Capgemini Consulting

Big Data BlackOut: Are Utilities Powering Up Their Data Analytics?

Utilities' Analytics Performance is Under-Powered

Big Data in the utilities sector can only get even bigger as the smart transformation of the industry accelerates. It is estimated that 680 million smart meters will be installed globally by 2017 – leading to 280 petabytes of data a year[1]. This Big Data surge is an opportunity for utilities to drive new levels of operational efficiency and transform the customer experience.

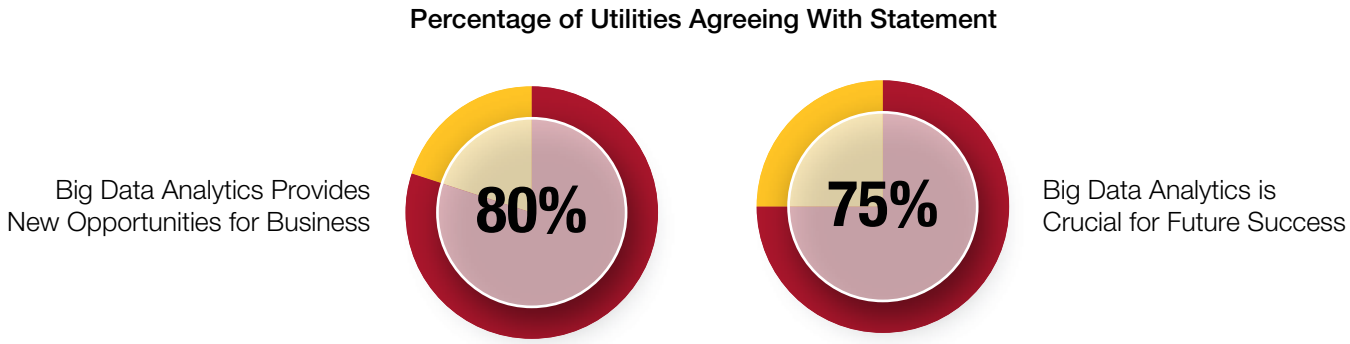
Take operational efficiency alone. The annual cost of weather-related power outages to the U.S. economy is estimated to be between $18 billion to $33 billion[2]. Organizations can use Big Data analytics to detect operational challenges and prevent outages, substantially reducing costs. EPB, an American utility, which estimated that power outages cost the local community $100 million, installed automated fault isolation and service restoration technology. During a July 2012 storm, automated switching in the distribution system instantly reduced the number of sustained outages by 50%. This innovation, combined with information on customer outage provided by meters, meant EPB reduced total restoration time by 1.5 days, representing almost $1.5 million in operational savings and significantly reduced costs for customers[3].

Are utilities grasping these analytics opportunities? In recent years, the industry has appeared hesitant. In 2012, we conducted joint research with the MIT Center for Digital Business to understand the digital maturity of a range of industries. Our study revealed that utilities had low digital maturity and their investment in digital technologies – such as analytics[4] – was conservative. Subsequent 2013 research, in partnership with the MIT Sloan Management Review, revealed that 57% of utilities did not consider analytics a major opportunity[5].

More recently, this sentiment has shifted. Big Data has moved front of mind for utilities executives. Our end-2014 survey – which covered 1,000 senior decision-makers across 10 countries and nine industries, including utilities – shows that for the utilities industry segment:

- 80% of utilities see Big Data analytics as a source of new business opportunities
- 75% of utilities see Big Data analytics as crucial for future success (see Figure 1)

