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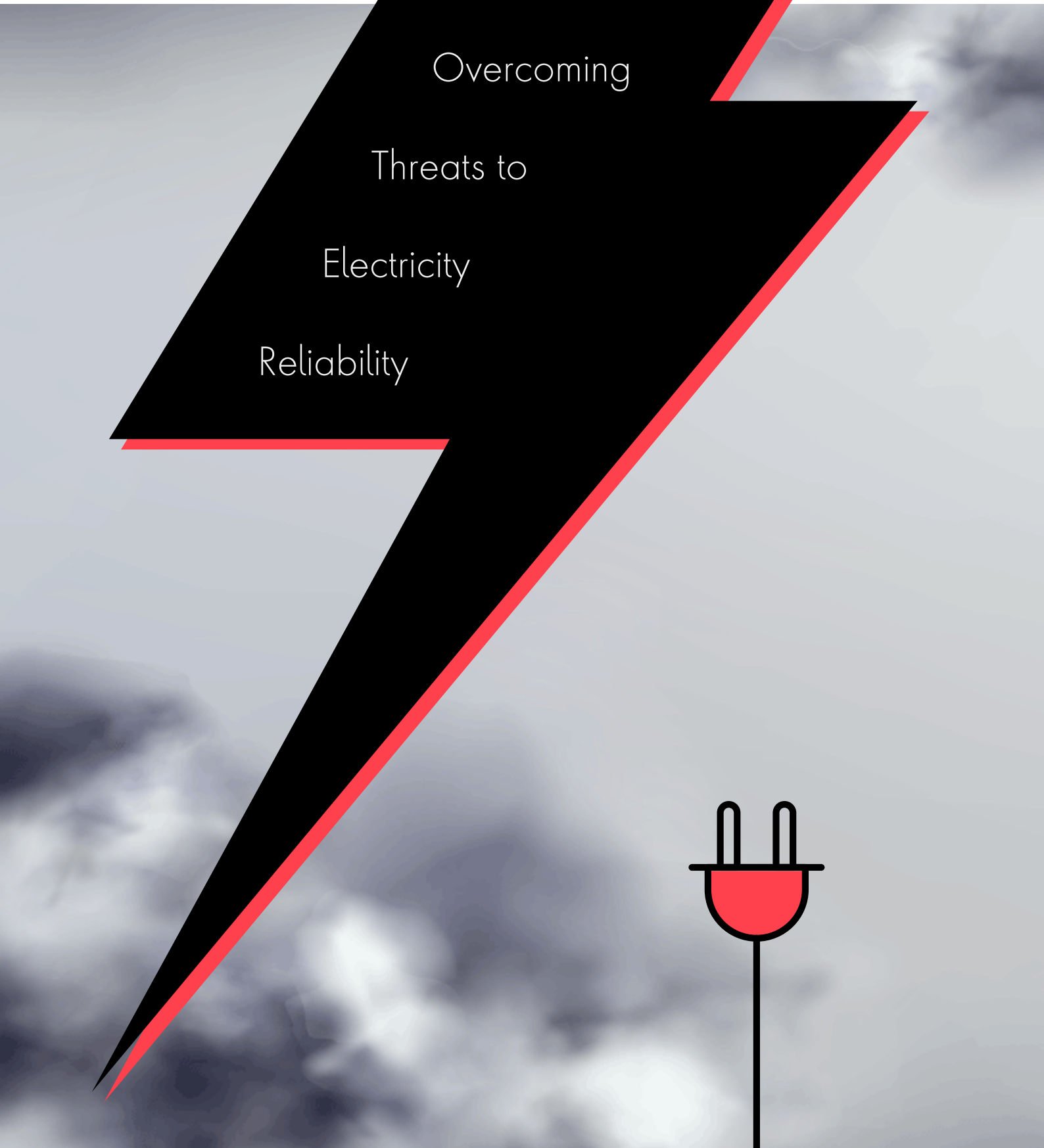
Overcoming Threats to Electricity Reliability



Introduction

Providing utility customers with reliable electricity isn't an option, it's a necessity. Our health, comfort and the economy depend on it. For electric utility companies, this is becoming more difficult because of an increase in extreme weather events (EWEs) and the growth of renewables, which can be unpredictable.

