THE IMPACT OF SEVERE WEATHER ON UTILITIES

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Chapter 1

Executive summary

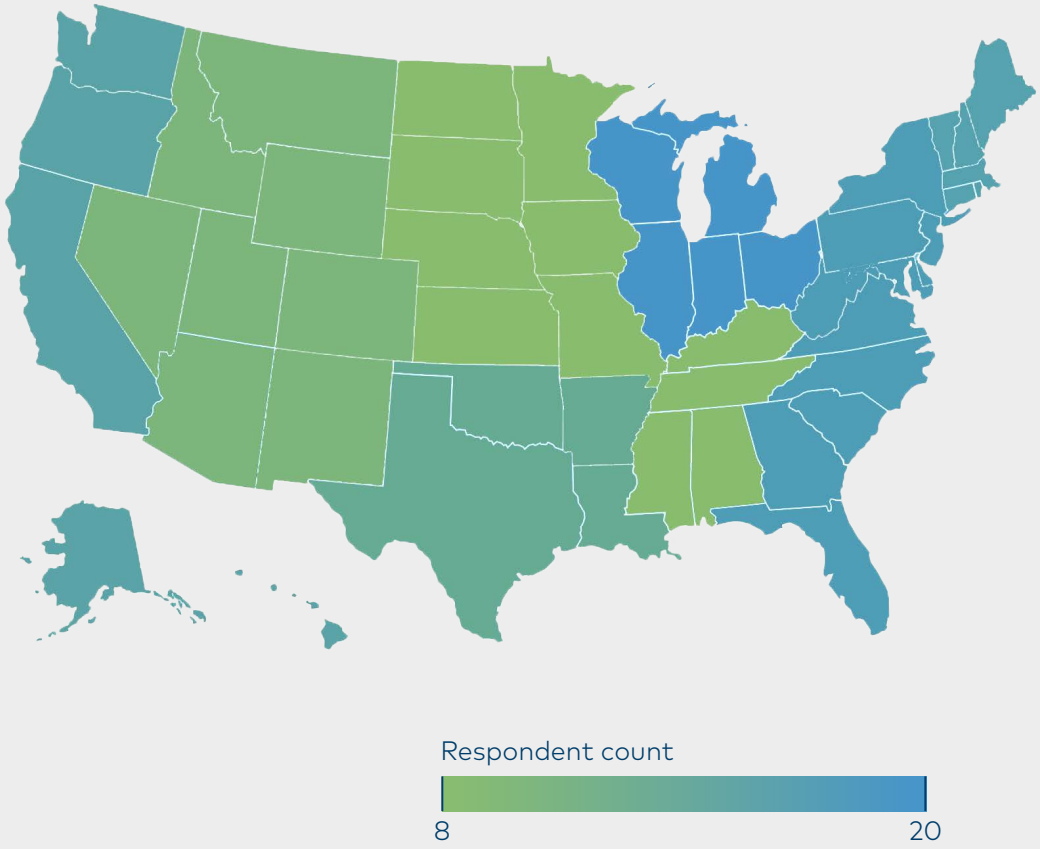
Executive summary

From atypical temperatures to fires and flash floods, weather challenges are playing out in different ways across the United States. However, one thing is clear: severe weather events are increasing. The country has experienced a 67% increase in major power outages from weather-related events since 2000.

Utility companies have always faced challenges from severe weather events. However, as the frequency of these events increases, utilities face tough choices around how to minimize and prevent outages. Utilities are exploring multiple options — from hardening infrastructure to predictive technology — to help them prepare, allocate, and deploy resources effectively. These decisions must be weighed against additional factors, such as cost, reliability, resiliency, regulatory measures, long-term investment, and public support.

A recent survey conducted by T&D World and Utility Analytics Institute (sponsored by DTN) highlights important weather-related trends in the industry. This report analyzes and evaluates the key findings from the utility response in North America to severe weather. Survey responses were collected from 109 individuals working in the utility sector via email from Endeavor Business Media to members of the T&D World and Utility Analytics Institute databases.

In what areas do you operate in the United States?



Unsurprisingly, given the impact of weather on utilities, all respondents indicated they have some capabilities in place to anticipate weather-related incidents. The most common capability is an external meteorologist (42%), followed by weather data feeds or application programming interfaces (APIs) (36%). Of the respondent, a small percentage (17%) report having in-house data science capabilities. While this service has been shown to help plan and mitigate outages, as well as provide insight for regulators, it is more likely to be found in larger utilities. Most utilities report using public weather data, such as the National Oceanic and Atmospheric Administration for predicting weather events; in-house data science capabilities are more likely to be deployed at large utilities with more than 1 million customers — of respondents with these capabilities, 72% came from large utilities.

In response to severe weather or natural disasters, 39% of utilities indicated their regulatory commission had shifted its interest and efforts toward hardening infrastructure to reduce outages from severe weather. Alongside this, 48% of respondents reported an increased investment in infrastructure hardening to meet regulatory requirements, compared to 20% who have increased their investment in weather prediction solutions.

