Load Disaggregation Made Easy

The most "non-intrusive" load disaggregation solution involves only a very smart meter

Load disaggregation, or "Non-Intrusive Load Monitoring (NILM)" as it's often referred to, represents a key opportunity for utilities to create new opportunities in a rapidly changing energy marketplace. Load disaggregation opens new doors to energy efficiency gains and improved results for load control and demand response programs. It also represents a new business and revenue opportunity for utilities to position themselves as trusted energy advisors to their customers.

The ability to use load disaggregation to break out discrete energy loads within homes or businesses, to identify and locate inefficiencies, to predict equipment failures, and to simply help customers save money is not a new idea. It's the execution that has been the challenge, as technology limitations have prevented utilities from pursuing load disaggregation cost-effectively or on a broad scale. The Active Grid and OpenWay® Riva changes that by making load disaggregation very easy, accurate and scalable.

Most leading NILM solutions available today involve analytic software running in the utility back office analyzing canned, historical data sets and/or solutions that rely on specialized equipment that must be installed at the customer premise. Despite the advances in data analytics and algorithms, the current state of load disaggregation comes down to a tradeoff between accuracy and cost, with scalability remaining a significant obstacle to widespread adoption.

Most of today's NILM solution providers disaggregate "energy-only" data (kWh) gathered by utility smart meters in 15-minute or 60-minute intervals.

These solutions require several months of data to ensure adequate model training and some degree of accuracy. These models are designed to identify distinct end uses by comparing loads to end use libraries of data, then reconciling the sum against data for the entire premise. Due to the data constraints and time horizon for analysis, these approaches yield neither timely nor very accurate results, apart from a small number of high-load appliances with very distinctive signatures.

The Value of Active Grid Load Disaggregation

» Opens doors and provides valuable data to support energy efficiency service offerings

» Requires significantly less infrastructure, bandwidth and expertise than back office solution

» Significantly more accurate and timely than back office solution

» Simpler and lower-cost than solutions requiring installation of equipment at customer premise

» Just requires an app installed OTA on OpenWay Riva meter

» Can provide nearly $4 million in annual business case benefit based on a utility with 1 million customers achieving 5 percent enrollment rate in load disaggregation services

Using a different approach, some companies offer load disaggregation solutions that utilize more detailed and diverse data – intervals measured in sub-seconds, and that include reactive power etc. However, this data is gathered by installing some form of proprietary equipment at the customer premise, such as CT (current transformer) clamps near the meter or smart plug-in modules for outlets for lower-load devices.

The need to enter the customer premise to install and maintain specialized hardware limits the scalability – and the appeal -- of this approach for many utilities, with most deployments numbering in the dozens or hundreds for load research projects.

Grid sensors and meters can collect vast amounts and types of data. These data include 1-second data on real power (kW); reactive power (kVAr); current (Amp); Voltage (V) by phase. Yet there is at present no system that can disaggregate loads on a utility system-wide basis using such granular data. Why?

Computation requirements to disaggregate loads for a limited number of premises are manageable; much more challenging is any near-real-time load disaggregation for an entire utility with millions of meters because of scaling difficulties on central servers. Then there are the issues raised by the vast amounts of data produced by many meters generating 1-second data of adequate variety. One million single-phase meters alone would produce 2 TB of data per day, increasing linearly with the number of meters and the number of phases per meter.

While storage of such vast amounts of data is possible, retrieving and processing it efficiently requires a different approach. The true showstopper is the impossibility, on grounds of fundamental physics, for mesh networks and/or cellular networks to transmit such vast quantities of data in a cost-effective way. This is where the distributed computing capabilities of the Active Grid and OpenWay Riva change everything.

OpenWay Riva, which represents the next generation of Itron widely deployed OpenWay solution, leverages significant advancements in Internet of Things (IoT) technology. These include distributed computing power, machine-to-machine communications, and edge analytics to deliver an entirely new level of awareness into the state of the distribution network. Instead of just collecting and transporting rafts of data over the network and back to the utility for analysis after the fact, OpenWay Riva analyzes large amounts of data continuously at the edge of the network, and that enables us to take a much more practical and 'non-intrusive" approach to load disaggregation.

With device-based processing power to crunch large volumes of high-resolution data at the edge of the network, OpenWay Riva goes beyond energy-only data to analyze kWh, kVAr, kVA, Amp, Volt, by phase, all collected in 1-second or better intervals and stored in FIFO memory on the meter, with analysis taking place continuously by an application running resident on the meter.

Start-up and shut-down events are recorded and characterized through repetition, leading to a set of identified end-uses known by their distinctive signatures. For example, strong reactive power on start-up, decreasing after a few seconds, is typical of air conditioners and other devices with motors; refrigerators have similar start-up characteristics but at lower overall current draw. Electric cooking, lights, and electronics draw little or no reactive power. Over time, the frequency and time-of-day prevalence of use helps further distinguish among appliances and devices.

By utilizing the distributed intelligence approach of OpenWay Riva, the bulk of the data stays at the meter, only high-level information on start, stop, and duration of end uses is transmitted over the network to the system head end and analytics platform, so analysis of high-frequency, high-resolution data can take place without congesting the communication network. This approach provides a highly effective solution to addressing the cost, premise access, scalability, latency, and data resolution challenges posed by current load disaggregation methodologies.

OpenWay Riva's load disaggregation capabilities provide the foundation for utilities to move beyond the volumetric business model to create an entirely new and scalable portfolio of utility service and revenue opportunities for customers that opt in to this type of program. It's also a tool to stake out a strong competitive position relative to new market entrants in the home energy management space seeking to disrupt the longstanding utility-customer relationship. Lastly, scalable load disaggregation capabilities also provide localized insight and a feedback loop to optimize the effectiveness of load control, demand response and dynamic pricing programs.

Load disaggregation with OpenWay Riva: cost effective, scalable, timely, non-intrusive and simple, requiring no more than an installed OpenWay Riva smart meter running the app locally. This is the Active Grid redefining what's possible.

CORPORATE HQ

2111 North Molter Road
Liberty Lake, WA 99019 USA

Phone: 1.800.635.5461
Fax: 1.509.891.3355