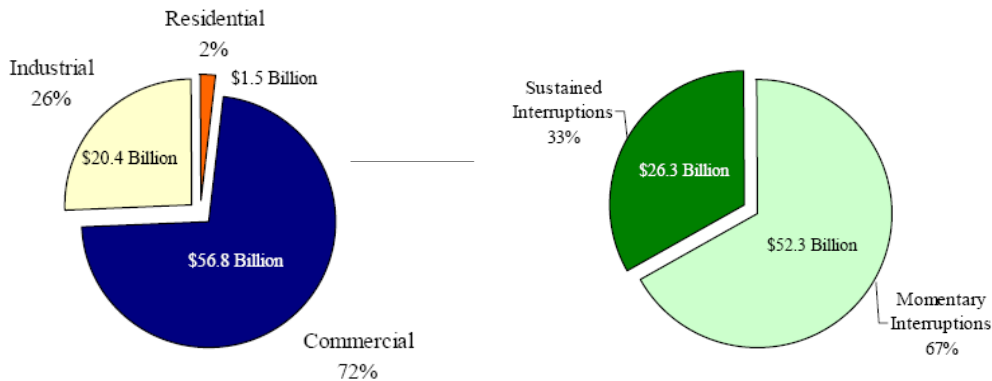


Case Study

Failing Recloser Bushing

Using LineTrackers and CymeDist To Prevent a Sustained Outage

Every utility is faced with the decision of investment versus reliability. By one estimate, the cost of power interruptions in the US is nearly \$79 billion dollars. There are a wide variety of tools available to utilities, from complete system upgrades to devices that help pinpoint the location of the outages. This case study outlines one tool that an Investor Owner Utility is using to minimize customer outages.



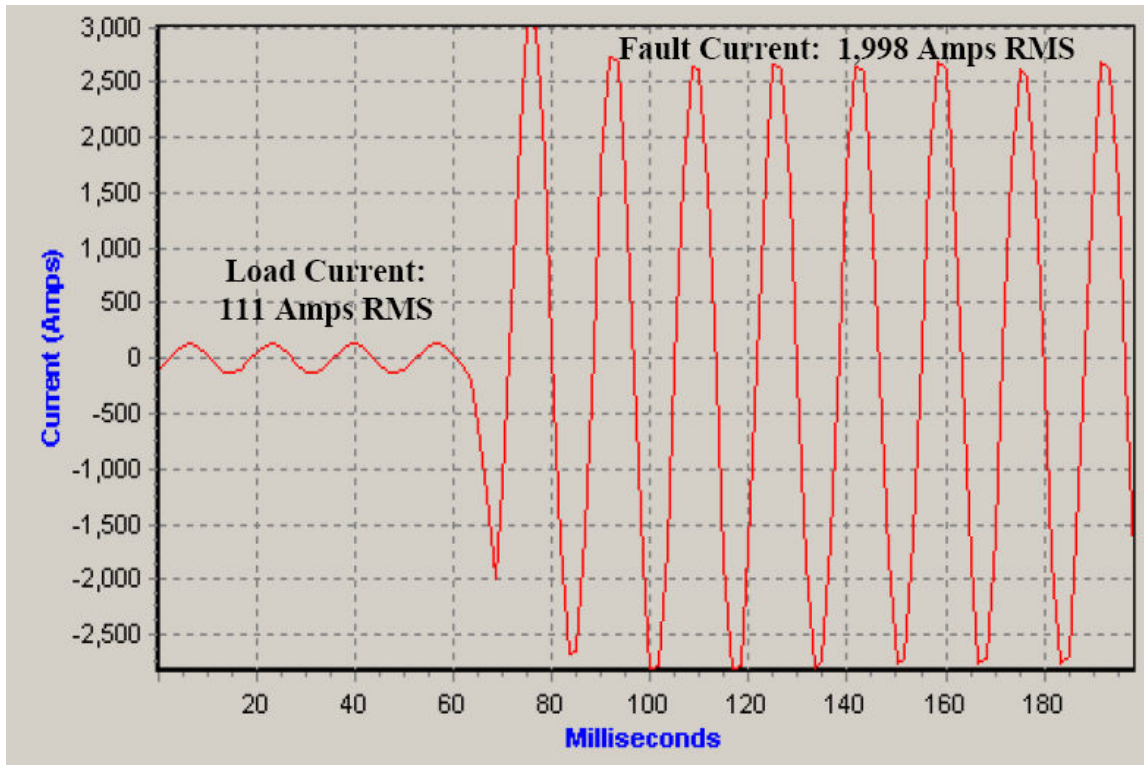
Source: Cost of Power Interruptions to Electricity Consumers in the United States (U.S.)
Kristina Hamachi LaCommare and Joseph H. Eto

Graph 1

This case study focuses on a large Midwestern investor-owned electric utility, which provides electricity to over 1.5 million customers. The utility has eight districts covering diverse territories including cities, industrial areas, forests and farm land. Their high voltage system includes nearly 5000 miles of line and their distribution system includes over 60,000 miles of line. This utility has been making many investments to improve their reliability including a new Outage Management System, updated GIS and many other field devices.

