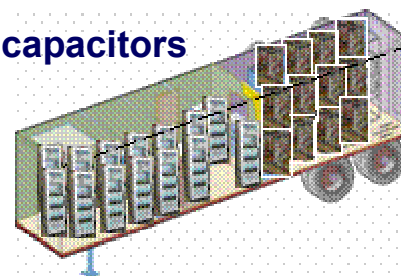


**2kWh Superconductor
Flywheel Demonstrator**



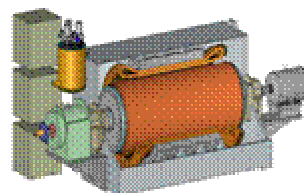
**Superconducting
Substation**

Ultra capacitors

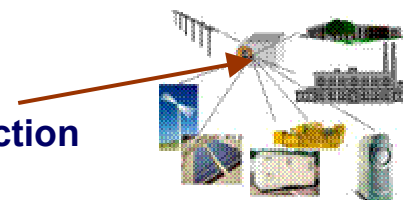


**ETO DC to AC
inverters**

**Supervar
System**



**Interconnection
Device**



National Reliability Challenges

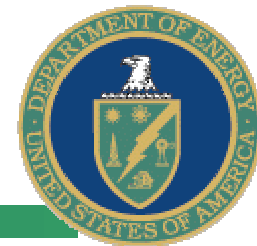


- **Prevention** – keep problems from occurring
- **Detection** – ready for immediate action
- **Response** – proper “tool kits” for any contingency
- **Modernization** – “next generation” of grid

technologies

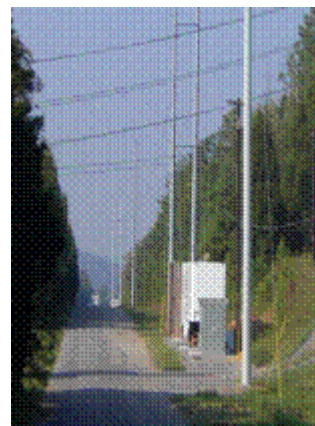
Prevention

Stop reliability problems from occurring in the first place



Technologies for Today

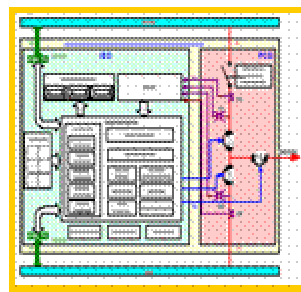
- **Advanced conductors and tower designs**
- **Modeling and system planning tools**
- **Communications**
- **Training**



Composite Core Conductors



Communications Systems



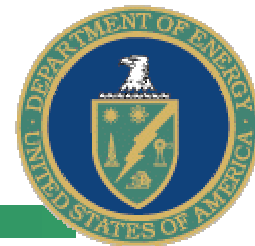
Modeling and Simulation Packages



Training Seminars

Detection

*Improve grid operator readiness
for taking action immediately*



■ Monitoring Systems

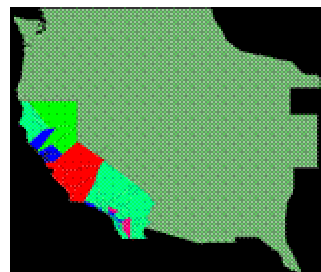
- Frequencies
- Voltages
- VARs
- Phasors
- Line Sag

