Schneider Electric
Leadership Series

DIGITAL

How Mid-Size Distribution Utilities Face Disruption:
Challenges and Strategies

Life Is On | Schneider Electric

Contents

Introduction

The 2015 United Nations Climate Change Conference (COP21) raised a real environmental urgency. The focus was on a more electrical world that is more digital, decentralized, and decarbonized.

This 3D+E vision is now shared by most worldwide stakeholders and integrates an electrical grid evolution: more efficient, active, and flexible. For example, these efforts are apparent in the latest Clean Energy Package from the European Commission, as well as in initiatives being enacted around the globe, including in Australia, California, and New York.

This electrical network evolution, sometimes driven by policy (e.g., in the EU), is frequently in line with large utilities' strategies. Smaller utilities, however, often do not have the ability to make their voices heard, or if they do through industry associations, face troubles in implementing policies (e.g. digital transformation [including, for instance, smart meters], EV, reliability standards [SAIDI, SAIFI, etc.]). There is a huge gap in headcounts and skillsets between large and small/mid-size utilities*.

The energy transition is not taking place at the same level in all geographies nor is it occurring at the same speed. Therefore, we decided to investigate the impact, consequences, and reactions to the New Energy Transition in several geographies that are being affected.

Throughout the world, there are discussions on unbundling rules which vary, depending on the region. These rules are impactful on the conversation.

* A utility's size is determined by its number of points of distribution (PoD)/points of service [(small>100k) (medium=100k-500k), (large=500k-5 million), (x-large=more than 5 million)]. The number of points of distribution is of a particular importance because European regulations allow utilities that have fewer than 100,000 points of distribution to remain bundled.

A note on bundling vs. unbundling

Unbundled utilities require the separation of the core functions of generation, transmission, distribution, and sometimes retail aspects. Separating these areas into multiple entities can create competition amongst the generation and retail segments. Independent retailers exist in unbundled geographies and unbundled utilities do not "own their customers."

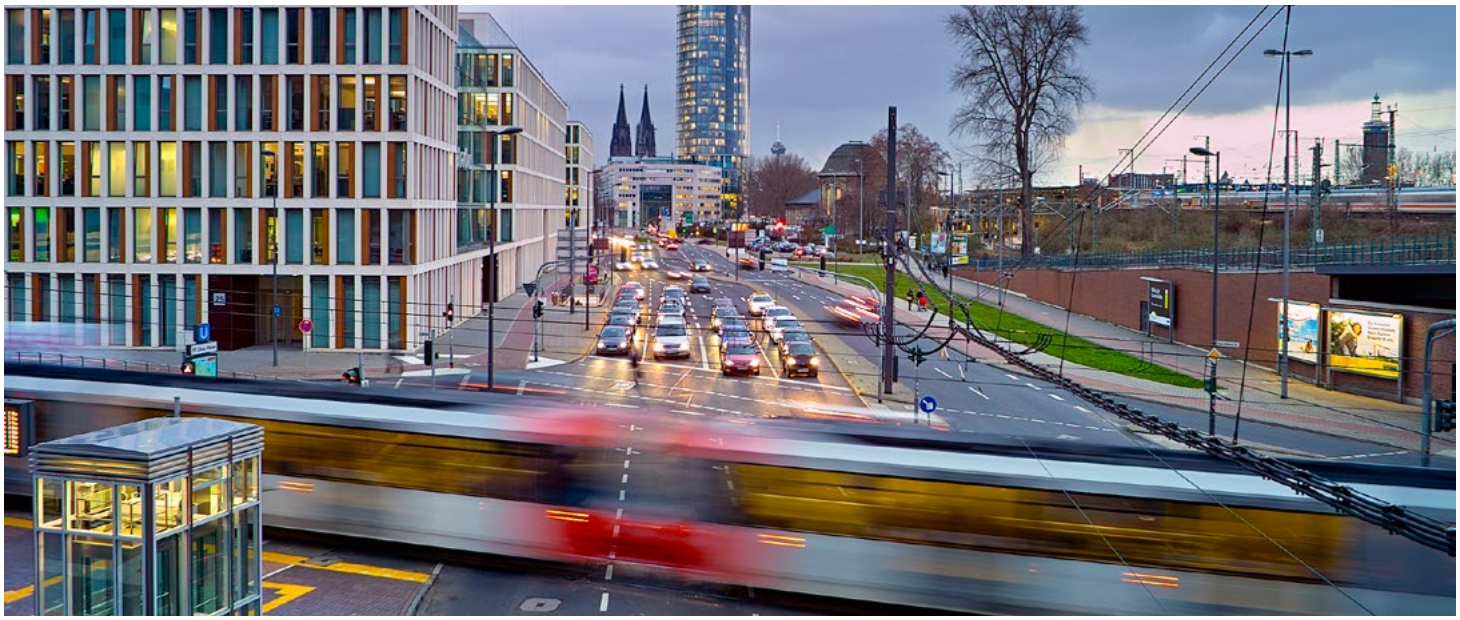
In contrast, for bundled utility services, one entity provides the entire operation of generation, transmission, distribution, and retail services as a combined service. Energy customers are unable to choose among service providers.

