White Paper

Rethinking Asset Management:
Evolving to Analytics-Driven Decisions

Landis+Gyr
manage energy better

How can utilities benefit from redefining their asset management strategies?

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Rethinking Asset Management: Evolving to Analytics-Driven Decisions

How can utilities benefit from redefining their asset management strategies?

Technology is empowering utilities to take asset management to an entirely new level. Many utilities today are using their advanced metering infrastructure (AMI) investments to analyze and visualize real-time data – and develop new asset management strategies that can improve reliability, customer satisfaction, efficiency, and long-term planning.

Managing distribution assets, while always a key consideration for utilities, is receiving renewed attention, as utilities look to maximize the life of existing and new asset investments, and solidify their business models in a rapidly-changing industry. Some of the major trends influencing utility asset management strategies center on budget allocation, regulatory changes, customer preference, and grid complexity.

Utilities are facing new budget pressures from declining or flattening load growth, and experiencing reduced revenues due to energy efficiency and the increased use of renewables. With growing pressure from investors, utilities are looking for ways to be more economical with capital and O&M expenditures.

The regulatory landscape is changing. Utilities are facing increased pressure from regulators to improve reliability standards within a tighter budget.

Customers are demanding more from the utility while expecting to pay less. And, customer expectations for reliability and quality of service are rapidly moving to the forefront of utility decision-making.

In addition to managing aging assets, utilities are exploring ways to reliably integrate large quantities of DER on to the grid. As a variety of residential loads such as residential photovoltaics (PVs), electric vehicles (EVs), air conditioners, water heaters, washers and dryers, each having different load characteristics keep coming on to the energy grid, they are adding new levels of complexity to the energy grid.

Pressure is growing:

- Budget constraints
- Regulatory scrutiny
- Customer expectations
- Grid complexity

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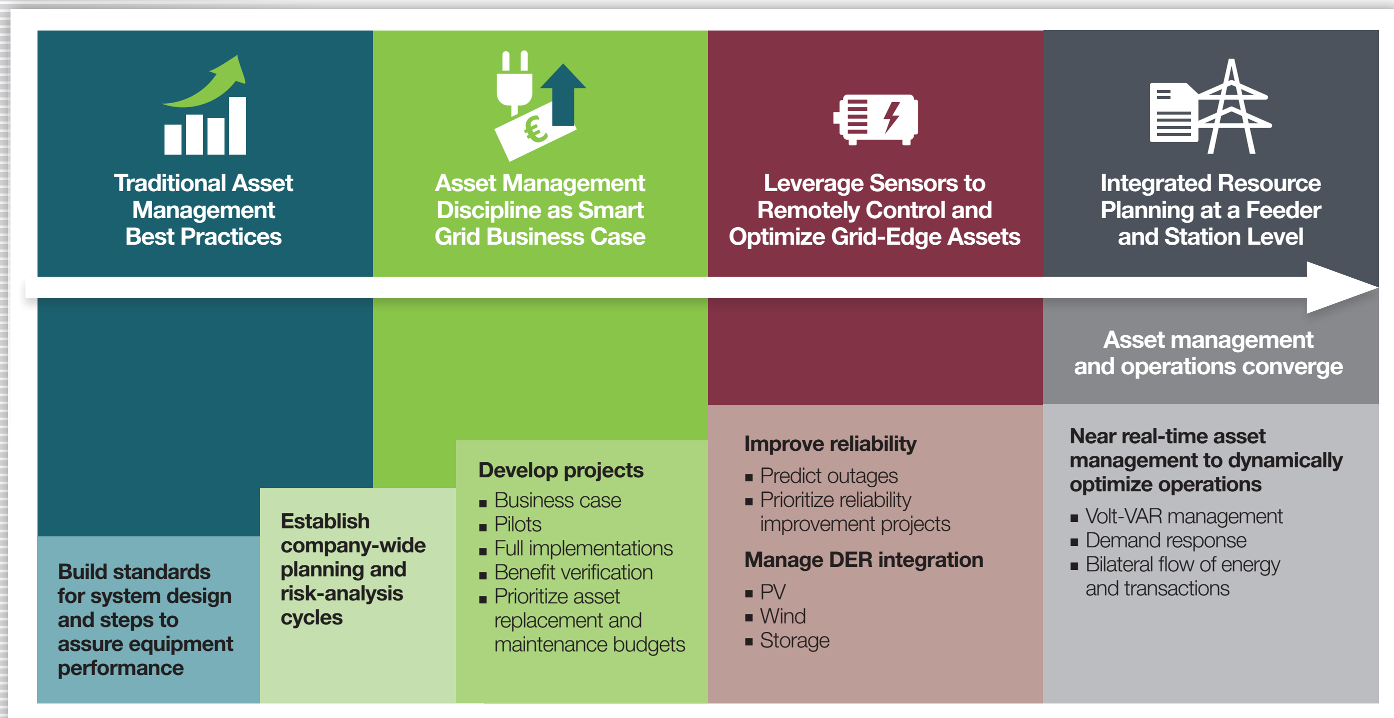
Evolution of Utility Asset Management Strategies

