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Electric Grid

Title

Real Time Grid Reliability Management 2005

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<https://escholarship.org/uc/item/02g1930p>

Author

Brown, Merwin

Publication Date

2008



Project Summary

Real Time Grid Reliability Management 2005

Context

The increased need to manage the U.S. electricity grid more actively in real time is in large part a result of the ongoing transition from a system operated by monopoly utilities to a competitive energy market with a high penetration of renewable generation, and new consumer appliances and equipment. Markets have replaced utilities in performing the match between generation and demand, and the addition of renewables and new consumer technologies, add to the operator's burden of controlling larger areas with revised operational responsibilities and more unpredictable system behavior. The increasing incidence of not only managed and unmanaged power outages but also transmission congestion, energy price spikes, frequency abnormalities, and voltage degradation on today's grid makes it clear that traditional management tools are inadequate and that these practices must be updated.

New tools need to analyze geographically dispersed events in real-time. This requires using time-stamped data in order to combine simultaneous information for dynamic system analysis and a dynamic response through automatic system controls and operator alarms. The measurements of synchrophasors can provide such information in real time. Synchrophasor data at various locations on the entire interconnection can provide a coherent picture or situation analysis of a wide area. Needed, however, is a visualization platform and appropriate applications to utilize the resulting vast amount of available data.

In addition to the need for real time tools, analysis of system emergencies has shown that existing dynamic models of loads and generators have become inadequate to allow planners to anticipate the behavior of the grid under a variety of conditions. Model Improvements are needed in these models.

Goals and Objectives

The overall goal of this project was to improve the reliability and cost/value of California's electricity through the use of new and better real-time operational tools.

Specific objectives were to:

- Develop a real-time Voltage Security Assessment (VSA) prototype operational tool to meet California Independent System Operator (CAISO)

specifications.

- Develop a prototype synchrophasor based real time monitoring system for use by CAISO, and
- Prioritize options for data collection to improve the load and generator models used by California and other grid operators and planners of the Western Electricity Coordinating Council.

Description

This project was a middle phase of a continuing program aimed at modernizing tools for operation of the electric grid in California. It consisted of 3 major tasks:

- A prototype VSA tool designed to accept Energy Management System data and forecast the available voltage margin before instability.
- A prototype synchrophasor-based visualization and application platform, and
- A scoping study to identify the research required to improve dynamic load and generator response models

Key Results/Conclusions

- A prototype VSA tool was developed and evaluated against data in 2 areas of California. A functional specification was developed for a next generation version of the tool.
- The Real Time Dynamic Measurement System (Version 3) was developed to read, display, and archive the synchrophasor data from CAISO and included alarming on events. Recommendations for the next generation were developed in consensus with CAISO and others.
- A plan for a future project on load data collection and modeling was created.

Why It Matters

Analysis of serious events such as the massive cascading outage, in August, 2003 concluded that improved real time operating tools are necessary to maintain reliability in the face of the increasing complexity and uncertainty of the electric system. This program is a large scale, cooperative effort to develop these tools.

{More details}



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Participating Organizations

Principal Investigator:

Lawrence Berkeley National Laboratory



Research Partners:

Arizona Public Service
Bonneville Power Administration;
California Independent System Operator;
Electric Power Group

Research Advisors and Consultants:

Montana State University
Pacific Gas and Electric
Pacific Northwest National Laboratory
Public Service Company of New Mexico
Puget Sound Energy
Southern California Edison
University of Wisconsin
Western Electric Coordinating Council

Project Start Date: March 27, 2006

Project End Date: February 28, 2007

CIEE Contract No.: MR-05-01

CEC Contract No.: 500-02-004

CEC Work Authorization: MR-036

Reports

Final Report: *Real Time Grid Reliability Management*

Final Report: *Real Time Grid Reliability Management*

Appendix A: *Real Time Voltage Security Analysis Survey Report*

Appendix B: *Real Time Voltage Security Analysis Summary Report*

Appendix C: *Real Time VSA Prototype Functional Specifications*

Appendix D: *Phasor Applications Summary Report*

Appendix E: *Real Time Dynamic Measurement System Training*

Appendix F: *Real Time Dynamic Measurement System User Guide*

Appendix G: *Improving Dynamic Load Final Report*

Funding



Funds for this project came from a \$1,600,000 award by the CIEE under a research contract 500-02-004 awarded to CIEE by the California Energy Commission (CEC) through the Public Interest Energy Research program (PIER)

For More Information, Contact

Dr. Merwin Brown,
CIEE Electric Grid Research Program Director
(916) 551-1871
merwin.brown@uc-ciee.org