Here is a brief look at bundling and naming trends:

- European Union: The EU uses an unbundled distribution system operators (DSO) model. DSOs are "wires-only" and manage and operate the distribution network, and not the retail or generation parts of the value chain. Unbundling between suppliers and DSOs is required. In specific situations, small utilities (< 100k service points) are exempt from some of the EU's requirements and may remain bundled.
- United Kingdom: The term "distribution network operators" (DNO) is still used in the UK, whereas the term "DSO" denotes a future model.
- North America: Here the term "distribution utility" includes bundled distribution as well as the retail aspect of a vertically integrated utility (VIU), municipality, or co-op. The DSO concept is new in the United States, reflecting the "utility of the future" model¬¬¬.
- Australia: Australia's distribution network service provider (DNSP) is the same unbundled model as the EU DSO.
- India: There is an ongoing regulatory discussion about unbundling DISCOM (distribution company) and separating "carriage from content" (i.e., separating distribution from retail).

For the sake of clarity, the term "distribution utility" will be used throughout the remainder of this report.

Survey overview



In-depth interviews with 27 mid-size distribution utilities around the world (including the United States, Australia, Germany, Austria, Denmark, Sweden, France, Turkey, and Italy, among others) have offered a detailed view of the challenges and opportunities facing distribution utilities, as well as their strategies for solving these challenges.

The distribution utilities in this report range in size from 30k to 2.1 million points of distribution (PoD) and their customer base varies from urban metropolises to rural. Despite the range of size and customer base, at a very basic level, what they share is the goal of providing a reliable electricity supply that meets customers' energy needs.

Cost issues remain at the core of the conversation, despite all the other salient issues. For example, in Europe in 2015, transmission and distribution losses ranged from 2-10%, according to the Council of European Energy Regulators. This can result in billions of dollars in losses across Europe.

While individual distribution utilities' pain points differ, they encounter shared challenges such as SAIDI/SAIFI and fixing the basics. They also encounter new ones, including:

- Preparing for the energy transition, including renewables and DER, electric vehicles, smart meters, data management, and a change in planning rules
- Improving the investment decision-making process
- Cybersecurity
- Regulatory frameworks do not change quickly enough to properly enable the energy transition, e.g., CapEx-based budgeting
- Addressing skills challenge, including difficulties in attracting new talent and a lack of skilled resources on digitized systems

01

Key challenges

Improving SAIDI and SAIFI

Our interviews revealed that the main challenge for mid-size distribution utilities is improving SAIDI and SAIFI* performance, as part of their "reliability" mission, which also encompasses the areas of outage restoration and management. It is often part of their KPI set by the regulator and connected to their investment or sometimes how they are evaluated for reliability measurements. Distribution utilities may be penalized for failing to meet targets.

Distribution utilities across all the countries in this report spoke about the problem, with many reporting that their operational KPIs include improving power reliability and reducing outage time/improving power restoration, to improve SAIDI and SAIFI. Some of the distribution utilities are also focused on how to better locate outages.

Distribution utilities are heavily dependent on customers for outage notifications. Now, using smart grid solutions (sensor, software, and analytics), smart meters, and self-healing capabilities, distribution utilities can remotely monitor power equipment to rapidly identify faults and shorten the frequency and duration of outages. In addition, outage management systems can better pinpoint faults for faster recovery.

* SAIDI and SAIFI are both standard indices for sustained outages. They are important metrics to track and improve because they provide quantitative measurements for both utilities and regulators.

Preparing for the energy transition, including renewables and DER, electric vehicles, and smart meters

In a more decentralized world, we see local production and local consumption appearing. However, production/consumption cycles are variable. There is a mismatch between generation availability and load patterns (e.g., a PV does not produce in a customer's home at the time of day they want to charge their EV).

Distribution utilities around the world understand how transitioning energy for the new energy landscape is changing the game as distribution utilities focus on more local, smaller, and decentralized energy production and distribution. Introducing renewables and distributed energy resources (DERs) to the energy mix and successfully managing them for maximum efficiency is critical.

The distribution utilities we interviewed are at different steps in this energy transition, but they all recognized that the transition is essential for future growth, success, and relevancy.