As part of their reliability improvement efforts, they have upgraded approximately 25% of their substations to microprocessor relays and have long term plans for upgrading additional stations. However, due to the time & expensive involved, it may be many years before the majority of the stations are upgraded. In order to decrease the number and duration of outages on key feeders, the utility has purchased GridSense LineTrackers for each of their districts to use as a troubleshooting tool. They are using the LineTrackers in conjunction with their CymeDist Analysis Software.

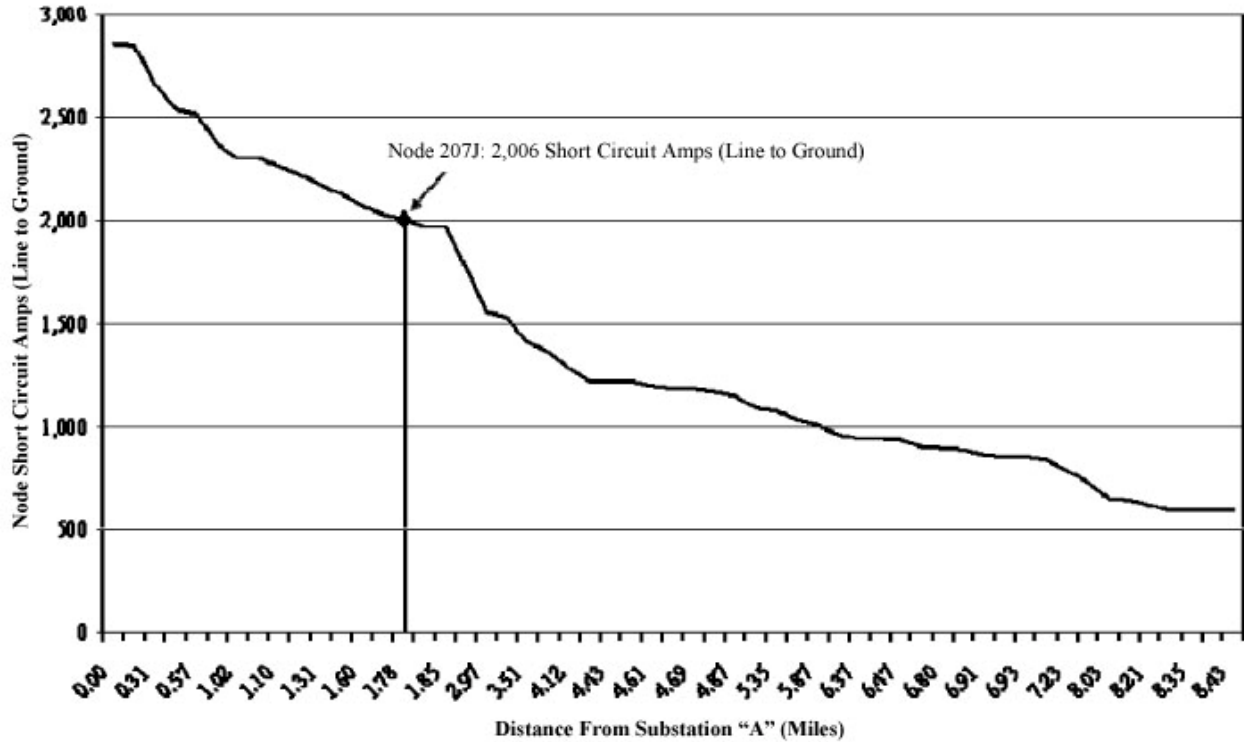
In early September the utility installed a set of LineTrackers outside of their Substation "A" that fed a feeder with unexplained, momentary outages. On September 16, the LineTrackers recorded a phase B to ground fault event as show in Graph No. 2 below. In addition, the LineTrackers confirmed that the substation recloser had operated, thus the fault was in the first zone of protection. (The GridSense LineTracker records both routine load profiles and captures events and outages.)



Graph 2 – Waveform snapshot recorded by the GridSense LineTracker

The utility used the 1998 amp fault value along with the CYME Load Concentration Point (LCP) Short Circuit Data shown in Graph No. 3 to determine the fault occurred 1.78 miles from the substation.

Substation "A"/Circuit "1"CYME Line to Ground Fault Current



Graph 3

The entire Substation "A" circuit has almost 100 miles of line in parts of 43 different township sections. The LineTracker enabled the utility to narrow the fault location down to within a few conductor spans of LCP 207J. The actual fault location was found one span approximately 300 feet away from the LCP 207J. A bushing on the source side of an older recloser was starting to fail and was causing intermittent flashovers. The Senior Engineer with the utility reviewed the data of the LineTracker and was able to confirm the failure location and mode of failure. He commented that had they not found the problem bushing with the LineTrackers, the bushing would have eventually failed and caused a longer term outage.

