The Energy Analytics Bus Benefits Everyone

The energy business extends well beyond the miles of power lines that are often the only visible part of the end product for most people. Behind the scenes of what the majority of Americans take for granted is a complex business with demanding customers, new competition, mountains of data, unique theft issues, and both economic and environmental regulations. The key to success is leveraging new technology.

The Business of Energy

The energy business begins with the generation of power, usually from a combined heat and power system, such as nuclear, coal, or natural gas, though power may come from other sources, such as wind or water-powered generators, and even from the home solar systems of consumers. It continues through the other phases, such as transmission, distribution to consumers, energy storage and recovery, theft prevention, and customer service. It also includes working with regulatory bodies to meet energy regulations and rules.

Energy Theft

Although seldom on the minds of consumers, energy theft is on the rise, and a large proportion of theft incidents go unidentified. For most utilities, unbilled revenue due to meter tampering cannot be easily quantified. However, *Forbes* estimates that up to $6 billion of electricity is pirated annually in the United States alone, and in some countries up to one-third of all generated power is lost due to theft or tampering.[1]

Even when a suspected case is identified, recovering revenue is difficult because of breakdowns in the investigative process. Revenue loss due to theft and tampering causes paying customers to bear an unfair share of the cost in their energy bills, although regulatory requirements and restrictions limit this. This leaves a large burden on the utilities themselves.

A Smarter Grid

The solution is to monitor all meter events and correlate with customer-specific predicted energy consumption profiles to detect fraud patterns. Automation of the investigation and billing processes helps ensure revenue recovery. The use of specialized analytics

processing on growing data sets across the grid not only helps reduce theft, it yields additional benefits by removing inefficiencies uncovered in the process. The end result is a smart grid powered by technology, which benefits the utilities and consumers alike.

Technology to the Rescue

For the first time in history, a joint effort by hardware and software vendors, researchers, government regulators, environmentalists, and utilities is solving problems related to energy generation and consumption. This includes new eco-friendly plants to help the environment, and smart grids to help consumers waste less power. It also helps utilities generate only what's needed, find newer and cheaper forms of energy, and fight electricity theft, which affects everyone's rates.

Smart Grid Business Value

Overall, a smarter power grid improves the utilities' business by helping to more accurately predict electricity usage, track operational costs, plan for weather-related or seasonal events, prioritize workloads, and better handle the growing number of power sources.

For the customer, the smart grid helps through reduced billing errors, improved usage prediction for better yearly balanced billing, and real-time discounts when power demand is low. For example, although still limited in availability, some consumers can now purchase smart appliances (i.e., a dishwasher or washing machine) that integrate with the smart grid to automatically run when electricity rates are at the lowest during the day.[2]

According to Donald Fisher at Software AG, this offering is typically part of a larger advanced metering infrastructure (AMI) deployment, and includes either demand-side system provider involvement or special receptacles that can be monitored. "These programs are currently in a pilot phase, and the required standards are still being worked on," adds Fisher. "First, utilities need to send real-time pricing for the appliances to react to. This is coming soon."

Looking at the data published by the U.S. Energy Information Administration (EIA), as of 2011 only 25% of all energy customers in the U.S. had smart meters installed. According to Fisher, most of these are capable of sending a single daily update of energy usage broken down into half-hour intervals for the majority of residential customers and small-to-medium-size businesses. Some systems for larger customers may send usage data more frequently.[3]

Theft Detection and Revenue Recovery

Perhaps the largest benefit to both utilities and consumers is the ability of the smart grid to help detect and reduce electricity theft. According to Fisher, most utilities have a goal to identify and recover all loss from theft or inaccuracies in billing or delivery. On the generation side, this means being paid for all power generated; for the wires companies, this means getting paid for every kilowatt-hour delivered. Fisher identifies challenges here such as AMI costs, and the fact that many utilities simply don't know how much power is lost or stolen.

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Additionally, due to the volume of data and the logistics of power generation and delivery, multiple strategies must be used to curb and prevent theft.

Big Data and Analytics

To begin, energy usage per customer is monitored and analyzed, and the resulting patterns are correlated with different types of customers. From this, general customer classes are defined, and individual customer usage profiles are created based upon unique individual and group electrical usage patterns.

Crossing this data with seasonal or weather-related variables, utilities can accurately predict energy use by customer class and by individual customer. Software applications take this data and automatically baseline "normal" usage with accepted variability to use in monitoring efforts going forward. As a result, utilities can more accurately monitor and detect possible theft, using technology to prioritize incidents according to probability.

Real-Time Event Detection

By analyzing historic usage data along with customer class and usage profiles, utilities can identify service failures and probable theft situations. Armed with data, utilities compare each customer's current and predicted energy usage in real time, then identify and rank abnormal usage events. They also look for customers that are "out of the norm" compared with others in the same customer class. For instance, a sudden sustained increase in electrical usage for a customer compared with past usage or others in the same customer class can indicate theft of power to heat an illegal "grow house" for marijuana cultivation.