This whitepaper analyzes EWEs, energy transition and the relationship between the two.

Based on utility outage stories and input from industry experts, the whitepaper also seeks to answer the question, *"What can utilities do about it?"*.

Research Methodology

This report was developed using this six-step methodology:

1. Planning & Theoretical Framing
2. Survey & Interview Question Development and Deployment
3. Analysis
4. Secondary Research
5. Reporting Consultation & Review
6. Final Whitepaper

Information sources include:

- Primary survey conducted by Publicis Sapient, in partnership with Energy Central and Appos during the summer of 2021;
- Primary "Digital Life Index" survey conducted by Publicis Sapient during November 2020;
- Interviews with industry experts from AESO (Alberta Electric System Operator) and Ausgrid; and
- Secondary quantitative and qualitative research papers and articles.

Extreme Weather Events on the Rise

During the 2021 United Nations Climate Change Conference (COP26), held October 31–November 12, 2021, world leaders made enhanced commitments to mitigate climate change.

EWEs have risen significantly over the past 20 years. They include unexpected, unusual, severe or unseasonal weather at excesses that has not been seen in the past. According to a report from the United Nations, there were 7,348 major natural disasters around the world from 2000–2019. By comparison, there were 4,212 natural disasters from 1980–1999, the previous 20-year period. This is a staggering increase of 43%.

"Each day, leaders spoke about the impact that rising global temperatures are having on their constituents — all while residents were often experiencing effects firsthand," wrote Kasha Patel in the Washington Post article.

"During climate negotiations at COP26, extreme weather was rampant around the world."

"We have seen the frequency of severe storms increase over the last two decades. This aligns with climate models that predict a 30% increase in thunderstorm activity in our network area over the next 70 years. The extent of the damage we are seeing is also worse. The last heavy storm season came on the back of a multi year drought, and the combined effect of high winds on weakened trees in dry soils created an environment for significantly more network damage than we would usually expect."

Junayd Hollis, general manager of assets for Ausgrid in Sydney, Australia.

Ausgrid is an electricity distribution company that owns, maintains and operates the electrical networks supplying 1.8 million customers in Sydney, the Central Coast, and Hunter regions of New South Wales, Australia.

Rising costs

The costs associated with EWEs are growing alongside the sheer number of events. The National Oceanic and Atmospheric Administration (NOAA) reports that the US has seen an average of seven events costing a billion dollars or more from 1980–2015, and that number has since jumped to 15.1.

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Billion-dollar events aren't limited to the regions we hear about most often. Since 1980, all 50 US states have seen at least one billion-dollar event. 2020 was the year with the most billion-dollar events: there were a whopping 22.

A significant portion of these costs can be attributed to critical infrastructure failures, which are also increasing.

In the US, major electrical grid failure or blackouts increased by more than 60% compared to the most recent five-year period, says a report published by the Journal of Environmental Science and Technology, "Compound Climate and Infrastructure Events: How Electrical Grid Failure Alters Heat Wave Risk." These events are characterized as having a duration of at least one hour and impacting more than 50,000 utility customers.

In one memorable example, infrastructure failures were blamed for the deadly outages in Texas in February 2021. It left 4.8 million homes and businesses without power for days, and 210 fatalities were reported, a number that BuzzFeed News Analysis reports may be closer to 700. Expensive systems used to communicate outages and restoration times are also under scrutiny and need to be replaced in many cases. A problematic OMS system upgrade at PSEG Long Island is being blamed for contributing to the utility's poor response to Tropical Storm Isaias during the summer of 2021.

The growing cost of extreme weather events is being felt in other parts of the world as well. According to Hollis, "The cost of extreme weather events has more than doubled in Sydney since the mid-90s."

