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Juggling old cables, new injection techniques and ongoing reliability expectations

Sub Title:
Part of the Utility2Utility article series
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For this installment of our Utility2Utility interview series, we sat down with Thomas Bruhl, electric services manager for the City of St. Charles, to ask about that old friend (and sometimes pesky foe) of electricity distribution: cable.

The City of St. Charles is a suburb about 40 miles west of Chicago. According to the City, the St. Charles Municipal Electric Utility began in 1892 when the city council unanimously approved a payment to Phillip Harvey of $520 for preliminary work on a lighting plant that would establish a city electric utility with capacity to power 1,500 incandescent lights.

Since then, the city utility has grown to over 120 MW of peak power use with six substations serving over 15,000 customers. For this installment of our Utility2Utility interview series, we sat down with Thomas Bruhl, electric services manager for the City of St. Charles, to ask about that old friend and sometimes pesky foe of electricity distribution: cable.

Tell us about the reliability issues you were having with your older cable.

Bruhl: The City of St. Charles has a detailed tracking system for outage statistics. In the mid-2000s, it was clear that cable faults were a significant contributor to customer outage minutes. With a prudent, proactive cable replacement program, we felt that many of those outage minutes could be prevented.

The single-phase residential installation standard in the ‘70s, ‘80s, and early ‘90s for the City was rear lot installation of XLPE, 1/0 AL, stranded, direct buried. Cable was installed in a trench until the end of the reel was reached and then a splice was direct buried at that point.

Once a subdivision experienced two or three cable faults, the City would replace the cable in the entire subdivision. Given that the neighborhoods were 30+ years old and open cut trenching in backyards was not possible, the direct buried cable was abandoned and HDPE

was installed via directional bore by a contractor. City crews then installed brand new cable in the pipe. On top of being fairly expensive, the customer experiences were sometimes very difficult. Dealing with complaints from open pits in yards, damaged private sprinklers and dog fences, and having many days of construction workers in a resident's backyard was less than desirable. On top of multiple outages in a neighborhood, our customers had to then endure construction activities and significant disruption of their lives. Even though it was a small percentage that was unhappy with the landscape restoration, for those customers, it was administratively cumbersome to satisfy them.

Tell us about the process of injecting. What does it involve?

Bruhl: First, the City developed a priority matrix that includes weighted factors of previous faults, tan delta test results and reliability impact of a fault related mostly to the number of customers on the loop.

The oldest cable is not always what is in most need of reinforcement.

The City of St. Charles provides two IBEW journeyman linemen to work with the technician from Novinium. The process starts by taking the span to be injected out of service by switching. Then the Novinium technician performs a TDR on the span looking for splices and condition of the neutral. Assuming that the cable passes those tests, the elbows are removed and an injection port is installed on the cable. At that point, Novinium will try to pass air from one end to the other, to make sure that the fluid will pass through.

If there are only one or two splices that impair injection, the City will dig those up and fluid can be injected from the splice back to the transformer or termination.

For normal spans without splices, fluid is injected at one end, and received at the other end. The City prefers what is called sustained injection, in which the fluid is injected and received

in a short period of time. The City crew reinstalls the elbows and the span is put back into service. A dedicated crew typically gets three to four spans per day, depending on the length of the spans.

The other process involves a slower injection where the reservoir and receiving bottles are left for a longer duration, requiring a return visit to take the bottles off.

Typically a crew is in and out of a customer's back yard in a couple of hours, with no disruption of any landscaping.

What benefits have you seen from this project?

Bruhl: First, we were able to reinforce many more feet for the same cable replacement dollars. By our calculations, injection is approximately one third of the cost of traditional replacement, once you factor in all of the labor, pipe, cable, and landscape restoration costs.

Because we could get so much more cable rejuvenated, we have been able to get ahead of the faults, and are now injecting subdivisions that have never had a cable fault, but VLF Tan-Delta suggests that the cable insulation in those areas is suspect.

While we haven't eliminated single phase residential cable faults, we have reduced them from a high of 10 in 2010 and 2011 down to one last year. In terms of customer outage minutes related to single-phase cable faults, we dropped that from 81,014 minutes in 2010 to 913 minutes last year.

What did you learn from this process?

Bruhl: There are a number of reasons that cable can't be injected. If the neutral is corroded, or there are too many splices in the span, you will be back to traditional replacement. Given the cost advantage, we try to inject as many feet as possible.

While the fluid is somewhat magical, it cannot work miracles. We have had a couple of cable faults shortly after injection. Those cables were going to fail imminently regardless of whether they were injected or not. Novinium warranties such, and also provided laboratory analysis of the faulted section. If the trees in the cable are too advanced, they win the race to failure before the fluid can avoid the fault.

There were a number of spans where the tan delta pretest was off the charts, and we shut down the VLF at a voltage below nominal operating. Typically, VLF testing is destructive, but after injection, those spans tested as good as or better than new with respect to IEEE standards for XPLE cable.

What advice would you give other utilities looking to replace a lot of old cable?

Bruhl: Cable injection could be a beneficial process in your cable replacement strategy. If you have VLF and tan delta equipment, and take a couple of days to test random spans in subdivisions, your priority might not always be aged based.

If you have a mature neighborhood with a history of cable failures, and the cable type is an injection candidate, try injection.

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