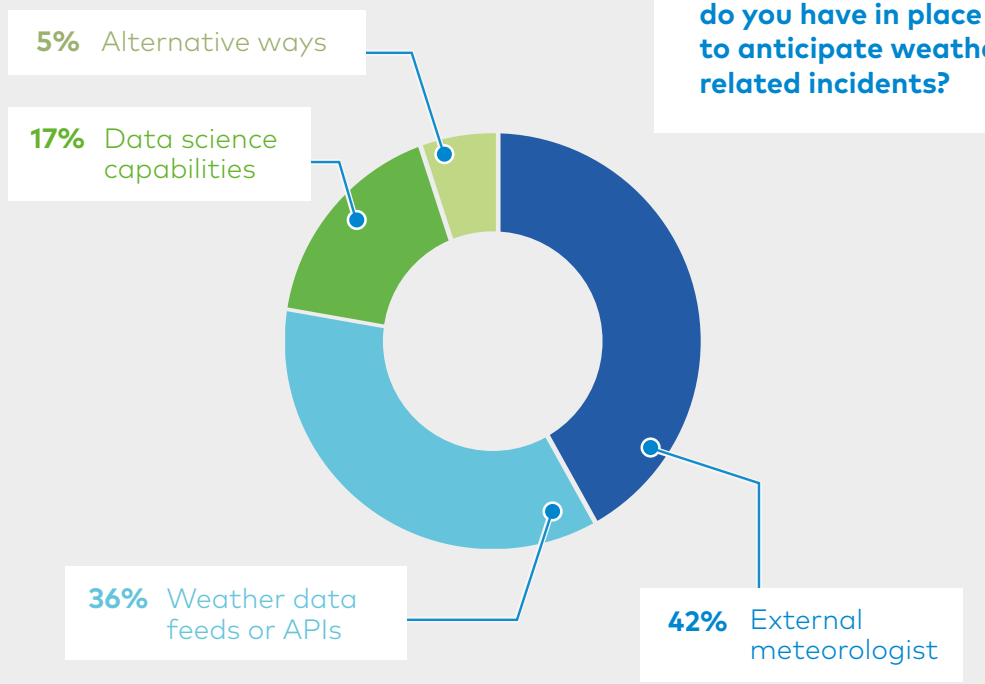
When asked to rank the criteria used for weather-prediction technology investment decisions, nearly two-thirds said the ease of integration with infrastructure and technology (74%) and ease of use (72%) were extremely important or important to their decision-making process. Achieving cost savings (69%) and return on investment (68%) are also highly influential criteria for utilities when making technology investment decisions.

Respondents were questioned on the benefits of a recent technology purchase for help with severe weather prediction or response: 62% have seen reduced outage times from the purchase and 58% have had better workforce deployment during severe weather and faster restoration times. This speaks to the practical advantages of having technology solutions in place to predict and/or respond to severe weather.

The survey also asked about the unexpected benefits of technology, with 39% reporting improvements in customer satisfaction from new technology to help with severe weather prediction or response.

Based on the survey results, most utilities still have a long way to go to optimize outage planning and performance using a predictive, data-based approach. While investment in hardening programs continues to be a priority, an opportunity exists for utilities to enhance their preparedness for severe weather events through advanced weather technology.

What capabilities do you have in place to anticipate weather related incidents?



Chapter 2

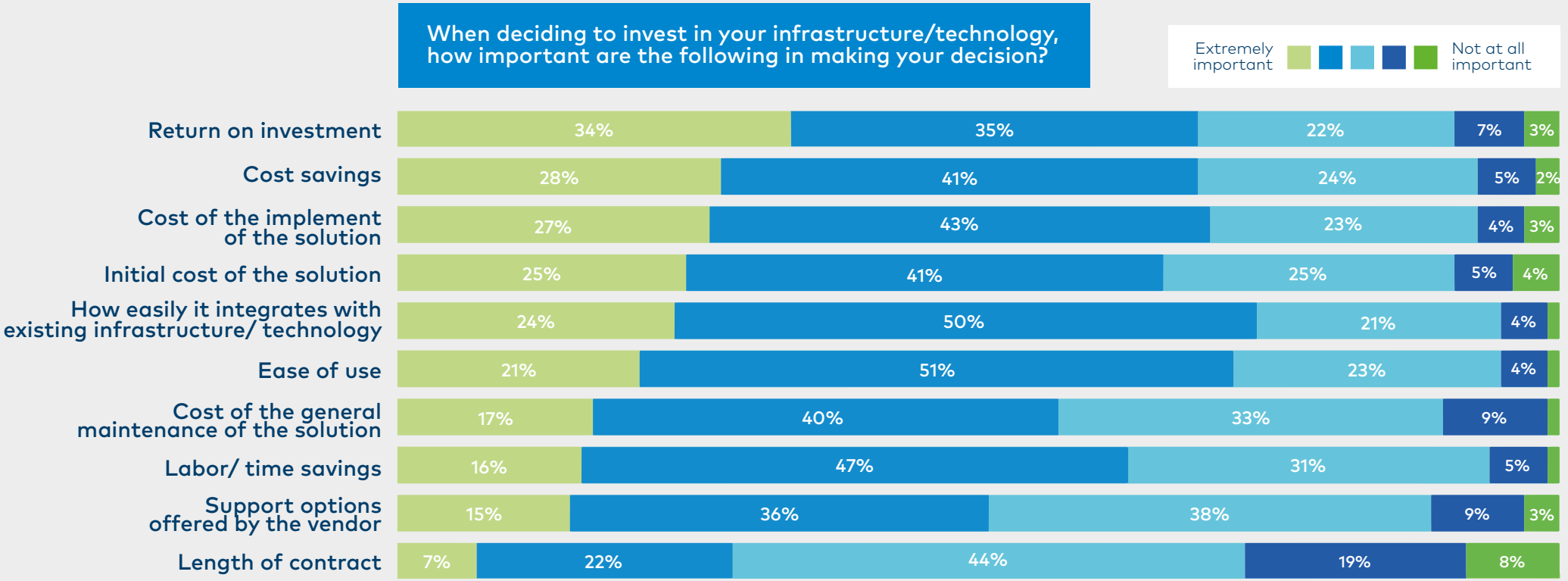
Key findings

Achieving ROI is non-negotiable to ensure reasonable rate increases

A McKinsey report estimates losses related to extreme weather events will increase by 23% for U.S. utility companies by 2050. Against this backdrop, it is not surprising that achieving a return on investment (ROI) and managing costs are two of the most important considerations for utilities when making decisions on infrastructure and technology investments. Utilities are highly conscious of the economic pressures facing their customers and must balance investments with reasonable rate increases.

Today, two-thirds of utilities surveyed indicated the initial cost of a solution is extremely important or important when making investment decisions, while 68% also ranked achieving ROI high. Utilities also factor in implementation and ongoing maintenance costs, with 70% and 57% respectively rating this extremely important or important to their decision process.

Overall technology and infrastructure investments that deliver cost-savings were considered extremely important or important to 69% of the utilities surveyed. And, tellingly, only 3% of respondents said ROI was not important at all.



