

GRADING THE SMART GRID

In-House Laboratory Puts Technology to the Test



Imagine smart meters that report power failures in your home to your electric company for you. Text message responses that report the estimated repair time. Intelligent systems that isolate failures and restore power automatically to customers in minutes, without a utility crew.

These are just a few of the things we can all look forward to as today's power distribution systems enter a new era of reliability made possible by increased automation, better communication and the self-healing potential of new smart grid technologies.

But the electric grid isn't the only thing getting smarter. Electric utilities and other heavy power distributors and users are also getting smarter about how they approach the modernization process.

Consider Pepco Holdings Inc. (PHI), which supplies power to 2 million customers in and around Washington, D.C. PHI is upgrading its entire communications backbone — including wireless infrastructure that supports two-way communications to remote field devices.

"We need assurance that our communications requirements can be achieved with reliability

and robustness," says Charles Peresta, senior supervising engineer for PHI. Identifying potential problems with system interfaces upfront through lab simulation and testing is key. PHI didn't want to wait until the system was installed to discover compatibility issues or problems.

So PHI validated the system design more than 1,000 miles away in the Smart Grid Laboratory that Burns & McDonnell operates in its Kansas City, Mo., world headquarters. In the near future, utilities will be able to work similarly with the company's Houston and New England offices to test technology settings, equipment integration and cybersecurity performance.

Technology in the lab made it possible to test the radio systems integration with various systems and assess its performance under a variety of conditions that approximated real-world and worst-case environments.

The tests gave PHI confidence in the system solution it was evaluating. By identifying the system's operational risks and limitations before it was installed, PHI reduced unexpected delays and rework that can occur when integrating with legacy equipment installed in harsh environments.

Beyond the Lab

Established in 2007, the smart grid lab today includes many of the latest technologies and devices used to modernize today's power grids.

"Originally, the lab was used primarily for engineers to gain familiarity and program microprocessor-based relays," explains Matthew Olson, department manager for telecom and network engineering at Burns & McDonnell.

The lab has now grown to house more than \$1 million worth of equipment, and it was expanded into new space in late 2011. The lab is now capable of doing much more, from testing advanced substation and distribution feeder automation to staging demonstrations of high-speed tripping and confirming the security, automation and protection of communication on a network.

"In the old days, this testing meant physically wiring panels and testing them," Olson says. "Today it is mostly done by changing configurations in software."

Engineers simply program controllers to meet a defined objective — such as when it involves

tripping a power line or testing a new technology's interoperability with vintage equipment — and then validating that it responds appropriately. Utilities don't have to wait until new systems are ready for installation to test them.

"In some cases," Olson says, "companies use the lab because they have an idea and want to know if it's feasible to implement while they're still in the planning process. We've also had users require a vendor to modify a product, and then use the lab to make sure the final product has been delivered according to their specifications."

The lab can be used to train employees on new technologies or to test new equipment for vendors. Users have also leveraged lab findings to justify investments in new technologies.

Time Saved, Confidence Delivered

Still, a majority of users — including a confidential Southern utility — come to the lab to pilot applications before field implementation. Like PHI, the Southern utility is building a new communications backbone to support advanced metering and

distribution automation, and the lab is being used to test its device programming.

"Our lab has the same equipment that the clients use, so we can mock it up and test it here, and then work with the vendors who supplied it should issues arise," says Chrissy Carr, senior project manager in the Burns & McDonnell Transmission & Distribution Group. "The equipment can get to the field faster if we do the legwork here."

Time savings in the field are significant.

"A project team might plan to spend many days or even weeks implementing a system in the field when, in reality, it will only take a day, because it's already been tested," Olson says. "Once a system is validated here, users can be confident that it will, in fact, work according to the specifications once it is installed."

"If a problem is found in the lab, we can work with vendors to isolate and correct it. It's a whole lot easier to address it here than it is out in the field."

For more information, contact Matthew Olson, 816-349-6608.



The Smart Grid Laboratory at Burns & McDonnell can test everything from feeder automation to protective relaying over packet networks and communications security. **Above left:** Matthew Olson reviews evaluation results. **Right:** Chad Stilwell, an electrical engineer at Burns & McDonnell, enters data as Olson observes. **Bottom left:** Equipment provides flexibility for a variety of services, including training and analysis.