
WHITEPAPER

The Data Core: Driving utility operational excellence through data integration



Introduction

Data is at the core of a modern utility, highly sought and meticulously gathered—and then left to sit in silos, misunderstood and underutilized. Utilities must find a way to break down those data silos if they are to build the complete picture of their business – but how?

This report discusses the results of a recent ABB and Zpryme survey of 150 North American utility executives, focusing on how data—and its critical role in generating the total picture of physical assets—can positively impact key areas across a utility such as:

- Asset health management
- Distributed energy resource management
- Cyber security
- Customer engagement

Utilities that learn how to reconnect their disparate data, IT systems and business processes can make more fully-informed decisions in order to achieve benefits including operational excellence, increased profits, decreased capital and O&M expenditures, and better planned safety efforts.

150 responses from utility executives across North America

88

Investor-owned utilities

36

Municipal utilities

26

Cooperative utilities

Roughly half of the respondents came from utilities with over \$1 billion in annual revenue, and 38% had revenues between \$100 million and \$1 billion. In terms of customers, approximately one-third of respondents had over 2 million customers.

Figure 1: Top drivers behind improving analytics efforts (%)

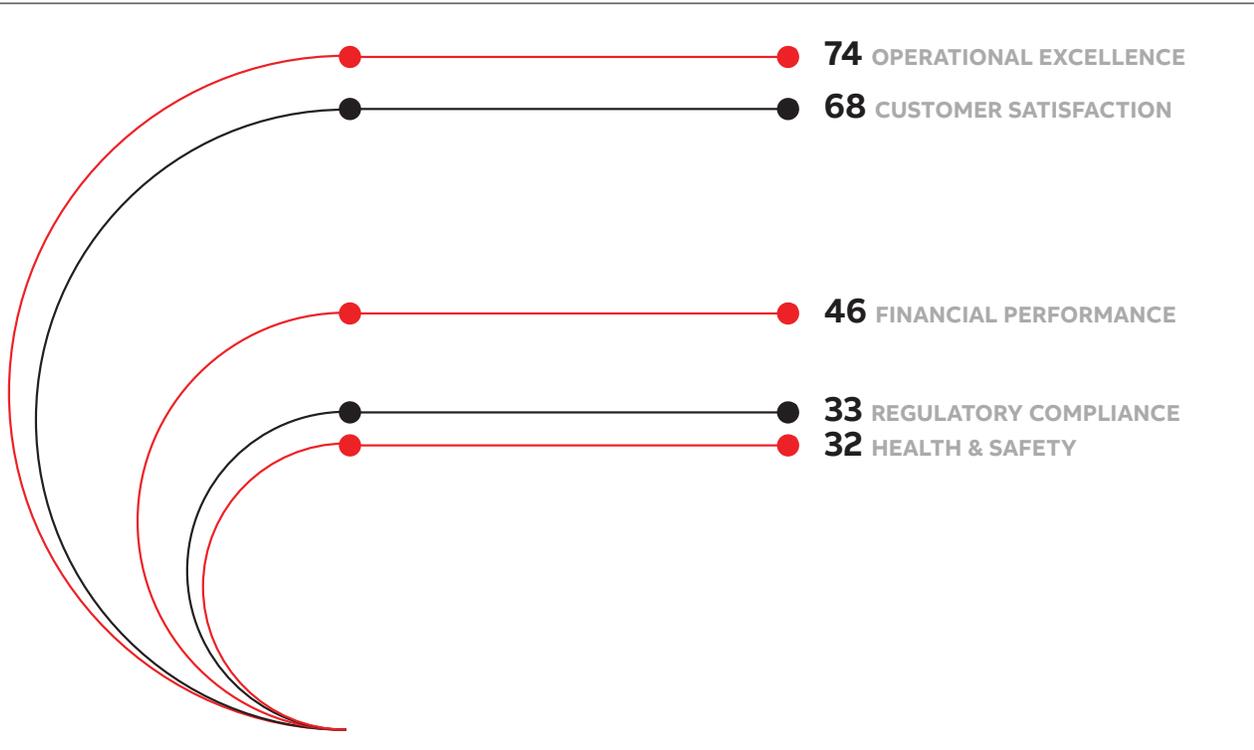


Figure 2: Biggest challenges with data management (%)



The challenge

Disparate sources, systems and processes

Along with expanding deployment of automation technologies, the smart grid era of utilities introduced an increasingly connected network of smart assets impacting electricity generation, transmission and distribution (T&D) – from smart meters to electric vehicles to community-scale solar and wind farms.