Base: All respondents (varies from 104 to 107).

Investment in weather prediction technology increases customer satisfaction and favorable news coverage

Among utilities that have installed technology to help with severe weather prediction or response, 39% reported increased customer satisfaction as an unexpected benefit. Of these respondents, the customer satisfaction increase is split almost evenly: 51% came from large utilities (those with more than 1 million customers) and 49% from smaller utilities (those with fewer than 1 million customers).

Looking in more detail at media coverage, one-third of utilities reported they had received negative media attention in response to an outage, and 25% have received positive media coverage. Of those receiving negative media coverage, two-thirds of the respondents were from large utilities, with more than 1 million customers.

However, for utilities whose customer satisfaction improved after purchasing technology to help with severe weather prediction or response, only 24% said they had experienced negative media coverage in response to outages within the last year and 34% have enjoyed positive coverage.

If your organization has installed technology to help with severe weather prediction or response, have there been **unexpected** benefits?

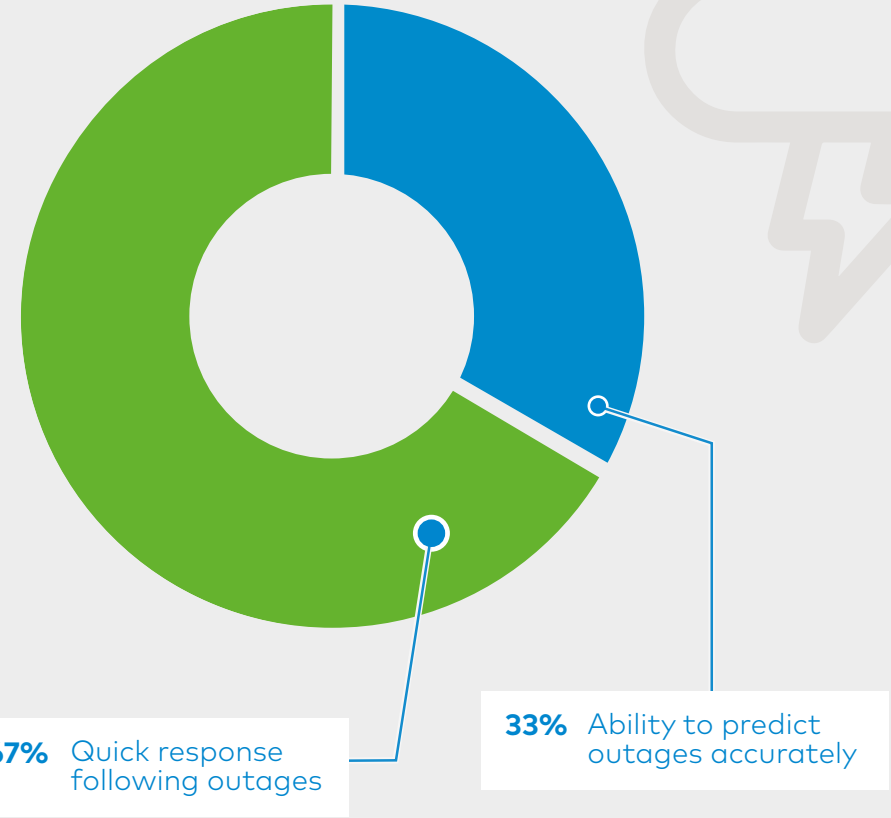
The utility sector favors resiliency over prediction capabilities to reduce outages

When asked to choose between the ability to respond quickly following outages or the ability to predict outages accurately, utilities favor quick response by a two-to-one margin. This is not surprising: when the power is out, utilities want to restore it as soon as possible. In an either/or decision between response or prediction, it's failing to resolve an outage as soon as possible that would cause more immediate pain.

This reality is reflected by 71% of respondents indicating their regulatory commission has taken one or more actions as a result of service disruptions, with 39% shifting interest/effort towards hardening to reduce outages from severe weather. Of these respondents, there's a 50/50 split between respondents based in areas prone to severe weather and respondents not based in severe weather-prone areas, which is indicative that infrastructure hardening is an important consideration across the board for utilities.

However, looking at the biggest benefit of a recent technology purchase to help with severe weather prediction or response, 62% reported shortened outage times. Meanwhile, 58% also confirmed they had better workforce deployments during severe weather and faster restoration times, with 42% also reporting outage prevention as a benefit.

Would you rather have the ability to respond quickly to outages or be able to predict outages accurately?



Public utility commission are driving policy to direct how utilities respond to environmental and weather challenges

