Transforming the Grid to Revolutionize Electric Power in North America

March 23, 2004

Bill Parks
Office of Electric Transmission and Distribution
U.S. Department of Energy

Electricity and the Economy

"If the energy structure of this country is inadequate or in some way excessively costly, it will undermine economic growth, and is therefore a major issue that must be addressed."

Alan Greenspan
Chairman, Federal Reserve Board
January 25, 2001

August 14th Blackout

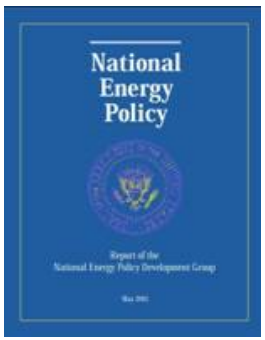
By-The-Numbers

- 1 Canadian Provinces
- 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
- $5-12 billion in economic activity lost

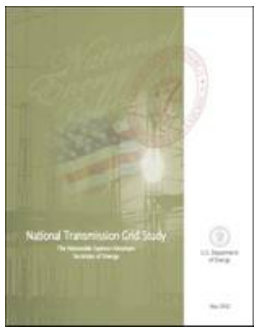
Leadership from all Levels

"…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 6, 2003



May 2001



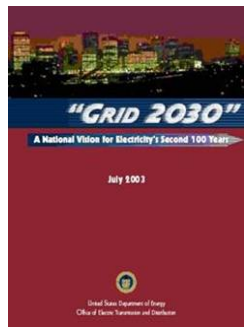
May 2002

Sept 2002

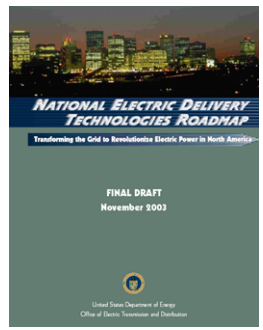
Presidents Council of Advisors On Science and Technology

Report on Energy Efficiency Findings and Recommendations

April 2003



July 2003



January 2004

"When the lights go out, modern life as we know it grinds to a sudden halt. Transportation is interrupted, communications fail, water systems shut down, factory work is disrupted, food spoils, businesses lose money, and people are inconvenienced and even endangered. "

Spencer Abraham, September 3, 2003

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

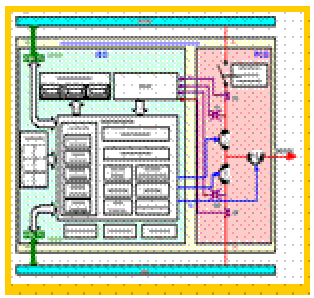
Stop reliability problems from occurring in the first place

Technologies for Today

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

Composite Core Conductors

Communications Systems



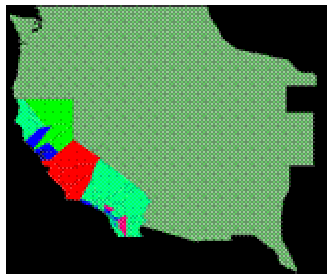
Modeling and Simulation Packages

Training Seminars

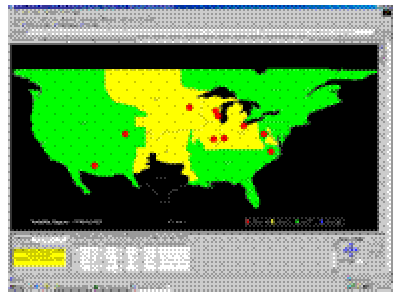
Detection

Improve grid operator readiness for taking action immediately

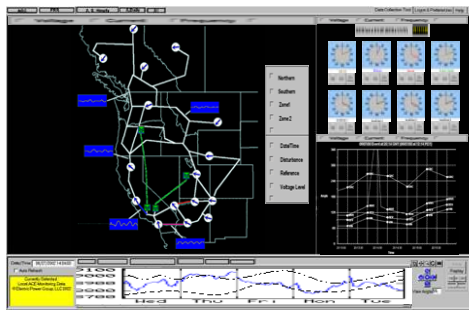
- **Monitoring Systems**
  - **Frequencies**
  - **Voltages**
  - **VARs**
  - **Phasors**
  - **Line Sag**
- **Data Acquisition**
- **Visualization Tools**
- **Communications**
- **Training**