Over the years, asset management strategy for utilities has evolved and will continue to evolve, as existing assets reach the end of their usable life. The asset management maturity model below highlights some of these changes.



Traditional Asset Management Best Practices:

Traditionally, distribution asset management has consisted of placing devices in the field and replacing them after they have failed. This is still a common process for the maintenance of many distribution assets such as poles, conductors, and distribution transformers. Utilities then began to implement systematic testing for asset replacement. This included periodic visual line inspections and the replacement of transformers based on manufacturer age. Utilities had established periodic maintenance processes and planning cycles that ensured asset operation, though these processes were not necessarily efficient or optimal all the time, leading to system inefficiencies and costly capital and O&M investments.

Combining Asset Management Business Case with Smart Grid Investments:

Over the last decade, utilities have evaluated AMI with asset management business cases in mind. While the primary business case for smart meters was to help gather consumption data and automate billing, asset management was a key secondary benefit associated with the smart grid

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investments. Many utilities ran pilot projects to this effect, ensured the benefit realization, and then moved on to full AMI deployments. With the deployment of AMI, utilities began to monitor the condition of assets in near-real time, visualized actual grid conditions, and could apply advanced analytics to optimize asset lifecycles.

Leveraging Sensors to Control and Optimize Grid-Edge Assets:

Next, utilities further leveraged asset management benefits from their AMI network by gathering data from grid-edge sensors and by using them to detect outages faster, predict outages, plan optimal reliability investment projects, and better manage the impact of renewables assets.

Real-Time Asset Management Enabled by Integrated Resource Planning:

The traditional energy flow — from generation to the consumers — is changing fast due to the growth of distributed energy resources (DER) within electric distribution territory. Renewables and storage technology are providing local generation options, and demand management and energy efficiency technologies are providing virtualized generation options. Today, it has become imperative for the utilities to move towards actively managing these distributed assets at the substation as well as at feeder level as a component of their integrated resource planning process (IRP), a process to manage available capacity and demand while utilizing a combination of utility-owned and customer-owned devices. This process will enable utilities to dynamically optimize demand response and enable Volt-VAR control programs, in order to improve voltage, reduce technical losses, improve asset life, and manage peak load while reducing capital spend.

From traditional asset management to integrated resource planning, utilities are using technology to make better decisions.

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5 Technologies Empowering Utilities' Asset Management Strategies

Utility asset management strategies have evolved directly with technologies that enable making actionable data-driven decisions based on the actual condition of distribution assets.

As the adoption of these enabling technologies grows, new strategies will emerge, redefining the asset management discipline and providing new avenues for utilities to derive the greatest value from their asset investments. Utilities can leverage five distinct technologies to empower their asset management strategies.

5 technologies:

- AMI Technology
- Data Analytics for asset planning and investment strategies
- Sensor Technology for Outage Detection & Prediction
- Advanced Load & Storage Management
- DER Visualization and Management

1 UTILIZING AMI TECHNOLOGY TO ESTABLISH A PLATFORM FOR BROADER ASSET MONITORING, ANALYSIS, AND CONTROL

While the primary business case for the deployment of advanced metering infrastructure (AMI) was focused on recording consumption data through automated, more frequent meter reading, AMI has proved to be an excellent platform that delivers significant value beyond just streamlined billing processes and costs. Utilities are now anchoring their asset management strategies around the active measurement and remote control capabilities provided by the real-time AMI network. In many parts of the world, AMI networks have been even deployed for 'secondary' business cases, such as distribution automation, remote sensing, and smart city infrastructure development. The flexibility and interoperability of the AMI network have allowed utilities to support new utility business cases, provide different asset management options, and open up new business models. Through its high performance, low latency, standards-based platform, the AMI network has extended the asset management function beyond the traditional centralized operation to a distributed operation, by leveraging grid-edge device intelligence.

