



Eaton helps Indianapolis Power & Light Company enhance safety and reliability of downtown power distribution system

Location:

Indianapolis, IN

Challenge:

Reduce arc flash risks for an underground power distribution system to enhance personnel safety without any power interruptions

Solution:

Eaton network protectors, arc flash safety solutions with remote racking technology, VaultGard™ communications and turnkey engineering services support a safe, reliable underground power system

Results:

Enhanced personnel safety, equipment reliability and electrical power distribution system uptime with accelerated installation and commissioning that reduced labor costs

“Overall, we could not ask for more from a project management perspective—we’re under budget and ahead of schedule, while incorporating best-in-class technology for our customers and crews.”

Mike Holtsclaw, IPL’s director of transmission and distribution engineering

Background

Since 1926, Indianapolis Power & Light Company (IPL) has delivered low-cost electricity with customer service ratings that are among the best. Today, IPL ranks in the top 10 percent nationally in reliability and is part of AES Corporation, one of the largest global power companies committed to operational excellence to meet the world’s growing power needs.

IPL provides retail electric service to more than 480,000 residential, commercial and industrial customers in Indianapolis and other central Indiana communities. To support reliable power in downtown Indianapolis, IPL operates a complex underground network that serves more than 2,600 critical customers with a peak demand of 114 megawatts, about 3.6 percent of the total system load. The network system in Indianapolis supports reliable power to the state capitol building, Indiana State House, Birch Bayh Federal Building and U.S. Courthouse, Chase Tower, numerous hotels and other customers with critical power needs.

The underground power system provides a secondary redundant network that is designed to meet both the higher reliability requirements and limited space in urban areas. This system delivers electricity through a complicated subsurface network that includes transformers and underground cables that operate in parallel. Power flows in either direction and network protectors are used like large-scale circuit breakers; they are designed to open when they detect power backfeed from a transformer.

Challenge

The subsurface system dates back to the early part of the 20th century. Many of these systems, including the one in Indianapolis, were installed in the 1930s. Unlike the primary power transmission and distribution system, equipment problems in secondary networks can go unnoticed, as they may not cause an interruption of power. Even if there is no immediate power loss, any equipment failure is problematic because the system serves government agencies, banks, and other downtown-based businesses where failures can result in high-profile events.

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IPL takes steps year-round to provide safe, reliable service downtown and conducts inspections of transformer vaults every two years. These inspections include a visual inspection of network transformers and network protectors, electrical testing of the network protector and the physical condition of the vault structure and electrical equipment. In particular, inspections check for corrosive effects of street and sidewalk de-icing chemicals and from other underground utilities such as steam (elevated temperatures) and water.

As part of its company-wide commitment to safety, IPL wanted to meet and exceed new arc flash safety requirements mandated by the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) 70E specifications. The code updates require utilities to conduct arc flash studies to determine the level of arc flash potential present and adhere to personal protective equipment (PPE) requirements.

Notably, much of the maintenance work performed on secondary network systems involve live equipment, carrying upward of 480 V. A network system often exceeds Category 4 PPE requirements (+40 calories per square centimeter) if measures are not taken to reduce the energy exposure.

To meet the latest requirements, IPL would need to de-energize the vault equipment and customers would experience outages for routine maintenance work. IPL sought to reduce the PPE level requirements to Category 2 (8 calories per square centimeter) to simplify maintenance procedures for personnel while avoiding outages for its customers, as complete downtime is simply not an option for public utility networks.

“We needed to reduce the incident arc flash energy in our vaults to help enhance safety for our maintenance teams without impacting service to our customers,” said Mike Holtsclaw, IPL’s director of transmission and distribution engineering. “To help address this challenge, we looked for an organization that would be able to provide the advanced solutions and expert support needed to expedite the project.”

The utility approached Eaton. IPL was already familiar with Eaton solutions for secondary power systems and had incorporated Eaton equipment into its network system for decades. The utility had also recently begun to use Eaton’s CM-52 remote racking technology to remotely connect and disconnect the network protector from the energized bus, helping to enhance safety for its maintenance personnel. The utility trusted Eaton to provide a turnkey solution that would streamline the project and help to meet the evolving safety requirements.

All in all, IPL sought to replace approximately 135 network protectors in 42 vaults between 2014 and 2018. It relied on Eaton to replace the equipment in a way that allowed its personnel to perform routine maintenance on any of its vaults without power interruptions.

Solution

IPL took action to support a safer and more reliable power system. As part of that broader effort, the utility maintains and updates its underground network with a focus on:

- Enhancing inspections and technology
- Inspecting and replacing network protectors and transformers
- Improving asset management

In 2013, IPL attended Eaton’s annual Electrical Network Systems Conference, featuring expert speakers and engineers, field personnel and maintenance leads from utilities in the U.S., Canada and Brazil. During this conference, another utility discussed a project that involved the replacement of 80 network protectors over two years. The utility worked with Eaton to manage the project. Eaton’s network protector solutions were used to replace the aging equipment, which allowed the utility to remotely rack its network protectors and enabled communications to support remote diagnostics. IPL was able to tour this utility’s vaults to understand exactly what the project involved. After that experience, updating its network system seemed much less of a theoretical problem; IPL knew it could be done and better understood what the project would involve.