When it comes to getting the most out of their data, utilities still lack connections among the disparate data sources and systems that have come on board with smart grid efforts, whether meter data or energy storage technologies. As shown in Figure 2, over two-thirds of respondents said the integration of different IT systems is the most common challenge with data analytics, even before budget constraints.

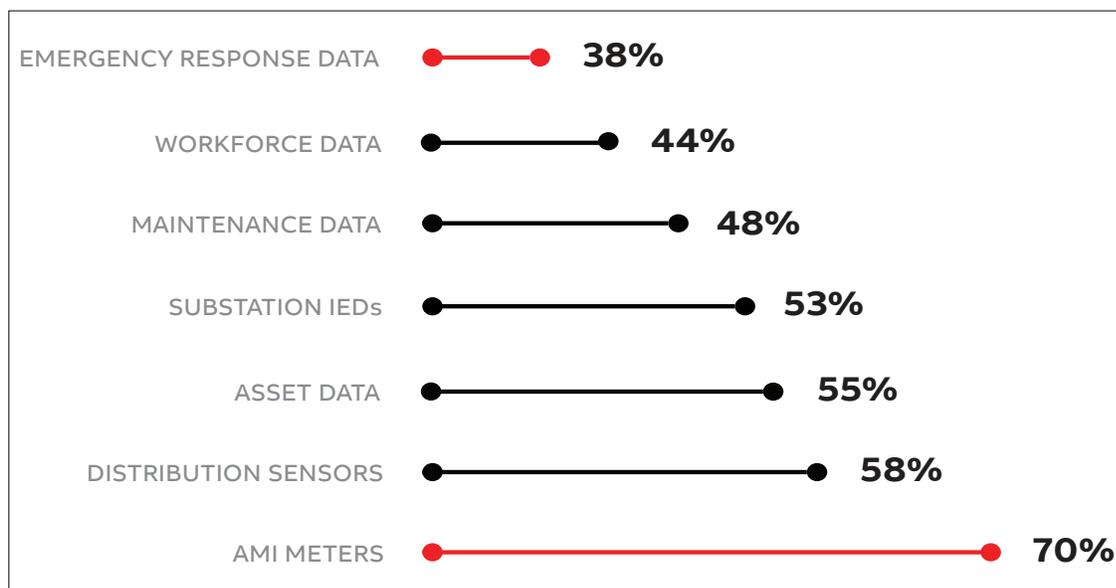
This lack of connection limits a utility's view across the organization; without that visibility, it's hard to know where improvements might be made. Asset management is a prime example. "When we don't have the ability to build a complete picture of an asset, we don't have a baseline," noted Dr. Siri Varadan, PE and Director of Product Management for the Enterprise Software product group within ABB. "Only when you know the baseline of an asset can

you tell that something is not right. We have to integrate all that data to build the big picture."

Gathering data to help build these baselines is simple; it can come from a variety sources. Figure 3 shows that AMI meters are the most frequently mentioned contributors of data, but over half of the respondents also collect distribution sensor and asset data as well as data from Intelligent Electronic Devices (IEDs) within substations. The problem isn't collecting the data, it's how the data is managed, analyzed, and viewed.

With all of these data sources in play, how does each contribute to other areas of the business? The data sources are just pieces of larger puzzles—such as Asset Performance Management (APM) or outage management—that utilities must consider.