That is why DER and renewables integration are a top priority for distribution utilities in this study. However, distribution utilities have different approaches for addressing the challenge of DER integration. Some German distribution utilities, for example, have focused on better integrating DER without needing to reinforce the grid, while Australian distribution utilities are focused on the challenge of rising small-scale PV (DER) integration.

Smart meters have become an important tool for empowering customers and improving their energy use, but their deployment speed varies. Australian distribution utilities, for example, report that smart meters are being deployed at a slow pace (with the exception of Victoria). More generally, distribution utilities struggle to build the data model and data usage framework, which requires a huge investment in a cloud data lake, data integration capabilities, and analytics, which are often not affordable.

Electric vehicle adoption and its related issues (energy use, charging, etc.) are being addressed with varying levels of urgency by the distribution utilities in this study. Distribution utilities in countries such as the United States and Sweden are more actively preparing for the growth of EV than some other countries in this report.

For this report, DER is defined as supply-side or demand-side connected distributed generation, storage, and controllable loads, embedding EVs. This is our definition, although we recognize that there is no clear consensus on its definition today.

Improving the decision process for investing

Determining the best, most important investments for a mid-size distribution utility requires the consideration of many factors, including ROI, business case, regulation issues, and business needs. Investments for IT systems like smart metering have a high proportion of fixed costs, making it harder for small companies to justify.

In general, either the distribution utilities are risk averse, in which case they tend to follow their peers or a larger player in the same country, or they have a rapid decision-making process in part because they are not large enough to interest the regulator.

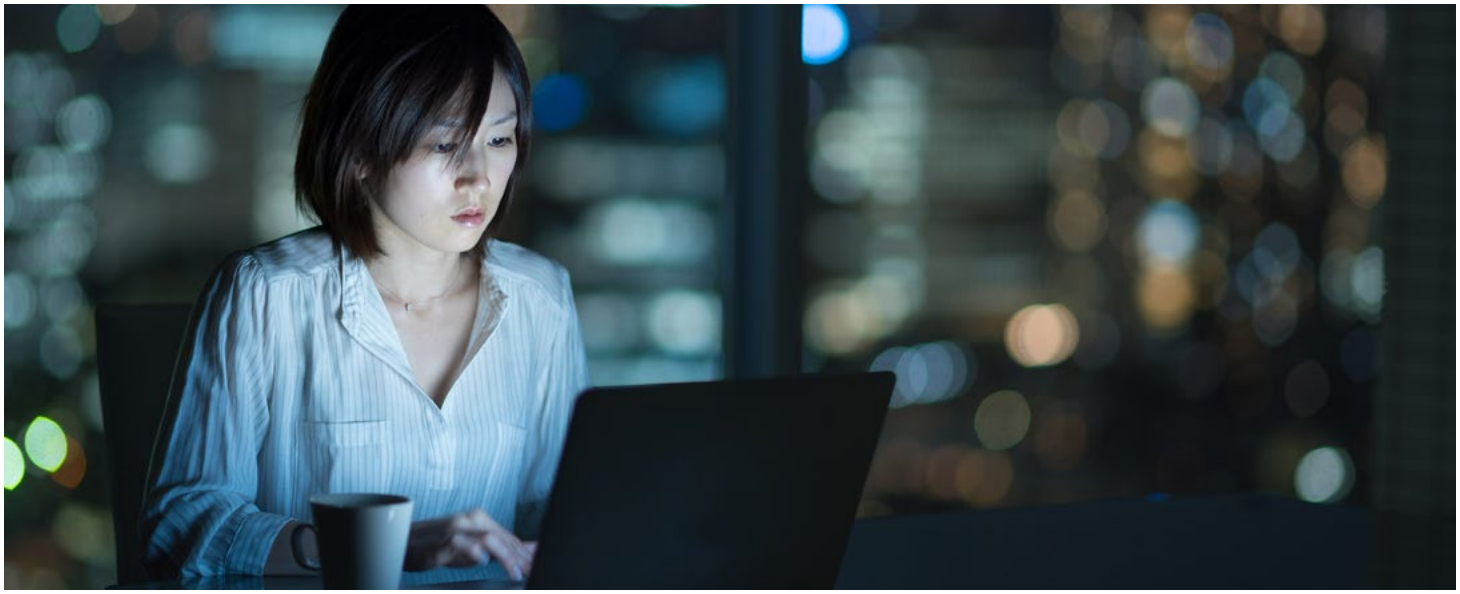
In our study, many investments were dependent upon regulations:

- Australian distribution utilities shared that it is essential to "build a business case to get approval for investment, but that this is too heavy a process for a small company." They said they "need suppliers' help to build a strong business case to convince the regulator of the importance of the investment." The Australian distribution utilities also said that the difficulty with new technologies is that the benefit is more difficult to assess so it is tougher to justify those investments.

