

NYSP2I Evaluates Performance of SmartKable's Line Ranger Network



Challenge

SmartKable wanted a third-party performance evaluation of their Line Ranger Network and its ability to provide useful power quality alerts.

Solution

SmartKable worked with NYSP2I and RIT to install multiple Line Rangers on transmission lines in RIT's solar grid network. Then, NYSP2I compared measurements from available Line Rangers to measurements from RIT's PM850 power meters as the baseline. NYSP2I also evaluated the Line Rangers' data relative to power anomalies and power quality.

Results

The evaluated Line Ranger measured current within approximately 4% of the baseline meter measurements, and voltage consistently within 1% of baseline measurements.

The Line Rangers provided data that signaled four power anomalies, which correctly indicated events leading to two solar field crashes and identified equipment problems.

The Line Ranger technology demonstrated its ability to monitor the rate of measurement signals, monitor harmonic distortion of current and voltage, and monitor reactive power, among other abilities.

It was concluded that the Line Rangers, when used together with a future automated advanced warning system, offer a promising option for detecting abnormalities in time to prevent power system failures.

SmartKable, LLC

SmartKable LLC, based in Skaneateles, NY, has developed a Line Ranger system that aids integration of renewable energy sources with the electric grid. When distributed, intermittent renewable power sources create natural load and phase imbalances at the interconnections to the grid; the results can include a degradation of efficiency, equipment life, and poor power quality. Such effects represent increasing challenges as the use of renewable sources continues to grow. The Line Ranger network provides the real-time data required to monitor, reduce, and help eliminate these effects, helping to improve the transition to renewable energy.

"SmartKable Powerline Solutions found the NYSP2I team to be very knowledgeable. Also, the level of data analysis and the detail within the study exceeded our expectations. We look forward to further collaboration in the future." **Bill Collins, Corporate Director**

Challenge

SmartKable wanted a third-party performance evaluation of their Line Ranger Network and its ability to provide useful power quality alerts.

Solutions

SmartKable requested assistance from NYSP2I to evaluate the performance of SmartKable's Line Ranger Network and monitoring software. SmartKable worked with RIT's Facilities Management Services (FMS) to install multiple Line Rangers on transmission lines in RIT's solar grid network. Then, NYSP2I evaluated the performance of the Line Rangers over the course of several months. Specifically, NYSP2I (1) compared the Line Ranger measurements to RIT's Schneider Electric PM850 power meters, as a baseline, (2) supplied PM850 power measurements to SmartKable, (3) evaluated power anomalies in voltage, current, and power, and (4) evaluated power quality as identified by SmartKable using their Line Ranger network.



Results

Current and voltage

- A Line Ranger tracked line current within approximately 4% of the baseline PM850 meter measurements. This deviation was consistent over the range of measurements. The 4% difference is likely attributable to the calibration coefficient used by SmartKable and could be easily adjusted to match the PM850 measurements.
- The evaluated Line Ranger measured line voltage consistently within 1% of the baseline PM850 meter measurements.

Power quality abnormality detection

Based on data from the Line Rangers at RIT, SmartKable detected and reported four anomalies related to power quality:

- Anomaly showing first derivative of current (rate of change) correctly forecasted a solar field crash
- Anomaly identifying non-correlation between current and weather correctly identified equipment problems
- Anomaly identifying apparent transformer degradation through harmonics analysis
- Inconsistencies between harmonics, reactive power, and weather conditions preceded a solar field crash

Other technical capabilities

With the planned addition of an automated advance warning capability in SmartKable's software, the Line Ranger technology would assist users in the maintenance of their grid equipment by:

- Monitoring the first derivative (rate of change or Percent Variation) of measurement signals can provide enhanced sensitivity to fast changes like arcing or short circuits in a system, enabling users to detect a tree branch touching a high voltage line, for example.
- Monitoring harmonic distortion of current and voltage can provide health information about mechanical gear, such as arcing in or around the transformer during rain events.
- Monitoring reactive power can enable prediction of transformer overheating, as high reactive power levels cause eddy currents in the core and overload the windings of transformers.

While more testing is needed, NYSP2I concluded that Line Rangers on transmission lines or other smaller lines, in conjunction with fully developed monitoring and alarm software, offer a promising option for preventing power system failures, by providing predictions of impending failures in time for repairs under planned shut-down conditions.

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