■ Data Acquisition

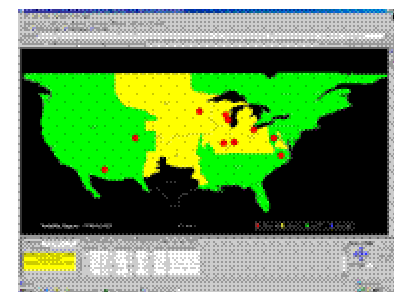
■ Visualization Tools

■ Communications

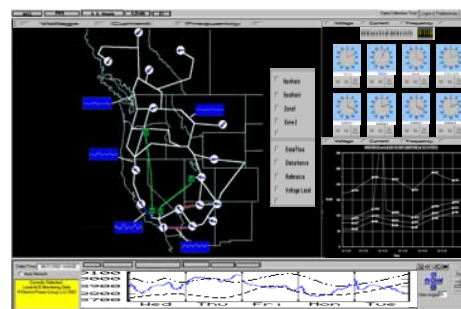
■ Training



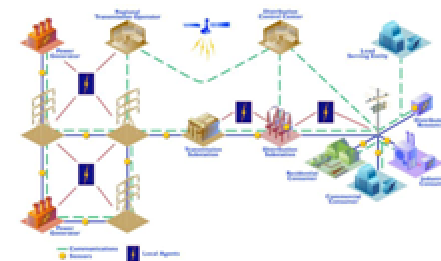
Voltage and VAR
Monitoring



ACE Frequency Monitoring



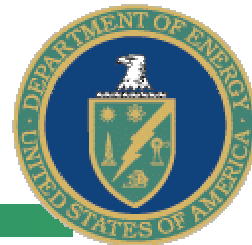
Synchronized Phasor
Applications



Distributed Sensing and Controls
Systems

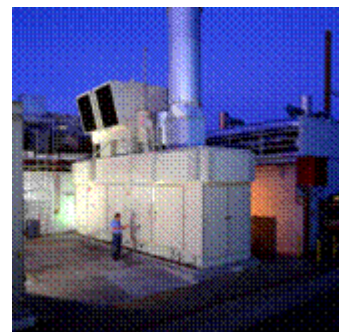
Response

Equip operators with a portfolio of resources comprising the best available tools and techniques



Technologies for Today

- **Distributed Generation**
- **Energy Storage Systems**
- **Demand Response**
- **Communications**



Industrial Gas Turbines



Aggregated Water Pumping Loads



Zinc-Bromine Battery System



Smart Thermostat



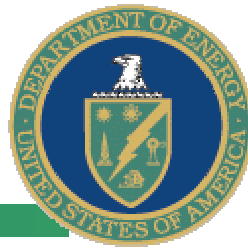
Reciprocating Engine Gen Sets



Microturbines

Modernization

*“Next generation” technologies
for meeting future needs*



Technologies for Tomorrow

■ “GridWorks” Technologies

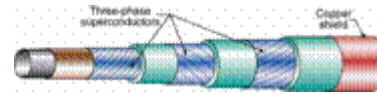
- High temperature superconducting devices
- Cables
- Transformers
- Motors
- Fault current limiters

■ “GridWise” Technologies

- Distributed intelligence
- Distributed energy
- Distributed communications and controls