- Regulation changes often, therefore TotEx planning is very difficult, with mistrust between regulators and distribution utilities. Additionally, the shift to TotEx can create savings, but questions arise about how that saving is passed on to customers.

- American distribution utilities have had more variation in their investment decisions. One major concern that some of the interviewed distribution utilities reported was intense pressure to keep rates low. For some of the smaller American distribution utilities, there are not many customers, so it is difficult to amortize the cost of the system when they make an investment. They also need to justify their decisions with a business case and set up a road map.

- All the Italian interviewees reported investment difficulties. One expressed that the investment challenge with ADMS is that its budget is split into silos. Another Italian distribution utility said that while a CapEx-based remuneration system is preventing smart grid investments, several EU-funded projects were used to finance innovations.



Addressing cybersecurity concerns

Although all of our interviewed utilities have the ultimate goal of cyber-secure operations, they have different top cybersecurity concerns and the approaches for improving security varied, including:

- Determining who will oversee cybersecurity. Many utilities are using external consultants for now, but some distribution utilities are working to bring this in-house eventually. (Germany, Austria)
- Some mentioned concerns about cybersecurity risks linked to the huge numbers of connected devices to be integrated, but a more long-term concern was how to secure possible transactions on platforms between prosumers' DER and networks. (Australia)
- Meeting government regulations oncybersecurity. (USA, Germany, Australia)

Investments in IT systems have a high proportion of fixed costs, making it harder for small companies to justify.

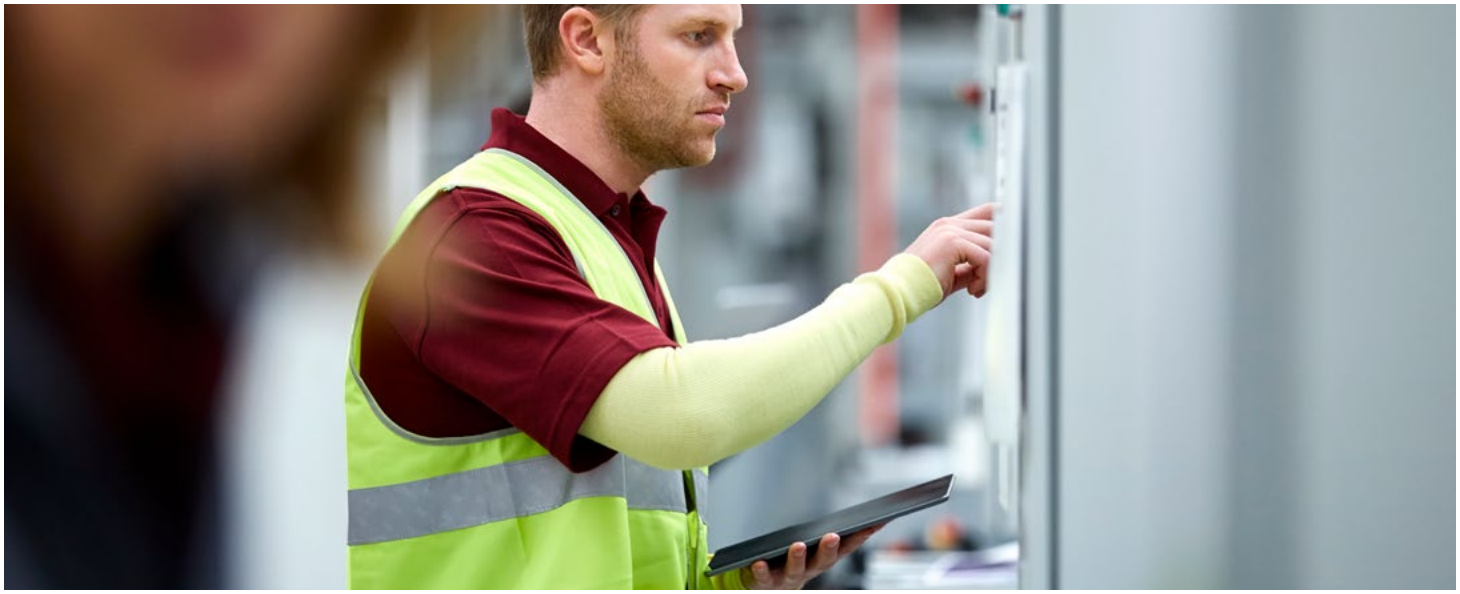
Current regulations are more CapEx-based than TotEx-based, which does not encourage utilities to invest in more innovative solutions or to buy software as a service

The interviewed distribution utilities reported that commonly used CapEx-based budgeting does not encourage them to invest in more innovative, software-type solutions or to buy software as a service, in the future.

