transmission reliability. So optimization programs that show them how to cut generating costs are of little interest. Yet under deregulation, system operators aren't doing much long-term planning, either. No wonder, since it's not even clear what their objectives should be. For instance, entrepreneurs would like to build generating plants in Nevada and ship their output to California. Should Nevada be able to say no? Should it be paid to say yes? Software-optimization tools can figure out the best way to balance competing interests—but only after the political system has decided how to rank priorities.

Beefing up and securing the U.S. power-transmission grid is crucial to the country's economic growth. Tough decisions about who should run the grid—and how—still have to be made. The good news is that the technology to help solve the grid's problems already exists.

By Peter Coy in New York

FIXING THE QUICK DIPS THAT COST A BUNDLE

With much of the engineering in the electric grid dating to the time of Thomas A. Edison, power surges and sags are endemic. They didn't take much of a toll on adding machines and other mechanical systems in factories and offices 25 years ago. But in today's digital economy, power hiccups wreak havoc.

The Electric Power Research Institute figures U.S. business coughs up as much as $30 billion a year to recover from power interruptions. Even fleeting fluctuations can cause computers to crash, telecom networks to freeze, and factories to grind to a halt. "And 92% of these problems are due to voltage sags that last only milliseconds," says Vikram S. Budhraja, a Pasadena (Calif.) consultant who chairs the Consortium for Electric Reliability Technology Solutions (CERTS).

Relief is on the way, thanks in part to CERTS. Created by the Energy Dept. to bring together the best minds in government, academia, and industry, the group is helping develop huge backup-power systems similar to the uninterruptible power supply (UPS) that sits beside many PCs. But these devices can be the size of a tractor-trailer rig and pack enough power to keep whole factories humming for a few precious seconds.

Perhaps the biggest UPS is at STMicroelectronics' chip plant in Phoenix, which averages two sags a month. Installed in August, 2000, by Chicago's S&C Electric Co., this $4 million system can store 12 million watts (mw), enough to sustain operations for 30 seconds, or until the grid is back to normal. Without a UPS, each dip could turn to scrap up to half the chips being processed—sending as much as $1 million down the drain.

RIPPLE EFFECT: *Storms can cause short power sags far beyond an accident site*

BIG BACKUPS

METAL-AIR BATTERIES Low power capacity, low cost, and enviro-friendly
SUPPLIERS: AER Energy, eVionyx, Chem Tech

SUPERCAPACITORS Low power capacity, discharges very quickly
Elit, Maxwell Technologies, Ness Capacitor

FLOW BATTERIES Medium power capacity, slow to discharge
Regenesys Technologies, Sumitomo Electric, Vanteck Technology

LEAD-ACID BATTERIES High power capacity, low cost, medium discharge time GNB Industrial Power

Data: Electricity Storage Assn.

S&C's UPS is based on lead-acid battery systems originally developed for Delco truck batteries. But new advanced-technology battery systems now emerging "are successes in the making," predicts Philip C. Symons, a consultant who heads the Electricity Storage Assn. in Morgan Hill, Calif. This summer should see the first U.S. operation of a sodium-sulfur battery developed in Japan by Tokyo Electric Power Co. and NGK Insulators Ltd. It will be installed by American Electric Power Co. in Gahanna, Ohio, to serve dual roles: providing up to 500 kilowatts (kw) for five minutes to protect nearby office buildings or padding the local grid with 100 kw over several hours during periods of peak demand.

Meanwhile, in Columbus, Miss., a new fuel-cell-based flow battery from Britain's Regenesys Technologies Ltd. will make its U.S. debut by yearend in a 12-mw storage facility being built by the Tennessee Valley Authority. During the night, when electricity is cheap, authority will charge up the unit's chemical fuel, then "burn" it during the day.

But the hottest new technology, says Budhraja of CERTS, comes from startup SoftSwitching Technologies Inc. (SST) in Middleton, Wis. SST's Dynamic Sag Corrector, or DySC, is basically an overgrown capacitor—a common electronic component. It has no battery. So while batteries usually peter out before 1,000 cycles, DySC systems can be charged and discharged tens of thousands of times.

SST's units are already shielding key operations that are turning out a wide variety of products, from railcar axles at Engines Inc. in Milton, W. Va., to fiber-optic cables at Lucent Technologies Inc.'s Norcross (Ga.) plant. DySC systems range from 200 watts for an individual machine to 1 mw for an entire production line and typically run from $800 to $200,000. Lucent's system is unusually big: more than 3 mw and $1.3 million. But that cost was recovered with the very first "save." With results like that, the digital economy should become increasingly insulated from power dips.

By Otis Port in New York

HERB SWANSON/REUTERS