Managing the Recovery Process

Technology can automatically kick off processes in response to suspected cases of theft, and automate theft recovery and prevention processes as well. This helps utilities prioritize the use of scarce investigative resources. Software can steer suspected cases for manual review based on modifiable criteria, and hook into smart grid operations technology (OT) systems for investigative efforts as needed.

Using technology to reduce false positives and the time wasted investigating them offers a huge operational benefit. For example, AMI systems provide tamper alerts today, but sending crews to investigate based on tamper alerts alone can waste tremendous resources, since many turn out to be false alarms. Eventually this may lead to *alarm fatigue*, where utilities either ignore the alert or turn the feature off altogether.

Revenue recovery efforts are monitored to track overall costs, uncover operational inefficiencies, and account for the revenue recovered in real time. Once theft is managed more effectively, associated costs go down, and regulatory bodies assure the savings become visible in rates for all customers.

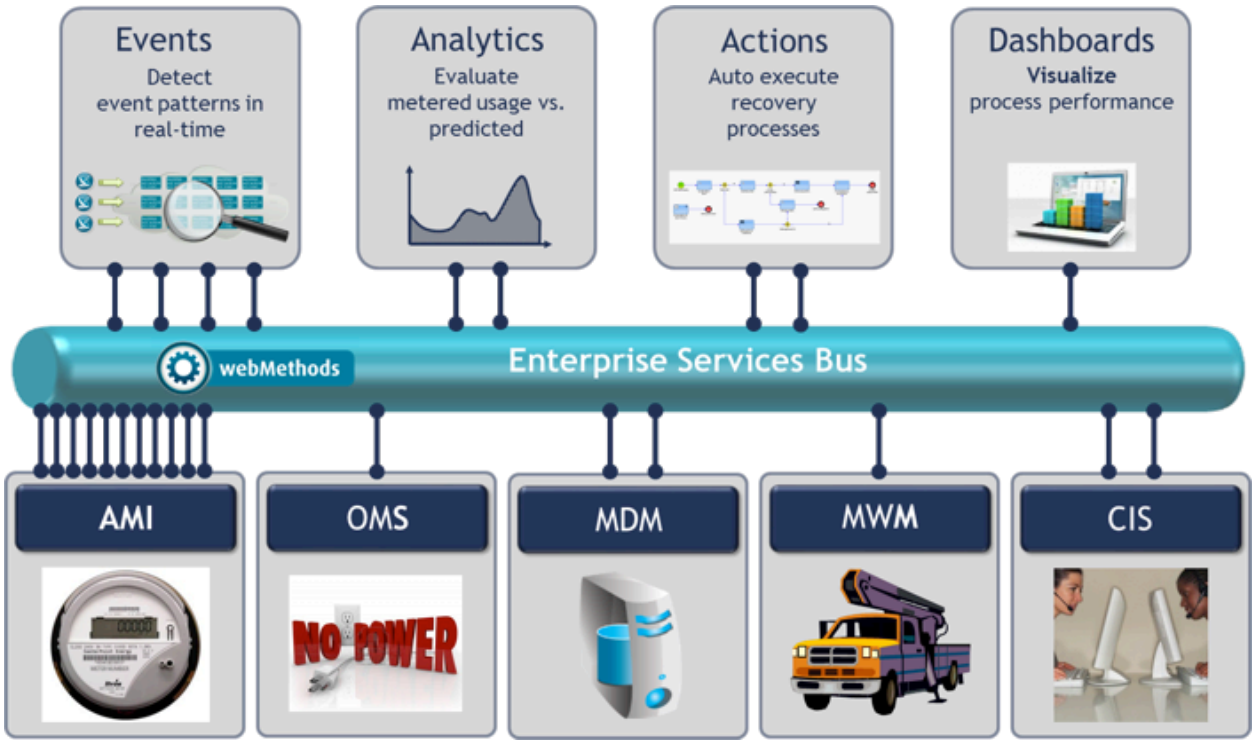
Smart Grid Technology

As discussed previously, technology exists to address the problem of energy theft, and to help improve overall efficiency in the power generation and delivery process. However, the technology is mostly in the form of disparate components that assist in certain areas. Although big data and analytics are beginning to help, they leave a lot of work to the energy providers. For example, smart meters generate so much data that most utilities are unable to extract much value from it.

What is needed is a set of components and tools working together to help discover electricity theft as it's happening, identify patterns to help predict and discover future theft, identify the ways energy is stolen, and then close those holes. The right technology can also help you uncover the root causes of the issue. For instance, according to Fisher, in North America it's usually easier and safer to acquire energy legally than to steal it. However, for illegal drug grow houses, and those with the technical competence and inclination, the cost and risk of theft are sometimes viewed as worthwhile.

