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Energy company using smart grids to reduce downtime

Duke Energy, a U.S.-based sustainable electric and gas company, is working to improve customer service to their roughly 7.2 million customers in the Southeast and Midwest with smart grids.

Doug Drinkwater
01/19/2017

Duke Energy, based in Charlotte, North Carolina, is a US-based sustainable electric and gas company that serves roughly 7.2 million customers in the Southeast and Midwest. The 112-year-old firm owns 58,200 megawatts of base-load and peak generation and distributes it to its customers. The 58,200 megawatts cover some 104,000-sq miles with 250,200 miles of distribution lines. Almost all of Duke Energy's power generation comes from coal, natural gas, or oil.

This base is huge, and yet, like many other energy suppliers, the firm struggles with maintenance and downtime, which can negatively impact customer relationships and revenues. How to optimize energy supply has become a global challenge and a competitive differentiator.

IIoT powers up

Duke Energy has been looking to rectify these issues. For example, the firm has been using self-healing grid technologies to isolate and correct faults with millisecond decision cycles, as well as drones for monitoring hard-to-reach places such as a 40-ft high transmission line or a 500-acre solar farm.



Duke Energy is not alone in this technology innovation, especially in an electric industry. The electric industry is considering such ideas as apps which turn smartphones into infrared cameras to find trouble spots on a power line, or augmented reality (AR) glasses that let technicians view 3-D wiring schematics as they work.

Lynn Good, Duke Energy's chairman, president, and CEO, talked about how the Internet of Things (IIoT) is playing a role. "We're exploring how the Internet of Things and other advancements could make these types of applications possible and enabling consumers to customize their energy experience in unprecedented ways." She continued that customers are now craving the same control and convenience from every service provider. "The bar has been raised, and the electric industry is no exception."

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Self-healing networks

Sacha Fontaine has been a consultant for Duke's smart grid division since 2010. He explained how Duke Energy has worked on advanced meter infrastructure (AMI), which connects smart meters, communications networks and data management systems together to enable customers to better manage their energy supply. He also talked about using smart street lighting in certain municipalities, and the deployment of self-healing networks.

Self-healing networks, Fontaine said, offer value to the business and to the customer because they do what personnel used to do manually. In the past, an individual would monitor the system but wouldn't automatically be alerted to a fault on the power line. Manually, they would have to see where to isolate the fault, so that the fewest number of customers are inconvenienced and left in the dark. Then, they would see what alternative sources of power could be used to power everyone else up (not on the fault line).

"It could take an hour. You have to send a crew to locate and isolate the fault, then get the power rerouted, and finally you could send the crew to fix the fault," explains Fontaine.

"With IoT we have remotely controllable devices through the grid that immediately alert us to outages. This takes it out of the hands of the dispatchers and puts it into a centralized system that would make the same decisions the system operator would make, but just a lot faster."

Through algorithms and machine-learning technologies, these networks can evaluate capacity, choose alternative sources, and isolate the smallest section of the network to isolate and repair.

"What used to take about an hour now takes less than 30 seconds, so it's a great improvement in terms of customer minutes of interruption," Fontaine said.

Another project Duke Energy has been working on since 2014 has been providing smart lighting to municipalities or cities. By providing more efficient lighting using LEDs, lighting lasts longer and uses up to 50% less power.

"They don't tend to burn out," said Fontaine, adding that "outage dropped by around 50%. ROI has been achieved in eight years. The added benefit is in knowing exactly which street light is out."

Another IoT project, AMI, was initially rolled out across five states in 2014. Duke, the biggest utility company in the US, worked with Itron, Cisco, and other tech firms to deploy smart meters-building blocks which enable distribution automation, distributed generation, and a whole host of distributed intelligence and embedded sensing applications. Pilot projects allowed customers to track time-of-use rates, get peak time rebates, and see critical peak pricing.

Customers in these pilot programs used smart thermostats, web portals, and direct load control devices to reduce their electricity consumption and peak demand.

"AMI was a great example; smart meters allowed us to do remote readings of energy usage every 15 minutes instead of every month," Fontaine said, adding that "the firm could remotely connect and disconnect service over the mesh network as necessary."

Other technologies are being looked at, but it's at an exploratory stage. Fontaine urges companies to "Try and see beyond immediate benefits of technology," saying that technology should be the "Building block for future benefits to customers and the company and not tech for tech's sake."

Future of renewable energy

What does the future look like? Unsurprisingly, it's all about renewable energy.

"It's definitely going to be renewable energy, or what a utility company might call distributed energy resources," Fontaine said. "Integrating that into the existing grid is not as simple as it might seem because of existing infrastructure—we built grid to send power one way from plant to end customer. What's happened with distributed energy—for example solar—is that now power can flow back into the grid, and this happens without the utility explicitly controlling that power flow. This is a huge change for utilities."

Fontaine added, "IoT will play a big part here from evaluating customer connections to analyzing grid and weather conditions. Sensors give intelligence and can lead energy providers to an age of smart energy and predictive modeling."

Good summarized the future of the company and its approach to innovation: "I often get asked the question, 'Are you innovating fast enough?' The answer is more complicated than yes or no. A company can't chase every new, shiny object. I have to provide reliable energy to 23 million people every day. You have to be disciplined and thoughtful about setting priorities and allocating resources. Once you do, run toward your goal—fast."

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