Putting a Dent in Energy Theft

Diversion detection based on the flow of current yields more accurate results and more recoverable revenue

Theft of electricity has a material financial impact on utilities and their customers throughout the world. Global electricity theft is estimated by the World Bank to be in the range of 8 percent of revenues. A 2014 study by the Northeast Group, LLC tallied the total cost of global electricity theft at $90 billion annually, with “non-technical loss” reaching 20 to 30 percent of revenue in some developing countries.

In the U.S., theft of electricity is typically estimated to range from 1 percent to 3 percent of revenues. That’s less than many other countries but still represents anywhere from $3 to $11 billion annually in electricity theft that customers and/or shareholders pay for.

Those are big numbers, but they also represent a significant opportunity to recover revenue; the upside being that recovered revenue from energy theft can go straight to the utility’s bottom line.

A Better Approach

To achieve this outcome, a new and better approach to detecting energy theft is needed. Current generation smart meters have tamper detection features but mechanical tamper alerts and analysis of historical customer billing records and consumption patterns is a labor-intensive endeavor that has limited success due to the imprecision of current approaches. Of a hundred tamper alerts received from a current generation smart meter system, only a handful, upon field investigation, may turn out to be actual cases of energy theft. The rest turn out to be false positives.

So instead of delivering a haystack of possible energy theft data based on “circumstantial evidence,” each of which requires further investigation and correlation with other data sources to find the needle, the Active Grid and OpenWay® Riva technology from Itron approach the problem differently.

OpenWay Riva not only detects energy theft as it’s taking place, it also tells the utility exactly where it’s taking place, how much electricity is being stolen, and the likely modus operandi, such as a meter bypass or tapping into the secondary.

The Value of Active Grid Diversion Detection

» Analysis of high-resolution data yields 300 percent higher detection accuracy than current systems
» Peer-to-peer communication enables detection ahead of the meter (e.g. secondary theft)
» Real-time detection enables utility to respond immediately
» Far fewer false positive alarms due to highly accurate connectivity model
» Simple solution, requires less back office infrastructure and resources
» No sensitivity to environmental changes at meter site that activate tamper alerts
» Adds more than $1.6 million in business case value annually compared to current AMI systems for a utility with 1 million customers
By applying Active Grid and OpenWay Riva technology, diversion detection is now based on real-time data and localized analysis of changes in electricity current flows and voltage levels in the distribution network, rather than sifting through circumstantial data piling up in the utility back office. In fact, OpenWay Riva increases the accuracy of energy diversion and theft detection by 300 percent or more over current smart metering systems. As a result, field investigative resources can be targeted more precisely and they can focus their efforts on actual cases of theft and recoverable revenue.

**Detection Based on the Flow of Current**

Here is how it works: whenever current is drawn from the network, there is always a corresponding drop in voltage, even if it's miniscule, at other meters on the same transformer. Now, if meters are smart enough to know exactly where they are located on the low-voltage network; if they have the computing power to analyze 1-second data at the edge of the network; and if they can talk "peer-to-peer" with nearby meters, the diversion detection process is transformed.

In effect, the meters ask each other, “Did you see that small voltage drop, and if so, was it associated with metered consumption or was it unaccounted for?” If the latter, someone is stealing energy.

Through the meter’s ability to communicate directly with other meters at different levels of the network, and knowing exactly where they are located are on the distribution system, the system identifies when current is drawn on the secondary of a transformer that did not go through a meter, greatly increasing the accuracy and timeliness of diversion detection. This also enables the utility to respond more promptly to a potential safety hazard on their distribution system.

**When, Where, How and How Much?**

The system is smart enough to tell the utility exactly where the theft is taking place. This process of monitoring and deductive communication happens continuously and intelligently throughout the OpenWay Riva network, and it represents a sea change in the ability for utilities to quickly identify, stop and deter electricity theft. And by analyzing the bulk of the data in the edge devices, this approach further minimizes data traffic, congestion and latency issues over the network.

By transforming energy theft and diversion from an inferential exercise to a data-driven analysis based on the physics of current flow, the Active Grid and OpenWay Riva deliver accurate and actionable information on energy theft and where it’s taking place. This greatly increases the ability of the utility to focus on recoverable revenue that can go straight to the bottom line, while also providing an effective deterrent to future theft.

Welcome to the Active Grid, where Itron is applying the capabilities of distributed intelligence to create entirely new and much more effective approaches to solving key problems and creating new opportunities.