Next-Generation Asset Management

Make improved decisions through advanced approaches to transmission and distribution asset analytics
To develop an enterprise view of analytics, a company must do more than integrate data, combine analysts or build a corporate IT platform. It must eradicate all of the limited, piecemeal perspectives harbored by managers with their own agendas, needs and fears—and replace them with a single, holistic view of the company.1

Utilities are under pressure on many fronts to meet the seemingly contradictory goals of minimizing costs while maintaining or improving grid reliability. In developed markets, decades of underinvestment in the transmission and distribution (T&D) infrastructure have created a pent-up need to replace aging components of the electric power system and gas delivery network.

Modernizing aging infrastructure has become an imperative for a number of reasons. For starters, electricity demands and industrial growth continue to increase globally. Additionally, there is an emerging influx of renewable power generation and electric and hybrid vehicles, which threatens to strain existing power systems. As a further challenge to business models, utilities in many Western countries (such as the United States and countries within the European Union) are concerned about the loss of important knowledge about their T&D assets as workers retire, taking that information with them.

Tackling the funding challenge
While there is no question that T&D infrastructure modernization is sorely needed, the capital-intensive nature of these upgrades poses one of the utility industry’s biggest challenges. With many utilities facing financial pressures, securing the funding to purchase new T&D equipment and for the ongoing operation and maintenance of existing assets can be daunting.

Over the past decade, modern approaches to asset management have helped utilities mitigate these infrastructure funding challenges, while also enabling numerous grid health and reliability benefits. Until now, however, it has been difficult for utilities to readily access and take full advantage of the information needed to make sound, data-driven and fact-based decisions.

Advanced analytics for improved asset management
Accenture defines analytics as the process of using quantitative methods to derive actionable insights and outcomes from data. There is a long tradition of analytics; it is the original function that spurred the invention and development of mainframe computers and, ultimately, software.

As technologies have advanced, so too has the sophistication of analytic methods. Utility operators now have a “new view” on the totality of their systems and data—yielding more insights and improved decisions about asset performance management, asset strategy and asset investment planning.

Advanced software functionality
One development in analytics revolves around advancements in business intelligence, statistical and quantitative analysis, and predictive modeling. Enhanced intelligence has enabled a shift from descriptive (what is happening?) or reactive (what happened?) analytics to much more compelling and valuable predictive analytics, which answer questions such as: “why is this happening?”, “what is the best that can happen?” and “what will happen next?” As a result of advanced asset analytics capabilities, asset management can become increasingly more focused on predicting system deficiencies and ensuring that investments and maintenance decisions are correct based on in-depth analysis and evaluation of detailed asset-level data.
Powerful in-memory computing

Another very important recent development is in-memory computing and database appliances, which can analyze data up to 3,600 times faster than traditional databases and which hold great potential for asset management. In-memory computing uses sophisticated data compression techniques to store information in random access memory (RAM) that is thousands of times faster than standard storage devices. This speed results in dramatic performance improvements, and the almost instantaneous availability of real-time information enables new insights into asset performance and health.

Today, most utility data required for effective asset management is distributed through numerous applications and stored in isolated silos, which makes it difficult and time-consuming to create a unified view of the data. Also, since analytical reports typically run on aggregated data from a data warehouse rather than directly on operational data, ad-hoc reporting based on current information is problematic. This incomplete view means that decisions are often based on insufficient information.

In-memory computing, combined with the power of today's multi-core processors, is creating breakthroughs in the way utilities view and manage their assets, making it possible to interactively query, filter and aggregate—the data needed for forecasting, simulations, failure modeling, planning, conducting what-if scenarios and other processes.

When it comes to analytics, Accenture literally wrote the book—two books, in fact. Co-authored by Accenture's Jeanne G. Harris, Competing on Analytics: The New Science of Winning (Harvard Business School Press, 2007) and Analytics at Work: Smarter Decisions, Better Results (Harvard Business Review Press, 2010) provide insights on how high-performance businesses are competing and thriving on analytics in a tough global economy that will not tolerate intuition and chance. Cited by CIO Insight magazine as one of "the most provocative, engaging business books of all time," Competing on Analytics has been translated into 13 languages.

Visual, spatial and temporal analytics

Visual, spatial and temporal analytics are several of the other more visible innovations underpinning advanced asset analytics. Today's software correlates data from asset management, enterprise resource planning (ERP), work management/field operations, grid sensors, weather feeds and other sources into multidimensional displays that present asset operating status visually in a spatial, temporal and near real-time context. This correlation takes asset management to a new level—far beyond safeguarding asset transactional health—with the ability to help identify disturbances and condition-based equipment problems before they occur.