Figure 1: Utilities' Perception of Big Data Analytics



N = 41

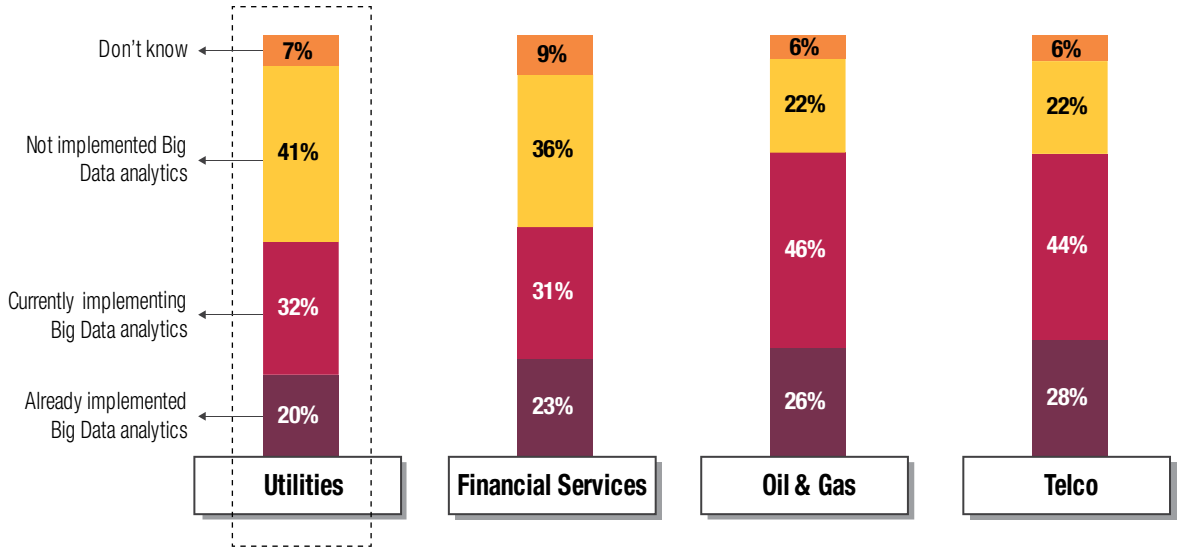
Source: Capgemini, "Big & Fast Data: The Rise of Insight-Driven Business", March 2015

However, while the industry may now recognize the potential of Big Data, it struggles to translate that into action. We also found that only 20% of utilities have already implemented Big Data analytics. There is a significant group (41%) with no Big Data analytics initiatives (see Figure 2). This compares quite unfavorably with take-up levels in other sectors.

If utilities are to step up strategic investments and initiatives, it will require a clear understanding of where long-term value lies. In the following section, we examine some of the key areas for improvement and how organizations are performing in taking those opportunities.

> *"Only 20% of utilities have already implemented Big Data analytics."*

Figure 2: Utilities' implementation of Big Data Analytics



N = 1000

Source: Capgemini, "Big & Fast Data: The Rise of Insight-Driven Business", March 2015

A Significant Big Data Prize, But Investment Missing its Target

> *41% of analytics initiatives undertaken are still limited to basic analytics with reporting functionality.*

Advanced Analytics Drives Operational Efficiency but Adoption is Low

Analytics can help transform a range of operational processes. For instance, analytics helps match power generation with expected demand, manage peak load (peak shaving) through variable pricing, and optimize the integration of decentralized energy generation. The use of predictive analytics also helps increase asset life and performance, while driving down overall asset maintenance costs. As an executive at a UK utility explained, *"We have a huge amount of fairly old assets and we can no longer afford to replace assets based on their age. We now have to be a lot more scientific in terms of the decision we make around what to refresh, when to refresh, and what to leave. The only way we could do it is by having proper predictive analytics to understand where the problems are going to be and then tackle those things[6]."*

Advanced Big Data analytics (predictive / real-time) can provide significant operational benefits to the tune of $300 per meter per year, as identified by C3 Energy, an enterprise application software company[7]. Indeed, an initiative taken by Center Point Energy USA used predictive and real-time analytics to prevent electricity theft, thereby saving almost $2 million[8]. Similarly, Vestas Wind Systems, a wind power company in Denmark, implemented a Big Data solution to optimize the placement of wind turbines in order to improve power output and asset life. This solution enabled Vestas to expand its wind library – a repository of weather and turbine data – more than 10 fold. It also reduced response time for wind forecasting information by approximately 97% – from weeks to hours, while reducing energy consumption by 40%[9]. Likewise, PSE&G[10] estimated that using predictive analytics models to perform proactive replacement of transformers would help bring down the overall cost of replacement (see insert below).

