

'IT'S QUITE MAGICAL'

ENERGY ROUTERS SHOW PROMISE FOR A MODERNIZING GRID

BY REED KARAIM

Keeping the system running smoothly is a goal for any electric co-op manager anywhere. But it becomes an even clearer objective when it comes to voltage optimization and power quality.

Improving both of those metrics was the aim when Sandhills Utility Services in Fort Bragg, North Carolina, installed the first three-phase grid energy router (GER) at a fast-food restaurant on the Army post's lines.

The GER is a smart device that can stabilize voltage, correct power factor issues, and mitigate harmonics in real time. The routers have the potential to provide significant peak load savings, help cooperatives handle increased distributed energy resources on their systems, and provide better overall power quality.

The cause of the problems at the restaurant was never determined, though it's not rare for voltage drops and imbalances on long feeder lines to create issues with equipment at a three-phase commercial location. David Keith, Sandhills's engineering manager, says the GER, made by ERMCO-GridBridge, made an immediate difference.

"It's quite magical," Keith says. "There was a dramatic load imbalance on the customer's side, which caused differing voltages. As soon as you put that device on, the demand immediately reduces, the energy reduces, the neutral current immediately reduces."

Sandhills Utility Services was formed by four North Carolina cooperatives to provide power to military bases under a mandate to privatize their utilities. Those same bases are also seeking to maximize their use of renewable generation.

As electrical engineers know, when more and more renewables come on a system, voltage optimization and maintaining power quality can become a challenge with over-voltages and voltage sags, power flicker, phase imbalances, and other issues that come with the uneven nature of distributed generation (DG).

Keith says Sandhills Utility Services hopes to eventually test a GER in that context.

"We're really looking forward to seeing if we can find some kind of solar or DG location to put this in," he says, "to see how it functions as a device to help us protect our system from the fluctuations that can occur from distributed resources."



ERMCO-GridBridge

PEAK LOAD MANAGEMENT

Brian Sloboda, NRECA director for consumer solutions, notes that GERs and other so-called "grid-edge devices" could play an important role as co-ops and other power utilities integrate solar power and other distributed generation.

But a more immediate benefit, he says, is in peak load management. With a long feeder line, the need to maintain voltage within minimum requirements at the end of the line requires the voltage to be higher along earlier sections of the line. A GER or device with the same functions can keep voltage within required parameters, so it doesn't need to be bumped up at the beginning of the feeder, Sloboda explains, which becomes most significant during peak loads.

NRECA tested the GridBridge technology earlier at farms in the service areas of four co-ops in South Carolina, where it proved successful in stabilizing voltage, mitigating harmonics, and reducing peak load, Sloboda says. The communication capabilities of the smart device were also valuable, providing data on voltage and power quality back to the co-ops. The tests showed clear benefits both to the consumer-members and the co-ops.

"Using it for voltage optimization can lower the peak demand around 10 percent without inconveniencing

the customer, so you're seeing some immediate financial benefit," Sloboda says. "I think most co-ops are in the position where they want to reduce their peak demand, and using this device can do it."

GER OPTIONS

GridBridge is fully owned by ERMCO (Electric Research and Marketing Cooperative Inc.), a transformer manufacturer based in Dyersburg, Tennessee, that is owned by statewide association Arkansas Electric Cooperatives Inc. NRECA and several of its member co-ops have been working with GridBridge since 2010 on developing and testing grid-edge routers.

Other companies also offer smart devices that promise voltage regulation, loss reduction, and improved photovoltaic or other DG integration. At the end of last year, NRECA partnered with an outside vendor to conduct an independent evaluation of products by Varentec Edge, American Superconductor, and ERMCO.

The evaluation found that all three helped integrate photovoltaic generation into distribution systems, but they differed in other capabilities and characteristics. A November 2018 advisory by NRECA's Business & Technology Strategies group, *Grid Edge Device Comparison*, includes a detailed look at the initial findings.

"Everyone does it in a different way," Sloboda says of the devices. "The two interesting things about GridBridge technology: Number one, it's at or combined with the transformer, so you're able to have a very surgical deployment. Some of the others are feeder-based, and you have to deploy several along a feeder. The other thing is that they included us and a co-op board of engineers as a sounding board with this product. They've always been very receptive to taking feedback."

CHANGING CONSUMER NEEDS

Deborah Fish, president of Utility Services Inc., studied the installation and performance of the GER at Fort Bragg for NRECA. The test location was chosen in part, she says, because Sandhills Utility Services had good historical data on the transformer performance, making an accurate assessment of the three-phase GER possible. The commercial load also was close to the post's fiber-optic network and was non-essential to operations, meaning any installation or test problems wouldn't have larger implications.

Sandhills's Keith says installation of the GER was relatively straightforward. The only challenge came in setting up the communication link.

"We have a closed fiber network, so as far as communications, we had to customize it a little bit. Once we got it set up for our SCADA, it worked well," he says.

Sandhills has had no problems with its operations since the device was installed, and while the utility is continuing to monitor results at the substation and SCADA levels as part of the testing, Keith says they view it as "a permanent installation."

Devices like the ERMCO-GridBridge GER are still cutting-edge technology, but Sloboda and Fish point out that their development reflects the changing nature of consumers' power needs. Voltage optimization wasn't as critical years ago. As long as voltage stayed within accepted margins, it wasn't a problem for most consumers.

"Today, your user's equipment is totally different," Fish says. "Digital equipment may not be able to withstand that fluctuation. When it comes to the sensitivity of digital equipment versus electromechanical equipment, there's really a tighter bandwidth, and within the co-op industry, we need to continue to strive to provide our end-users the best quality they can get."

The benefit of grid-edge devices, Sloboda says, is that they "allow for very precise control, and as we see with customers with sensitive electronics and more customers using solar, devices like this are going to fill a need that more utilities are going to have."

Fish notes that putting one grid-edge device into a distribution system isn't going to have a significant impact for the co-op, but as the technology becomes more commonplace, it could be transformative, especially when it comes to distributed energy generation.

"Solar is everywhere in the country right now, and more and more is coming on line. I think, as you see those rooftops installed and you see larger commercial customers doing solar on premises, from a voltage standpoint and a power quality standpoint, products like the GridBridge device are going to become almost a necessity," she says. "You're going to need to have something you can have on the feeder that can respond almost instantly to voltage fluctuations and power quality, and this device has this."

Keith says the results that Sandhills Utility Services has seen from its installation have him excited about the potential of the devices down the road.

"You're automatically looking at a 4 to 6 percent demand reduction, and you're looking at, possibly, a 5 to 10 percent energy reduction," he says. "Imagine, across the nation, if we had a 10 percent energy reduction." **RE**