With its capacity to drill down to the individual asset level, new software is helping utilities identify which assets are in danger of failing, which should be repaired first and how much revenue is at risk should an asset fail.

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“Two-thirds of large US companies believe they need to improve their enterprise's analytical capabilities. And even though more than half (57 percent) of the companies we surveyed said they lack a consistently updated, enterprise analytical capability, nearly three-quarters (72 percent) said they are working to increase their company’s business analytics usage.”³

The benefits of asset analytics

The ability to aggregate, integrate and analyze asset data helps asset managers advance from their historical focus on pulling together data and focus instead on leveraging asset analytics in support of their engineering, asset policy and strategy, asset performance management, investment planning, risk management, and regulatory reporting and filing processes. There are many business benefits to be derived from advanced asset analytics and visualization solutions. These may include:

• Reduce the cost and effort for equipment maintenance through better knowledge about equipment condition.

• Reduce support costs by automating data extraction, profiling, cleansing and integration, removing the need to manually gather and evaluate information.

• Shift asset management personnel effort from low-value information gathering and assembly to high-value analysis and execution.

• Realize incremental benefits and enhanced return on investments from existing ERP, enterprise asset management (EAM), geographic information systems (GIS), mobile workforce management and other systems.

• Defer capital projects by extending the useful life of assets and improving project planning and priority assessment.

• Improve visibility and decision-making capabilities for senior executives and multiple business units by consolidating asset data from various sources and leveraging modern visualization to present the same data in multiple views tailored to the needs of each user.

• Enhance safety from reduced exposure of a utility workforce to obsolete assets that may require unique skills to maintain the assets.

• Improve capital and operations and maintenance (O&M) effectiveness, with more accurate and informed targeting of investments.

• Defer capital spending requirements through unloading of unhealthy assets.

• Gain efficiencies in regulatory filing and compliance activities by providing the precise, auditable information increasingly requested by regulators, which, in turn, makes it easier for them to approve funding for infrastructure investments.

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Advanced analytics draw on powerful analysis platforms to present data and complex interrelationships in a manner tailored for the business and operational needs of different types of utility employees. From the field, to the asset manager, to the board room, asset analytics provide the unique views of information, analysis capabilities and insights different employees need to make better decisions at their level of accountability. The following are representative examples:

Asset strategy teams

The asset strategy team can take advantage of analytics to improve asset replacement, refurbishment, investment and maintenance strategies. Working with high-to-medium latency data, these teams can merge and analyze historical data, failure statistics and scientific results such as total oil analysis for oil-insulated equipment to help them optimize capital and O&M investment strategies. Analytics also provide new and powerful capabilities in identifying and prioritizing candidate asset work, projects and programs.

Asset maintenance and planning

With advanced asset analytics, operational teams can view events in near-real time to either proactively identify issues quickly or use the information available to more competently react to disruptions. Collaboration and visualization of historic, temporal event-driven and spatial data enable faults to be clearly displayed, and the information available from sensors in the field can be used to help identify the root cause. If required, requests to operate switches on the network can be made to avoid problems, and the near-real-time view of the network can be used to assess the impact of changes. Integration to the utility EAM solution enables work orders to be initiated and crews dispatched to address any imminent issues. The planning team can drill down into assets to review recent planned and corrective maintenance activity, along with any upcoming vegetation management, replacement, refurbishment or new load-related investments. Having line-of-sight visibility into the current asset state as well as an organization’s plans for the asset base can readily translate into both capital and O&M savings over the short and long term.

Furthermore, integration to the EAM environment enables planning teams to drill down into assets to review recent and planned investments. In fact, by using advanced asset analytics, utilities can assess the level of risk for each individual asset, feeders and the overall system, providing a top-to-bottom understanding of the power system and the revenue required to optimally mitigate risk.

Field crews

Today’s mobile versions of asset analytics provide utility field crews with a much more thorough understanding of an asset’s inspection and maintenance history. At the same time, mobile analytics help field crews better understand the importance of their role and the accuracy of data they are capturing to the functions and decisions across their utility’s energy value chain.