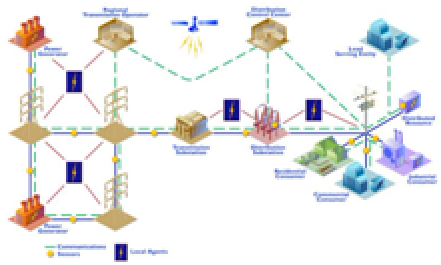
Voltage and VAR Monitoring



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

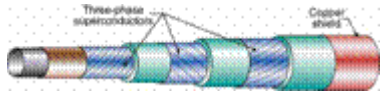
Microturbines

Modernization

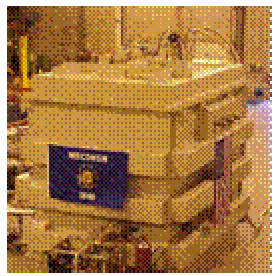
"Next generation" technologies for meeting future needs

Technologies for Tomorrow

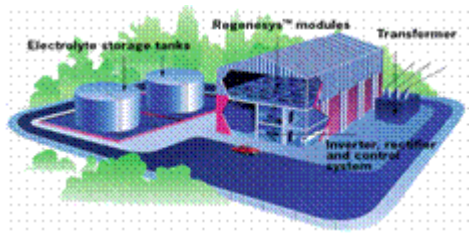
- **"GridWorks" Technologies**
  - **High temperature superconducting devices**
  - **Cables**
  - **Transformers**
  - **Motors**
  - **Fault current limiters**
- **"GridWise" Technologies**
  - **Distributed intelligence**
  - **Distributed energy**
  - **Distributed communications and controls**
- **Advanced Materials**
- **Power Electronics**



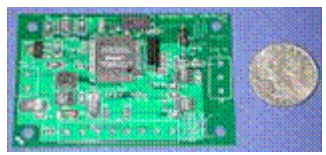
Superconducting Cable



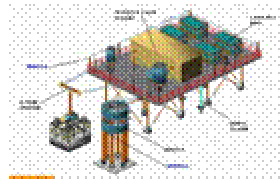
Superconducting Transformer



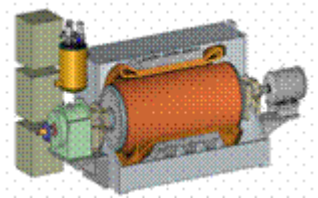
Advanced Energy Storage



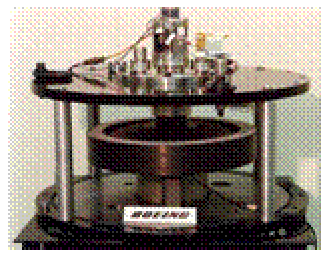
Grid-Friendly Appliance Controller



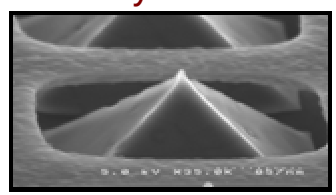
Fault current limiter



SuperVAR System



Superconducting Flywheel



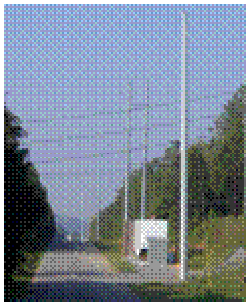
Diamond Devices

Office of Electric Transmission and Distribution

Mission

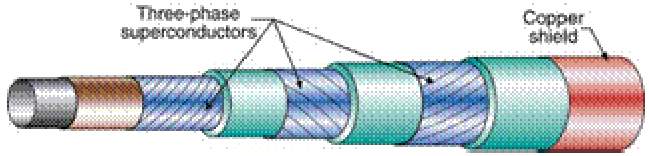
To lead a national effort to help modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security

