

# **Blackouts Are Inevitable**

Coping, Not Prevention, Should Be the Primary Goal

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As we approach the first anniversary of the Blackout of '03, we're reminded of the many times that officials, from New York Gov. Nelson Rockefeller in 1977 to Gov. George Pataki now -- along with a host of senators and representatives -- have assured us that they will take steps to prevent future blackouts. Yet roughly every four months, the United States experiences a blackout large enough to darken a half-million homes. Now the pressure is on Congress to enact an energy bill that will protect us from the lights going out. There's just one problem: It can't be done.

In a large, complicated arrangement such as our system for generating, transmitting and distributing electricity, blackouts simply cannot be prevented. Data for the past four decades show that blackouts occur more frequently than theory predicts, and they suggest that it will become increasingly expensive to prevent these low-probability, high-consequence events. The various proposed "fixes" are expensive and could even be counterproductive, causing future failures because of some unanticipated interaction.

The state of current engineering is such that we cannot verify that any particular change won't impose problems larger than those it is designed to remedy. Nor can we eliminate all problems. Further, with a bit of "luck" and sufficient resources, an informed, intelligent terrorist organization could get around any protective structures and software to bring down the system.

Fortunately, we do have a model to follow. The problems uncovered by the blackout of August 2003 can be addressed by the kind of changes that transformed the air traffic control system from one that had occasional deadly crashes to one that has provided a relatively crash-free environment, despite enormous growth in daily flights and occasional errors by pilots and controllers.

While making obvious improvements in control and operation of the grid, we should focus the greater part of our effort on fulfilling the mission of the electricity system, not on trying to prevent blackouts. When hurricanes, tornadoes, ice storms or other problems black out the system, backup generators at hospitals, airports and other critical institutions prevent their missions from being interrupted.

The problem in New York, Toronto, Cleveland and Detroit last Aug. 14 was not that the hospitals or television stations were blacked out. The problem was that other critical missions could not be accomplished. Elevators were stuck between floors, trains stopped between stations, traffic lights went dark, cell phones quieted, and, in Cleveland, water ceased to flow and sewers overflowed. Water treatment and pumping the water to reservoirs requires electricity; without power, water would cease to be available to many people after just a few days. If the blackout had persisted for a week, public health and welfare would have suffered from the failure of a rapidly growing number of critical missions.

Since transmission was a prime contributor to the blackout, one proposal has been to invest \$100 billion in upgrading the system. But while transmission investments are required to make deregulated electricity markets work, they will not prevent future blackouts.

Natural hazards produce many local and regional blackouts, and society has learned to cope with them. In fact, August 2003 revealed that many private institutions are far ahead of the public sector in defining their critical missions and taking steps to fulfill them when the lights go out. But it was even more obvious that other facilities, and especially such public functions as traffic lights, water and sewage, were not protected. In the public sector, we need to set priorities among the missions that depend on electricity.

Protecting missions can be surprisingly inexpensive with clever engineering. For example, light-emitting diodes produce green, red and yellow lights with only a small fraction of the energy required for incandescent bulbs. Inexpensive batteries and "trickle chargers" could be added to LED traffic lights to ensure that they could continue to operate for days into a power outage. The longer the outage, the more difficult and expensive it is to accomplish the critical missions. Providing traffic lights and water depends critically on how long the power is off. Adding batteries in traffic lights could keep them running for a few weeks.

In the case of a massive blackout, of course, the critical mission is the orderly evacuation of workers and shoppers, not maintaining normal traffic flows for a month. Some upgrading of the transmission system is clearly necessary. But the most cost-effective ways of accomplishing the critical missions are devices that allow:

- Elevators to descend to the next floor without power.
- Subway and elevated trains to creep slowly, one by one, to the next station.
- Traffic lights to operate correctly.
- Land line and cell phone communication.
- Selected service stations to dispense fuel.

The first task is to list the important missions that are accomplished by the electricity system. The second is to rank these missions in order of priority. Third, we must identify which missions are already protected. The fourth and final task is to find cost-effective ways of accomplishing the most important missions when the power fails.

This approach is very different from the debate with which congressional conferees are dealing. They should know that, despite the rhetoric, we will not be able to prevent all future power failures. While some investments to decrease the frequency of future outages are worthwhile, the Energy Department, the Federal Energy Regulatory Commission and state regulators need to focus on lowering the cost and disruptive effect of future blackouts. We need to be able to accomplish the essential missions of the electricity system despite a blackout -- and to do so at the lowest possible cost.