Despite the benefits of advanced analytics, adoption levels appear low. Our analysis of over 100 utilities, and interviews with utility industry executives (see research methodology at the end of the paper), found that 41% of analytics initiatives undertaken are still limited to basic analytics with reporting functionality (see Figure 3).

Analytics Drives Customer Satisfaction but Initiatives are Few and Far Between

A key challenge facing utilities is low customer satisfaction levels. In our previous paper - *So Near Yet so Far: Why Utilities Need to Re-energize Their Digital Customer Experience* - we took a detailed look at this issue. The analysis examined how the customer experience in utilities is sub-optimal and the significant gap between what utilities are doing and how satisfied their customers are[11]. Analytics is an opportunity to enhance utilities' understanding of consumption patterns, and improve the customer experience through a variety of means. These include providing usage patterns, using predictive analytics to minimize outages/improve reliability, and alert customers with usage spikes among others.

> *Advanced Big Data analytics can provide significant operational benefits to utilities, to the tune of $300 per meter per year.*

PSE&G – Using Analytics to Drive Down Transformer Replacement Cost

Public Service Electric and Gas Company (PSE&G) is one of the largest combined electric and gas companies in the United States, servicing 1.8 million gas customers and 2.2 million electric customers. It has assets worth nearly $17bn and a revenue of nearly $8 billion.

PSE&G implemented a Computerized Maintenance Management System (CMMS) to assist with repair, replacement and maintenance decisions for assets, including transformers and other equipment. It used analytics to generate a condition score for transformers based on multiple factors, such as moisture, dielectric strength, combustible gas rate of change, and cooling performance. An asset replacement (predictive) algorithm uses this condition score, and other factors (chronological age, spare availability) to determine the appropriate time to replace transformers.

PSE&G also employs advanced analytics on real-time sensors to track various operational metrics. Usage of analytics has helped the company in identifying problems and remediating issues before a failure, saving millions of dollars in equipment failure avoidance. The company has also determined that replacing some transformers proactively (by using analytics models), rather than reactively, will help it save over $100m over a 25-year period.

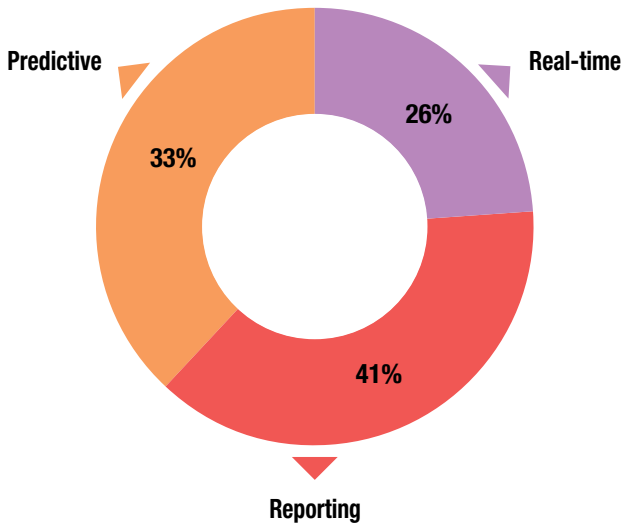
Source: PSE&G, "Determining True Age of Transformers Through Advanced Analytics", DistribuTECH San Diego, CA, February 2015

> *EDF Energy used analytics to reduce customer churn, accruing potential savings of up to $30 million per year.*

Conducting extensive analytics of consumer sentiment and feedback is another opportunity. Our earlier research found that only 26% of customer mentions on social media on the quality of communication on outages was positive[12]. Gulf Power's experience shows how analytics can address this. The company used analytics to establish that, with outages, customer satisfaction is highest when power is restored in the 10-minute window before the initial expected restoration time that was communicated to customers. Interestingly, it found that restoring power more than two hours before the expected restoration time negatively affects customer satisfaction[13]. Understanding metrics like this can help utilities fix their biggest customer experience challenges.