■ Advanced Materials

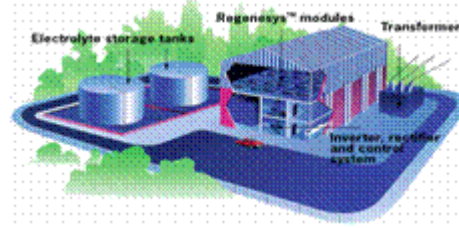
■ Power Electronics



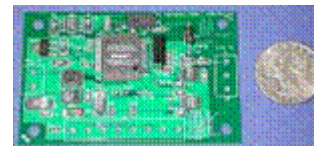
Superconducting Cable



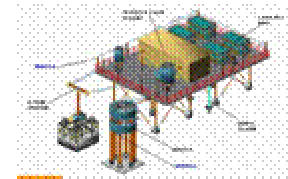
Superconducting Transformer



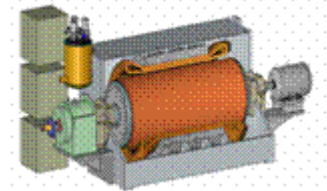
Advanced Energy Storage



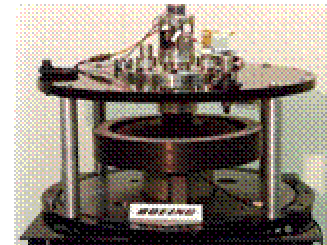
Grid-Friendly Appliance Controller



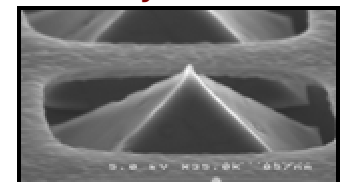
Fault current limiter



SuperVAR System

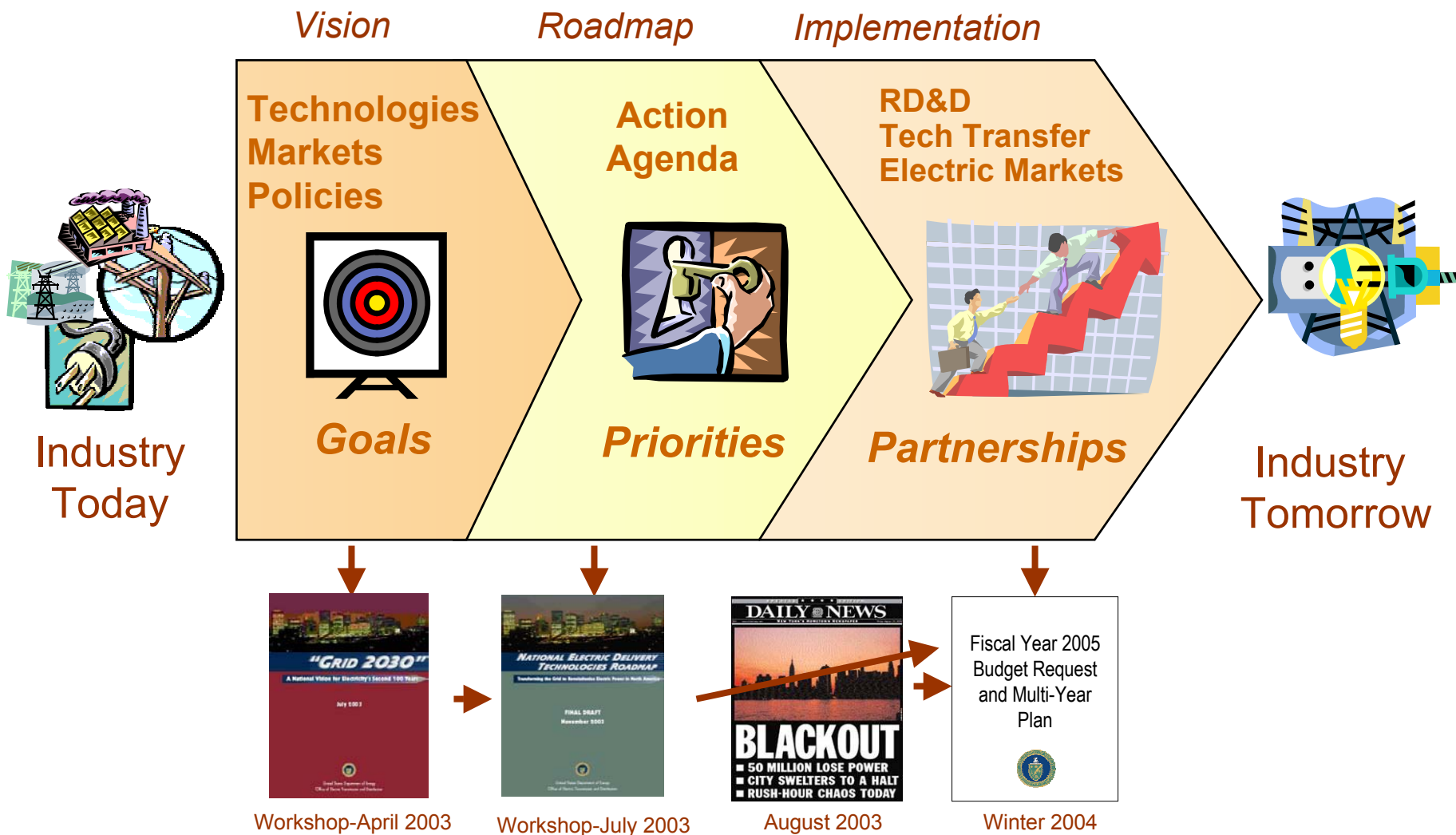
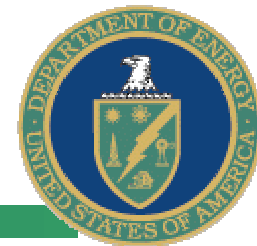


Superconducting Flywheel

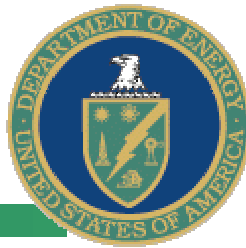


Diamond Devices

National Electric Vision and Technology Roadmap



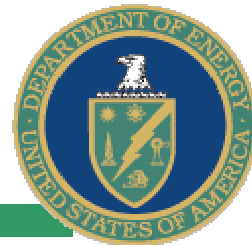
The Vision ... “Grid 2030”



Grid 2030 energizes a competitive North American marketplace for electricity. It connects everyone to abundant, affordable, clean, efficient, and reliable electric power anytime, anywhere. It provides the best and most secure electric services available in the world.



Electric Delivery Technologies Roadmap



An Action Agenda for Turning the Vision into Reality

Design "Grid 2030" Architecture

Conceptual framework that guides development of the electric system from transmission to end-use

Develop Critical Technologies

Advanced conductors, electric storage, high-temperature superconductors, distributed energy, distributed intelligence/smart controls, and power electronics that become building blocks for "Grid 2030"

Accelerate Technology Acceptance

Field testing and demonstrations that move the advanced technologies from the laboratory and into the "tool kit" of transmission and distribution system planners and operators

Strengthen Market Operations

Assessing markets, planning, and operations; improving siting and permitting; and addressing regulatory barriers bring greater certainty and lower financial risks to electric transactions and investment

Build Partnerships

Leveraging stakeholder involvement through multi-year, public-private partnerships; working with States to address shared concerns