Figure 3: Types of data gathered by utilities (%)



Siloed data, siloed approaches

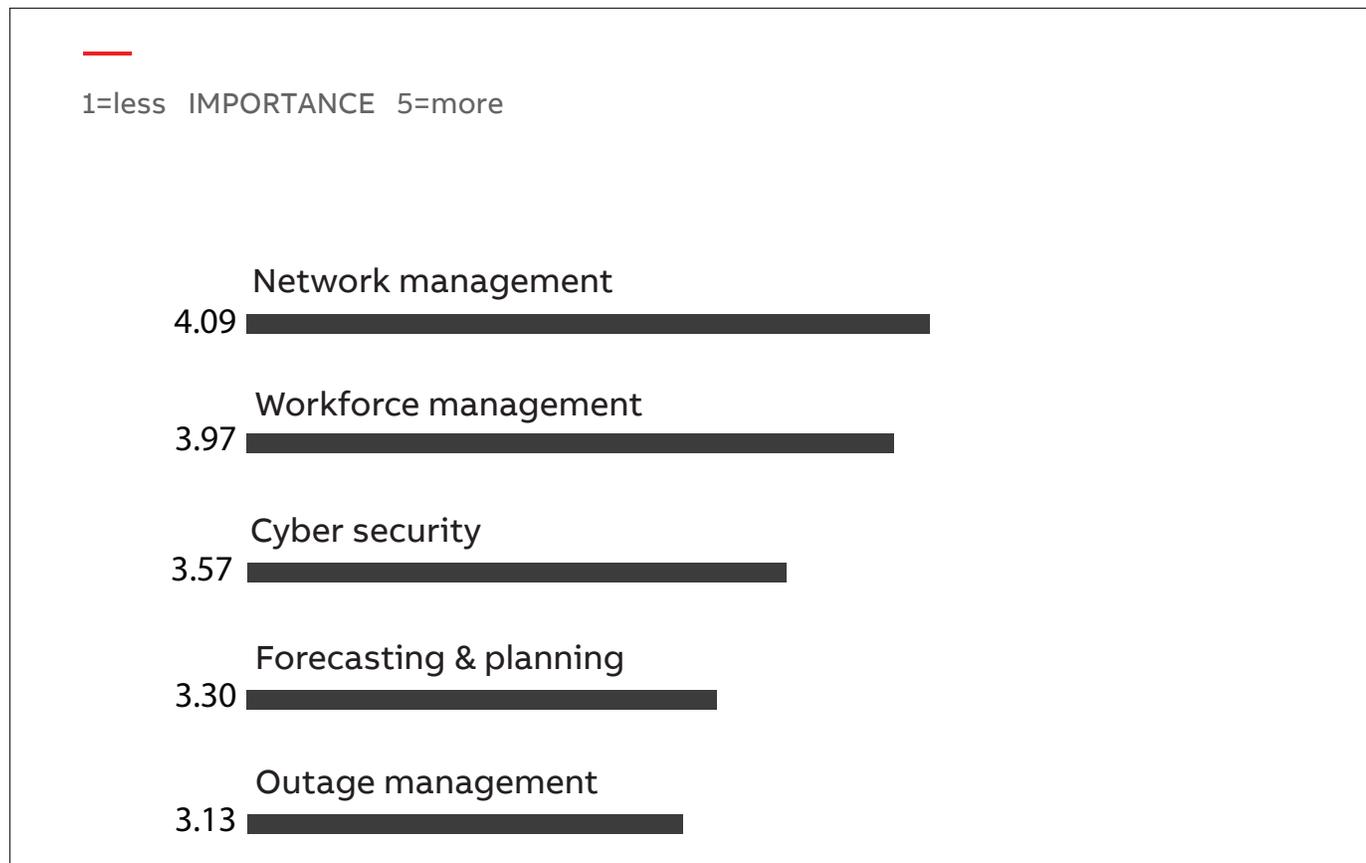
In addition to siloed data and systems, many utilities also silo key areas of their organizations.

Figure 4 demonstrates the importance of data analytics for different business areas within a utility—a score of “1” means that data and analytics are not perceived as important and a score of “5” means that they are considered extremely important.

