NAESB 3rd Annual Meeting

US DOE Perspectives on Standardization in Electric Power Delivery

Eric Lightner
Office of Electric Transmission and Distribution
September 14, 2004






Electric Power Delivery is Strategically Important

"...it's clear that the power grid needs an overhaul. It needs to be modernized. As we go into an exciting new period of American history, we want the most modern electricity grid for our people... we need more investment; we need research and development..."

President Bush
September 2003

"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. "

Secretary Abraham
April 2004

August 14th 2003 Blackout

By-The-Numbers

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

Selected Reliability Events - 2004

*Recent LBNL study estimates annual U.S. costs from outages to range from $24 to $85 Billion

Office of Electric Transmission and Distribution

Mission

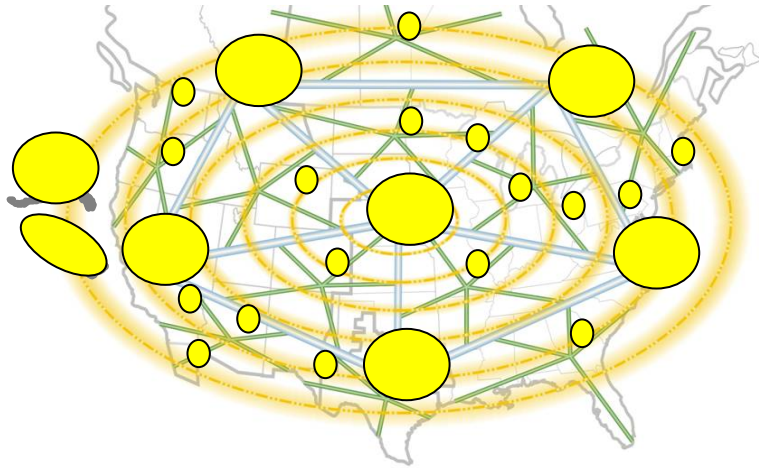
"To lead a national effort to help modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security"

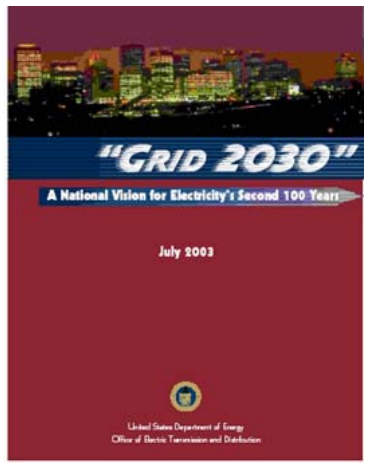
"Grid 2030" – A Vision for the Future

Imagine the Possibilities...

- Electricity is ultra-reliable and affordable
- A self-correcting power grid, resilient to terrorist sabotage
- A national energy superhighway
- Consumer participation in a more reliable system
- Near-zero economic losses from power outages and power quality disturbances

"Grid 2030"





July 2003

Electric Delivery Technologies Roadmap

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

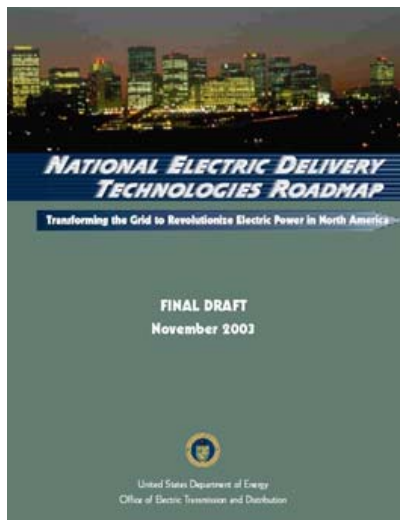
Strengthen Market Operations

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

An *Action Agenda* for Turning the Vision into Reality



January 2004

OETD - Organization

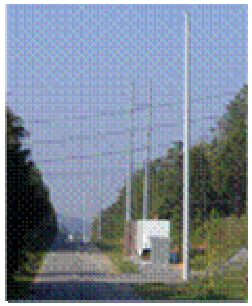
Electric Systems RD&D

- **Superconductivity**
- **Transmission Systems**
- **Distribution and Integration**
- **Electricity Storage**
- **GridWorks**
- **GridWise**

Electric Power Systems Operations and Analysis

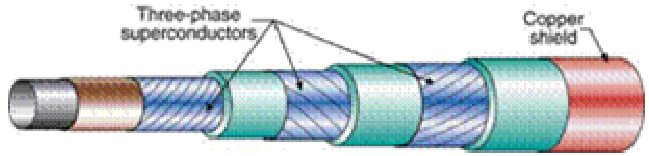
- **Electricity Policy Modeling and Analysis**
- **Electricity Markets Technical Assistance**
- **Presidential Permits for Electricity Exports**
- **Power Marketing Administration Liaison**

