Title
Critical Operating Constraints Forecasting for California Independent System Operator (CAISO) Decision Support

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Publication Date
2008

ELECTRIC GRID RESEARCH PROGRAM

Project Summary

Critical Operating Constraints Forecasting for California Independent System Operator (CAISO) Decision Support

Context

In today's power market, while demand forecasting is well handled, tools for projecting the balance of energy supply and demand through the rest of the day are not adequate. When resource margins become very short, knowing in advance when and how severe various operating constraints would become is tremendously valuable to the grid operators. Advance knowledge of even a few hours of where these constraints would appear would enable the operators to take action to mitigate the problem before it occurs.

During the 2005 summer season, CAISO encountered conditions of very tight resource margins and serious congestion problems in Southern California. It was fortunate that Southern California had a mild summer in 2005 with peak temperature reaching only 95 degrees, far short of the possible peak of 102 degrees. In anticipation that conditions in future summers could likely be much worse due to increasing demand for electricity and the limited transmission capacities into Southern California, this research project was initiated.

Goals and Objectives

The main goal of this work was to provide CAISO with the capability to look ahead for the next 24 hours and predict whether the system will be able to get through the day without running into critical operating constraints, such as line overloads or low voltages, under credible contingencies.

Specific objectives were to enable the simulation of various scenarios of power importation or other alternatives such as load reduction to find the best way to avoid such problems and to provide a functional specification for the development of a commercial version of the tool.

Description

This project consisted of the development of a prototype tool based on the Electric Power Research Institute (EPRI) Community Activity Room (CAR). The CAR presents constraints as boundaries in a space with the current status as a position in that space and the distance to a boundary as the margin. The prototype was evaluated using historical data and its predictions were compared with actual observations.

To promote the commercialization of this concept, the methodology of the prototype tool was specified in detail in a functional specification document. The results of the research were presented in a workshop with the intent to make this technology available to any commercial software developer who wished to turn this method into a commercial product.

Key Results/Conclusions

This project developed the methodology for Critical Operating Constraint Forecast COCF and tested it in a prototype with support from CAISO for testing and demonstration. The results showed that this method is capable of forecasting loading of transmission paths over the next 24 hours, using current data on the transmission paths flows and assumptions about where the generation deficit would be supplied for the rest of the day. The model provided the ability to the user to try different import scenarios to simulate how to avoid the potential critical operating constraints. Knowing an approximate time when the constraints might become critical will be very useful for the grid operators to prepare for any emergency remedial actions, such as appealing for load reduction, etc. The results of the COCF compared well with the results of the planning study.

Why It Matters

Improved forecasting of critical operating constraints in the next 24 hours can increase the reliability and efficiency of the California electricity system. With the increased levels of renewable penetration, the volatility of potential transmission constraints due to wind and solar generation will be magnified and create significant challenges for CAISO in managing the power grid. Avoiding a blackout can potentially save Californians hundreds of million dollars. The risk of blackouts will likely increase in the future with the high penetration of renewable generation, power markets and new electric customer appliances and equipment, so improvements in forecasting critical operating constraints could yield significant cost savings, help achieve the State's public goals for CO_2 reduction, and provide reliable and low cost electricity to the State's power consumers with minimum environmental impacts.

{More details}

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Participating Organizations

Principal Investigator:

Electric Power Research Institute

Research Partners:

California Independent System Operator

Project Start Date: August 7, 2006

Project End Date: March 31, 2008

CIEE Contract No: MR-06-07

CEC Contract No.: 500-02-004
500-99-013

CEC Work Authorization: MR-053
BOA -140

Reports

Final Report: *Critical Operating Constraints Forecasting – A Decision Support Tool*

Funding

Funds for this project came from two awards totaling $350,000 by the CIEE under research contracts 500-02-004and 500-99-013 awarded to CIEE by the California Energy Commission (CEC) through the Public Interest Energy Research program (PIER)

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