The board room

Asset analytics give C-level executives new insights through at-a-glance “dashboards” and highly visual “cockpits” that provide an easy-to-understand view of performance. For example, an asset risk management cockpit provides a high-level “executive summary” view of overall grid or system risk, as well as an organization’s individual risk dimensions. This “risk profile” summary can then be linked to the next level of detail, giving the C-level executive the ability to drill down into problem areas. This capability to view standalone summaries with associated details provides the information needed to investigate specific high risk areas and issues. These high-level executive reports on key metrics can also be used to present critical data in a standard format.

The “art and science” of what’s possible
Case study: asset analytics for T&D asset management and engineering support

Several business and regulatory mandates drove this large utility to increase its work program focus on improving reliability, extending network capacity and replacing an aging asset infrastructure. One of the key outcomes was development of industry-leading asset management strategies, policies and capabilities to (1) improve asset strategy, planning and investment management functions and (2) move away from siloed sustainment and growth planning activities that required time- and labor-intensive analysis of tremendous volumes of T&D asset data.

The utility engaged Accenture to co-architect and deliver an asset analytics solution for data-driven and risk- and fact-based T&D asset management and engineering support. The solution includes key asset-based risk analytics that drive the critical information on how assets are evaluated, have performed and are forecasted to perform. Pulling together numerous mission-critical, nonintegrated databases and information from more than 20 different applications, Accenture is helping the utility develop an asset analytics solution that allows staff to evaluate asset history, calculate health indices, and forecast future health based on asset condition, criticality, demographics, economics, performance and utilization. The solution will give personnel throughout the asset management, engineering and planning workforce individualized asset-specific analytics that can be visualized through controls and instrument panels similar to an airplane cockpit, providing rapid, easy assess to critical utility asset information.

Using these analytics, along with dashboards, charting and analysis tools, utility staff will be able to examine risk and how it evolves over time, determine ways to optimize asset-based investments in ways that minimize risk and, once such investments are made, determine inherent system risk has been addressed and what residual risk remains. This risk-based approach for asset management will serve as a beachhead for T&D transformation within the utility and establish a new leading practice for the utility industry with respect to analytically enabled T&D business processes and decision making, as well as the application of state-of-the-art in-memory, business intelligence capabilities.
How you adopt an enterprise perspective for analytics depends on the answer to one question: who else in my company could be interested in the same data, technology and analytics now or in the future?4

Based on work with 200 utilities in more than 30 countries, including planning and delivery of more than 100 asset management solutions, Accenture has obtained valuable experienced-based insights that can help utilities seeking to take advantage of advanced asset analytics. Some of the most important of these insights include:

**Start now, using what you have**
Utilities can generate meaningful outcomes from partial or nonintegrated data. Many utilities have found that they do not need to fix and integrate all asset data to generate meaningful results using the data they already have. For example, even if the available GIS data mislocates some of a utility’s equipment, the EAM-based maintenance history and condition data can be analyzed to provide valuable intelligence for decision making.

**Integrate, don’t duplicate**
Avoid creating additional pockets of data in siloed repositories through the use of modern integration architecture and frameworks. By their nature, most T&D assets comprise multiple subsystems, each characterized by multiple modes of degradation and failure. Furthermore, existing asset data is often fragmented and spread across many different places in the organization. In fact, some utilities have several hundred data stores. This is why it has been so difficult until recently for utilities to establish exactly how much power was passing through which asset relative to its existing or forecast condition. The result was a widespread reliance on best-guess estimates and averages, along with a tendency to overbuild assets to provide a margin for error.

This approach has proved to be expensive and ineffective. Tools and technologies are now increasingly available to enable utilities to integrate different types of asset condition data from across the utility so that it can be used by analytics programs to improve asset management.

**Choose the appropriate technology**
There are many options available when it comes to software, data stores, data warehouses, business intelligence tools, visualization platforms and analytics software, and each has its pros and cons. To keep costs down, utilities should avoid overengineering. Similarly, varying degrees of automation exist, from simple spreadsheets to cockpits that sit directly on top of an ERP system, data warehouse and integrated data stores. The appropriate choice is a function of the desired results, the time available to deliver them, the volume of metrics, what existing systems are in place and the size of the organization.

Architecture also plays a critical role in accelerating and future-proofing the design of an asset management solution and in the effectiveness of asset analytics. The architecture should be configurable, platform independent, scalable and extendable.

Accenture experience shows that an agile implementation approach is the most-effective means for implementing asset analytics so utilities can benefit from ongoing incremental solutions that provide new asset management insight, situational awareness and data integration. This helps the evolution of the system be highly visual and intuitive and also helps align asset analytics with quantitatively enabled business processes.