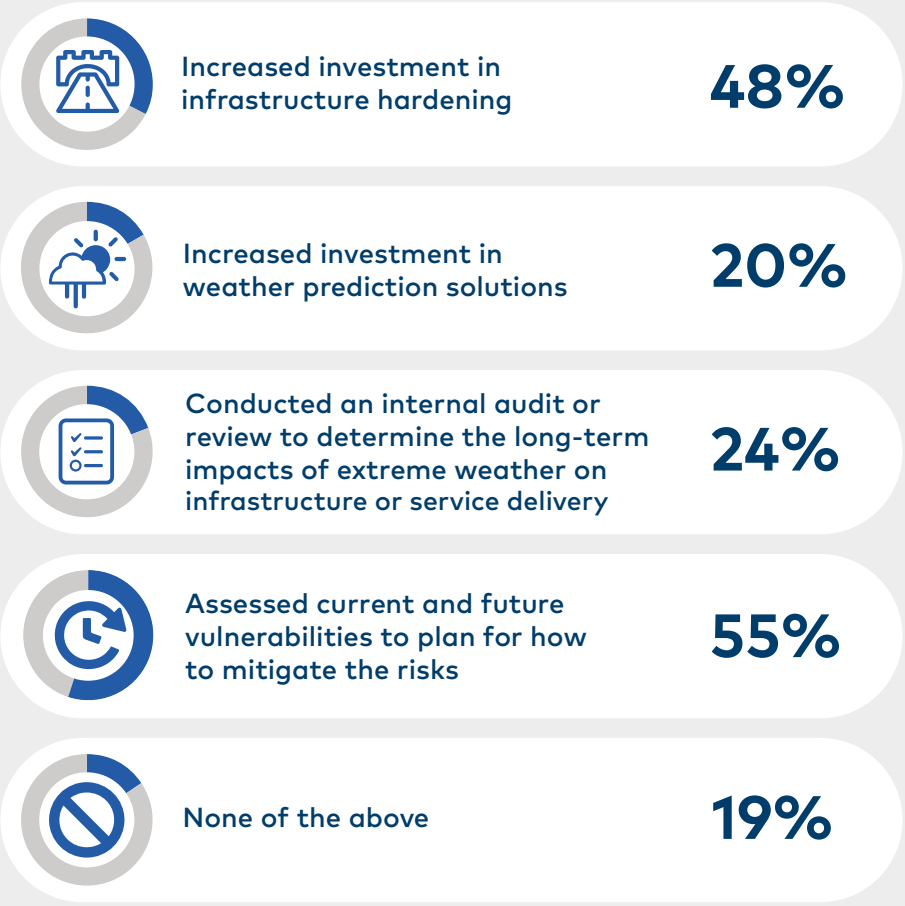
Public utility commissions (PUCs) are driving policies that direct how utilities respond to severe weather challenges. Already, this trend can be seen in new regulations. For example, the increase in wildfires and their toll on life and property has increased regulations related to wildfire risk. The California Public Utilities Commission has adopted regulations to protect the public from potential fire hazards associated with powerline and aerial communication facilities. Likewise, new regulations that came into effect on July 1, 2021, in Connecticut require utilities to pay consumers following lengthy power outages.

Against this backdrop, utilities are responding: 48% have increased investment in infrastructure hardening to meet regulatory requirements, with 51% also planning to make hardening investments in the coming 12-18 months.

In total, 20% have increased investment in weather prediction solutions to meet regulatory requirements. Though only a small percentage of overall respondents, of those that have increased investment in weather-prediction solutions, 70% came from organizations with more than 1 million customers.

Interestingly, 64% of utilities surveyed have been neither financially penalized nor rewarded for performance reliability in the last three years, and only 7% confirmed their utility had been penalized for performance reliability. This suggests that regulatory commissions are looking to work with utilities and make the changes required to minimize outages and disruption, using penalties as a last resort and not a first.

To meet regulatory requirements, has your organization:



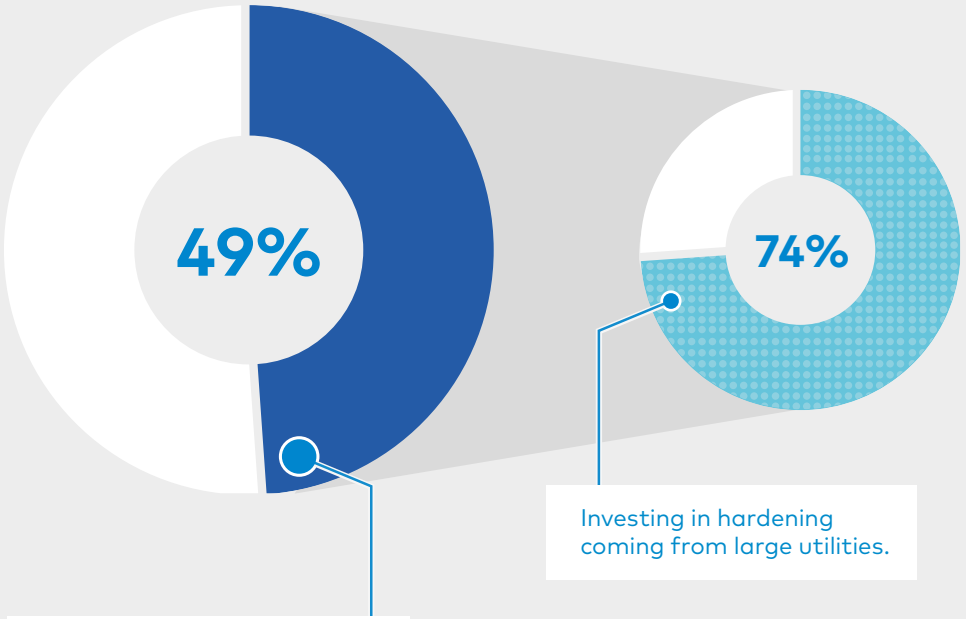
Utilities are starting to view investments in emerging weather predictive technology as an intelligent operational investment

Outages caused by storms and exacerbated by aging assets are increasingly difficult to manage. They're also more costly as public expectations rise and regulatory scrutiny intensifies.

Utilities must ask regulators for a customer rate increase to justify the capital expenditure. Yet, technology investments are considered operational expenditures and must be absorbed by the utility. It would be beneficial to both the utility and the customer if new technology was classified as a capital expenditure. The utility may be more motivated to invest in technology that can benefit short-term and long-term response efforts, which in turn would benefit the customer through pre-event communication from the utility and potentially reduced outage times.

Utilities have made multibillion-dollar investments and commitments to modify their generation portfolio and build new transmission assets. Many also are engaged in rebuilding, replacing, and extending their distribution systems. All of these commitments create some level of concern for credit-rating agencies, which assess a utility's ability to meet its debt obligations.

Is your organization planning investments in infrastructure hardening this year?



The nature of the industry means the utilities favor investments in hardening — a clear capital expense investment. This is backed up by the 49% of survey respondents whose utilities are planning investments in infrastructure hardening this year. Of these respondents, 74% were from large utilities with more than 1 million customers.

Yet, there are only so many times utilities can pass costs onto consumers, and there is a limit that impact hardening alone can have on outage prevention. Grid hardening can be expensive. After completing much of its $3 billion grid-hardening program, Florida Power & Light Co. still suffered more than $1 billion in damage during Hurricane Irma in 2017.