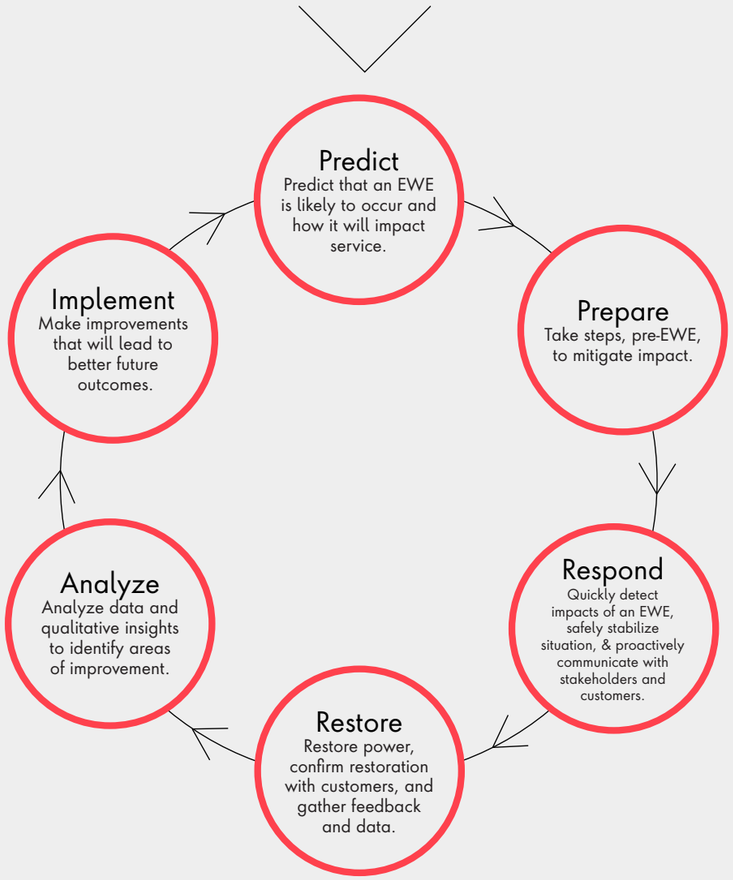
The human factor

The cost of picking up the pieces after an EWE and related power failures can't be measured by currency alone. These catastrophes and related service failures threaten lives. Using computer models to study three large US cities, authors of the research published by the Journal of Environmental Science and Technology predict that a combined blackout and heatwave would expose at least two-thirds of residents in those cities to heat exhaustion and stroke. Cold temperatures can be just as deadly. Hundreds of people died in Texas during the February 2021 deep freeze and blackout.

There are threats even when extreme heat and cold are removed from the equation. Many people rely on electricity to power their life maintaining devices like ventilators, oxygen concentrators, intravenous equipment, communication devices and nebulizers.

Responding to EWEs

Most utilities follow the below model (or similar frameworks) for responding to EWEs. The difference between utilities is seen in the response capabilities across the different steps.



How prepared are utilities?

A new survey, deployed by Publicis Sapient, Energy Central and Appos, asked utilities to rank themselves on how prepared they were for an EWE.

Only a little over 1% indicated they were fully prepared to "provide regular and accurate estimated times of restoration," showing that improvements need to be made.

Mobile technology for both field workers and customers is a good starting point; however, leveraging insights from asset health analytics and resource optimization should be a goal.

When asked if COVID-19 had any impact on their preparedness, 42% said they were more prepared, while 58% indicated that their preparedness was the same as the pre-pandemic era. COVID-19 left utilities no choice; they had to adapt quickly to changing circumstances, showing that evolving to ensure better power reliability is possible.

Respondents rated themselves highest in "identifying and accurately communicating the cause for outages to customers."

They rated themselves lowest in "gathering feedback from customers about their outage experience."

Challenges

The top three challenges affecting utilities' ability to prepare for EWEs are:

- Using advanced data and analytics to better predict and respond;
- Combining customer, field and grid information in a single view; and
- Modernizing the grid.