Outside of North America (i.e., the Caribbean, Central and South America) electricity theft is often an accepted cultural norm. This may be energy-cost related, or from overcharging due to metering issues or corruption. Analytics can help determine if there's a link between overcharging and theft. In cases where there may be a necessary trade-off between having lights or food, the focus for utilities is to offer appropriate energy assistance programs that help consumers pay energy bills. This is often enough incentive for them to secure power legitimately.

Figure 1. The Software AG Energy Analytics Bus unifies your IT and OT systems.



"Those that quantify the value of an AMI system for theft detection base it on estimates," says Fisher. "Most look at the value per 10,000 customers, along with published data from EAI and other sources, such as the average monthly bill per customer." For instance, Fisher points out that in 2012 the average U.S. consumer used 10,836 kilowatt-hours of power annually at an average cost of $1,287. Fisher goes on to explain, "If we estimate a 2% loss of electricity, with a 50% recovery rate, it amounts to $12.87 per customer per year. The value of that revenue at current costs for 10,000 customers over a 10-year period is about $1.07 million. In this scenario it makes sense to invest about $500,000 per 10,000 customers in new technology, with an expected return of 15 to 20%."

According to Fisher, the other issue is that many utilities don't know the true extent of theft or loss; that figure can be greater than currently estimated. The question is how to use technology in a cost-effective manner to ensure the most return from your recovery efforts. An end-to-end, integrated solution is the answer.

The Energy Analytics Bus — An End-to-End Solution

Today's smart grid solution needs to combine information technology with operations technology to enable fault detection, automate self-healing processes, handle incoming power as well as outgoing power demand, and uncover operational inefficiencies and energy theft. All of the distributed technology, in the form of sensors, smart meters, and remote computer systems, require end-to-end orchestration to extract the maximum value and meet specific needs.

Software AG offers a new solution with an integrated Energy Analytics Bus built on the webMethods enterprise service bus (ESB) standards-based integration platform (see Figure 1). With it, you can combine your existing IT and OT systems into a heterogeneous solution, or use Software AG's energy software solutions end-to-end. The power of the ESB derives from how it connects and integrates disparate components, even legacy systems, into one orchestrated system.

Software AG's solution forms an Energy Analytics Bus that supports real-time events processing, big data analytics, the definition of automated processes based on rules you define, and dashboards and tools to help you visualize and optimize your processes. At the heart of it is a world-class ESB, which unifies your AMI, outage management (OMS), meter data management (MDM), mobile workforce management (MWM), and customer service systems (CIS).

Complex Event Processing

The integrated APAMA complex event-processing (CEP) engine analyzes the relationships between events as they occur. The Presto and Optimize analytic engine monitors process metrics and other key parameters to discover patterns and create customer usage profiles. All of the components work together to collect and manage your smart grid data and perform meaningful analytics on it. Pattern analytics process historic and real-time data as it's collected to, for example, evaluate metered usage versus predicted usage based on customer profile and historic data.

This set of integrated analytics enables system automation, which helps workers react to issues without manual intervention. The Software AG ARIS Business Process Management (BPM) and process orchestration tools allow you to define rules for business-related activities that execute in a specific order across multiple systems, applications, and data sets. Applicable processes include reacting to fault conditions and automated execution of recovery efforts, as defined by tools that act on customer data and usage. The ability to react properly in these scenarios depends on having the right data accessible across all of your systems. This is where the integrated Energy Analytics Bus comes into play.

Visualization and Mobile Communication

With data collected, rules in place, and advanced analytics defined, the next step is to accurately depict the state of the system at a glance using dashboards and mobile devices. Dashboards help visualize the volume of data being captured, and allow utilities to identify patterns of energy use and theft. This visualization helps to manage the incident risk-to-loss return, and prioritize the recovery efforts for those with the greatest potential return. Additionally, analytics processing dashboards can help to avoid alarm fatigue by identifying the most probable cases of theft first, avoiding false alarms.

Mobile devices with integrated mobile apps can be used by mobile workforces to get critical data to and from workers on the ground as soon as it has been acquired. Not only does this improve incident response time, it ensures greater data accuracy than manual alternatives.

Conclusion: The Software AG Technology Advantage

Software AG offers a comprehensive solution for utilities that integrates IT and OT systems, with capabilities that address the detection of theft and loss as well as recovery. The Energy Analytics Bus and components are optimized to work together as a cohesive Software AG product, as well as in unison with existing IT or OT systems already deployed. Visit **Softwareag.com/na** today to read more on the Energy Analytics Bus solution and what it can do for you.

Learn more by visiting
Softwareag.com/na

[1] Reference: http://www.forbes.com/sites/peterdetwiler/2013/04/23/electricity-theft-a-bigger-issue-than-you-think
[2] Reference: http://www.whirlpool.com/smart-appliances
[3] Reference: http://www.eia.gov/tools/faqs/faq.cfm?id=108&t=3, and http://www.eia.gov/electricity/annual/html/epa_01_02.html