Analysis by Climate Central reveals the grid's aging infrastructure, combined with extreme weather events, resulted in 147 million U.S. homes and businesses experiencing power outages between 2003 and 2012. According to the Edison Electric Institute, an estimated 90% of outages occur on distribution systems. However, a Congressional Research Service report on Weather-Related Power Outages and Electric System Resilience states that "the remaining 10% stem from generation and transmission problems, which can cause wider-scale outages affecting larger numbers of customers." Climate Central estimates the weather-related outages between 2003 and 2012 cost the U.S. economy between $18 billion and $33 billion per year on average.

Intelligent operational expense investments, like predictive weather technology, reduce the need to continue increasing hardening capital expenditure investments. Where hardening programs can take decades, predictive weather technology can be deployed more immediately alongside infrastructure improvements. In addition, they enable utilities to deliver stability in electricity rates to customers and help to improve outage prediction and planning — even in a world where the frequency of severe weather events is increasing.

Chapter 3

How weather challenges are playing out across the country

How weather challenges are playing out across the country

Across the United States, weather challenges are playing out in different ways. But one thing is clear: severe weather events are increasing. The 2020 fire season in California and Oregon had the highest fire intensity of the last 18 years. By 2080, the risk of extreme fire weather is expected to increase by at least 50% in western North America, according to an article on "Human-Driven Greenhouse Gas and Aerosol Emissions Cause Distinct Regional Impacts on Extreme Fire Weather," published in Nature Communications in January 2021. The year 2020 also saw a record number of named storms across the Atlantic, with a record 12 storms making landfall in the continental United States. In total, between 2000-2019, 467 extreme weather events occurred across the country.

Extreme weather is damaging the aging electrical grid. Since 2000, the United States has experienced a 67% increase in major power outages from weather-related events. The challenge for utilities is visibility into when and where severe weather events will occur, so they can prepare and deploy resources effectively to restore power following outages.

Utilities are increasingly impacted by extreme events

Utilities not historically impacted by severe weather events are starting to see the dynamic change as more of these extreme events occur.

In February 2021, Texas suffered a major power crisis caused by an Arctic freeze; 54% of the power outages that led to massive blackouts were a result of "weather-related issues" at power plants.

The situation highlights the dramatic impact of extreme weather events. Many power plants in the southern United States are not enclosed inside a building, with boilers and turbines exposed to the elements. Keeping key power plant infrastructure outside is by design to prevent excessive heat build-up during warmer periods. But, as in the Texas power crisis, it can leave power plants vulnerable to cold weather.

It is not just temperatures that impact utilities. Flash floods hit Louisiana in May 2021, with 15 inches of rainfall occurring in some areas. Thousands of people were left without power in Jefferson Parish, as high winds and lightning caused outages.

West Coast utilities are still adapting to the growing severity of fire threats

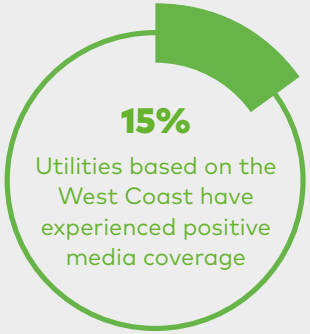
Wildfires are increasing in frequency, intensity, and season length. At the start of 2021, California already had experienced nearly four times the number of wildfires as the same time last year. Once a four-month, high-alert season from July to October has become a year-round risk.

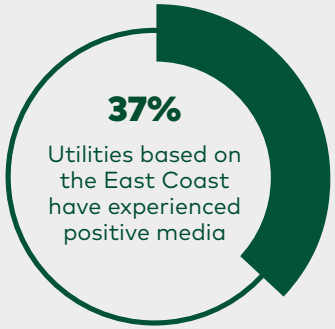
While East Coast regions have a long history of preparing for and responding to hurricanes and other severe weather threats, wildfires are increasing. This is reflected in the responses from utilities located in the fire-prone regions on the West Coast, where only 15% of utilities reported positive media coverage, compared to 37% from the hurricane-prone areas.

Additionally, only 11% of utilities on the West Coast reported increased reliability scores — for example, system average interruption duration index (SAIDI), system average interruption frequency index (SAIFI), and customer average interruption duration index (CAIDI) — compared to 30% of all respondents and 40% of respondents from the East Coast.

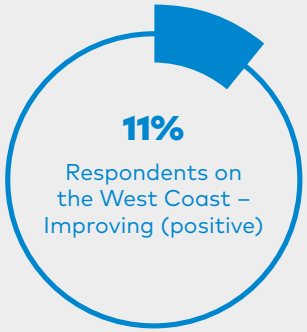
The high intensity of fires experienced last season will no doubt influence how media and consumers alike perceive utilities. However, if the longer-term trend is for fire weather to be a year-round threat, affected utilities will need to adapt.

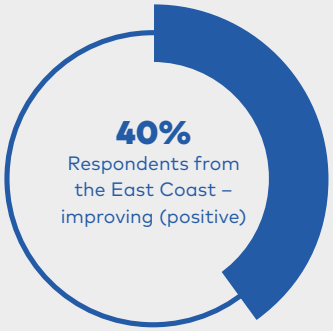
In response to outages in the past year, have you experienced positive media coverage?





How are your utility's reliability scores (SAIDI, SAIFI, CAIDI, etc.) currently trending?





Hurricane-prone utilities are likely more prepared for severe weather

Hurricanes are an established phenomenon, meaning they have fewer unknowns compared to wildfires. Utilities on the East Coast also are supported by safeguards, like suitable insurance policies and building regulations.

This trend is reflected in the survey, with 86% of respondents on the East Coast reporting a reduction in outage times due to a technology purchase that helps with severe weather prediction or response. This drops to 40% of those on the West Coast.

Meanwhile, 40% of East Coast utilities also reported more favorable news coverage as an unexpected benefit of new technology, compared to only 15% of utilities on the West Coast.

However, despite above-average activity in the 2020 season, the below-average severity of the hurricanes at the time of response may have influenced responses. Therefore, utilities on the East Coast may have enjoyed a comparable boost in media perspective on customer satisfaction.

