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'Preventable' failures caused US power blackout

By Celeste Biever

A disastrous string of preventable communication failures, software misuse and power line shut-downs caused the landmark electricity blackout that struck North America in August, according to an official report released on Tuesday. Over 50 million people in eastern and central US and Canada lost power.

Engineers could have nipped the blackout in the bud if their companies had adhered to reliability standards designed by the North American Electric Reliability Council (NERC), concluded Spencer Abraham, US energy secretary, and head of the US-Canada Power System Outage Task Force charged with producing the interim report.

"When something goes wrong, and critical procedures are not followed, a number of relatively small problems can combine to become a big one," said Abraham.

"It was preventable," said Herb Dhaliwal, the Canadian Minister of Natural Resources, Canada, and also on the taskforce. The economic cost of the blackout has been estimated to run into billions of dollars.

Monitor and predict

Broadly, the NERC standards recommend that predictive and monitoring software be used by electricity transmission operators, to keep an eye on their section of the grid. Operators should correct high fluctuations in voltage and inform neighbouring transmission companies within 30 minutes.

But it is not currently mandatory for electricity operators to comply with the standards. Until they do, a massive blackout could happen again on any warm summer's day, says Mariesa Crow, an electrical engineer at the University of Missouri-Rolla. Rising temperatures boost US power demand due to the widespread uses of air conditioning.

Abraham said that the Department of Energy plans to recommend the standards become mandatory early in 2004.

According to the report, problems began around midday on 14 August when electricity reliability coordinator Midwest Independent System Operator (MISO) failed to use two vital software tools properly.

One, called a state estimator, makes intelligent guesses of the voltages in lines that are not monitored. Information from the state estimator is fed into the second device called a Real Time Contingency Analysis (RTCA), which calculates what would happen to voltages across the grid if a particular line were to go down.

On August 14, a shut-down on a line went unreported, causing the state estimator to make a false guess. The incorrect data was entered into the RTCA, which consequently failed to pick up on the looming problem. To compound things, when the shut-down was finally entered into the software and a new estimate obtained, a MISO analyst forgot to switch on the RTCA and promptly "went out to lunch".

Unstoppable cascade

On the same day, a slew of similar glitches struck at FirstEnergy, a group of electricity operator companies in Akron, Ohio, meaning faults propagated through FE's layers of predictive software. As FE itself was not aware of the looming failure, it did not try to notify other operators before it was too late. Early notification could have provided relief.

To make matters worse, FE's alarm system, which points out potential disasters, was not working. FE also failed to log that overgrown trees had caused high voltage fluctuations in crucial transmission lines that afternoon.

The result was that operators throughout Ohio were not aware of a growing collection of shut-down lines and escalating voltage fluctuations. At 1605 EDT, the final straw came when Ohio's Sammis-Star line tripped, sparking an unstoppable cascade of shut downs that crippled New York, Ontario, and six other states.

"This blackout was largely preventable, but once the problem grew to a certain magnitude, nothing could stop it cascading out of control," explained Spencer.

A full report and recommendations will be released early in 2004. But Crow is not convinced that making the NERC standards mandatory will prevent blackouts in future. She says the root of the problem is the US's increase in power consumption and simultaneous failure to build more transmission lines: "I think we are going to see widespread blackouts until we build a bigger system."

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