Improved customer satisfaction leads to higher retention rates, as an executive at a German utility major confirmed. *"Analytics lets you contact the customer with personalized offers on existing contracts. This definitely improves customer retention,"* he explained. Indeed, utilities like EDF Energy have used analytics to reduce customer churn, accruing potential savings of up to $30 million per year[14]. Similarly, Endesa reduced customer churn by 50% (see insert below).

Figure 3: Maturity of Analytics Initiatives by Focus Area



N = 115

Source: Capgemini Consulting Analysis

Endesa Uses Analytics to Reduce Churn By 50%

Endesa is a leading electricity dealer and second-largest gas vendor in Spain. The company wanted to acquire and retain customers in a deregulated and highly competitive energy market. Implementing an analytics solution helped the company to segment and better understand its customer base and streamline campaign management. This in turn helped build customer loyalty and acquire new customers. Endesa reduced churn by 50% in two years, reduced customer acquisition costs by 50%, and improved cross-selling. It also furnished Endesa with a 70% reduction in the time required to design new campaigns and generate a target customer list.

Source: SAS client case study

> *Analytics lets you contact the customer with personalized offers on existing contracts. This definitely improves customer retention.*
>
> –Executive in European utility

We have already outlined how the customer experience in utilities has significant weaknesses. You would therefore assume that this would be a focus for efforts. However, this is not the case. Our 2012 research with the MIT Center for Digital Business also showed that utility firms were already lagging other industries in addressing these issues. That research revealed that roughly half the firms we surveyed did not use analytics to target marketing to customers, qualify sales prospects or optimize pricing[16].

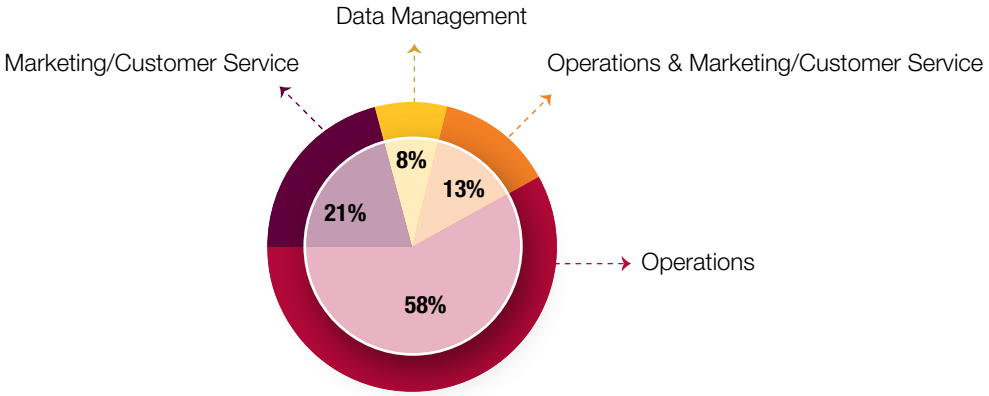
And our current research[b] shows that this situation persists. We found that two-thirds of utilities do not have analytics initiatives focusing primarily on the customer (see Figure 4).

The lack of customer-focused analytics initiatives is partly driven by infrastructure limitations. When utilities are in a nascent stage of upgrading infrastructure, then it is difficult to improve areas that have a direct impact on the customer experience, such as predictive asset maintenance, which can improve outage management and reliability of supply. Another challenge is that customer service does not appear to be a key area of responsibility amongst utility analytics executives. Our research found that amongst 1,000 respondents across sectors, utilities had the lowest (10%) percentage of analytics executives that had customer service as a main area of responsibility. This compares quite unfavorably to the pan-industry average of 25%. More worryingly, less than 3% of utility analytics executives consider customer service to be the most significant part of their role[17].

> *Less than 10% of utilities respondents believe that customer service is a key area of responsibility.*

[b] *We performed a comprehensive analysis of the analytics initiatives of 100 large utilities across North America, Europe and Asia Pacific (see research methodology at the end of the paper). This analysis is based on publicly available information.*

Figure 4: Analytics Initiatives, % of Utilities



N = 100

Source: Capgemini Consulting Analysis

Note: Percentage of all utilities in our research that have launched analytics initiatives. The categories of initiatives are mutually exclusive.