Network management rises to the top of the list, but it is important to note that lower-ranked

business areas such as outage management and asset management ultimately feed into the success of network management efforts. Utilities can’t afford to say, “I don’t need to know what’s going on there”; asset health management, network management, workforce management, and cyber security must be considered holistically or risk triggering a cascading failure in the business.

Figure 4: Importance of data and analytics for key business areas (Scale of importance 1-5)



Spotlight interview

Collaboration and integration are keys to success



Joseph Thomas

Vice President, Electric Systems Operations
The United Illuminating Company

The integration of different IT systems is the most frequently mentioned challenge with data management for U.S. utilities. How does that compare with what you're seeing?

Utilities for many years had the philosophy to get best-of-breed applications. Well, with that you have numerous systems and databases – and trying to integrate them is very costly. Managing version control is also a challenge, and it really doesn't set the stage for the ever changing customer, regulatory and energy market expectations. Another aspect is the challenge around data quality. Over the years there weren't many capabilities to scrub data before it actually hit your core data systems.

The key is for utilities to figure out how to reduce the number of systems, select the right vendors that are progressive and will help take you where you need to go, and ensure the data that we migrate into these new systems is high-quality.

What does a complete picture of an asset look like? What would it include?

You have electrical infrastructure, or the assets that include substations, transformers, wires, poles, and the meters at the transmission and distribution levels. Another asset is the supporting communication system and technologies to communicate with and manage those assets. The final asset is the data, and managing that data as an asset to serve all stakeholders. The key is to transform data into information that brings value to everyone.

When we integrate all that, the complete picture is really that we can monitor an asset's performance, and predict outcomes. If an asset has the potential to have a problem we can measure it and identify the appropriate actions before it actually fails.

How will next-generation utility efforts—such as DERs, microgrids and virtual power plants—change your organization's data and asset management needs?

It's already happening. We have at least eight to 10 solar applications a week in our service territory. We used to have 200 to 300 per year a couple of years ago – this year we'll have over 2,000. We're seeing solar farms, fuel cells being successfully built and placed into operation. We're currently in the process of building a municipal microgrid for one of our towns.

The challenges I see are the electrical system of the past was very vertical and designed for one way power flow. It came from the power plants via transmission and distribution lines right to the customers. You could model what the impacts of any system or customer changes to system reliability and performance with an overall focus on ensuring safe delivery of energy. Now when you have new types of non-dispatched sources interconnecting at the distribution level, you really don't have the appropriate real-time visibility and rich data to run models and to determine if the new source may or may not cause a problem.

What recommendations do you have for other utilities as they work to overcome data silos within their own organizations?

First and foremost, select good leaders that are in a mode of partnership. It's all about serving the customers, and meeting customer, regulatory and shareholder expectations all of the time. We must have well-defined strategies and visions, and be working together as a team.

The second is any project that has an IT component has to have a governance oversight consisting of IT/OT and business unit leaders. It is really a culture of teamwork and collaboration, gaining a respect for each other and how everyone contributes to the success of the project and overall company results.

Approaching data from a holistic view

When data sets get together, they become more than the sum of their parts.

Integrating disparate data sets can improve the overall health of a utility through:

- Faster restoration times
- Reduced equipment downtime
- Streamlined workforce management processes
- Superior customer service

The next section of this report explores key areas that can benefit from this approach.

Cyber security

Naturally, as connected devices and systems increase, so do cyber security issues. Utilities face questions such as: How do we deploy things like smart grid or distributed generation technologies, and do so in a secure manner? Yet the very devices and systems that raise the questions also provide the answers: increasingly connected data from asset management and network operations can help identify unusual behavior that might not have otherwise been noticed.

Data analytics can help utilities uncover cyber security breaches more quickly and ensure a more resilient network.

Supporting emerging markets

Much of the value utilities expect from a smarter grid will come from smart meters and their data and control opportunities, but other areas will deliver value as well.

As illustrated in Figure 5, smart meters led the response pool, but approximately 28% of respondents expect their largest return on investments to come from emerging areas such as renewable power, energy storage, microgrids, and virtual power plants, all of which fall under Distributed Energy Resource (DER) management. How can asset management and data support these emerging technologies?

