Author's Commentary: The Outstanding Emergency Power-Restoration Papers

Joseph Malkevitch
Dept. of Mathematics and Computing
York College (CUNY)
Jamaica, NY 11451

In the summer of 1991, hurricane Bob left considerable damage as it went up the East Coast of the United States. I live on Long Island, where Suffolk County was hit hard. Watching TV coverage of the havoc wrought by the hurricane gave me the idea for a mathematical modeling problem.

For me, teaching mathematical modeling offers the dually appealing features of being able to develop interesting mathematical theory in an environment that stresses both problem-solving and applications. Students who do not always share my esthetic for the delights of mathematics can rarely turn their backs on how mathematics is used, often in dramatic ways affecting daily life. Working on open-ended problems is exciting and fun, especially when in the social context of working with other people.

Modeling problems fall loosely into two types of questions: applied situations in which complete information is available about the phenomenon to be analyzed, and situations that lend themselves to analytic study but for which complete data are not available. The first type often has limited avenues of approach and leads to structured mathematical attack. However, I have a great fondness for the second type, where the very vagueness of the situation means that a variety of attacks suggest themselves, and that the "nature" of the solution depends on the attack used. Such problems encourage genuine "brainstorming," a process that yields great excitement and pleasure.

The power company responsible for restoring power to customers who have lost electricity seems to me to face hard choices. If the company begins efforts during the storm, it risks danger to its employees, plus the possibility that it might solve a problem in one area and shortly later have to dispatch another crew there for later damage. On the other hand, if the company waits until the storm is over, it runs the risk of adverse publicity due to customers who wait a long time until power is restored.

The power company has a variety of potential concerns to weigh, which include

- costs to restore power,

- time to restore power for politically sensitive sites, and
- time to restore power to all users.

Various tradeoffs seem possible in my mind, between costs to the power company (i.e., overtime; hiring extra crews; legal fees to deal with suits due to loss of life, food spoilage, or lost business opportunity) and costs to the power company's customers in time or money.

Another issue is how to locate the source of a power outage. When power is lost in an area, the company may learn of the outage from its own instruments but also from customers who call in. Some callers may have information of potential value to the company.

A key technical and policy question is determining a priority scheme for restoring normal functioning to the system. Once the power company has verified the causes of the outages, a dynamic system must be implemented to allocate crews with the proper equipment and training, get crews from one outage site to another, and keep personnel working up to par. Issues here include estimation of time to get between sites and tradeoffs between using regular personnel vs. extra crews especially hired to help.

It seemed to me that the situation of power restoration after a hurricane had a variety of tantalizing aspects, which could be made concrete enough to call forth solutions that could be compared in a reasonable manner, yet additional aspects would leave open a broad array of attack modes.

As I had fun playing with all of these aspects of the problem in my own mind, it gave me a healthy respect for what local power companies must do to be in a state of preparedness for power emergencies, large and small. Not only did I look forward to the creative ideas that contest participants might develop, but I also looked forward to learning more about what the power companies do in practice. Creating problems, it seems to me, is easily as much fun as working on their solutions!

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About the Author

I was born and raised in Brooklyn, attended Stuyvesant High School and Queens College (CUNY), and received a Ph.D. in geometry under Don Crowe at the University of Wisconsin–Madison. My mathematical interests lie in geometry, mathematical modeling, the mathematics of equity, and mathematics education. I enjoy playing with my sons Alexander (20 mos.)

and Benjamin (2 yrs.) and listening to classical music, especially string quartets.

After I submitted the MCM problem, my understanding of the problem—and appreciation for solutions—was made personal when a windstorm knocked down a tree limb in our yard and severed a power cable, provoking a 12-hr power outage.