Big Data Outage: What is Holding Back Utilities?

> *Advanced Metering Infrastructure collects information that can translate to as much as a 3,000-fold increase in the amount of data.*

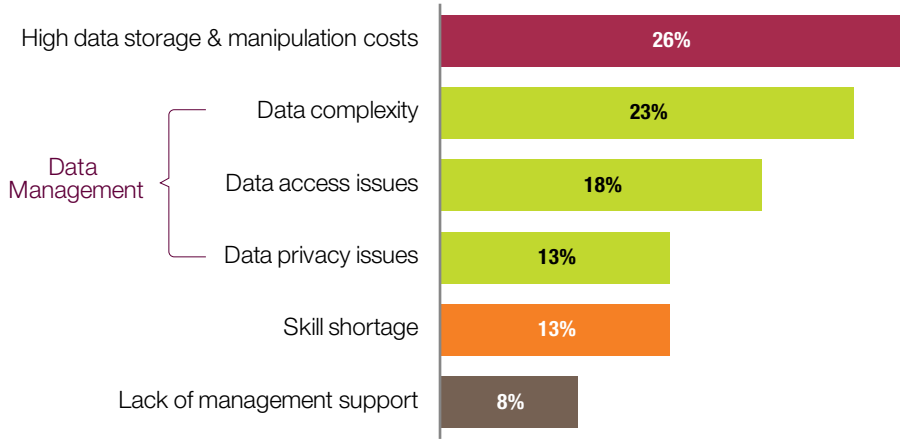
The analytics opportunity for utilities is clear, but there continues to be a lack of real impetus and value delivery. What is putting the brakes on utilities? The primary reasons include concern over high costs and the sheer complexity of data[18] (see Figure 5).

Big Data Creates Big Storage and Manipulation Costs

Advanced Metering Infrastructure collects information multiple times every hour, as opposed to the monthly measurement that was the norm. That can translate to, in some cases, as much as a 3,000-fold increase in the amount of data utilities would have processed in the past[19]. For a typical electricity utility, the number of triggers to data growth and their corresponding impact on data requirements are massive (see Figure 6).

The massive increase in installations of smart meters and the corresponding rise in data usage will necessitate significant investment in data storage infrastructure and information management programs. Indeed, utility spending on smart grid infrastructure, of which data centers are key, is expected to cumulatively total hundreds of billions in dollars over the next two decades.