According to Supratik Chaudhuri, director and industry principal, Utilities at Publicis Sapient,

"Over the years, utilities have developed many supply and demand models for long, mid- and short-term planning. But often, only historical data sets are used for planning purposes. Scenario models that are enhanced to include other types of third-party data sets can help forecast future supply availability and demand requirements. Planned and unplanned outages, weather variations and other risk factors, like the lack of feedstock availability and pipeline outages, can help to avoid outages caused by EWEs."

Ausgrid is using data and analytics to predict and prepare. "When we know with reasonable certainty that a severe storm is coming 12-24 hours in advance, we can begin to mobilize our workforce, contractors and peer networks to get additional resources prepared ahead of time. This can bring the whole recovery effort in by a couple of days," says Hollis.

"The key for us is to use advanced analytics to aid in that decision-making," says Hollis.

EPCOR Utilities implemented intelligent middleware processing to gain a single view of information about their power system in near real-time. "According to the Western Energy Institute article, An Intelligent Way to Integrate AMI with ADMS for Outage Management", this integration has enhanced EPCOR's ability to locate the source of outages in their grid and to communicate outage information to their customers, allowing a faster and safer response.

The Texas crisis earlier this year reminded us that critical infrastructures are vulnerable to failure when confronted with events that exceed the levels of stress for which they are designed, and now grid modernization efforts are on the rise.

"In one example, Ausgrid is currently conducting a climate risk assessment. It includes analyzing data to identify not just the changing probability of acute climate risks resulting in damaged network assets, but also chronic risks affecting our workforce, our assets and our customers, such as higher ambient temperatures and rising sea levels."

Supratik Chaudhuri says:

"Good data and analysis are critical. For that, utilities need a unified view and one golden version of the truth. This centralized system should be able to drive all your natural disaster communications, activities and tasks. The data and intelligence you counted on during the last extreme weather event may be outdated. Distribution routes may no longer be the same, for example. Make sure you have the latest versions and that the people who need access to the data can access it securely."

Energy Transition Well Underway

What's being called energy transition, the move to clean energy sources, is well underway. Several factors are driving this, including a growing interest in environmental stewardship to combat the impact of global warming.

According to the Intergovernmental Panel on Climate Change (IPCC), scientists say we must limit global warming to 1.5°C to avoid the worst impacts of climate change. To make this happen, global emissions must decrease by 50% from 2017 levels by 2030 and reach Net Zero emissions by 2050.

Another factor pushing the energy transition is the desire to lower utility bills. It wasn't that long ago when renewables were viewed as only an option for the rich, but that has changed.

"The costs of both solar and wind have fallen so drastically that in some regions of the US, as well as in the UK and Europe, wind power has become cheaper than traditional high-carbon energy resources," reports S&P Global.

"As costs continue to fall and wind and solar become mainstream, the renewable energy sector will only keep growing and solidify as a strong investment opportunity." According to the International Energy Agency, the world's total renewable-based power capacity will increase by 50% between 2019 and 2024.

According to Lane Belsher, director of grid and market operations for AESO,

"Today, solar generation accounts for only 300 MW in an 11,000 MW system. However, that is set to more than double in the next 12 months with a new solar farm delivering 400 MW expected to come online in Southern Alberta. Gas accounts for about 60% of generation, and this is increasing because of the carbon tax in Alberta."

Enablers of the energy transition include:

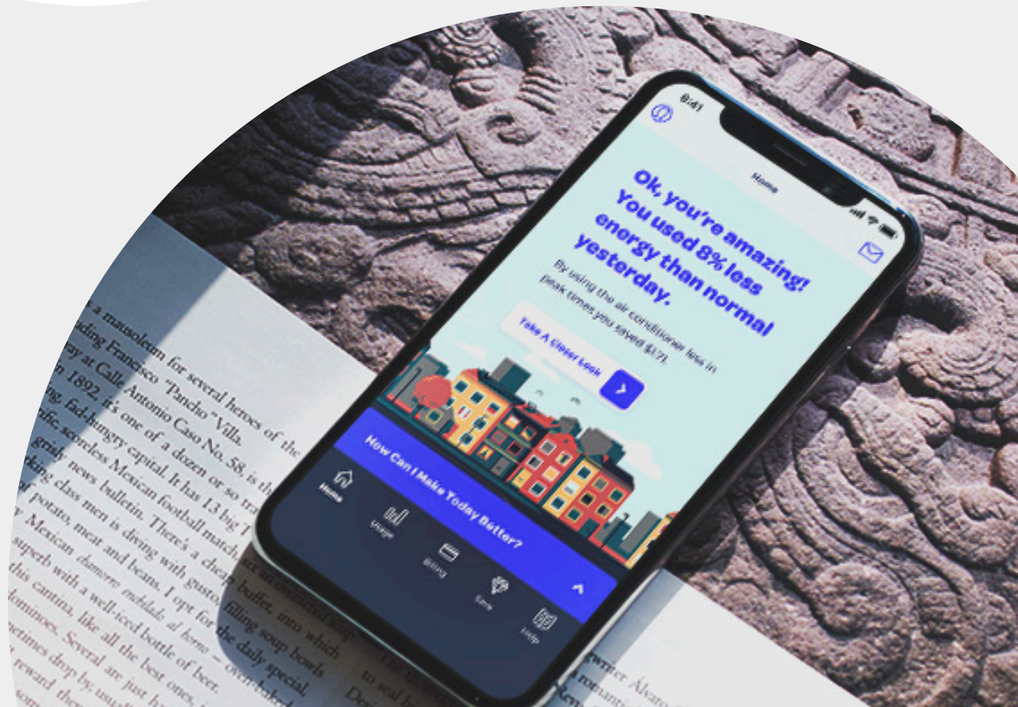
- Expanding technological innovations in energy storage and energy efficiency enablers; and
- Increasing availability and affordability of renewables.

Demand response project snapshot

One successful demand response program worth mentioning is Peak Performance Pricing. Launched through a partnership between Oshawa Power and Publicis Sapient in April 2018, it leverages smart meter energy consumption data and other data sources to drive electricity bill savings for participants. This includes giving them energy savings tools delivered through convenient channels such as an advanced web portal, emails, text messages, specially trained customer service representatives and an interactive, state-of-the-art smartphone app called Peak Power.
https://www.publicissapient.com/work/ontario-energy-board

Solar and battery project snapshot

In partnership with Reposit Power, Ausgrid is running a smart solar and battery storage demonstration project. It aims to demonstrate a method of effectively managing a two-sided market in which service are bought from distributed resources such as rooftop solar and EVs. For an initial period of five years (could increase to 10), Reposit will offer a "no electricity bill product." To participate, customers must invest in an $18,000 system for a combination of solar panels (at least 6.6kW), battery storage (at least 11.8kWh) and a Reposit box. Once that system is installed, the household will be abstracted from the electricitysystem, and the customer will no longer receive a bill.

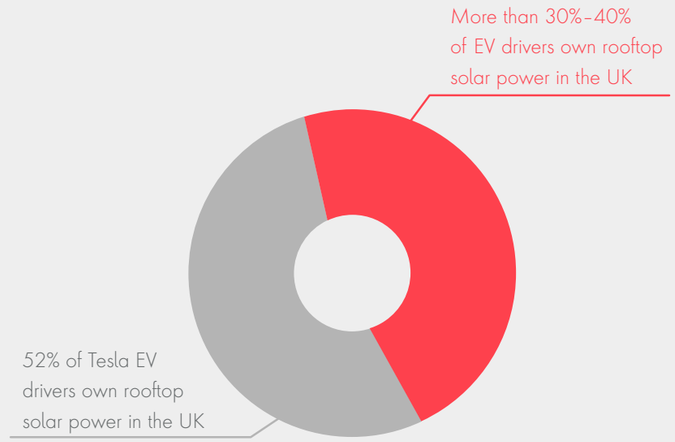


Electrification gaining traction

While the growth of renewables is ahead of electrification trends, electrification is another primary enabler of the energy transition. S&P Global reports,

"As the average cost of lithium-ion batteries has fallen drastically on a mixture of manufacturing economies of scale and technology improvements, companies and consumers alike are increasingly turning to electrification for power transportation, making the transition to electric vehicles (EVs) one of the largest potential areas for electrification. The global EV adoption rate could reach 10%–12.5% by 2025."