In the U.S., for example, one utility reported that "Given CapEx-oriented regulation and all the headaches to go through to buy as a service, it is not worth it, plus utilities do not make money on it." An Italian utility agreed, saying, "a CapEx-based remuneration system and regulations prevent smart grid investment."

Currently, CapEx-based budgeting is the norm, but TotEx (total expenditure)-based budgeting could potentially bring more flexibility and value and reduced infrastructure costs to distribution utilities and other industries that depend on infrastructure assets. TotEx is CapEx-OpeX equalization. This equalization might lead to better spending, so could potentially result in lower costs for end customers (ratepayers), if those savings are properly passed on.

CapEx-based budgeting does not encourage distribution utilities to invest in more innovative, software-based solutions.



Skills challenge to manage energy transition: Gaps in data management, AI, machine learning, systems architecture, and more

Between an aging workforce and a swiftly changing technological environment, distribution utilities need more skilled workers with diverse skill sets to build, operate, and manage a modernized grid infrastructure. These skills range from analysts and IT workers, who interpret and manage big data, to technicians, smart meter installers, software architects and engineers, and customer service support. With the issue of cybersecurity increasingly at the forefront of the electricity industry's concerns, the industry will also require a workforce adept in risk assessment and behavioral science, as well as familiarity with cybersecurity risk factors.

According to our interviews, a skilled workforce is lacking, particularly for renewables and supporting the integration of DERs, smart grids, storage systems, and the increase in demand management.

Distribution utilities also reported the challenge of replacing the aging workforce. In the U.S., one distribution utility anticipated many skilled employees retiring and noted that "the infrastructure is also aging, and the industry does not marry very much with the technology of today."

To address this issue, building new capabilities is essential for digital transformation. Distribution utilities must take steps to both identify and attract digital workers while continuing to help their current workforce develop new skills.

A 2018 report* found a skill and competency gap for both new and incoming employees, who will require the skills and competencies to support "interconnected devices and the two-way flow of electricity including telecommunications, networking, and distributed energy integration."

A U.S. report** also forecasts that the smart grid and electric utility industry will need 105,000 new workers by 2030, but anticipates that only around 25,000 existing industry personnel will want to fill those positions.

* CEWD report: State of the Energy Workforce 2018

** The U.S. Department of Energy report: Transforming the Nation's Electricity Sector: The Second Installment of the QER, 2017

02

Strategies to meet these challenges

STRATEGY 1

Looking for dedicated consortium and resource pooling to buy adequate solutions and benefit from economies of scale

A majority of the distribution utilities we interviewed spoke of the increase of mergers, collaborations, and shared services. These were necessary because of the pressure to cut costs, ensure the quality of supply, and improve efficiencies. These include both temporary and permanent strategies that leverage multiple mid-size distribution utilities to adapt to their constrained environment.

The pooling of resources is becoming more common and necessary, according to the distribution utilities we interviewed. Several said they are looking for a dedicated consortium and want to pool resources to buy adequate solutions. These consortia include partners, cooperatives, and shared services. They often focus on one specific area (smart meter, dedicated software, etc.). The strategic question of maintaining independence/determining who is in control is also important in these alliances.

These results mirror what other studies have found. The number of distribution utility mergers and acquisitions globally has soared in recent years, but according to reports, the reasons differ according to region, although financial considerations are always key.

Future of Mid-Size distribution utilities

Distribution utilities' performance is measured by standards such as their financial performance or reliability/quality performance. Objectives set by regulators vary by geography and may include penalties for failing to meet them. The evolution of standards and requirements, which are more and more digitalized, is also a booster of global cooperation or a change of landscape. This could signal the necessity to merge, as we see it in Scandinavia, Switzerland, Canada, and other countries.

A commonly shared opinion among some regulatory agencies is that there is no future for small and mid-size distribution utilities and consolidation is a must.

Merging and consolidation trend

This movement is already gaining speed. For example, one of the interviewed distribution utilities was created by the merger of two companies just three years ago. Its strategy has been to gain efficiency through combining systems from those former companies. This includes customer information, call systems, and ERP.

An example from Denmark: Danish regulators mandated OpEx and CapEx cost reductions, benchmarking between distribution utilities, improved power quality requirements (measured by SAIDI and SAIFI), and improved cost-efficiency. To meet the goals, distribution utilities needed to grow/merge or disappear. It is anticipated that in 10 years, only a handful of distribution utilities will remain there.