Remote monitoring of capacitor banks to identify issues and reduce maintenance

Scheduled annual inspections and unplanned maintenance works have proven inadequate in preventing device failures, and are not cost effective. To address this issue, utilities like We Energies and Colorado Springs Utilities (CSU) are taking advantage of the AMI network to remotely monitor and inspect the capacitor banks more regularly than just annual inspection. By configuring the smart meters to periodically monitor and report neutral current thresholds over the AMI network, these utilities are able to track the devices at risk of failure or requiring maintenance work. Regular monitoring, via the AMI network, has allowed these utilities to eliminate manual maintenance, and more effectively schedule maintenance for at-risk devices.

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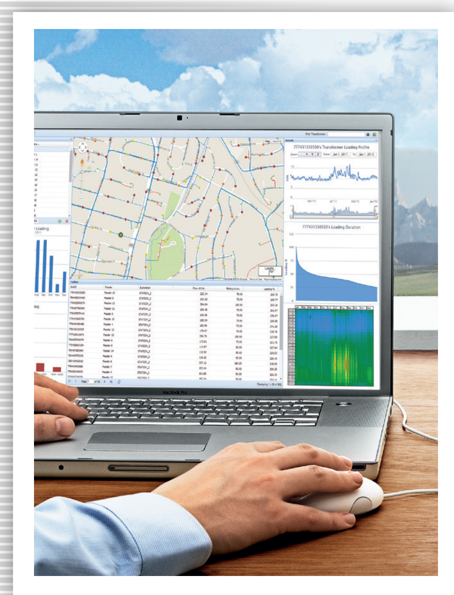
2 LEVERAGING DATA ANALYTICS TO SUPPORT ASSET PLANNING AND INVESTMENT STRATEGIES



"You can't manage what you can't see… Data analytics can come to the rescue."

Recent reports state that 800 million smart meters will be installed globally by 2020.[1] Add to this, the number of smart sensors currently being deployed all across utility territories to monitor various transmission and distribution assets. Utilities can take advantage of analytics applications to gather and analyze data from grid-edge devices (such as smart meters and sensors) and from various source systems, and analyze the data to get a better understanding of the asset operational behavior. The core of the data-driven analytics strategy is the utility's ability to both visualize their distribution system and run asset management scenarios with high-level granular data derived from actual system conditions. Utilities can then use the results of this analysis to develop, test, and justify asset management projects. Data analytics can provide better visibility into the assets and proactively determine asset life, optimize asset investments, prioritize reliability planning, incorporate DER into asset plans, and preemptively point out common causes of asset failures. Utilities are using analytics to improve system visualization, develop risk-based strategies that eliminate unplanned asset failures, and improve reliability while enhancing their asset investment strategies.

Improve system visualization through more accurate GIS modeling

One of the key asset management challenges for utilities is to get a visualization of the assets distributed within their territory, and get an accurate understanding of the flow of power in and out of these assets. Geographical Information Systems (GIS) have traditionally been at the core of many utility asset registration and accounting processes, providing vital information about assets' geo-spatial locations. Data from GIS systems can be merged with operational data from smart meters and sensors to improve a utility's ability to geo-spatially visualize and analyze asset performance in the field. Inaccuracies in GIS modeling, including inefficient and inaccurate GIS updates, often leave utilities with an incomplete view of the assets in the field. Analytics can help utilities validate asset data by pointing out inaccuracies in the GIS model and recommending necessary action to fix the inaccuracies in the model. With a more complete and accurate GIS model, utilities can better visualize and manage their asset performances.

Eliminate unplanned asset failures and establish a risk-based asset strategy

Asset failures are often the result of a combination of asset age, usage, and environmental conditions, among other factors. Run-to-failure, age-based replacement, and periodic inspection strategies have been proven to be inadequate, very often leading to unplanned failures and ineffective utilization of assets.

