The Future of Electricity Markets?

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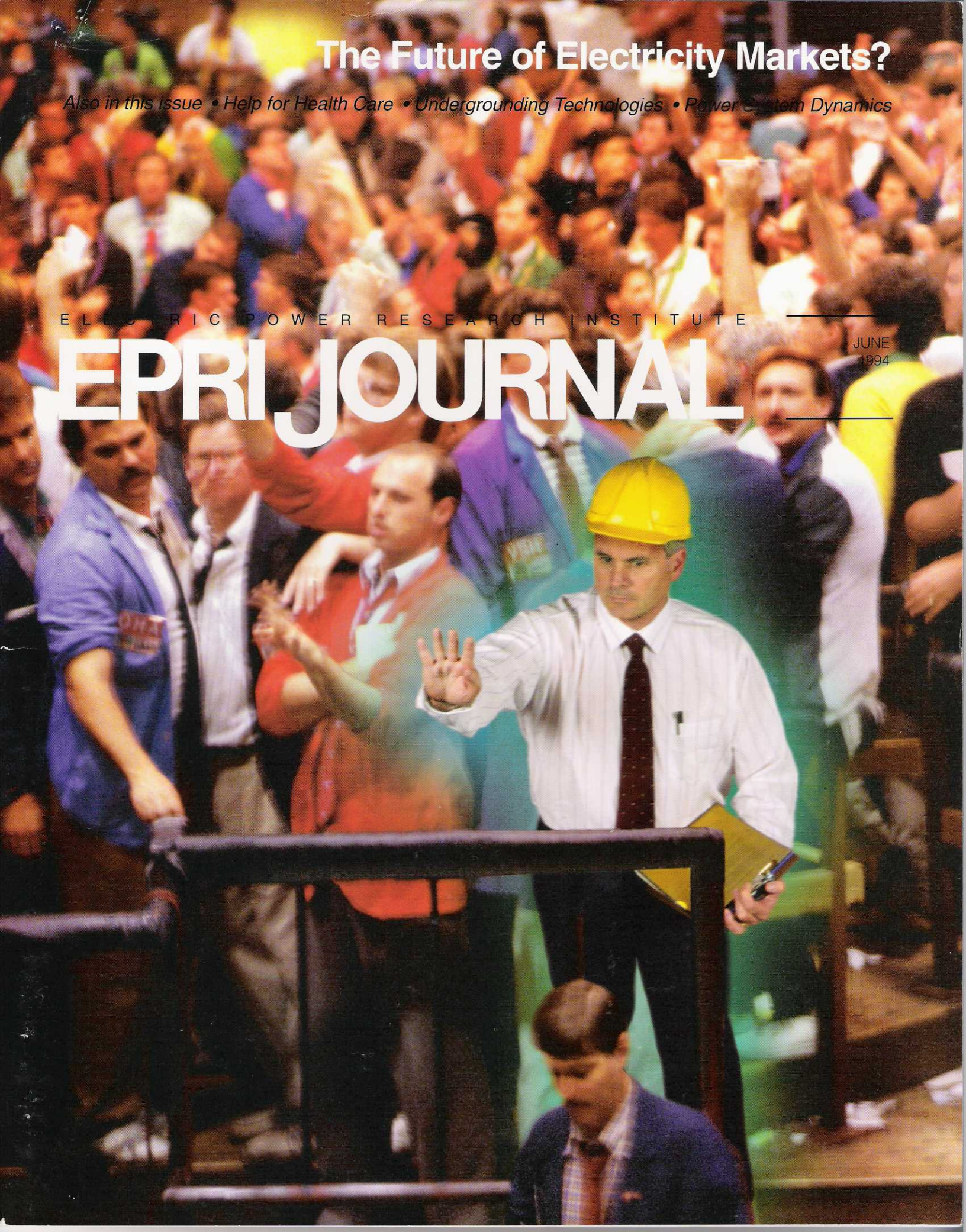

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SAFER TRENCHING **EPRI's Soft Trencher, seen here in prototype demonstration, will not harm the buried structures it encounters, such as communications cables and plastic sewer pipes. The operator uses a remote-control panel to guide the trencher head, which has supersonic air jets to break up soil for removal by a high-volume vacuum system.**

leading to a strain gage at the pulling eye. The tension was further eased by the use of advanced cable pushers at the entry hole—the first application of this technology.

"We're very pleased with the number of firsts that were achieved in the Nacoochee Valley project," says Charles McCall, senior engineering associate at Oglethorpe. "Since we serve 39 rural electric cooperatives in Georgia, we are particularly interested in new, low-impact construction technologies that can be used to install cables in environmentally sensitive rural areas. In addition to cofunding the demonstration of this technology, we have participated in EPRI workshops on planning underground facilities."