Pooling, benchmarking with peers

Examples include:

- Pool — Luxemburg: Distribution utilities are pooling their resources for multi-utility smart metering services.
- Pool — Belgium: A group of Belgian distribution utilities is combining resources for common control room operations and more common interests.
- Merge — Belgium: A large- and a mid-size distribution utilities are considering joint IT operations and possibly a merger.
- Merge — France: A mid-size French distribution utility has recently acquired very small utilities in the Alps region.
- Merge in a first phase, now pooling — Denmark: Here, small distribution utilities are considering joining forces to own and operate a common multi-utility control room.
- Pool — France: A French association of local authorities is calling for joint IT investments for small distribution utilities.
- Merge and acquire — North America: Throughout North America, mergers and acquisitions of small utilities by larger utilities have become very common.
- Merge — Canada: There have also been mergers between small Canadian distribution utilities, including some municipalities have merged to implement a common ADMS and GIS project, as well as cases of medium-size distribution utilities merging.

By benchmarking against their peers, distribution utilities get valuable information that lets them identify areas for improvements and better measure their own performance.

STRATEGY 2

Need to increase visibility on LV network

Increasing visibility on LV networks is both a goal and a challenge for our interviewees. It is essential for distribution utilities to forecast network behavior and manage power quality issues. Visibility is becoming even more important with the increasing use of DERs. In Australia, for example, the use of PV is skyrocketing. However, Australian distribution utilities reported that they lack the necessary visibility into MV/LV networks to correctly manage PV integration and demand response. Because they lack visibility, they must operate 100% reactively, without the ability to understand the remaining DER hosting capacity.

In California, one distribution utility reported that it is undergoing the enhancement of its automation system. It seeks to leverage automation to become more efficient and increase visibility. The goal is also to define use cases and address them, in order to take further steps based on how they are satisfied. The same utility also reported that there is "not much automation at the substation level. There is a lack of visibility right now, and data points are very widely spread."

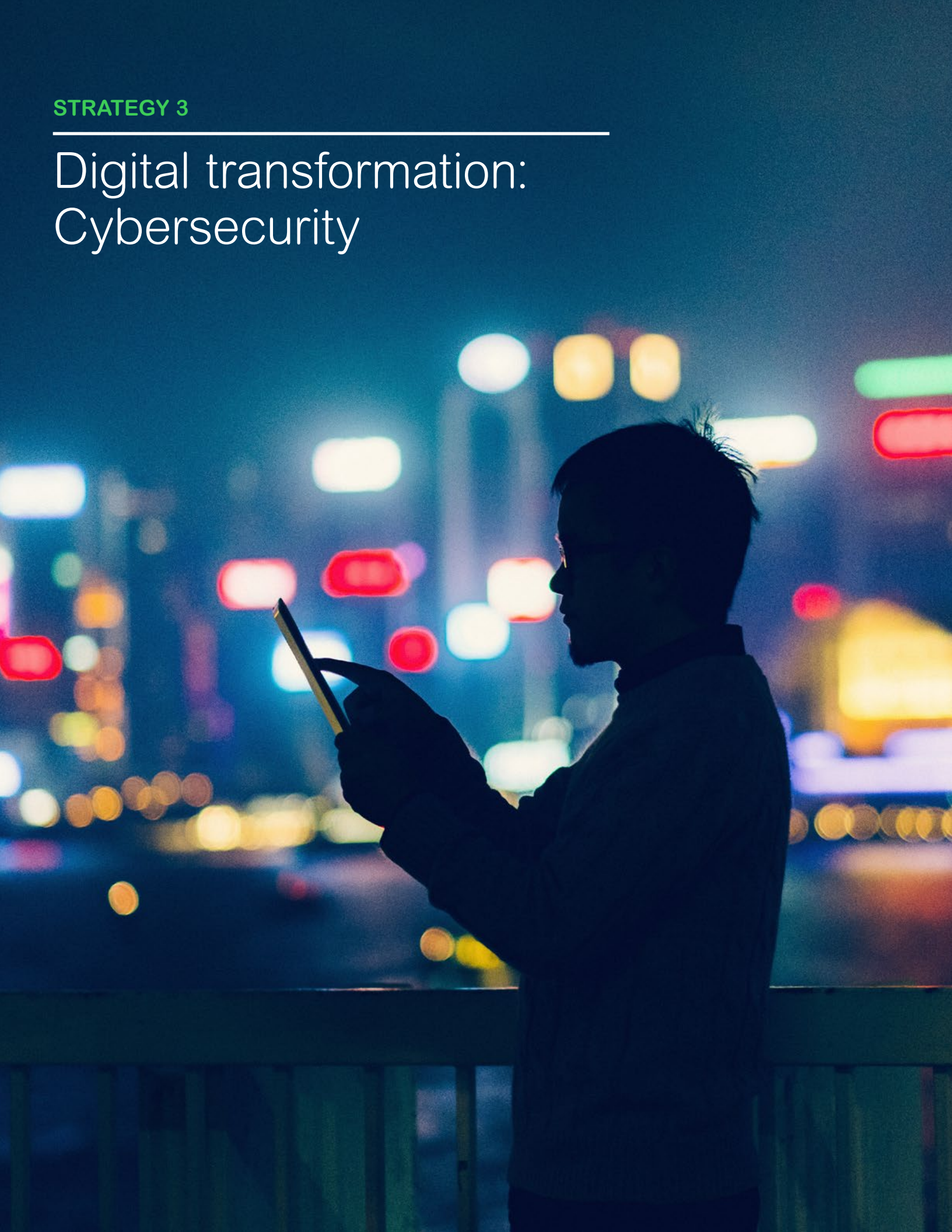
The second data source relies on smart meters.