Portfolio of RD&D

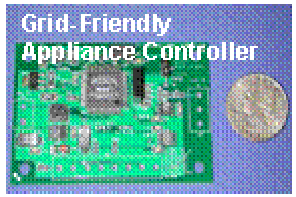


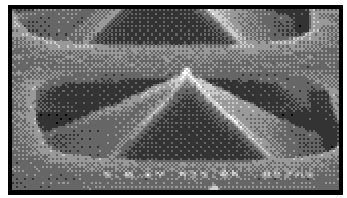
Advanced Conductors

Novel storage concept

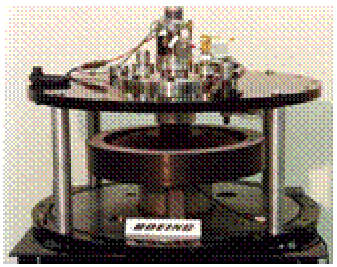


HTS tape to HTS cable

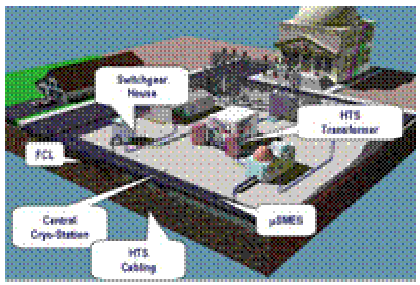




Diamond Sensor

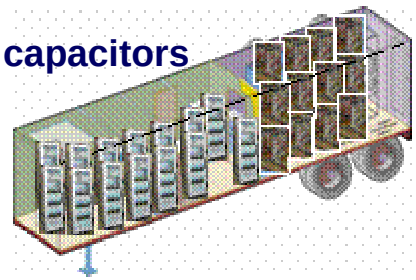


2kWh Superconductor Flywheel Demonstrator



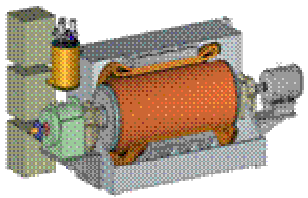
Superconducting Substation

Ultra capacitors

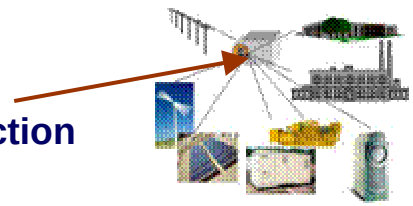


ETO DC to AC inverters

Supervar System



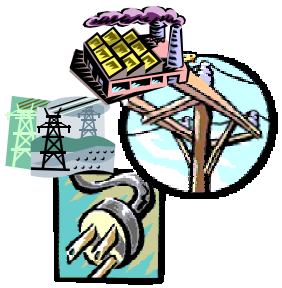
Interconnection Device



Additional 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**

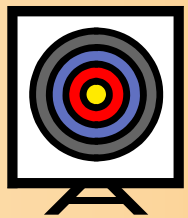
National Electric Vision and Technology Roadmap



Industry Today

Vision

Technologies
Markets
Policies



Goals

Roadmap

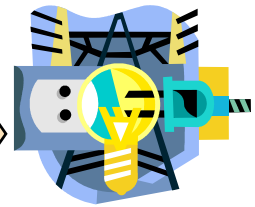
Action Agenda

Priorities

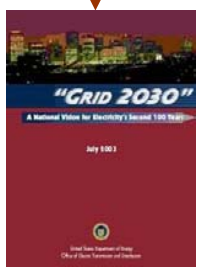
Implementation

RD&D
Tech Transfer
Electric Markets

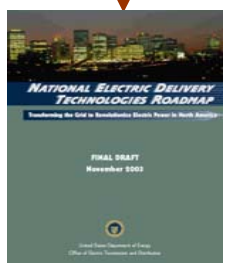
Partnerships



Industry Tomorrow



Workshop-April 2003



Workshop-July 2003

August 2003

Fiscal Year 2005 Budget Request and Multi-Year Plan

Fall 2003

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 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

Public Private Partnerships

Companies

- **TVA, AEP, SCE, Con Ed, DTE**

Suppliers

- **GE, Boeing, American Superconductor, IBM,**

Groups

- **Utility working Group (Navigant-1 project FY04 tbd)**
- **Gateway group(1 project FY04)**
- **CEIDS (steering committee, FY03 funds)**
- **NRECA (co-sharing R&D objectives)**

States

- **Leverage funds with CA, NY, others**
- **Policy papers with NCSL, NGA, NASEO, NARUC**

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