Figure 5: Top Challenges for Utilities in Implementing Big Data Analytics

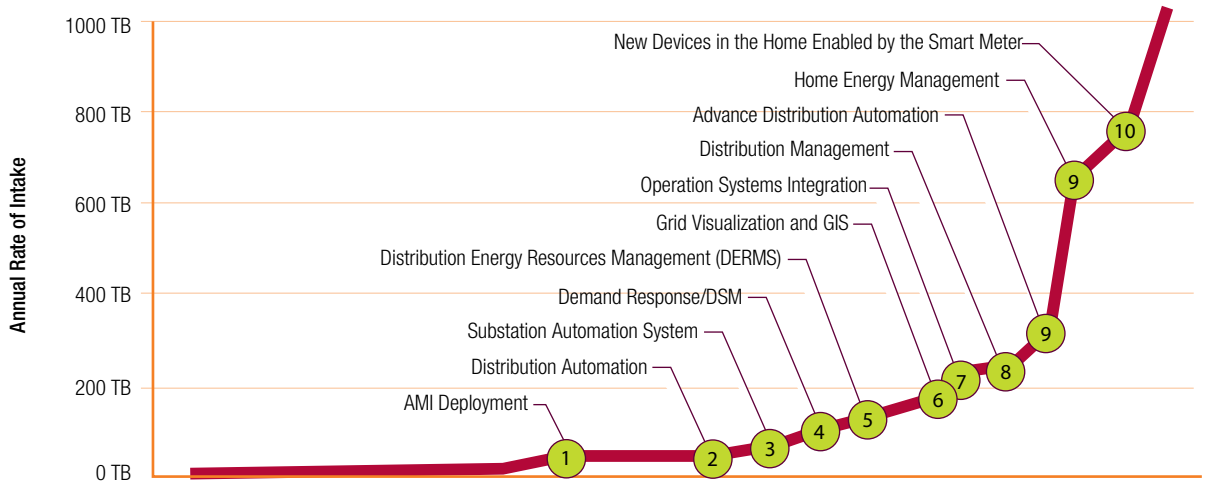


Challenges are identified based on responses of surveyed utility executives. The figure represents the percentage of respondents who voted for the challenge as being the most important impediment to analytics implementation.

N = 41

Source: Capgemini, "Big & Fast Data: The Rise of Insight-Driven Business", March 2015

Figure 6: Triggers to Data Growth and Estimated Increase in Annual Data Intake for a Utility



Source: EPRI Intelligrid Via Lockheed Martin Presentation, "Solving Big Data Challenges US Electric Utility Industry", July 2014

Note: 1 TB (Terabyte) = 1,024 Gigabytes

Utilities are Struggling with Data Management

Our research found that more than half of utility executives cited data management – a combination of complexity, access and privacy – as significant challenges[20]. Many respondents were concerned that Big Data sets were too complex to collect and store, and required a lot of time for analysis. In particular, unstructured data was highlighted as being too difficult to interpret. The added concern was that the volume of unstructured data had increased over the last two years.

Apart from complexity, data access and privacy issues were also cited as the top implementation challenge[21]. Data access issues include silos that prevent data from being pooled for the benefit of the entire organization, while data privacy concerns security and confidentiality of sensitive data.

Power Surge: How to Ensure Analytics Drives Business Value

As we have seen, utilities – compared to other industries – have been slow Big Data starters. However, the potential upside, and the achievements of analytics leaders in the industry, is leading to a sea-change in attitudes. Utilities are poised to increase their investment in analytics from $700 million in 2012 to $3.8 billion in 2020[22].

However, to ensure these investments bear fruit, organizations need to take a structured approach. This begins with a realistic analysis of their analytics maturity levels, where they want to get to, and what they want to achieve. That framework gives a baseline for key investments and initiatives. Utilities can then identify the right data sets and the smart systems they need, invest in the right skills, and put in place the right data governance model, potentially including mechanisms such as Chief Data Officer. Within this structured approach, utilities should err on the side of pragmatism.

Begin with Small Initiatives that are Aligned with Organizational Big Data Strategy

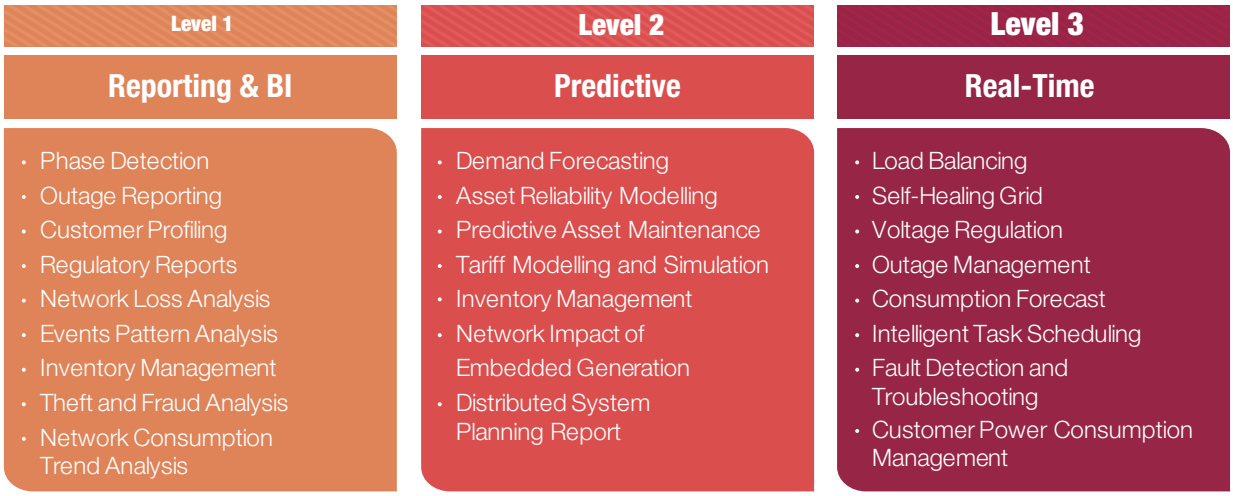
The first step that utilities need to take is to understand the "what-for" of their Big Data initiatives. Given that utilities have struggled to define the value of initiatives, they can begin with pilots and proofs of concepts. These are a very pragmatic and results-driven way of convincing management of the viability and value of analytics initiatives. As an executive at a European energy trading firm says, *"We implement new analytics packages in pilots, and use learning from these to scale up the implementation[23]."* Utilities also need to ensure that they take a "fail-fast" approach to analytics initiatives. By only committing small resource levels, time-boxing the programme and moving fast, many hypotheses can be tested without significant business, budget or project risk.