Electrification is also important to the energy transition because it helps advance the use of renewables. A global customer behavior survey, Digital Life Index, deployed by Publicis Sapient shows a link between domestic renewables and EVs in Europe, but this isn't the case in the US:



These percentages are expected to increase as EV adoption is increasing alongside more affordable storage options.

Electrification is expected to catch up with renewables as an enabler of the energy transition.

"This is the 'point of singularity,' when the world rings out the old and rings in the new, welcoming the future of alternative energy," says Wood Mackenzie.

Utilities central to energy transition

Because the electricity sector accounts for more than 30% of US carbon emissions, Publicis Sapient has carried out significant work in this area. We have identified five major themes that are key to the success of the energy transition.

Decentralization

- DERs (utilities/customers)
- Microgrids
- Battery storage
- P2P transactions

Decarbonization

- Drive to Net Zero
- Renewables
- Energy efficiency
- Demand response
- Green supply chain

Digitalization

- Grid edge technologies
- Connected/homes/devices/smart cities
- Change in customer expectations

Electrification

- Transportation - EVs & EV charging
- Industrial automation & electrification
- Sustainable construction

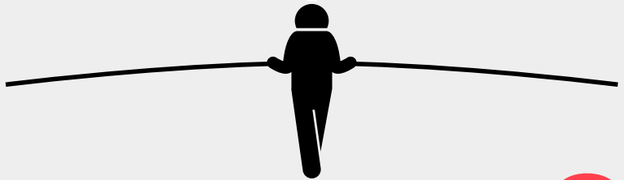
Financing, risk & compliance

- Performance-based regulations
- Sustainability-tied financing
- Intermittent generation risk
- Extreme weather events

Load balancing challenges

For the reasons described earlier, renewables currently pose a challenge for short-term load balancing. This is explained by Kevin Dawson, the director of forecasting and analytics for AESO, below:

"As the percentage of renewables increases, so does the unpredictability of supply which makes an already delicate balancing act more challenging. This will only get more difficult as the percentage of renewables increases unless economic storage solutions can be adopted. Renewables are not an issue for long-term forecasts, but they are an issue for short-term balancing. Variability of supply will increase with an increasing percentage of renewables. There is a lot of wind under development in Alberta. Solar can be more variable minute-to-minute with potentially ever-changing cloud cover. In the past, weather would impact load. With increased reliance on wind and solar, weather impacts not just load but also supply."



"To what extent will this energy shift towards clean and renewable sources pose challenges to your utility's service reliability?" was a question asked in the survey. With one being not a challenge at all and five being a major challenge, 82% rated themselves from three to five. Only 9% indicated that this was not a challenge at all.

Respondents were then asked to rate their preparedness to deliver specific initiatives related to energy efficiency renewables. These include the following:

- *Building/buying from renewable sources;*
- *Influencing customer usage with new rate structures;*
- *Reducing peak day demand through demand response;*
- *Increasing energy efficiency through advisory and customer education;*
- *Supporting the building of new energy-smart buildings or retrofitting old ones; and*
- *Offering value-added products like solar, EVs, and efficient appliances.*

Building/buying from renewable energy sources and increasing energy efficiency through advisory and customer education are the two areas where respondents expressed the most maturity.

The areas where respondents are the weakest include supporting the building of energy-smart buildings or retrofitting old ones and reducing peak day demand through demand response.