Rather than relying on traditional maintenance and replacement guidelines, many utilities are using data analytics to develop more proactive maintenance plans. Analytics is being used to analyze historical loading profiles, overloading situations for various utility assets (e.g., feeders, feeder sections, or distribution transformers), and digging through tons of asset operational data to analyze asset loss of life. Utilities are taking advantage of this analysis to right-size the assets, reduce total cost of ownership, and plan for predictive maintenance programs. Building on condition-based asset analytics, data analytics is being further leveraged by utilities to incorporate risk-based asset strategies that include failure probabilities, criticality indexing, and device health indexing. This process is helping utilities gain broader insight into the implications of their asset management decisions, improving maintenance plans as well as portfolio strategies.

"Data analytics has allowed Burbank Water & Power (BWP) to utilize economics-based decision-making process to right-size as well as better manage over- and under-loaded transformers, while identifying lifetime costs of ownership and replacement of overloaded assets. This process has resulted in reduced labor costs and inventory carrying costs for BWP. By refining their asset management strategy with asset loading analytics, BWP was able to completely eliminate unplanned transformer outages in the 2014 peak season."

Improve reliability while enhancing asset investment strategies

As utilities actively work towards modernizing the electric grid in an effort to further enhance grid reliability and resiliency, they are facing the tough challenges of working with constrained and highly scrutinized O&M budgets. Data-driven analytics is helping utilities perform detailed cost-benefit analyses and provide the best capital investment recommendations for optimal usage of capital and O&M budgets. Data analytics is helping utilities quickly develop forward-looking, multi-year project plans with optimized capital investment recommendations for reliability improvement, all the while minimizing costs. Utilities have traditionally relied on days and weeks of manual calculation to lay out these plans, which now take only minutes to put together. Automated and optimized calculations performed by data analytics remove any unwanted human errors and can be confidently presented to the utility commission and other stakeholders for further evaluation and approval.

Many utilities today are considering improving reliability through the placement of automated switches and auto-reclosers, along the distribution feeders, that can minimize the impact of an outage. Utilities are using data analytics to cost-effectively determine the optimal quantity and the locations for placing these automated switches that improve grid reliability. These analytics applications have been field tested and deployed by utility engineers, and are already generating great savings for the utilities.

Utilities are using analytics to make optimal asset investment and reliability improvement decisions about:

- Automated switch deployment
- Undergrounding
- Placing animal guards
- Tree trimming
- Placing lightning arrestors

3 IMPROVING CUSTOMER SATISFACTION WITH FASTER OUTAGE DETECTION AND PREDICTION

As utilities continue to work towards better managing unplanned service interruptions and better communicating service restoration plans with customers, they realize they can always do more to continuously improve customer satisfaction. According to J.D. Power and Associates, among customers who experienced power outages, satisfaction rates increased significantly (from 576 to 729, on a scale of 1000) when power was restored within the Estimated Time of Restoration (ETR) versus when power restoration occurred after the ETR.[2]

One of the key advantages of AMI technology is the capability of smart meters to send last gasp signals over the network during power outage scenarios, which helps deliver faster outage detection. Many utilities are analyzing these signals from smart meters to identify assets experiencing outages, and pinpoint corresponding asset location and the overall affected outage area. Utilities are using this information to come up with an accurate ETR that can be communicated to the customer. Also, by using meter pings over the AMI network, utility operators can confirm restoration after the crew has worked on the outage, but before the crew has packed up and departed the outage site. This results in tremendous time savings in the restoration process, especially in cases of nested outages. This all helps utilities maintain or improve the ETR.

Utilities can further leverage the data from meters as well as grid-edge sensors to run probabilistic models that can predict outages and alert system operators of possible asset failures or outage events even before the outage occurs. By recording the outage data from meters and sensors, that include momentary outage data, utilities can fine-tune the reliability indices calculated based on outage management system (OMS) data. This process provides a complementary view of the reliability indices compared to those calculated by the OMS, enabling a better understanding of the type, cause, and duration of asset outage.