Portfolio of Technologies

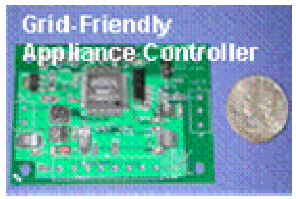


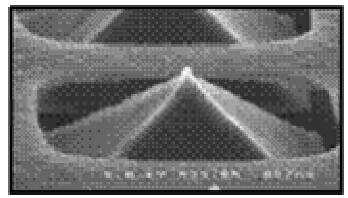
Advanced Conductors

Novel storage concept

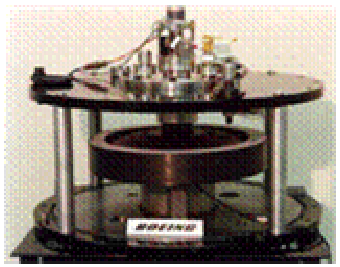


HTS tape to HTS cable

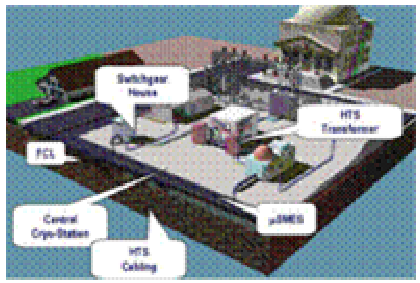




Diamond Sensor

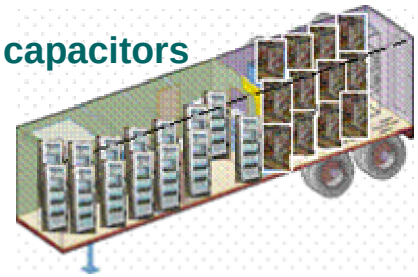


2kWh Superconductor Flywheel Demonstrator



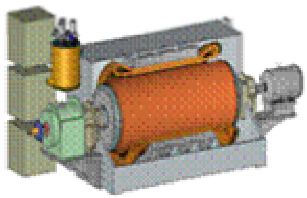
Superconducting Substation

Ultra capacitors

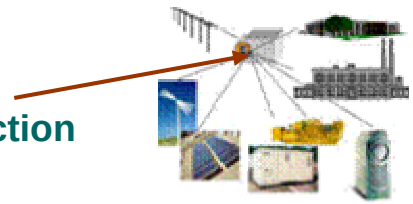


ETO DC to AC inverters

Supervar System



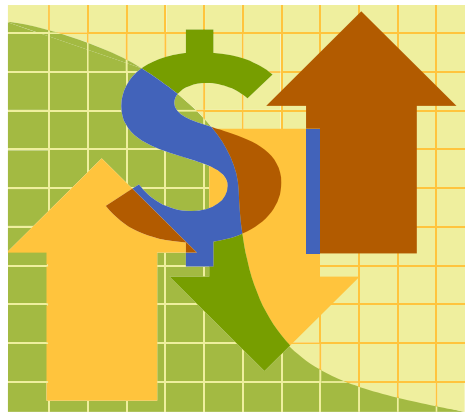
Interconnection Device



Analysis Activities

Recent Studies

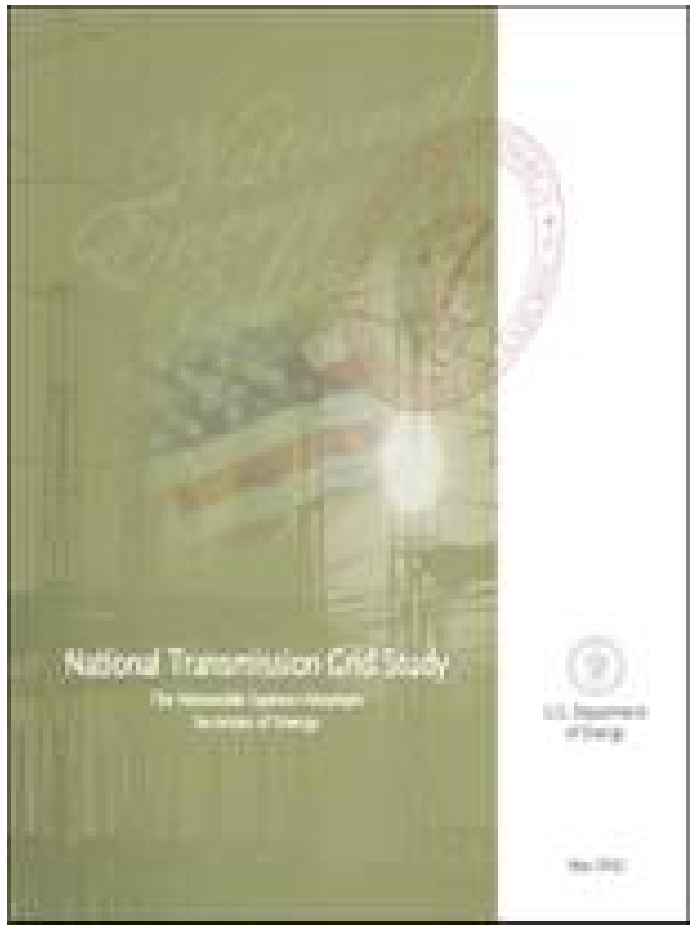
- August 14, 2003 Blackout Reports
- Costs of Power Outages and Power Quality Disturbances
- U.S. Transmission Capacity – Present Status and Future Prospects
- Customer Response to Real Time Pricing
- Economic Benefits of GridWise Vision
- Economic Benefits of HTS in Selected Locations