Chapter 4

Hardening vs. prediction

Switching from an either/or to an integrated mindset

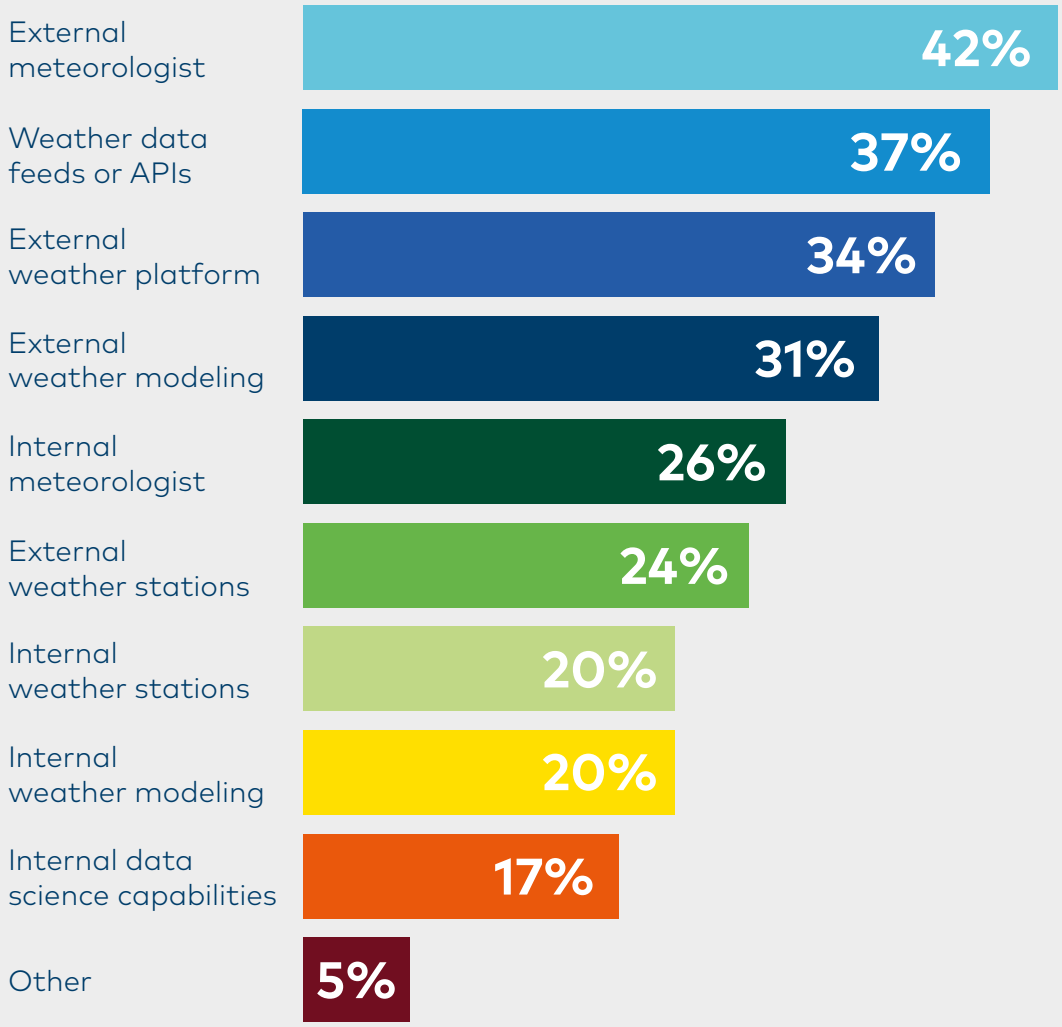
While 48% of organizations have chosen to invest in traditional hardening solutions, compared to 20% increasing their investment in weather-prediction solutions it is not clear that this needs to be an "either/or" choice — either harden the infrastructure or invest in weather prediction. Weather technology, enabled by digital transformation, can shorten outages and increase resiliency, rather than serving a purely predictive role.

The prominence of respondents reporting investment in hardening programs indicates the industry is maturing from outage response towards more proactive measures. But with the addition of predictive weather technology, utilities go from having two tools in their toolbox (response and hardening) to having three (response, hardening, and prediction). But it doesn't need to be a choice of one or the other. Utilities can choose to both hardening and prediction.

Already, utilities likely have multiple capabilities in place to anticipate weather-related incidents. The most-reported capability is an external meteorologist, with 42% having this capability and 36% having weather data feeds or using APIs.

However, only 17% said they have data science capabilities in-house (for example, machine learning and artificial intelligence). With relatively low overall adoption, any breakdown can only be considered indicative rather than conclusive. But with 72% of respondents with data science capabilities coming from large utilities, it indicates that larger organizations are more likely to have these advanced capabilities in-house and that data science is an emerging technology in the utility sector.

What capabilities do you have in place to anticipate weather-related incidents?



In respondents who favor the ability to predict over the ability to respond this was notably higher, with 50% already having data science capabilities.

As reported in the key findings, 67% of utilities chose quickly responding to outages over accurately predicting outages, compared to 33% who favor the ability to accurately predict outages. Of respondents who favor prediction, nearly two-thirds were from larger utilities.

The preference for response over prediction is even more pronounced on the East Coast. For respondents based in this area, 81% prioritized quick responses, compared to 19% who favored accurate predictions. This could reflect the longer standing preparedness of these regions for severe weather events — though the cost of repairs from damages caused by Hurricane Irma despite hardening investment challenges this view.

When used effectively, technology to predict outages can be an integral part of sizing the response to a weather event and allocating the right resources.

As severe weather approaches, predictive technology uses accurate near-term forecasts to help utilities make better callout and holdover decisions. It enables utilities to track storms in real-time, so they can stage crews at the right time to respond to outages. Predictive technology also helps uncover whether an event is intensifying or subsiding.

Understanding organizational weather maturity

Organizations differ significantly in their adoption and use of weather data. The DTN Weather Maturity Curve classifies organizational maturity, related to what stage they are currently in for adopting weather data. The maturity curve assesses organizations based on their understanding, influence, and usage – focusing on the role weather data plays in decision-making, the types of weather tools and data used, and the appreciation of how weather influences business performance.

The five-stage maturity curve encompasses all phases organizations can pass through on the journey toward weather maturity. Organizations can also have capabilities across one or more stages of the maturity curve.