4 TARGETING LOAD AND STORAGE DEPLOYMENTS TO PROTECT CRITICAL ASSETS AND MAXIMIZE ASSET LIFE

Localized peaks and substation overloading can cause asset management challenges and equipment degradation. Overloading and localized peaks also have a direct impact on grid reliability, as the impacted assets will need upgrade or replacement long before planned infrastructure investments. Capital investment for asset refresh, such as substations, can cost millions of dollars and can potentially take years.

Today, utilities are using targeted load management and strategic energy storage deployment to create a virtual ‘generation stack’ by flattening the load during system peaks and overloading situations. This helps the utilities protect critical assets, maintain reliability, reduce wear, and defer costly asset upgrades.

5 ADDRESSING NEW ASSET CHALLENGES PRESENTED BY DISTRIBUTED ENERGY RESOURCES

The amount of renewables expected to come on to the distribution grid is increasing exponentially. By 2020, 20% of energy consumed within the U.S. will be from renewables.[3] Due to their intermittency, renewables are adding a new level of complexity to the grid, requiring more attention. Integrating renewables into the energy grid poses additional asset management challenges for the utilities – cases of overloading feeders beyond capacity limits leading to overheating and deterioration of feeders, voltage fluctuations causing regulatory attention, and reverse power flow issues creating safety hazards. This calls for utilities to fully understand their impact – and develop a plan to better manage them.

Utilities are considering data analytics to gain visibility into areas with high concentration of DER. Analytics can help highlight areas with voltage fluctuations resulting from variability in the renewable outputs, spot a sudden loss of generation that stems from weather or cloud cover, and visualize areas with reverse power flow. Analytics can alert system operators of two-way flows in areas with significant DER penetration, thus helping improve safety especially when crews are working on electric lines. Analytics can also help utilities manage DER deployments by recommending optimal size and strategic location for renewables, and by identifying strategic storage deployment to minimize the effect of renewable intermittency.

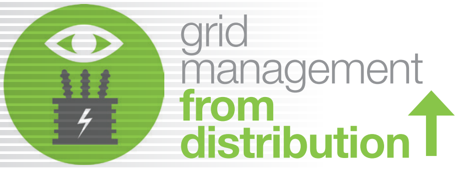
Distributed energy resources create new challenges – but real-time analytics can help visualize their impact.

What's Next? Preparing for Tomorrow's Distribution-Centric World

Asset management is evolving to meet the challenges of a rapidly changing industry. This evolution is being actively supported by the growth of smart technologies and AMI investment by utilities.

Utilities should consider their asset management strategy to be a combination of solutions that work in conjunction to deliver the largest power quality, safety, and reliability benefits, based on each utility's unique budgetary constraints and asset management requirements.

Utilities can better prepare for tomorrow by leveraging data analytics, efficiently operating existing assets while embracing new distributed energy resources, and finding ways to seamlessly integrate them into the grid without compromising reliability, raising costs, or damaging existing assets. Utilities also want to consider the new paradigm in terms of grid management from distribution up.



By rethinking the system operation from distribution up the feeder, utilities can move towards actively managing their distribution assets as a component of their integrated resource planning process. As part of this process, utilities will need to optimize system operations by integrating operational and asset management timeframes into real-time asset management. The overall integrated resource management process will enable bidirectional flow of energy and transactions, optimize asset use as well as improve the bottom line for utilities.

About Landis+Gyr

Built on a powerful advanced grid analytics platform, Landis+Gyr's comprehensive suite of applications leverages existing smart grid investments to deliver actionable intelligence and elevate grid performance.

Utilizing statistical and physics-based advanced algorithms, Landis+Gyr's analytics applications help extend asset life, improve reliability and outage restoration times, reduce losses, manage voltage and power quality issues, and integrate DER safely and effectively on to the distribution system. Landis+Gyr supports new business and operational models for utilities as they embrace the next great challenge of moving towards an actively controlled power distribution grid.

1 https://iot.telefonica.com/press/m2m-800-million-electric-smart-meters-to-be-installed-globally-by-2020
2. http://businesscenter.jdpower.com/JDPAContent/CorpComm/News/content/Releases/pdf/2011014-eubs.pdf
3. http://www.pv-tech.org/news/obama_sets_20_renewables_target_for_us_government_by_2020

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