Gary Rackliffe, Vice President of Smart Grids North America for ABB, noted that additional sensors and detailed information about these distributed assets can help build a more complete picture of the grid. With the right analysis, a utility can spot

Figure 5: Expectations for areas with largest return on investment in the next 10 years (%)

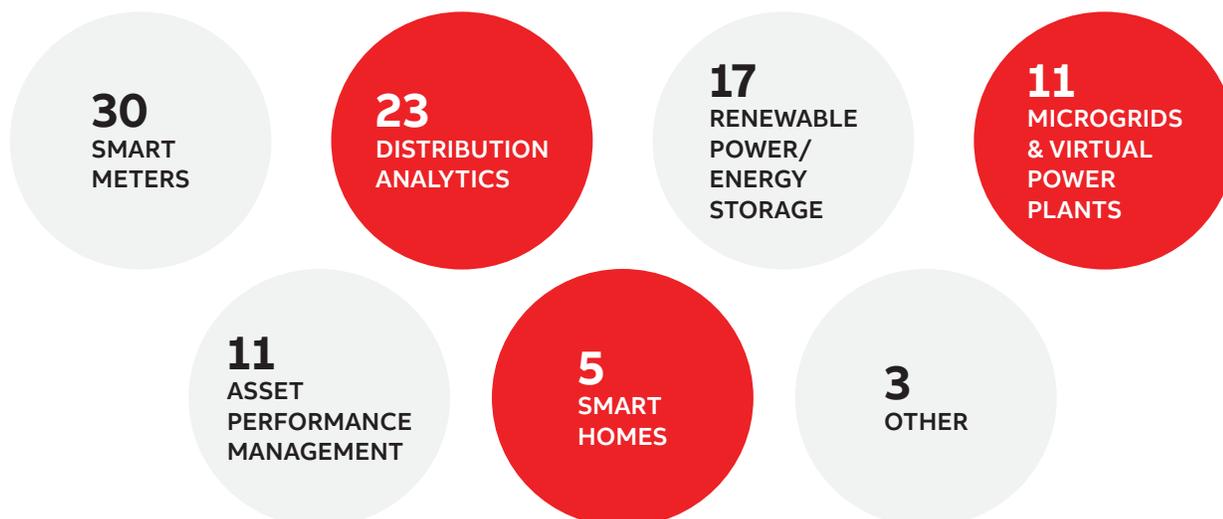
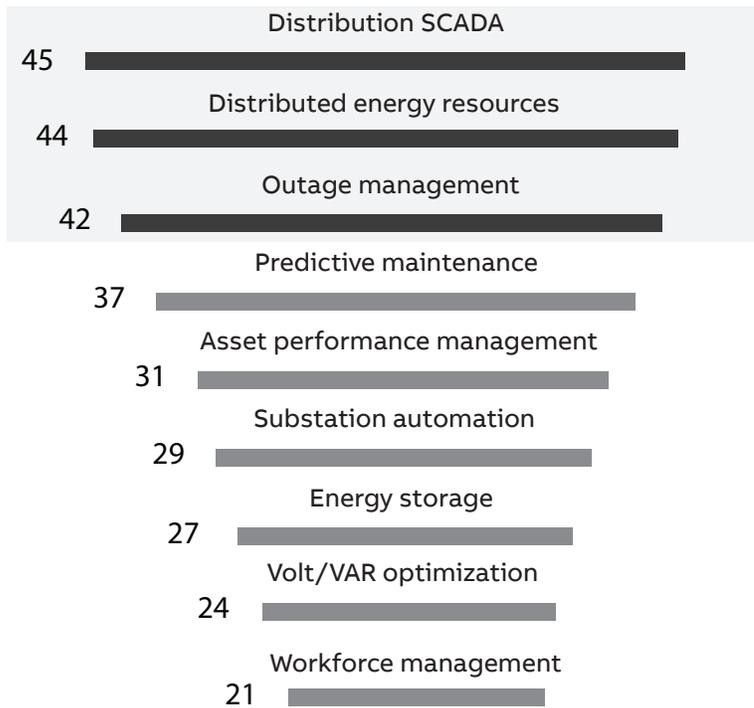


Figure 6: Top 3 areas utilities plan to invest in during the next five years

trends in asset performance, enabling proactive changes in maintenance that can help extend the life of assets or give early warnings of impending failures, which will be increasingly important as utilities manage dispersed assets on their networks.