Across all survey respondents, 85% have capabilities at Stage 2, indicating that their current weather technology enables them to check weather forecasts to support hardening initiatives and help field crew planning.

Nearly half (41%) are at Stage 3 or higher on the maturity curve, which means they can predict and track severe weather paths in advance and utilize basic impact prediction.

Only 17% of utilities have Stage 4 capabilities, incorporating weather data integration and data science capabilities that unlock advanced impact prediction. Respondents with these capabilities can use weather data integration and machine learning to predict weather-related grid outages for quick crew deployments.

While no organizations are yet at Stage 5, it offers a future direction for the industry that unlocks AI-driven decision making around response, hardening and prediction.

Passive

Stage 1

Definition
On-demand weather forecasts and mobile apps

Use cases
On-demand weather forecasts and mobile apps

Operative

Stage 2

Definition
Specific weather platforms and services

Use cases
Check weather forecast for field crew planning

Cohesive

Stage 3

Definition
Specific enriched weather data consultancy

Use cases
Predict and track ahead of severe weather

Predictive

Stage 4

Definition
Weather data integration and machine learning

Use cases
Predict weather-related grid outages for faster crew deployment and restoration

Prescriptive

Stage 5

Definition
Artifical intelligence applied to intergrated data with weather component

Use cases
Harden the grid at specific locations ahead of severe weather

Chapter 5

The benefits of weather technology on customer experience

The benefits of weather technology on customer experience

Modern utilities rely on their reputation with customers to maintain and grow revenues. Word of mouth, reviews, and positive customer feedback are essential for utility companies to grow and thrive year over year.

Consumers expect their electric utilities to keep the power on — at a reasonable price. A major factor in how they view utilities is based on how long it takes them to restore power after an outage. Most utilities have seen their reliability scores (SAIDI, SAIFI, CAIDI) improve or hold steady, as reported by 69% of survey respondents. Only 7% said their scores have deteriorated.

Of the utilities who have seen their reliability scores improve or hold steady, 30% reported improved reliability scores with 60% of these coming from large utilities, and 40% coming from small utilities. Of respondents who said their customer satisfaction is improving, 54% also reported improved reliability scores. This indicates a correlation between reliability scores and improved overall customer satisfaction.

When it comes to customer satisfaction overall, 80% of respondents have seen customer satisfaction or customer perception of the brand trends improve or hold steady.

Out of all respondents, 39% reported improved customer satisfaction as an unexpected benefit of installing a technology to help with severe weather prediction or response. The trend of improved customer satisfaction is almost evenly split between respondents from large and small utilities, at 52% and 49% respectively.

Have you seen your reliability scores improve and hold steady or deteriorate?

69%

7%

How many came from large utilities and reported improved reliability scores?

60%*

*Out of the respondents that improved or held steady.

Chapter 6

Collaborating on technology purchase decisions

Collaborating on technology purchase decisions

Peer collaboration and the experiences of other utilities play an influential role in technology purchase decisions. Survey respondents are very likely to agree that they make technology investments based on the experiences of peer utilities with similar investments.

As a traditionally non-competitive industry, U.S. utilities can benefit from cooperating with each other. Mutual assistance and active participation in user groups and forums to share experiences enable utilities to learn from each other.

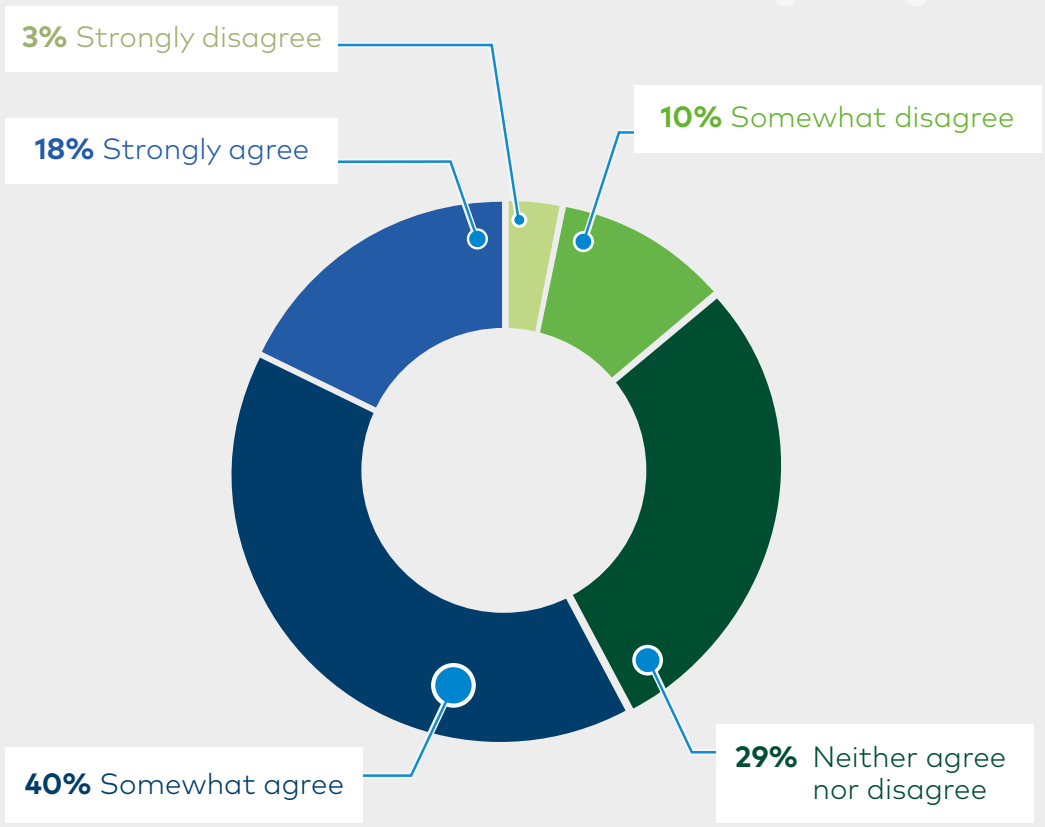
Survey respondents back-up the collaborative approach, with 55% saying they strongly agree or agree that they are more likely to make technology investments when a peer utility reports a positive experience.

