INTERMEDIATE/SECONDARY **ARTICLE: The Blackout of 2003**

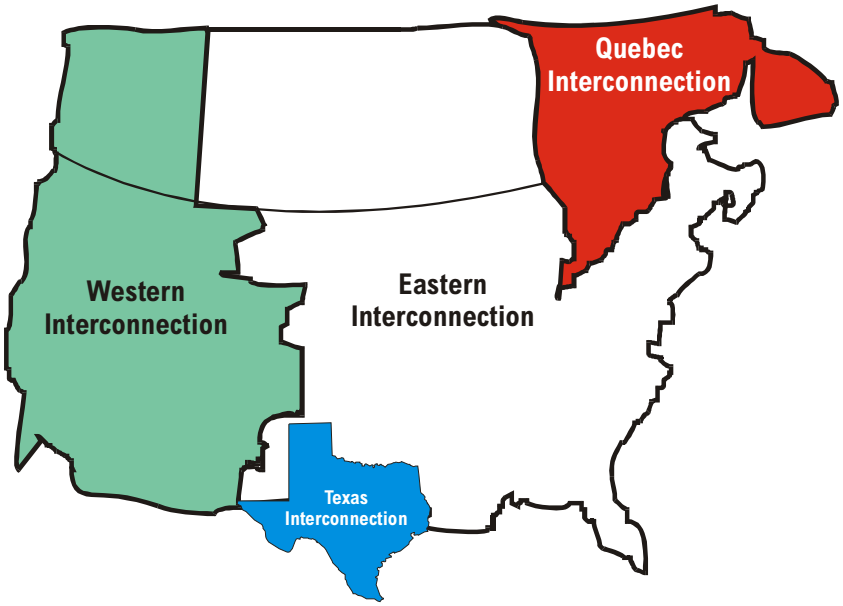
On August 14, 2003, much of the Northeast United States and parts of Canada suddenly lost electrical power. Many cities were without electricity for several days. Subways came to a stop and people on the top floors of high-rise buildings had to walk down many flights of stairs when the elevators came to a halt. The lives of many people changed dramatically until the power was restored. The real question on everyone's mind was, "What happened?"

The North American Electric Reliability Council thinks the power blackout originated from transmission lines in Ohio that short-circuited, causing facilities all along the grid to shut down. Investigators believe that an overheated transmission line sagged into a tree outside of Cleveland at 3:32 p.m. on August 14th and short-circuited. The failure of that transmission line put enormous strain on the other lines in Ohio. Soon a utility company that serves southern Ohio sealed itself off because its lines were close to burning up from the additional load. This created a barrier on the grid between the southern part of Ohio and the northern part.

The Cleveland area, in the north, began drawing huge amounts of power from Michigan and Ontario, knocking out more lines and shutting down more power plants, pushing the crisis to the borders of New York. The New York power system, acting to protect itself, sealed its borders with Canada, which created a different problem. It has no place to quickly send its surplus power and overloaded its own system. A widespread shutdown then occurred. In a moment of unexpected darkness, terms like "power grid" and "transmission lines" were all over the news, but many people still aren't sure exactly what they mean.

Power grid: A geographical section of transmission lines. The United States has three power grids – the Western Interconnection, the Eastern Interconnection and the Texas Interconnection. Canada also has three – the Western, Eastern, and Quebec grid, which includes Atlantic Canada. The border between the Eastern and Western grids lies between Alberta and Saskatchewan. The Eastern and Western grids are connected in some areas by direct-current lines, but are largely independent of each other.

Transmission lines: Cables that carry electricity. The tall electrical towers throughout the country hold large power lines that transmit high voltage electricity over long distances. Transmission lines can also be buried underground.



Electricity: The flow of electrons through conducting wire. The electricity flowing over the grid is a function of voltage and current. Combining high voltage and low current generates the same amount of power as combining low voltage and high current. Current produces heat, which can cause wear to transmission lines. Because heat damages the wires over time, power is transmitted with high voltage and low current. While this prolongs the life of transmission cables, the current still degrades the lines over time.

Electricity is one of the world's most valuable commodities and the market to sell it is crowded. The problem is, while there has been enormous investment in electricity generation, there has been relatively little attention paid to the maintenance and expansion of the lines used to transport electricity. The result is too much electricity traveling over too few or inadequate transmission lines.

The Blackout of 2003 *continued*

Cross-border connections: Transmission lines that cross the borders of countries. When parts of Canada's electricity grid were connected with the U.S. grid, the intention was to open a new market for surplus electricity and to establish a source of backup power. The shared system allows generators to operate more efficiently, because they can continue to generate electricity when local demand is low. With open markets and shared transmission lines, power can be sold across hundreds of miles.

Since the transmission lines are shared, however, there is little incentive for companies to invest heavily in their upkeep. It's simply not a profitable venture, so it isn't done and breakdown is the result. Many of the lines in the North American system were built decades ago.

In the years since the transmission lines were built, they have been used to transport more electricity over longer distances, adding more stress to the system. The lines degrade under the extra heat and eventually burn. The electricity is then shunted to another line and, if that cable can't sustain the extra load, it breaks too. That's what led to a 1996 blackout that included areas of Alberta and British Columbia, and ranged all the way to Baja, California. And it's apparently what happened to the lines in Ohio on August 14th to cause the major blackout in the Northeast.

Researchers at Cambridge Energy Research Associates pointed out an additional problem—communication. The system for communication among the organizations that operate the power grid is inadequate. Problems can erupt within the grid in seconds and expand very quickly. A communication system needs to be able to respond just as quickly. In many areas, the only method of communication is over phone lines. Most people agree, however, that quicker communication would not have prevented the August 14th blackout.

Chances are the blackout isn't the last incident. The U.S. Department of Energy estimates that American generating capacity will increase more than 20 percent by 2010. Transmission line capacity in that same period is expected to increase only four per cent. Suggestions to improve the capacity and reliability of the grid include:

- Make an investment in new infrastructure. We need to build more lines that can carry more electricity. This will take huge amounts of money and a long time.
- Integrate the regional power networks more efficiently in terms of infrastructure and communication.
- Mandate electric reliability standards and procedures.
- Add new silicon switches. The switches would allow transmission lines to be operated like toll roads. This would place some power generating facilities in strategically better positions than others, and some energy companies could suffer.
- Install flow cell batteries. Flow cell batteries store up energy when supply exceeds demand and dole it out when demand exceeds supply. They are very expensive. A battery to store 24 hours of power for a small community would cost twice as much as a new power line. It would also be the size of a low-rise building.
- Install computer programs to isolate outages. Computers could anticipate the cascade effect and trip circuit breakers to isolate and minimize the problem. Massive blackouts would not occur because the program would trip all switches surrounding a circuit breakage. These computer models are still in the testing stages. Once perfected, they will be quite useful in combination with silicon switches.

Summarized from articles and testimony by CBS News Online and Cambridge Energy Research Associates