Similarly, Web services should be leveraged as a means to enable different applications to share data and services. Through their ability to bring information together across operating systems and platforms, they can help utilities to exchange information much more seamlessly—and economically—among internal departments, customers and partners.

**Accenture’s experience-based insights**

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The time is now for advanced asset analytics

Improving T&D infrastructure in developed markets is essential to advancing society toward a low-carbon landscape. To succeed on many fronts, utilities need to better optimize their returns on capital investment, run their operations more efficiently and meet rising customer and regulator expectations.

All of these will require a "next generation" of asset management, which is firmly underpinned by a deeper and more forward-looking understanding of T&D assets. This understanding will be key to achieving high performance, differentiating the industry’s leaders from the followers.

The asset health, performance and operations data needed for effective asset analytics exist in various processes and applications fragmented across different areas of the enterprise, as most utilities have invested heavily in enabling systems and in gathering the information leveraged by these systems. Advanced asset analytics is the next step to help utility executives, asset managers, planners and engineers improve the benefits of these investments by extracting more value from them. In bringing together EAM data, geospatial data and other types of visual inspection, diagnostic, measurement and maintenance history data typically housed in an array of systems across the enterprise, both structured and nonstructured asset data can be analyzed to provide an array of valuable insights and outcomes. Advanced analytics can help utilities find and better understand this data to achieve large gains in asset performance and health and in the asset investment decisions that are made.

Asset analytics offer the ability to immediately improve asset longevity, performance and health by using systems and data that are already in place—and at the same time improve the return on investment from the systems and data.

From descriptive to predictive

The cornerstone of next-generation asset management will be the ability to see, understand and respond to not just what is happening now in the asset base, but also to what will happen in the future. Asset analytics will provide utilities with the strong foundation and investment confidence they need to operate and excel with minimized risk. The imperative of using the wealth of asset data available in utilities' back offices and operations, along with expanding the future use and availability of real-time asset intelligence, will provide a means to planning and investing in a secure and dependable T&D grid infrastructure while promoting efficient and effective operations. For example, applying analytics against maintenance data, historic readings, engineering specifications, observed performance, operating state and spatial content, utilities have new and accurate ways to determine mean time before failure, achieve better reliability centered maintenance and perform failure modes and effects analysis.
Case study: analytics for transformer asset management

Like many utilities in North America, a Canadian local distribution company (LDC) is grappling with aging infrastructure and the reliability problems that presents for its more than 500,000 urban customers. The LDC's transformer analytics and visualization pilot was a step toward understanding how data from metered transformers could translate into providing additional insights into transformer loading, utilization and health.

In concert with the utility's smart metering program, the LDC deployed more than 3,500 meters that collect load data at 15-minute intervals. The utility turned to Accenture for an automated process to extract and aggregate its meter data and apply analytics for insights into loading relative to demand and to determine whether specific transformers are over- or underutilized.

Specifically, the utility examined:
- Use factor: The relationship between the peak demand on a transformer and the rating of that transformer.
- Demand factor: The relative portion of load on a circuit compared to the load on a particular transformer.
- Coincidence factor: The relationship between the system peak and the individual peaks of the transformers.
- Load factor: The variation in demand.
- Voltage profile: A look at voltage drop on a feeder.

The pilot allowed utility managers to visually identify overloaded transformers and consider replacement before failures resulted in unplanned outages. And, because overloading shortens transformer life, it helped the utility theoretically extend asset life and optimize spend over the asset's life cycle.

Utility managers also used findings to weigh likelihood of transformer failure against replacement cost and forecast optimal replacement timeline scenarios. Adding maintenance, inspection and condition-analysis data would help utility managers further fine tune such analytics of this type that are event- or load-focused.
About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 244,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world’s most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$25.5 billion for the fiscal year ended Aug. 31, 2011. For more information, visit www.accenture.com.

About the Accenture Utilities industry group

The Accenture Utilities industry group has more than 30 years of experience working with electric, gas and water utilities worldwide. Our group works with more than 200 utilities in over 30 countries and has 10,000 people supporting our utilities clients. We work with 80 percent of businesses with utilities in their portfolio on the 2011 Global Fortune 500 list. We provide the deep industry knowledge, people and assets utilities need to develop the strategies and adopt solutions to improve performance in the dynamic energy market.