Looking ahead at renewables

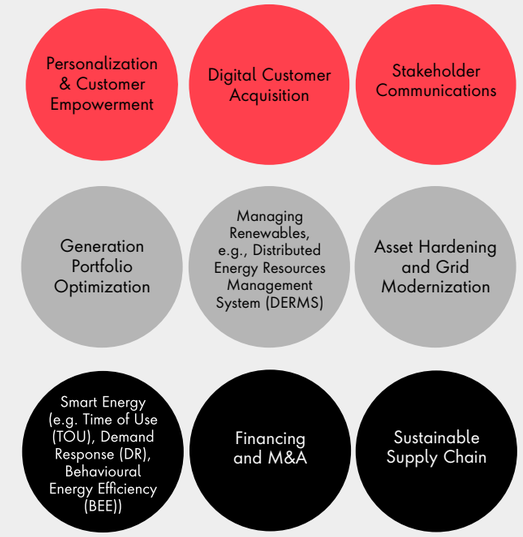
For some utilities, the energy transition isn't challenging reliability today but will in the future.

Currently, Alberta is not highly dependent upon renewables. But this will change with energy transition and measures like the carbon tax. The intermittency of these renewable energy sources will increase greater volatility to supply." **Lane Belsher, AESO**

Combined, EWEs and energy transition make the already complicated job of balancing supply and demand that much harder.

Utility investments in reliability

Publicis Sapient recently analyzed where utilities are investing across three key areas. The results are shown below:



"One thing that is changing on our side is the technology to provide more clarity about when power will be restored. Customers get really frustrated when there's no information. In the event of a big storm, there are often large chunks of the network we can get back on in the first few hours, but the next day or two is mainly focused on rectifying safety issues before the network rebuild process can commence. With more data on which crews are where out on the network and sequencing and prioritization, we're getting better at providing more accurate restoration times." **Junayd Hollis, Ausgrid**

"When AESO sees potential supply imbalances, they will communicate to customers via broadcast communications, i.e., social media or news channels. Of course, the market tends to communicate to generators and distributors based upon price signals. Of course, there are other more automated methods of communication between market participants." **Kevin Dawson, AESO**

Working with Utilities to mitigate EWE impact

Utility Case Study #1

This large utility suffered widespread power outages because of storm damage. The utility wasn't set up to provide complete information about restoration times, which hampered its ability to answer customer questions. This included an inability for customers to contact the utility through the website and contact center for real-time information.

Moreover, the process for updating the outage management system (OMS) was manual and time-consuming. The information that was available on the website was inaccessible for an hour because it crashed due to capacity overload.

The utility engaged Publicis Sapient to advise and help with improvements in several areas including the OMS, website, contact center, mobility and virtual storm room. Below are some of the initiatives Utility A took to transform its outage response for the future:

OMS

ACTIONS

Enabled faster customer communications by establishing a centralized communication point that receives notifications from an incident management mobile app to accelerate data input from the field to the OMS Automated data flow from the Works Management application directly to the OMS to accelerate information timelines.

RESULTS

Improved response times.

Website

ACTIONS

Audited website and helped with measures to improve overall reliability and developed a dedicated storm portal.
Gave customers access to dedicate storm page from the website for network status and localized restoration progress.

RESULTS

Ensured website reliability.

Contact Center

ACTIONS

Redesigned contact center call routing system and trained additional staff to act as "surge support" during the event.
Implemented cloud solution for contact center.

RESULTS

Enabled more customer calls to connect with CSRs through redesigned contact center routing system. Provided customers with real-time, automated data flow with job status and localized restoration times.

Mobility

ACTIONS

Improved consumer experience using outage maps from mobile devices.
Developed tailored customer SMS for Life Support Customer.

RESULTS

Communicated with customers through mass and tailored SMS solutions via the CRM.

Virtual Storm Room

ACTIONS

Tested and trained the Virtual Storm Room Coordination Platform and team in a simulated environment.
Introduced new, tactical customer representative role in storm room team structure.

RESULTS

Provided customers with more information, including restoration estimates with accelerated data input from the field to OMS via virtual storm room.

Utility Case Study #2

This leading utility, like many other large utilities, was struggling with inconsistencies across its business that impacted its ability to manage outages. First, it had four disparate region-based incident approaches. This gave the utility a limited ability to effectively utilize shared resources. It also struggled with the following:

- Inconsistent data and communication flow, often through phone or email, resulting in lost or duplicated information;
- Inconsistent and ad hoc methods for dispatching work (i.e., paper-based job packs and jobs dispatched by phone and recorded on whiteboards); and
- Inability to capture accurate and timely information from the field.