Outage restoration

When asked, “What are the top three areas in which you plan to invest the most in the next five years?” outage management was listed as a top area by more than 40% of utilities, as shown in Figure 6. But although asset management runs in the middle of the pack, it and the data associated with it can directly impact the success of outage management efforts.

“Outage management systems have significant integration,” said Sam Okoli, Product Management, Out-

age Lifecycle Management, from the Enterprise Software product group within ABB. “We need these systems to work as one to deal with outages. A lot of utilities are getting Outage Management Systems (OMS) that are not equipped to deal with all of the data that could benefit them.”

“Data from assets can feed into the analysis and control of the network. We’ll also have better remote monitoring and diagnostics with condition-based maintenance.”

— Gary Rackliffe, Vice President of Smart Grids North America, ABB

With increased access to many different data sources, utilities need to focus more on using the data to develop specific and targeted programs for their customers, and provide more information when outages occur. Utilities also need to better utilize smart meter infrastructure to provide more localized estimated restoration times—i.e., letting specific customers know when they will receive power, down to each residence within a block.

The ability to monitor many more assets will help utilities dive deeper into the causes and solutions for outages. “We’re going to see more pervasive data and better SCADA* systems to identify nested outages,” said Okoli. “We’ll see an increased focus on providing better real-time communication between field and the control, and really making sense of data. It won’t just be that customers are experiencing an outage, but why are they out? That’s going to be helped by more connected sensors.”

* (Supervisory Control and Data Acquisition)

Spotlight interview

Taking asset management to the next level



Jeff Fleeman

Director, Advanced Transmission Studies and Technologies American Electric Power

The integration of different IT systems is the most frequently mentioned challenge with data management for U.S. utilities.

How does that compare with what you're seeing? What are your organization's most significant challenges with data management?

We definitely have issues with disintegrated systems and disintegrated data. We are aware of it increasingly as we need better access to data to make decisions and support those decisions. It's only going to get worse with further complications that are coming—with more players and more distributed generation for example.

We grew into this problem gradually. It happened by evolving data and analysis tools over time to solve different problems, and not having one centralized plan.

What does a complete picture of an asset look like?

It is a pretty long list. You need some standard definitions, identification and descriptive data, location and installation data, maintenance data, environmental data, and logistics and accounting data.

Tell us a little bit about Asset Health Center...how is that helping to build a better picture of your assets?

It is a starting point, I'm very proud that we're doing it. I think it is industry-leading in its ambitiousness. So far it has helped us understand some things that we didn't predict, and in other cases it helped us prevent failures. It will do three main things for us:

- It is going to prevent failures and their consequences
- It is going to optimize our maintenance efforts
- It will help us prioritize our replacement of aging or poorly performing assets

This will help us as we have to replace more assets because the customers will have to pay for these assets as part of the regulatory construct. We'll need to be justifying why we are replacing these assets. So having Asset Health Center will be able to help us a lot by answering regulators' concerns about why we're replacing assets.