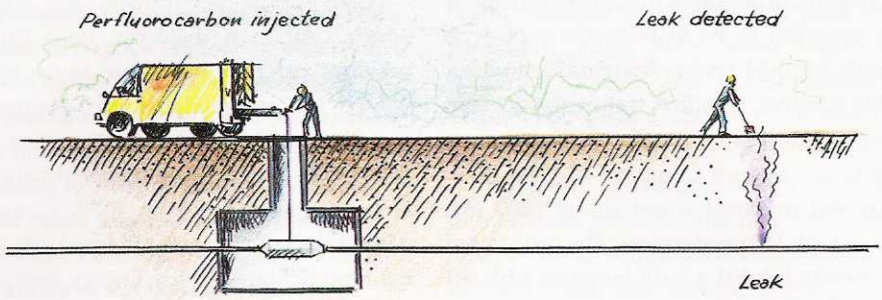
Improved trenching

Although drilling is rapidly becoming the preferred technology for installing cable in areas where surface excavation would be particularly expensive or disruptive, trenching remains competitive in many situations where surface access is not a problem. In those cases, however, another difficulty is frequently encountered: how to avoid existing buried structures, ranging from communications cables to gas mains and sewer pipes. City utility maps are often incomplete or out-of-date, and the increasing use of plastic pipe means that ordinary metal detectors cannot be relied on to locate underground obstacles. EPRI is helping utilities respond to this challenge by developing two products that will make trenching safer and less expensive—the Soft Trencher, which won't harm existing structures, and a ground-penetrating radar system that can map both metallic and nonmetallic objects underground.

The Soft Trencher, now in prototype demonstration and scheduled for commercialization later this year, uses supersonic air jets to break up the soil without harming nonporous objects that are encountered. A high-volume vacuum lifts the soil from the excavation and transports it to a conveyor system for loading onto a truck or depositing in a windrow beside the trench. The Soft Trencher is designed to remove soil 25% faster than a backhoe while reducing the danger of

damaging existing buried facilities. (Penetration of a gas pipeline by a backhoe is the suspected cause of the devastating explosion last March in Edison, New Jersey, which killed 1 person, injured 100 others, and destroyed eight apartment buildings.)

Developed by Battelle and Concept Engineering Group, Inc., the Soft Trencher can dig excavations 1 to 6 feet wide and up to 10 feet deep. In good soil, it has a nominal trenching speed of 1 foot per minute. The operator can stand in front of the Soft Trencher for a better view and use a remote control to guide its operation. The excavation head is mounted on a 22-foot telescoping boom and contains nozzles that accelerate air from a conventional compressor into highly focused jets that move at approximately twice the speed of sound. These supersonic jets penetrate the soil, building up pockets of high pressure that fracture it. The vacuum system connected to the excavation head then lifts the soil out of the trench—together with 6-inch rocks and sticks up to 18 inches long.



SNIFFING OUT LEAKS **Perfluorocarbon, a harmless fluid with a unique chemical structure, is injected into the dielectric fluid of a transmission cable system to provide a tracer for leak detection. Since the tracer can be detected in parts per quadrillion, a simple portable apparatus is all that is needed to take air samples and literally sniff out the location of a cable system leak.**

The ground-penetrating radar is being developed to locate buried utility lines, building foundations, and other underground structures that could pose a hazard to the construction process, whether excavation or earth boring. Pipes made of plastic are particularly difficult to locate with current instruments. Previous attempts to build ground-penetrating sonar or radar devices have not produced instruments that could be used routinely and cost-effectively by electric utilities.

Current efforts are focused on designing two radar-based ground penetration systems. One will use computer imaging technology to identify and map structures down to about 12 feet. The other will be a lower-cost, quick-check device that can be used specifically to detect buried plastic pipes and electrical cables. Prototypes of both devices are expected to be available for utility demonstration by 1997.

Cable diagnostics and refurbishment

Major cost reductions are also possible in the maintenance and replacement of existing underground transmission and distribution systems. New diagnostic equipment can find faults in distribution cables and leaks in pipe-type cables much more quickly and cheaply than previous methods could. New techniques have also been developed to remove jammed cables from existing conduits, thus freeing up valuable channels for future use. Finally, for underground vaults in need of refurbishment, corrosion-resistant composite materials are becoming available that can extend the life of existing structures.

The Fast Fault Finder is a patented new EPRI instrument for locating faults in unbranched underground residential distribution (URD) cables up to a mile long. "Previous fault location methods generally required highly trained operators, and some risked further damaging a cable by subjecting it to repeated electrical pulses," according to EPRI's Harry Ng. "The Fast Fault Finder is fully automated and provides a simple digital readout of the distance to a fault." Based on EPRI research in voltage waveform analysis, the device works by recognizing the transient waves created by an arcing fault. It can determine the location of a fault to within 2% of the total circuit length.

AUTOMATED FAULT LOCATION **The Fast Fault Finder can locate a fault in an underground residential distribution cable to within 2% of the circuit's length. Unlike previous methods, which required highly trained operators, the Fast Fault Finder automatically provides a digital readout of the distance to a fault by analyzing transient voltage waves created by arcing at the fault.**