U.S. Department of Energy

Office of Electricity Delivery & Energy Reliability

Transmission Reliability Program

Overview

The Transmission Reliability Program was established by Congress in 1999 to support a national laboratory/electricity industry partnership to conduct research on the reliability of the nation's electricity delivery infrastructure during the transition from regulated markets to competitive markets under restructuring. Competition and market forces are creating an exponential increase in the volume of power transactions and causing the grid to be used in ways for which it was not designed. The Transmission Reliability Program is developing advanced technologies, including information technologies, software programs, and reliability/analysis tools to support grid reliability and efficient markets during this critical transition.

Program Areas

Real Time Grid Reliability Management

Real Time grid reliability management develops operational decision support tools, as well as visualization and monitoring software programs with data from Wide-Area Measurement Systems (WAMS). Work includes the following:

- In partnership with the North American Electric Reliability Council (NERC) and independent system operators (ISOs), develop tools for reliability coordinators, control areas and operating engineers that monitor, track, predict, and respond to maintain grid reliability;
- Develop advanced measurement and control technologies, and integrated security software to enable real time computation of grid status and electricity market pricing.

Load as a Resource

This activity evaluates the capability of load to respond to price signals to improve grid reliability and market efficiency. Work includes:

- Characterization of loads and assessment of technologies for communicating price signals;
- Potential of load to provide ancillary services;
- Characterization of load response as a function of time for integration into real time grid and market operations.

Reliability and Markets

Efforts within the reliability and markets area focus on developing a comprehensive set of integrated market/engineering design principles, tools, and technologies to support efficient, competitive electricity markets. Work includes:

- Modeling and simulation of market rules;
- Development of computational methods;
- Analysis of market behavior and its impact on system performance.

Reliability Technology Issues and Needs Assessment

Work in this area involves monitoring and identifying technology trends and the emerging gaps in electric system reliability. Work includes:

- Technology assessment;
- Competitive market performance;
- Grid reliability research and technology;
- Development road map;
- Development of grid reliability metrics and indicators;
- Assessment of transmission bottlenecks.

Mission

To develop technologies and policy options that will contribute to maintaining and enhancing the reliability of the nation's electric power delivery system during the transition to competitive electricity markets.

Program Areas

Activities within the Transmission Reliability Program are organized into four categories. See the box to left to read more.

Program Manager

Phil Overholt
202 | 586-8110
philip.overholt@hq.doe.gov

Program Manager Communications

Vernellia Johnson
202 | 586-7701
vernellia.johnson@hq.doe.gov

Man Working in Control Room

Success Stories

Area Control Error (ACE) – Frequency Real-Time Monitoring System

The ACE-Frequency Real-Time Monitoring System was developed by the Consortium for Electric Reliability Technology Solutions (CERTS), which conducted the research for DOE in collaboration with the North American Electric Reliability Council (NERC).

The ACE-Frequency Real-Time Monitoring System allows NERC reliability authorities to monitor compliance with rules that govern the reliable supply of electricity in real time and instantly pinpoint emerging violations. NERC will now be alerted immediately to reliability threats and will be in a position to work with operators to take corrective actions, thereby reducing the chances of costly blackouts.

The ACE-Frequency tool also increases reliability in the 14 control areas in North America by using data visualization techniques to assess compliance with rules designed to ensure reliability. The software relies on data generated every four seconds by existing SCADA systems to determine which control areas may be out of compliance and assess how to return the system to normal. The ACE-Frequency Monitoring System is part of the suite of applications being developed by CERTS using the Grid Real-Time Performance, Monitoring and Prediction Platform (Grid-3P) to monitor grid reliability and market performance in real time.

Powerline Conductor Accelerated Test (PCAT) Facility at ORNL. In foreground, from left to right, Glen McCullough, TVA Chairman; and Bill Madia, ORNL Director.

The software is now being used by the 23 NERC reliability authorities who are responsible for overseeing electricity reliability for all of North America.

A sample of the first 3M composite conductor being tested at ORNL.

Composite Conductor Testing

The Transmission Reliability Program is working with 3M, Oak Ridge National Laboratory (ORNL), and the Tennessee Valley Authority (TVA) to develop, evaluate, and test advanced high-capacity conductors.

3M is leading a team to develop a high-strength, high-temperature overhead conductor—aluminum conductor composite reinforced (ACCR). The ACCR can increase the current-carrying capacity of a transmission line by 1.5 to 3 times over that of conventional conductors now in use, without the need for tower modification or re-permitting.

In a cooperative effort, DOE, ORNL, 3M, and TVA designed and built a high-current test facility at ORNL to evaluate conductors, accessories, and sensors under accelerated conditions by cycling those to high load levels over an extended period of time. ORNL is now performing outdoor thermal testing on the ACCR conductor and its accessories to evaluate their overall sag and temperature performance compared to design specifications.

Future possible testing activities on overhead conductors include:

- testing indoors in a unique facility with a 56-foot ceiling and 1,400-foot length, and;
- testing conductors at full-system voltage (161kV) and current.

In addition, these facilities can be used for:

- configuring and testing power electronic systems for transmission system control;
- developing and testing sensors for transmission system monitoring, and;
- testing superconducting devices.