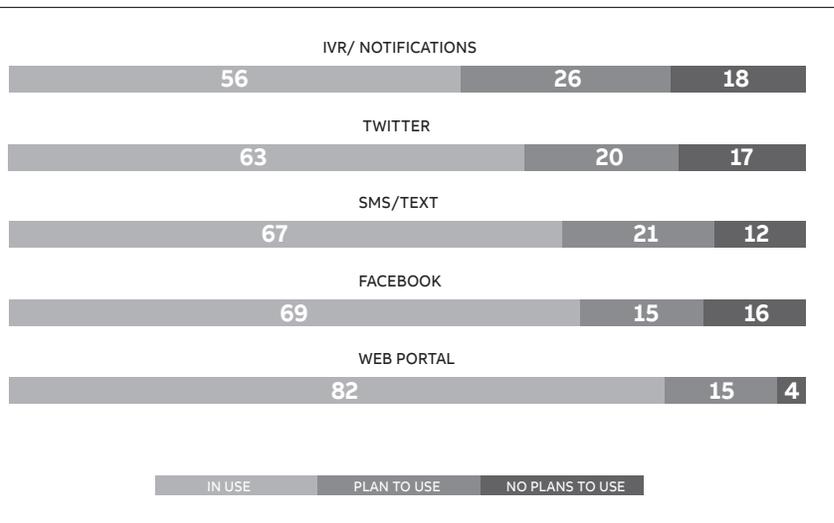
What recommendations do you have for other utilities as they work to overcome data silos within their own organizations?

We need to collaborate, we need to integrate, and we need to automate. Some of these things are hard, but it's not going to get any easier. We have to commit ourselves to the fact that we will solve these problems. We need to work on it, and say we will solve it even though we can't solve it overnight. We can start marching in that direction.

Taking it to the next level with social data mining

This report has covered much around the benefits of better integrating asset data, but a truly comprehensive view of a utility must include the customers it serves.

Figure 7: Current and planned use of social media for customer communications in an outage (%)

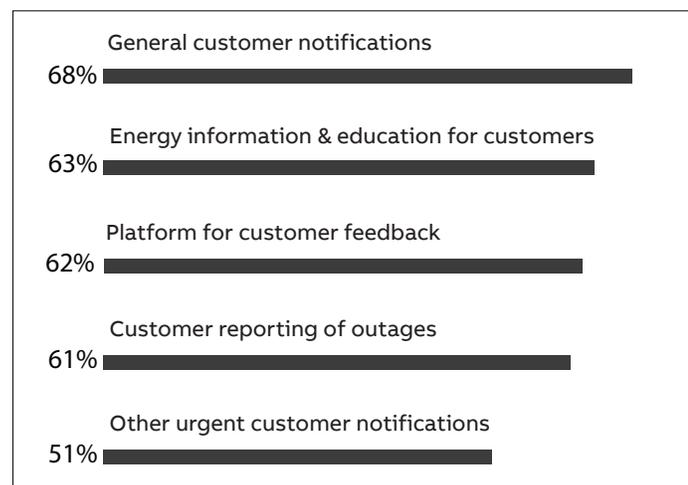


To achieve this, customer data will play an increasingly important role in delivering operational excellence.

One area of customer engagement occurs during an outage. In the world of outages, utilities most widely use web portals to communicate with customers in the event of an outage, but the numbers in Figure 7 indicate that utilities are using a variety of technologies to engage with their customers regarding outages. In fact, social media, such as Facebook and Twitter, along with texting are more popular forms of engagement than automated phone calls. Not only are utilities finding new ways to communicate with customers, but the information gathered in these efforts goes beyond reporting outages to include data such as user behavior on social media sites.

Utilities are also stretching social media for a variety of communications with customers that go beyond just reporting and monitoring outages. As shown in Figure 8, opportunities for using

Figure 8: Areas of customer engagement using social media



social media in a customer engagement strategy include: general customer notifications (68%), energy information and education for customers (63%), and platforms for customer feedback (62%).

It's important to note that social media is a two-way street that can help build a more holistic picture of the utility for both employees and customers. Customers are not only able to receive data from utilities, they can also provide it back to them, which can help utilities to improve reliability and service. In the case of outage management, Okoli pointed out that "Consumers are going to respond to better outage management by receiving more information about their consumption and how they can change their consumption patterns. Utilities can provide customers with suggestions about how to change the use of certain loads in the home, which can help reduce or minimize outages."

Spotlight interview

Customers are assets, too

Matt Croucher

Director, Demand Analytics
CPS Energy

The integration of different IT systems is the most frequently mentioned challenge with data management for U.S. utilities. How does that compare with what you're seeing?