The utility called upon Publicis Sapient to help create consistency across the organization in the areas of incident management, resourcing, mobility and virtual storm room.

With Publicis Sapient's help the utility was able to establish the following:

Resourcing

ACTIONS

Developed centralized view of staff shift times to improve coordination. Implemented a formal memorandum of understanding (MOU) with application service providers (ASPs) and direct network service providers (DNSPs) to allow for a quick and easy response at the start of events.
Established a national working group with all key DNSPs, which meets bimonthly to align on incident mutual aid managed.
Codeveloped an accelerated onboarding framework and deployable capabilities inventory.

RESULTS

Increased prioritization of community infrastructure and vulnerable customers with new protocols established for external resource requests.
Gave key stakeholders and external support resources access to dedicated liaisons.
Scaled and engaged external resources during an outage event to reduce the restoration period by 1–2 days.

Incident Management

ACTIONS

Established a single incident management framework across regions.
Expanded to the more comprehensive Annual Summer Readiness Review.

RESULTS

Provided more timely information on the incident status and estimated restoration times. Provided centralized and faster responses to events.

Mobility

ACTIONS

Developed a mobility solution to enhance integration to enterprise system and improved robustness of the platform.

RESULTS

Integrated field technology with OMS and customer platforms to give internal and external resources real-time status updates.

Virtual Storm Room

ACTIONS

Established virtual storm room that includes a single platform to seamlessly manage communications, work management tools to easily manage crews and a mobile application that guides "spotters" and gathers real-time information from the field.

RESULTS

Developed an integrated view of the situation and use real-time insights to take proactive action.

Working with Utilities to mitigate EWE impact (continued)

Several communication best practices emerged across both case studies, including:

- Executing a coordinated, agile event response among internal incident management teams, field crews and other stakeholders; and

- Leveraging this response to offer reliable information to customers.

A coordinated, agile event response will allow companies to take a strategic position on event management to overcome event and reputation risks.

> “ When AESO sees potential supply imbalances, they will communicate to customers via broadcast communications, i.e., social media or news channels. Of course, the market tends to communicate to generators and distributors based upon price signals. Of course, there are other more automated methods of communications between market participants,” says Dawson about AESO’s communications practices.

Post outage activities

Outage management doesn’t stop when the power is restored.

When asked,

“How prepared are you to gather feedback from customers about their outage experience?”

Only 2% said they were “extremely prepared.” This is concerning.

After the lights are back on, it’s imperative to gather as much data and qualitative insights about the event and your customers as possible. Analyzing this information will give utilities the insights to make improvements that will help better predict, prepare, respond and restore power in the future.

The big ask

EWEs are increasing in both frequency and severity and are creating uncertainty in supply and demand.

As for the energy transition, the benefits are well documented, but increasing the mix of renewables increases uncertainty on the supply side.

Combined, these two factors make the already complicated job of balancing supply and demand that much harder. They exacerbate the need for utilities to develop new capabilities and adopt new technologies to preserve an impressive track record of reliability. This includes making improvements across the six stages of the EWE lifecycle, like those mentioned in this report.

Whether this means conducting a climate assessment like Ausgrid, preparing for more solar in the energy mix like AESO or something else, the “big ask” is putting plans in place to move the needle towards heightened reliability.

Supratik Chaudhuri concludes:

"Extreme weather events are set to continue, at least for the near future, but in this paper, we've touched on examples of how data can hold the key to tackle these challenges at the scenario modeling stage to prevent outages in the first place and by providing a centralized and faster response to events by integrating field technology with outage management systems and customer platforms to give a real-time status. In turn, keeping customers safer, happier and better informed."

Get in touch:

To find out more about how **Publicis Sapient** is navigating the energy transition and creating memorable experiences for utility stakeholders, contact:

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