National Interest Electric Transmission Bottlenecks

Objective: Identify and facilitate mitigation of critical bottlenecks

- **Public Meeting in Salt Lake City Utah July 14, 2004 Following NARUC Summer Meeting**
- **Federal Register Notice – Comments Due 9/20/04**



www.electricity.doe.gov/bottlenecks

Electric Delivery Standards Development

General considerations underlying the U.S. DOE approach

- **Industry leadership…but collaborative process**
  - **State and local agencies**
  - **Federal role – catalyst and technical assistance**
- **Outcome-based, not prescriptive**
  - **Avoid "picking winners" too soon**
  - **Standards should unleash, not stifle innovation**
- **International implications**
  - **Canada and Mexico are part of the U.S. grid**
  - **Avoid impeding ability of U.S. manufacturers to compete abroad**

Standards Activities

Development of IEEE 1547 Series of Standands

- **Development of UL Standard 1741 for the Interconnection of Distributed Generation**
- **Certification Laboratory Pilot, Accreditation Plan, and Interconnection Agreement Handbook**
- **GridWise Standards Mapping**
- **IEEE 1547 Adoption in PJM**

Interconnecting Distributed Resources with Electric Power Systems

Approved June 2003

Ongoing R&D Supporting Interconnection Standards

- Interconnection Standards Development, NREL
- Development of a UL Standard for the Interconnection of DG, UL

1547 Standard (2003) for Interconnecting Distributed Resources with Electric Power Systems

Guide for Networks

Guide for Impacts

P1547.3
Draft Guide for Monitoring, **Information Exchange and Control** of DR Interconnected with EPS

P1547.4
Guide for DR **Islanding Systems**

Guide for Interconnection System Certification

P1547.2
Draft **Application Guide** for IEEE P1547 Draft Standard for Interconnecting Distributed Resources with Electric Power Systems

P1547.1
Draft Standard for Conformance **Test Procedures** for Equipment Interconnecting Distributed Resources with Electric Power Systems

DP Specifications and Performance

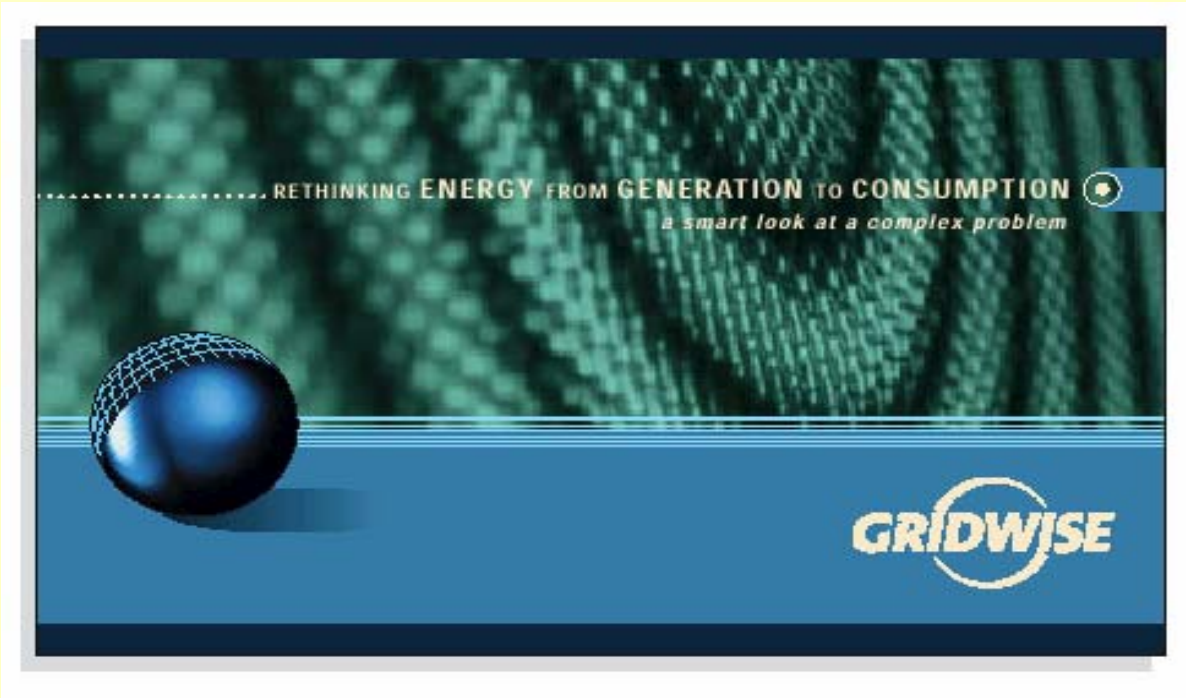
This schematic identifies existing standards development projects and activities under discussion by P1547 Work Group members.