Big Data Analytics for Utilities – Indicative Use Cases

Big Data and analytics can help utilities improve operational efficiency and customer experience. Operational benefits include revenue assurance, network and production management, demand forecast, asset management, and optimization of support functions. Similarly, analytics helps improve customer experience through customer relationship optimization, proactive marketing and custom offers and services.

Marketing and Customer Care			Operations				
Offer and services	Proactive marketing	Network and production management	Support function optimization	Asset management	Demand forecast	Customer relationship optimization	Revenue assurance
• Tariff optimization	• Customer base management	• Customer base management	• Supply chain	• Real-time asset performance monitoring	• Energy consumption forecasts	• Electricity load optimization	• Fraud detection
• Services: energy management tools, smart home	• Brand & communication (e-listening, web analytics, media campaign optimization)	• Brand & communication (e-listening, web analytics, media campaign optimization)		• Predictive maintenance	• Trading optimization	• Capacity planning (including renewable energy)	• Network loss prevention

Figure 7: Analytics Application Areas by Maturity



Source: Capgemini Consulting Analysis

Carry out an Analysis of Your Current Analytics Maturity Level and What You Are Trying to Achieve

Organizations need to begin with a pragmatic assessment of where they are in their analytics evolution (see Figure 7). The aim is to move from basic reporting and Business Intelligence to the higher-value opportunities offered by predictive and real-time analytics. As our research has shown, most organizations have been focusing on reporting thus far. Utilities should ask themselves a series of questions on their maturity. Do we have well-defined criteria to evaluate use-cases for selection? Do we have well-defined and quantitative metrics to measure the success of our Big Data initiatives? How well-integrated are our datasets and have we defined policies and procedures to ensure high data quality?

> *"Nearly 44% of utilities have already introduced or are in the process of rolling out customer data management systems."*

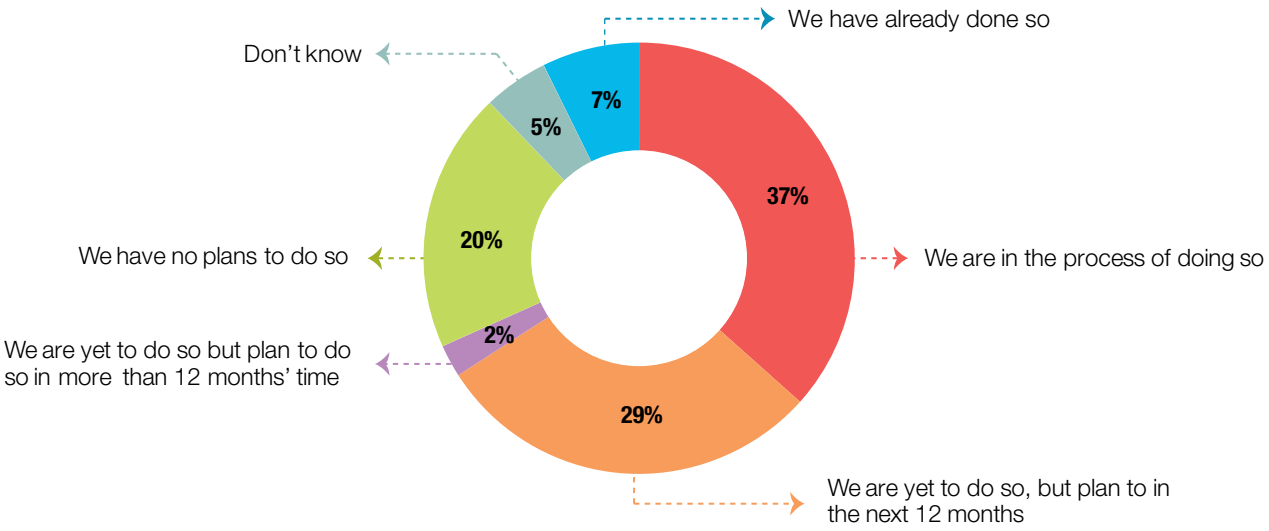
For utilities who want to move up the maturity curve, three areas will be critical:

- Investing in the right data management tools
- Identifying what skills are required and what is needed to attract, reward and retain the right skills
- Putting in place the data governance framework needed to manage data, including integrity of data, data privacy and security

1. Identify what Data is Needed and the Data Management Systems Required to Deliver that. Many utilities have recognized the importance of smart data tools. Our research found that nearly 44% of utilities had already introduced or were in the process of rolling out customer data management systems (see Figure 8). Nearly two out of every three utility executives in North America consider shrinking the gap between data collection and data use as a key priority[24].

2. Invest in Skill Development. Analytics skills are in high demand across industries and the utility industry is not immune to the challenge of getting the right skills. Utilities should use a mix of in-house training, talent acquisition and partnership to plug the skills gap. For instance, an executive at an American utility says, *"We partner with third parties who have a lot of experience in this space to kind of help kick off projects and do lead projects[25]."*

Figure 8: Investments in Customer Data Management Systems



N = 41

Source: Capgemini, "Big & Fast Data: The Rise of Insight-Driven Business", March 2015

3. Create an Effective Governance Model including Mechanisms such as Chief Data Officer. Effective data governance will be critical to realizing value from analytics. This includes having a clear data management policy and the right governance approach. Governance can include data management steering committees or the appointment of a Chief Data Officer to oversee data quality and ensure data is unlocked from different silos and successfully integrated. Our research found that utilities lag almost all other industries in this area. 39% of utility executives either did not know if their organization was setting up a CDO type C-level role, or confirmed that there was no immediate plan to do so. This compares unfavorably with other sectors such as oil & gas (23%) and telco (26%).

Data Powers a New Future for Utilities

Utilities are at an important cross-roads in their history. Electric utilities, in particular, are tackling two major issues. One is the worldwide push for renewable sources of energy. Second is the rapidly declining cost in energy storage, which brings their business model into question. Big Data offers an exciting opportunity to transform utility operational effectiveness, while at the same time dealing with the historical problem of low customer satisfaction. Big Data also affords opportunities to utilities for inventing new business models through the data generated by the smart infrastructure. Highly efficient utilities, with a transformed customer experience, will be in a much stronger position to tackle the mega-challenges that face them. It is time for them to inject some power into their Big Data strategy.

> *"44% of utility industry executives either did not know if their organization was setting up a CDO type C-level role, or confirmed that there was no immediate plan to do so."*

Research Methodology

To understand how leading utilities fare on analytics adoption and usage, Capgemini Consulting studied 100 large utilities across North America, Europe and Asia Pacific with a turnover of over $1 billion. Nearly 90% of these utilities have revenue in excess of $4 billion.

In terms of geographical split, 48% of the sample is from North America, 37% from Europe and 15% from Asia Pacific. In terms of business operation, we looked at utilities across electricity, gas and water. In the sample, 48% are standalone electric utilities and 1% are present in both electricity and gas.

We studied the analytics initiatives of these utilities available through public sources. The key focus areas include analytical maturity, effect on value chain, reasons and approach for implementation, and benefits delivered.

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