Likewise, 58% strongly agree or agree they are less likely to make a technology investment when they see that a peer utility has had a negative experience with the investment.

The industry has many conferences (in-person and virtual) and collaborative efforts where people from one organization get to know and work with people from another. They have active networks through which they keep up with each other personally, as well as significant changes (positive and negative) in their organizations. Utilities of all sizes gave comparable answers on their willingness not to make an investment when a peer has a negative experience with that technology, and in their willingness to make an investment when a peer has experienced success.

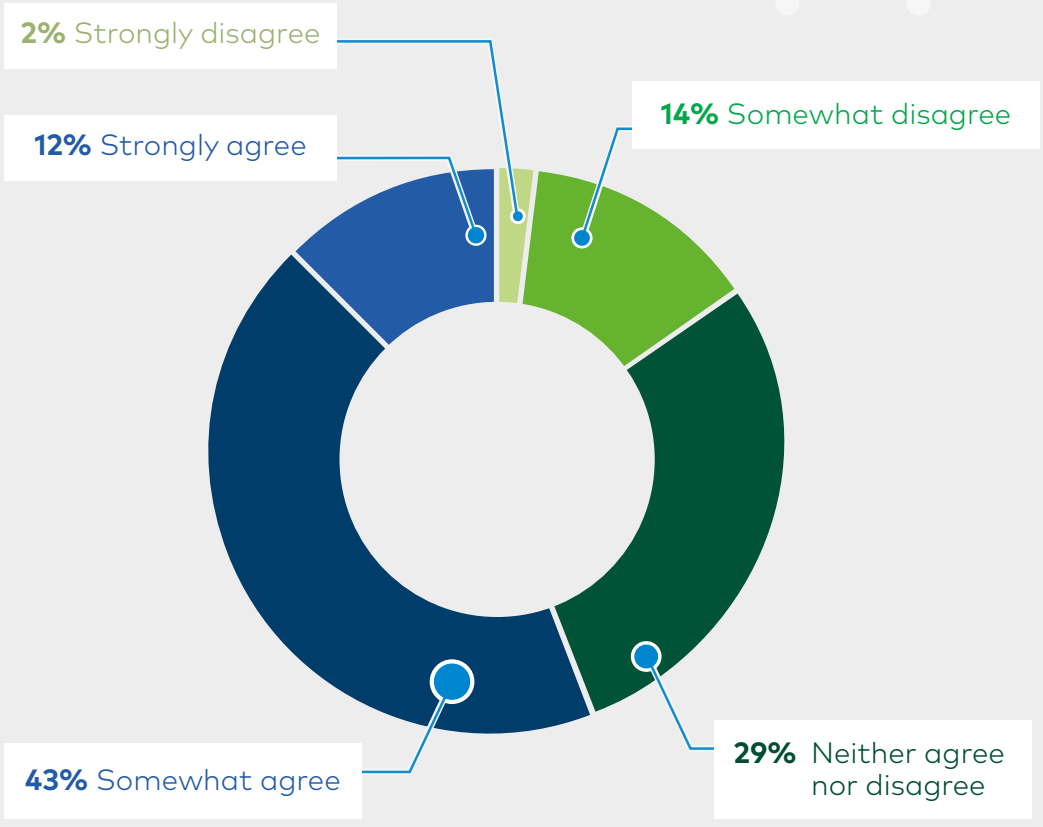
To what extent do you agree or disagree with each of the following statements?

We are less likely to make technology investments when we see that a peer utility has had a **negative experience** with these investments.



To what extent do you agree or disagree with each of the following statements?

We are less likely to make technology investments when we see that a peer utility has had a **positive experience** with these investments.



Chapter 7

Conclusion

Conclusion

As weather volatility continues to be the norm, utilities that focus on being weather-ready will be better equipped to protect their profitability, meet regulatory requirements, and ensure a high level of service for their communities.

Survey responses show investment in hardening programs continues to be a priority. However, the opportunity remains for utilities to enhance their preparedness for severe weather events through advanced weather technology.

Advances in weather data analytics enable utilities to not only forecast weather conditions, but also to predict outages and the potential damage to infrastructure. These insights can significantly impact preparedness plans or even prevent the outages altogether. They allow utilities companies to have the right resources in the right place following an outage, to restore service fast.

About DTN

At DTN, our mission is to empower customers worldwide with independent, intelligent, and actionable insights that help them make sense of data and support confident decision-making.

More utilities rely on us than any other weather partner. For nearly 40 years, we've served the industry, delivering highly accurate forecasts, expert meteorological consultations 24/7/365, and cutting-edge risk management tools designed to limit outages, improve planning, and ensure safety.

Our team includes more than 200 professional meteorologists — including 150 in active forecasting roles. Their extensive knowledge and forecast expertise help feed our solutions suite, which delivers critical capabilities that support proactive asset inspection, grid capacity optimization, weather risk visualization, outage and damage prediction, and more. Click here to explore our offerings for utility and renewable organizations.

Overview

Methodology, data collection, and analysis by T&D World and Utility Analytics Institute for DTN. Data was collected from March 25 through April 10, 2021. Methodology conforms to accepted marketing research methods, practices and procedures.

Methodology

On March 25, 2021, Endeavor Business Media emailed invitations to participate in an online survey to members of the T&D World and Utility Analytics Institute databases. By April 10, 2021, Endeavor Business Media had received 109 completed, qualified surveys.

Responsive Motivation

To encourage prompt response and increase the response rate overall, a live link to the survey was included in the email invitation to route respondents directly to the online survey.

The invitations and survey were branded with the T&D World and Utility Analytics Institute logos in an effort to capitalize on user affinity for these valued brands.

Each respondent was afforded the opportunity to enter a drawing for one of four $100 Amazon.com gift cards. On April 2, 2021, a third mailing was sent to non-respondents offering a $10 Starbucks card to all qualified respondents.

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