We're definitely going through the challenging process of trying to merge data sets housed in various proprietary IT systems. Traditionally within the utility sector, data collection, management and dissemination has been determined at the business unit level which leads to a significant amount of disparate datasets as well as a high degree of incoordination. As we look to enhance the value from our internal data by combining datasets, we're finding it difficult because some datasets are easy to extract and other ones are more difficult—for example, you might have to acquire different licensing agreements.

There is also a human capital challenge. Often the people who know the data, the databases and the logic around their organisation is a limited few. The focus within the utility industry has been on reporting only and not true analytics. Hence, there are a lot of data queries that were setup 15 years ago, and everyone just runs the same report often to maintain consistency in reporting through time. Once you try to deconstruct those, you don't necessarily have the immediate expertise anymore to handle the change management in a smooth manner.

What does a complete picture of an asset look like?

In the utility industry when we look at assets, we look at physical hardware. We need to develop a better picture of the data generated from our physical assets, but also our customers. We don't have a complete integrated and cohesive picture of the customer. Our goal is to build this picture out. Given that the focus of customer data has often been on the billing aspects of the business often the more detailed customer information data collection is not as robust as it would be compared to our physical assets.



What role does social media play in delivering reliable network operations? How do you see that evolving in the future?

Social media is going to shine more light on reliability and outage performance. People can be tweeting back and forth, and sending Facebook messages to utilities nearly instantaneously and to a wider audience. Very quickly people can see the issues that others are having with their utility company. It will certainly add pressure to provide more reliable network operations because everyone is providing a media-type voice.

How will next-generation utility efforts—such as DERs, microgrids and virtual power plants—change your organization's data and asset management needs?

More people are having an impact on the grid, and it's going to generate a need for data collection and analytics at the grid edge. As we get more sensors and more sophisticated information from the grid and the devices connecting to the grid, we're going to have to get better at using and understanding that data.

What recommendations do you have for other utilities as they work to overcome data silos within their own organizations?

Do something, even if it is a small project with a few data sources to break out of your silos. Identify different departments in your organization that are interested in collaboration. There is an emphasis to break down organizational silos within the utility sector from a knowledge transfer, coordination of activities and budget considerations but the data generated within each business unit remains the most siloed out of everything. There is going to be value if people do use data in their own groups, but the full value comes from trying to develop use cases across the organization. Connected data is always going to be more valuable to a utility than just big data that is siloed.

What's the future for utilities?

This report reveals that there are numerous opportunities available to utilities as they begin to break down the silos across their organizations and connect different data sources to make more fully informed decisions.

Data can drive significant changes, but only when it feeds the big picture. Recommendations for utilities include:

- Understand what data your organization has today and what it's doing with the information
- Consider what data is needed to build a more complete picture of your organization's assets
- Explore how different data sources can be leveraged across your organization, for example: how asset data influences areas such as cyber security and outage management
- Consider the roles of customer data and social media in building a more complete picture of the utility for both employees and customers
- Plan for how emerging technologies, such as microgrids and DERs, will fit into your organization in terms of data needs and opportunities, as well as how those technologies may change your organization's approach toward data

What is your data doing for you? Isn't it time it did more? Contact us to learn more about unlocking the potential of your data resources.

Enterprise Software is part of the Grid Automation business unit in ABB's Power Grids division.

ABB is a global leader in power and automation technologies. Our solutions improve the efficiency, productivity and quality of our customers' operations while minimizing environmental impact. Innovation is at the forefront of what we do and many of the technologies that drive modern society were pioneered by ABB.

The Enterprise Software product group offers an unparalleled range of solutions for asset performance management, operations and workforce management, network control and energy portfolio management.

Additional information

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB AG.



ABB Ltd.

Grid Automation
Enterprise Software

Americas:

+1 678 825 1458

+1 800 868 0497 from US and Canada

Europe, Middle East, Africa:

+44 1483 794080

Asia Pacific:

+61 7 3303 3333

abb.com/enterprise-software