- In Italy, a distribution utility told us that "it is thinking about possible innovative services to improve their visibility."
- An Austrian interviewee said utilities "need smart meters roll-out and remote control of transformer and pole-mounted substations to develop visibility and automation of its LV network to cope with renewable integration."

But even when smart meters are rolled out, de-regulation (not bundled together with distribution) can introduce obstacles. New Zealand is the ultimate case: as retail activity is de-regulated, the utilities have been obligated by regulators to separate retail from distribution. Now the retail part of the utility that collects data from smart meters is not allowed to share those data with the distribution part due to privacy restrictions. Therefore, distribution utilities cannot access and use smart meters' data to optimize network operations.

STRATEGY 3

Digital transformation: Cybersecurity



Cybersecurity is clearly a large concern across the energy sector. Major cybersecurity attacks have already targeted many industries, including energy. The rapid increase of connectivity, and the Internet of Things (IoT), including connected devices, smart meters, sensors, and digitization, have been a boon for utilities, allowing them greater control, productivity, and improved efficiency, resiliency, and reliability. However, the sheer volume of connected devices and the digitization of operations also make distribution utilities a target for cyberattacks. Although it is nearly impossible to eliminate all cybersecurity threats, distribution utilities' goal is to lessen the probability and effect of an attack. Doing so involves beefing up cybersecurity to mitigate threats to operations, assets, and individuals and protecting privacy, reputation, and intellectual property.

One cybersecurity challenge for distribution utilities is the many regulations concerning privacy. Consumer data, including that collected by a smart infrastructure such as smart meters, gives deep insight into consumers' behavior. While that information is key for distribution utilities to better manage energy efficiency and optimize energy use, there is also a risk that that data could be misused.

Laws are now being enacted to protect consumers. For example, the EU's General Data Protection Regulation (GDPR) law seeks to give consumers more control over their personal data, which can make distribution utilities' use of data and analytics more difficult. A privacy impact assessment (PIA) that examines how data is collected, used, shared, and maintained is also being used by many countries including Australia, the United States, and Canada.

The distribution utilities we interviewed were focused on improving cybersecurity to mitigate risks and expanding their cybersecurity policies, while also meeting new, stringent cybersecurity regulations. For example, a U.S. utility in our study reported focusing on information protection by changing the way it acquires, stores, and uses data, and by strengthening its cybersecurity department and its policies and procedures. Whereas in Australia, utilities reported that their cybersecurity risks were linked to the huge number of connected devices that are being integrated, but they were also focused on the future, particularly how to secure possible transactions between prosumers and the network.

A large number of the utilities we interviewed outsource cybersecurity from audit to the implementation of processes. Some U.S. distribution utilities are considering moving more applications and data warehouses to the cloud, in order to provide quicker and more integrated information, even though this may be a risky concept and raises concerns.

Multi-energy consideration

Depending on the geographies, the small and mid-size utilities often have the responsibilities of multi-energy sectors (such as telco, waste to energy, etc.), requiring the ability to manage and optimize those disparate but connected activities. For example:

USA

- Electricity and water in municipalities
- Electricity and gas in larger utilities

Germany

Many cases with:

- Electricity/gas
- Electricity/gas/heat
- Electricity/gas/heat/water

France

- Electricity and gas (plus street lighting, etc.)

STRATEGY 4

Customer engagement

For bundled markets, where utilities "own" their clients, customer engagement has become a top priority because it improves customers' overall experience and reduces operational costs for distribution utilities. By using connected devices like smart meters, as well as advanced analytics, distribution utilities receive a closer look into customers' energy use, which they can then use to help determine what offers will be more appealing while improving grid operations. Customer engagement is not limited to smart meters, which provide clients with real-time energy use information. Utilities are now also providing mobile applications, online chat capabilities, self-servicing tools, and outage notifications.