IPL selected Eaton’s network protector technology to replace all its 480 V equipment. Eaton offered expansive solutions for new vault equipment, communications and automation for underground applications, as well as a host of training programs for IPL maintenance teams.

“The solution Eaton developed far exceeded anything else in the market. We gained features beyond our original requirements that allowed us to further enhance personnel safety during routine maintenance on our network system,” said Holtsclaw.

EATON SOLUTION

- Arc flash system studies
- CM-52 network protectors
- CM-52 remote racking device
- Arcflash Reduction Maintenance System™
- VisoBlock secondary disconnect technology
- VaultGard™ communications platform
- Installation
- Training and testing

This project involved more than just replacing network protector devices; IPL also sought to add communications solutions to enhance maintenance and system reliability, and technology designed to enhance safety and reduce arc flash risks. Overall, the project involved the replacement of approximately 135 network protectors over a four-year period.

Eaton’s CM-52 network protectors used on this project incorporate a variety of features to enhance safety and help reduce arc flash risks. The network protectors have one of the highest interrupting ratings in the industry and incorporate a deadfront drawout design. The Eaton technology includes an integral Arcflash Reduction Maintenance System, which is designed to sense fault current in either direction. This system establishes a preset instantaneous trip level that overrides the time delay function of a traditional current relay and schemes of the network protector, allowing the breaker to trip faster and reducing the energy exposure to Category 1 (4 calories per square centimeter). The Arcflash Reduction Maintenance System can be remotely activated before personnel go into the vault.

“We worked with Eaton to replace one network protector in each vault first. This approach allowed our maintenance crews to work in any vault with reduced incident energy levels and without service interruptions for our customers,” said Holtsclaw. “This aspect of the project was completed in 2015 and will make the rest of the change out work easier and safer.”

In addition, the network protectors incorporated in IPL’s underground system include Eaton VisoBlock technology. This low-profile disconnect switch allows maintenance personnel to isolate a network protector from the energized network bus, allowing them to work on de-energized equipment.

IPL also took advantage of Eaton’s CM-52 remote racking technology for this project, which enables its maintenance crews to connect and disconnect Eaton’s network protectors remotely, reducing the risk of arc flash exposure.

In addition to the network protectors, IPL selected Eaton’s VaultGard communications platform to provide communications, control and predictive diagnostics to prevent an event or failure.

All of IPL’s protectors are tied into this system, which provides monitoring and remote control of the secondary network; VaultGard technology is designed to help utilities identify network issues before they cause costly system-wide problems. Eaton’s intelligent technology tracks vital network protector performance metrics, including data monitoring (voltage, current, power metrics, etc.), logging and alarms, and it graphs captured data. The system can also integrate with the IPL’s existing SCADA.

Eaton also managed the entire project and provided on-site support for installation, commissioning and maintenance training for the network systems. Eaton was able to replace each network protector and commission the new unit in one day. With one of the largest and most experienced teams of power systems engineers in the industry, Eaton was able to provide the resources needed to meet IPL’s aggressive project timeline.

“By working with Eaton’s engineering services team, we’re able to get the project completed faster,” said Holtsclaw. “Our crews could not replace the network protectors and accomplish all the other aspects of their work in the timeframe we sought. Eaton’s familiarity with the equipment and network systems, as well as its rigorous safety standards, are helping make this project a success.”

Results

To date, Eaton has installed 52 480 V network protector devices with IPL to help avoid equipment failures and upgrade the power distribution system to support safe, reliable power. Eaton’s new network protector innovations and services team did more than simply replace aging electrical infrastructure—they allowed IPL to enhance safety and reduce arc flash risks by:

- Allowing personnel to remotely connect and disconnect equipment
- Providing a means to disconnect individual network protectors from the overall network system
- Reducing the time to clear faults
- Enabling early warning alarms and data through communications out of the underground vaults

Additionally, Eaton’s VaultGard communications system is helping IPL shift away from time-based maintenance toward predictive, usage-based diagnostics. The data that the Eaton system provides can be trended and analyzed to determine predictive maintenance schedules, plus network protectors can be opened and safety features activated remotely—helping enhance safety for maintenance personnel by mitigating dangers before they enter the vault.

“Currently, we’re ahead of schedule on replacing the network protectors and expect that the overall project will be completed earlier in 2018 than forecasted,” said Holtsclaw. “From a budget standpoint, costs are a little less than we expected. Overall, we could not ask for more from a project management perspective—we’re under budget and ahead of schedule, while incorporating best-in-class technology for our customers and crews.”

The project will help IPL continue to uphold its reputation of providing extremely reliable service for its 2,600 downtown Indianapolis customers, while maintaining the highest safety standards for personnel and equipment.



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Printed in USA
Publication No. CS083072EN / Z18020
March 2016

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