

# Telemetric Network Protector Automation Solution

## Kansas City Power and Light, Kansas City, MO



### Profile

- Headquartered in downtown Kansas City, Missouri, KCP&L generates and distributes electricity to retail customers, cities and electric utilities in Missouri and Kansas.
- They operate 8 stations with 25 generating units providing power to nearly 500,000 customers and sell into the wholesale market for the central states region.
- Over 4,000 megawatts of efficient generation assets are in operation or under construction.

### Application

KCP&L was looking for a way to allow system operators to monitor and control network protectors on their system. Issues with the KCP&L network included high operations and maintenance costs due to manual patrolling of all network protectors to check for units stuck in an open or closed position because of malfunctioning relays or protectors that were not functioning properly due to other problems. The KCP&L electrical underground crews regularly performed physical inspections and tests. They manually recorded how many times protectors opened and closed based on the operations counter in the vault. These inspections showed some protectors had excessive operations that shortened their lives considerably. Safety was also an important issue. For example when a protector was switched to automatic, or unblocked, any malfunction of the unit was a potential hazard while underground workers were still in the vault.

KCP&L's project goals were:

- An economical network monitoring system
- Allow remote control of network protectors
- Decrease operations and maintenance costs
- Enhance safety associated with manual switching of network protectors
- Improve Customer Service
- Extend transformer and network protector life
- Provide operators with a convenient overview of the network operating conditions



ETI Concentrator Box with Telemetric DNP-RTM, power supply and harnesses for connecting to ETI MNPR network protector relay (also shown).

KCP&L sought a two-way communications method that would be reliable, cost effective and work in their network protector vaults located in the metro areas of their service territory. KCP&L investigated several options before selecting a solution from Telemetric and Electronic Technology Inc. (ETI).

### Network Protectors

KCP&L has approximately 150 network protectors on their system in three underground network "grid" systems, with two located in downtown Kansas City and the third in Kansas City's Country Club Plaza. A network "grid" is a system with multiple 13-kV feeders serving multiple transformers that operate with their secondaries in parallel. This system is used to serve loads that demand reliable and continual service. There are also twenty-four "spot networks" installed in various locations in their metropolitan area. These "spot networks" serve the same purpose as grid networks, but

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are smaller. In this case, two to four transformers operate with their secondaries in parallel to serve a customer with a critical load.

The network transformers on both the grid and spot networks are connected to a network protector. The network protector has network relaying that automatically switches the protector in and out of the circuit based on electrical operating criteria such as voltage, kW load, and phasing. These protectors play a critical role in that they are designed to automatically isolate 13-kV faults while maintaining service to customers through the non-faulted feeder sections. However, if a network protector fails to operate due to a defective relay or other electrical or mechanical defect, this can cause multiple transformers to become overloaded and fail due to thermal stress. Failed transformers can cause cascading problems on the network. Furthermore, network transformers and protectors are not easy to replace due to their location in vaults beneath sidewalks and streets. It can take hours for an underground crew to locate and fix the problems resulting in sustained outages for customers affected.

### Automation Solution

KCP&L studied three different network automation solutions. Out of these three, KCP&L selected the Telemetric and ETI/Richards Manufacturing solution because they both supported DNP 3.0 and two-way communication. Also, the ETI relays were being used successfully at Consolidated-Edison in New York and KCP&L was successfully using Telemetric DNP-RTM units in other applications. In addition, KCP&L performed a cellular signal strength survey in a number of their network vaults to confirm communications would function as expected.

The hardware portion of the project included the Telemetric DNP-RTM that was installed in a concentrator box supplied by ETI/Richards Manufacturing. The box included a 120VAC to 12VDC rectifier to supply power to the DNP-RTM. A quick disconnect cable from the concentrator box mounted at the top of the network vault provides the communications link from the DNP-RTM to the ETI/Richards relay located in the network protector. ETI/Richards also supplied temperature sensors to

measure transformer oil temperature, float sensors to measure the water level in the vault, and water sensors to detect moisture inside the network protector.

Although the hardware was important, it would not be very useful without the software portion of the project. The software portion is what makes this project more than just a network monitoring system; it makes it a network automation system with two-way communication. The secure Telemetric Web site supplies a user-friendly interface to the ETI/Richards network relay. On the Web site, KCP&L engineers can configure alarms to trigger upon some action or an undesirable situation, such as low voltage or unusually high temperature. Users can also be notified if the status of the protector changes, such as from unblocked (automatic) to blocked, or from closed to opened and vice versa. The Web site also makes it possible to configure creative notifications. For example, if the circumstances are right for a protector to close or open, yet it refuses to do so because of some mechanical issue, a notice can be sent. Such notifications are sent directly to users' email addresses or pagers.

KCP&L also uses Telemetric SCADA-Xchange™ middleware to integrate DNP data from the network protector relays into their EMS system.



Typical Installation of Concentrator Box at the Top of a Network Vault.