EXECUTIVE SUMMARY
FROM RELIABILITY TO RESILIENCE
Confronting the Challenges of Extreme Weather
High-impact weather events around the world are becoming more frequent and severe, and most electric utilities remain unprepared for the increased operational stress. In fact, despite increased discussion of resilience in executive offices and in industry-focused literature, only about a quarter (24%) of the more than 200 utility executives we surveyed as part of our global Digitally Enabled Grid research survey feel very well-prepared to manage the challenges of extreme weather events. Our survey included executives responsible for networks, smart grid, energy/power delivery, operations/grid operations, system planning, distribution, as well as select functional leads.

90% of utility executives believe extreme weather poses an increased financial risk to their businesses.

For years, electric utilities focused largely on grid reliability; however, that approach alone has become inadequate for utilities and for society at large, especially when one considers the bigger picture. When a utility is facing extreme weather and a secondary event (such as cyber-attacks, earthquakes, geomagnetic storms, warfare, wildfires, and, as we now see, pandemics such as COVID-19) occurs, the situation can quickly move from bad to worse. Greater resilience is the answer. The key is being able to shift successfully from a strategy centered on reliability to one centered on resilience.

The complicating factor is that resilience, to date, remains something of an amorphous concept in the utility business. With no standard, broadly accepted definition of resilience in the industry or from regulators, it falls on the utilities themselves to take the lead on developing appropriate incentives, metrics and modeling, and laying the foundations for a collaborative approach between regulators, customers and the utilities. This will require a new, forward-looking and holistic strategy that is data- and digitally driven with a focus on energy efficiency and renewables.
Developing a resilience strategy

An effective resilience strategy persuades stakeholders—from regulators to customers—that developing and maintaining the necessary capabilities to handle such events is worth significant upfront, ongoing costs. Stakeholders will need to understand that supporting greater capabilities may not appear to pay off; success means the absence or minimal period of interrupted services. Homing in on the following three imperatives will help executives develop resilience (see Figure 1).

Figure 1. Three strategic imperatives lead to a successful resilient network.

ESTABLISH THE FOUNDATIONS OF RESILIENCE

- Develop leadership in resilience within and outside the business
- Underpin investment and performance targets with clear regulatory mechanisms based on risk and societal value of resilience
- Develop a robust quantitative basis for resilience risk analysis and investment decision making

BUILD THE RESILIENT NETWORK

- Build new system flexibility capabilities through digital solution deployment
- Utilize artificial intelligence (AI) and emerging technologies to enhance outage prediction and system restoration strategies

EXPLORE EMERGING RESILIENCE SERVICES

- Support the utilization of end-user resilience solutions
- Develop differentiated network resilience solutions to support poorly served communities and those with high resilience requirements

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From Reliability to Resilience: Confronting the Challenges of Extreme Weather
Establish the Foundations of Resilience

Lacking strong regulatory direction on resilience, network utilities have an opportunity to take the lead to define and deliver resilience. In fact, it is an imperative. Consider:

1. Utilities cannot afford to wait—**92% of survey respondents** thought that growing extreme weather events increase the financial risk level of networks businesses and 90% said they will increase the potential risk to the ongoing financial viability of the network business.

2. **Only utilities themselves** have the data and capabilities to develop methods to assess resilience levels effectively.

3. Shaping the dialogue with customers and regulators will help utilities to **develop an incentive approach** that gives scope for innovation and out-performance.

Build the Resilient Network

Delivering the investments and operational process improvements necessary to build a more resilient network is the next step. To do so, utilities can:

1. **Harden the network** – traditional approaches such as pole replacement, undergrounding of assets and development of flood defenses.

2. **Develop greater system flexibility**, using investment in redundancy, network reconfiguration, distributed energy resources (DERs), microgrids and customer participation to limit the impact of extreme events.

3. **Strengthen restoration effectiveness** – bolstering the capabilities to reduce outage time to a minimum.

All three will be required; however, the focus in this report is primarily on building flexibility, both in system operations and restoration.
In order to deliver sufficient resilience, utilities should consider developing and scaling new services that move beyond their current distribution models.

The switch to electric vehicles (EVs) and the need for EV infrastructure will drive many aspects of network evolution while the lowering cost of storage is opening up many potential options for embedded storage and beyond-the-meter storage. The rapid deployment of such DERs can potentially form the basis for solutions to support local resiliency where the network itself has failed. For example, 93% of our respondents agree that self-islanding solutions will be a major contributor to improved resilience in the longer term, providing a route to improved resilience for buildings with storage and solar power. Such solutions can be extended to incorporate EVs as emergency electricity sources for housing (vehicle to grid) and can also be used to electrify community disaster centers to provide critical services during major outages.
The challenge of becoming more resilient may be formidable, but it is also unavoidable.
Extreme weather events are no longer outliers and affect networks on a regular basis—this poses an increased financial risk to utilities. Therefore, utilities that do not become more resilient, are putting their organizations and their customers in jeopardy.

Moreover, the benefits of weather resilience planning will better prepare utilities to handle other unexpected crises that threaten their ability to respond by threatening supply chains and employee deployment plans, including events such as COVID-19, cyber-attacks, earthquakes and geomagnetic storms.

To help utilities develop the resilience they need to manage these challenges with confidence, we asked our survey respondents to weigh in on a wide range of questions about the greatest challenges they face with regard to extreme weather. We also asked them to identify the most promising among their activities to develop resilience, and those that were most frustrating.

We supplemented those findings with secondary research, modeling and further analyses, as well as interviews with a select group of senior utility executives. Through this process, we identified the key elements of a viable strategy to increase resilience, presented in this report, along with examples of organizations that have made great strides in their resilience strategies, including San Diego Gas & Electric (SDG&E), Florida Power & Light (FPL), Enel, UK Power Networks and Horizon Power. The payoff from this approach can be substantial, leaving utilities far better prepared to handle unpredictable, high-impact weather events, their financial impact, and other crises as well.
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