Projected Activities

- Transmission Bottlenecks **– Metrics for identifying congested corridors across the U.S.**
- GridWise Architecture **– Common platforms, protocols, and design features for incorporating IT and open architectures**
- Grid Operator Tools **– Shared networks and common formats for exchange of real time data on system conditions**
- Demand Response **– Regional program designs and product offerings through ISOs and RTOs**

Apply advances in information / communication / control technologies to transform the electric system into a smart automatic network, with grid / market / customer price transparency

- Public/private partnership through GridWise Alliance



Ongoing R&D Supporting Architecture and Standards

- **GridWise Architecture and Standards, PNNL**
  - Architecture Board assembled to align structural framework and communication standards for interoperability

Ron Ambrosio
Manager, IBM T.J. Watson Research Center

Jay Britton
Principal Architect, AREVA-T&D Corporation

David Cohen
Acting CEO and CTO, Infotility

Rik Drummond
CEO, Chief Scientist, Drummond Group Inc.

Albert Esser
CTO, VP Technology, Emerson Network Power

Erich Gunther
CTO, EnerNex Corporation

Stephanie Hamilton
DER Manager, Southern California Edison (SCE)

Larsh Johnson
President, CTO, eMeter Corporation

Jack McGowan
President, Energy Control Inc.

Vito Stagliano
VP, Transmission Policy, Calpine Corporation

Wade Troxell
Associate Professor, Colorado State University

Eric Wong
Manager, Bus Dev & Govt' Relations, Cummins Inc.

Vacant seat
(to be filled)

Ways to Work Together

- National Interest Electric Transmission Bottlenecks process
- Integration of IT into grid planning and operations at both transmission and distribution levels
- Harmonize business rules with states and across regions
- Facilitate evolution of regional bodies for coordination and cooperation among states (RSC,s and MSEs)

OETD Partnerships

Utilities

- AEP, SCE, Con Ed, DTE, Southern
- NYISO, ISO-NE, PJM, MISO, CAISO, IMO
- TVA, BPA, WAPA
- Others

Suppliers

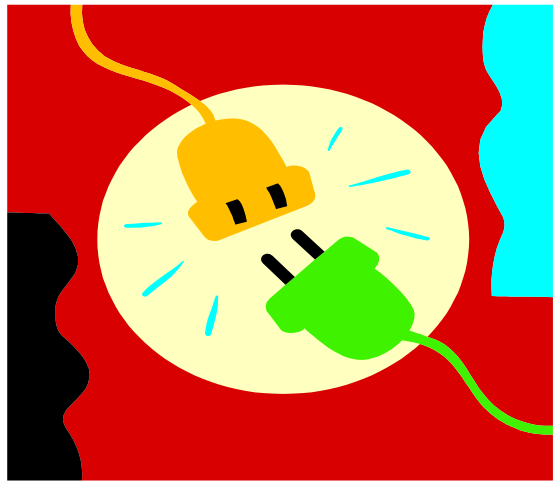
- GE, Boeing, American Superconductor, IBM, others

Groups

- CERTS
- GridWise Alliance
- NRECA
- CEIDS
- NERC
- EEI, others

States

- NYSERDA, CEC, others
- NARUC, NCSL, NGA, NASEO, others



We can't do it alone…

Making connections with partners is crucial for success

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

OETD Resources

http://electricity.doe.gov

- OETD Program
- National Electric Vision and Roadmap – go to "About the Office"

http://www.pi.energy.gov

- National Energy Policy

http://www.ntgs.doe.gov

- National Transmission Grid Study