German utilities reported customer engagement challenges. They recognize that they need new, communicative behind-the-meter products and services. However, the distribution utilities have end-user access issues because of unbundling rules. One German interviewee found that 90% of its customers do not want to interact with the distribution utilities or retailers.

Another German distribution utility reported that new products need to be offered to customers through platforms, while another said that it is focusing on communicative products for customers for service, security, comfort, and good user experience.

Australian distribution utilities are investigating how ADMS can help with customer engagement. They said that utilities are on the journey of customer engagement and need to understand human decision making and behavior. They also discussed how they can provide a structure that gives customers a trade-off decision (how much capacity they make, manage their air conditioning, solar storage, etc.).

French distribution utilities are looking at customer engagement from the perspective of microgrid use, proximity, and customer/client care.

In Italy, some distribution utilities feel that they "are invisible to the customers." They said that their service is taken for granted. One of the Italian distribution utilities is looking into innovative services to improve their visibility, while others said they are not focused on this topic yet.

One of the current developments for a Swedish distribution utility is providing information when there is an outage and then measuring how customers feel their interaction was with the utility. It said that there is very little customer interaction if there is not an outage.

An Austrian distribution utility is focused on an increase in online services, including chatbots. It plans for more investments in local customer service centers to improve customer intimacy. Its ability to develop customer engagement programs will depend on regulations. It plans to develop energy efficiency and EV services programs to promote a more efficient energy system and to develop electromobility.

U.S. distribution utilities' approaches to customer engagement vary. One shared that it has a separate department for customer engagement. Another is working on feed-in tariffs and putting incentive programs in place. It is also trying to give visibility to residential clients in terms of an annual dollar amount and looking into solar panel leasing programs for customers. Another U.S. distribution utility is researching how it can use demand response to balance the load, especially during periods of peak demand.

By using connected devices, distribution utilities can determine which offers will be more appealing to their customers.

Conclusion

Throughout these interviews, consistent themes have emerged. It is clear that distribution utilities are actively pursuing innovative ways to leverage digitization and technology to drive new opportunities and provide business value, manage threats, and tackle the energy transition for a more sustainable future.

Providing reliable power, not only by improving SAIDI and SAIFI but also speeding power restoration time and more effectively locating outages, is the top priority for many of the distribution utilities we interviewed.

The energy transition is moving to the forefront as distribution utilities focus on integrating renewables and DER, as well as managing smart meters and data management. Storage and electric vehicle adoption are also two topics that seem to be in an early stage for small and mid-size distribution utilities, except for a few mid-size utilities from high-GDP countries. This is expected to be impactful in areas with high population density and could become a large topic for them in the future but did not rise to the forefront of our interview conversations.

The investment decision-making process is becoming even more challenging for a multitude of identified reasons, including determining how to best invest in the energy transition, which includes factors like regulatory issues and investment ROI. The evolution of the type of regulation, from traditional “cost+” (CapEx-based) to a possible TotEx -based future, could affect even more how distribution utilities will make decisions about their investments.

Concerns about cybersecurity are moving to the forefront as connected systems and IoT bring more risks, attacks become more frequent, and privacy regulations require more attention. Tackling the skills challenges – both addressing the shortage of skilled workers and the need for more skills to work on digitized systems – is becoming a high priority.

Distribution utilities have reported a number of strategies and approaches for addressing these challenges. Mergers, acquisitions, and resource pooling are more commonplace as they increase their investments in infrastructure and technology and seek to benefit from economies of scale. Increasing observability of LV networks through automation and smart meters is developing much-needed visibility. Distribution utilities are focused on strengthening their cybersecurity to mitigate risks. Finally, distribution utilities reported strengthening customer engagement strategies as a way to reduce operational costs while improving customer satisfaction.

Glossary

Unbundling: Unbundled utilities require the separation of the core functions of transmission, distribution, generation, and sometimes retail aspects. Separating these areas into multiple entities can create competition amongst the generation and retail segments. Independent retailers exist in unbundled geographies and unbundled utilities do not “own their customers.”

Bundling: Bundled utility services are when one entity provides the entire operation of generation, transmission, distribution, and retail services as a combined service. Energy customers do not have the choice to choose the company they prefer. There is no competition.

Tariff: A tariff is a rate plan or pricing scheduled offered to customers by utilities.

Learn more

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Enel Case Study

SA Power Networks Case Study

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November 2019

998-20701363_GMA-US

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