

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

CERTS (Consortium for Electric Reliability Technology Solutions): new methods, tools, and technologies to protect and enhance the reliability of the U.S. electric power system

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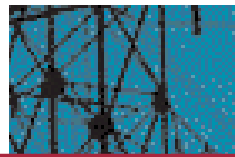
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The Consortium for Electric Reliability Technology Solutions (CERTS), a partnership among industry, national laboratories, and universities, was formed in 1999 to research, develop, and disseminate new methods, tools, and technologies to protect and enhance the reliability of the U.S. electric power system during the transition to a competitive electricity market structure. CERTS is currently conducting research for the U.S. Department of Energy and for the California Energy Commission's Public Interest Energy Research Program. The members of CERTS include the Electric Power Group, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, the National Science Foundation's Power Systems Engineering Research Center, and Sandia National Laboratories.

CERTS is collaborating with the public and private sectors to address reliability R&D challenges as the U.S. electricity industry makes a transition to competitive markets. CERTS projects include demonstration of real-time reliability management tools at CAISO and NERC, microgrid testing at UC Irvine, technical support for DOE National Transmission Grid Study, and other public-private initiatives.



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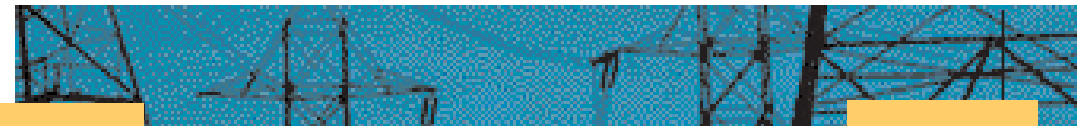
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PSERC is a National Science Foundation Industry/University Collaborative Research Center that currently includes the Arizona State University, University of California at Berkeley, Carnegie Mellon University, Colorado School of Mines, Cornell University, Georgia Institute of Technology, University of Illinois at Urbana-Champaign, Iowa State University, Texas A&M, University of Wisconsin-Madison, and Washington State University.

**NEW METHODS, TOOLS, AND TECHNOLOGIES  
TO PROTECT AND ENHANCE THE RELIABILITY  
OF THE U.S. ELECTRIC POWER SYSTEM**



### Mission

The U.S. electric power system is in the midst of a fundamental transition from a centrally planned and utility-controlled structure to one that will depend on competitive market forces for investment, operations, and reliability management. Electricity system operators are being challenged to maintain the reliability levels needed for the digital economy in the context of changing industry structure and evolving market rules. The economic growth of the nation is tied ever closer to the availability of reliable electricity service. New technologies are needed to prevent major outages like those experienced in the Western grid on August 10, 1996, which left 12 million customers without electricity for up to 8 hours and cost an estimated \$2 billion. CERTS was organized to conduct needed public interest research on electricity reliability technologies.

### Vision

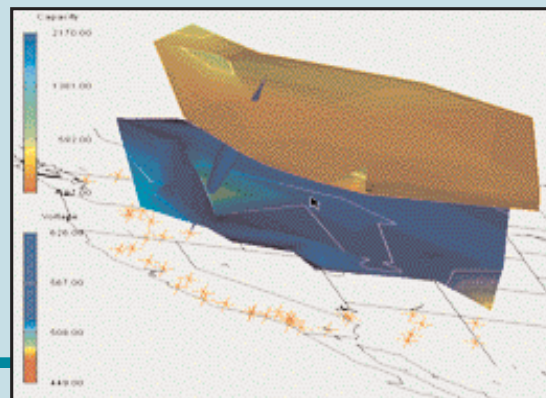
CERTS' vision is to:

- Transform the electricity grid into an intelligent network that can sense and respond automatically to changing flows of power and emerging problems;
- Enhance reliability management through market mechanisms, including real-time information transparency on grid status;
- Enable customers to manage their energy use and reliability needs in response to real-time market price signals; and
- Seamlessly integrate distributed technologies—including technologies for generation, storage, load control, and communications—to support the reliability needs of both the grid and customers.

The U.S. electric power industry has historically been vertically integrated; utilities were responsible for planning, operations, and reliability management. As the U.S. makes the transition to a competitive electricity market, these functions are being disaggregated, leaving no single entity responsible for developing tools, technologies, systems, and management strategies to insure the reliability of the grid. A number of forces have combined to dramatically reduce funding for research on reliability: utilities are pre-occupied with restructuring their businesses to meet the uncertainties and challenges of a competitive market, and ownership and control of transmission assets have been separated as Independent System Operators and Regional Transmission Operators are created to take over transmission duties. Evolving regulatory policies have also led to reduced investment in both transmission infrastructure and system reliability.

**CERTS is developing technology solutions to deliver high levels of grid and electric system reliability in competitive electricity markets. CERTS conducts research in support of the public interest in reliable electricity in four areas:**

- **Real-Time Grid Operations and Reliability Management**—tools and technologies that help to reliably monitor and operate the power system in a competitive electricity market, and lay the groundwork for transition to a smart, switchable, future network that can anticipate and respond automatically to emerging problems. Current

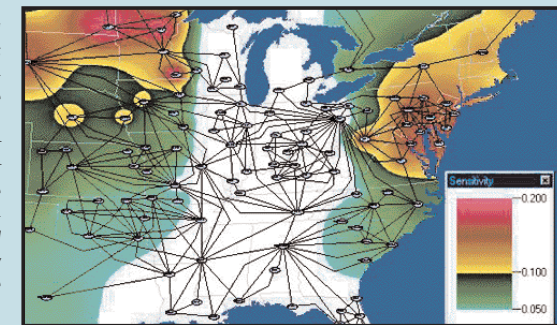


The CERTS VAR-Voltage Management Tool is able to mine, analyze, and present existing SCADA operational data visually to users both geographically and dynamically. It was installed at both the Folsom and Alhambra CAISO control centers for beta testing in 2002.

**research focuses on prototyping and demonstrating real-time reliability management tools; developing new system security management tools; and conducting basic research and outreach related to advanced measurement technologies and controls.**

- **Reliability and Markets**—science-based analysis to test market rules and their impact on efficiency and reliability. Current research focuses on evaluating market designs for reliability management through a combination of the theoretical and experimental economic approaches of CAISO, PJM, and NY markets and assessing the reliability impacts of alternative market designs.
- **Load as a Resource**—analysis and demonstrations to hasten the arrival of meaningful load participation in competitive electricity markets, including experimental economic analysis of the effect of price responsive load in reducing market prices and price volatility; assessments of emerging demand response programs and technologies for enabling customer participation in electricity markets, and demonstrations of load in providing ancillary services (notably, spinning reserve).

Transmission loading relief (TLR) procedures curtail market transactions in order to ensure reliability. However, they result in higher electricity costs for consumers because the displaced transactions must be replaced with electricity supplied from more expensive generators.



- **Distributed Energy Resources (DER) Integration**—tools and techniques for integration of distributed technologies to meet customer needs and enhance the reliability of electricity systems. Current research focuses on developing modeling tools and microsource performance data, and conducting field tests of advanced concepts for the protection, control, and integration with the system of large numbers of small (<1-MW) DER, which are organized in *microgrids* in the low-voltage distribution system. CERTS microgrid concepts are being evaluated in a field setting at UC Irvine.