UC Berkeley

Electric Grid

Title

Multi-Area Real-Time Transmission Line Rating (RTR) Study

Permalink

https://escholarship.org/uc/item/0bm6n3s9

Author

Brown, Merwin

Publication Date

2008-12-31

Multi-Area Real-Time Transmission Line Rating (RTR) Study

Context

Real time (thermal) ratings for transmission lines offer the promise of increasing power flow capacity at a cost significantly less than other alternatives. Previous projects verified that tension-monitoring technology was applicable to single transmission lines and developed special application technology for a multiple-line path (Path 15). A third project used the real-time data from several key transmission lines in the Sacramento area to evaluate the benefits of applying real-time ratings to the alleviation of area-wide generation dispatch and voltage constraints.

These projects had promising results, and the next step was to investigate the potential for simultaneous mitigation of these constraints by developing a methodology for forecasting the capacity of the lines up to 24 hours ahead.

Goals and Objectives

The goal of this project was to demonstrate the feasibility of implementing real-time transmission line (thermal) ratings (RTR) for a large multi-utility area under normal system conditions, by linking the benefits from real-time thermal ratings with simultaneous mitigation of voltage constraints, and by developing RTR forecasting methods.

The three main objectives of this project were a) to identify conditions where combined constraints restricted dispatch; b) to quantify the magnitude and cost of such restraints; and c) to investigate prediction of line ratings in the timeframe which would be useful for dispatch purposes.

Description

The area around Sacramento, one of the fastest growing and most complicated transmission regions in California, was the focus for the project. The area's largest transmission owners: Pacific Gas & Electric (PG&E), Sacramento Municipal Utility District (SMUD) and the Western Area Power Administration (WAPA), identified several lines that were expected to overload in the near future, and it was proposed that these lines be monitored and the data archived for analysis.

The project intended to evaluate various algorithms for forecasting transmission line ratings and test the suitability and accuracy of the algorithms using historical real-time transmission line data collected from monitoring equipment installed and operating prior to this contract.

Findings of the algorithm study were to be integrated with the results of the previous project, which looked at the potential for using real-time ratings to alleviate generation and voltage constraints but in isolation to each other. The applicability and the benefits of the real-time constraint management and ratings forecast methods for the selected lines would be evaluated.

Key Results/Conclusions

In the Sacramento area, there are thermal limitations that interact with voltage constraints and limit the energy imports to the area. On one line, this limitation resulted in at least three unnecessary generation curtailments. Real-time ratings could increase import capacity to the area by over 250 MVA.

Despite extensive studies of various available rating prediction algorithms, none of the algorithms were found to have acceptable accuracy for prediction of ratings in the targeted time range of 4-24 hours.

While ratings are not sufficiently predictable to be used for daily dispatch purposes, ratings have persistence in the short term (15 minutes to an hour). Ratings can increase rapidly, for example, during a rain storm. On the other hand, ratings cannot decrease rapidly, as it would require either a rapid increase in ambient temperature or an abrupt reduction of ambient wind velocity. Under such extreme conditions, the temperature of the line will change slowly due to the thermal mass of the conductor, allowing some flexibility in dealing with contingencies.

One of the important lessons of this project was that management of this type of project with three organizations with differing objectives and scheduling constraints is logistically very difficult.

Why It Matters

In areas such as Sacramento, there are serious limitations on the ability to import sufficient power at certain critical periods. The successful use of real time ratings could significantly increase the availability of imported power, reducing costs and reducing or eliminating the need for curtailments.

{More details}

ELECTRIC GRID RESEARCH PROGRAM

Project Summary

Multi-Area Real-Time Transmission Line Rating (RTR) Study (Pg 2)

Participating Organizations

Principal Investigator:

The Valley Group, Inc.

Research Partners:

Pacific Gas and Electric Co.
Sacramento Municipal Utility District
Western Area Power Administration

Research Advisors:

California Independent System Operator
Pacific Gas & Electric Co.
Southern California Edison Co.
San Diego Gas & Electric Co.
Western Area Power Administration
Sacramento Municipal Utility District

Project Start Date: July 1, 2005

Project End Date: December 31, 2008

CIEE Contract No.: C-05-32

CEC Contract No.: 500-99-013

CEC Work Authorization No.: BOA-121

Reports

Final Report: *Multi Area Real Time Transmission Line Rating Study*

Funding

For More Information, Contact

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