DTN

The Impact of Severe Weather on Utilities

CONTENTS

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Excutive summary

From atypical heat waves to wildfires, tornados, and flash floods, **severe weather events are increasing**. Since 2000, the U.S. has experienced a **staggering 67% increase** in major power outages from weather-related events.

Utility companies have always faced challenges from severe weather events. But as frequency increases, they face tough decisions on how to minimize and prevent outages. The industry is exploring multiple options, from hardening infrastructure to predictive technology.

With objectives to help prepare, allocate, and deploy resources effectively, these decisions must be weighed in consideration of costs, reliability, resiliency, regulatory measures, long-term investment, and public support.

A survey conducted by T&D World and Utility Analytics Institute – sponsored by DTN – identified several important weather-related trends within the industry. Unsurprisingly, given the impact of weather on utilities, all respondents have, at least, some capabilities in place to anticipate weather-related incidents.
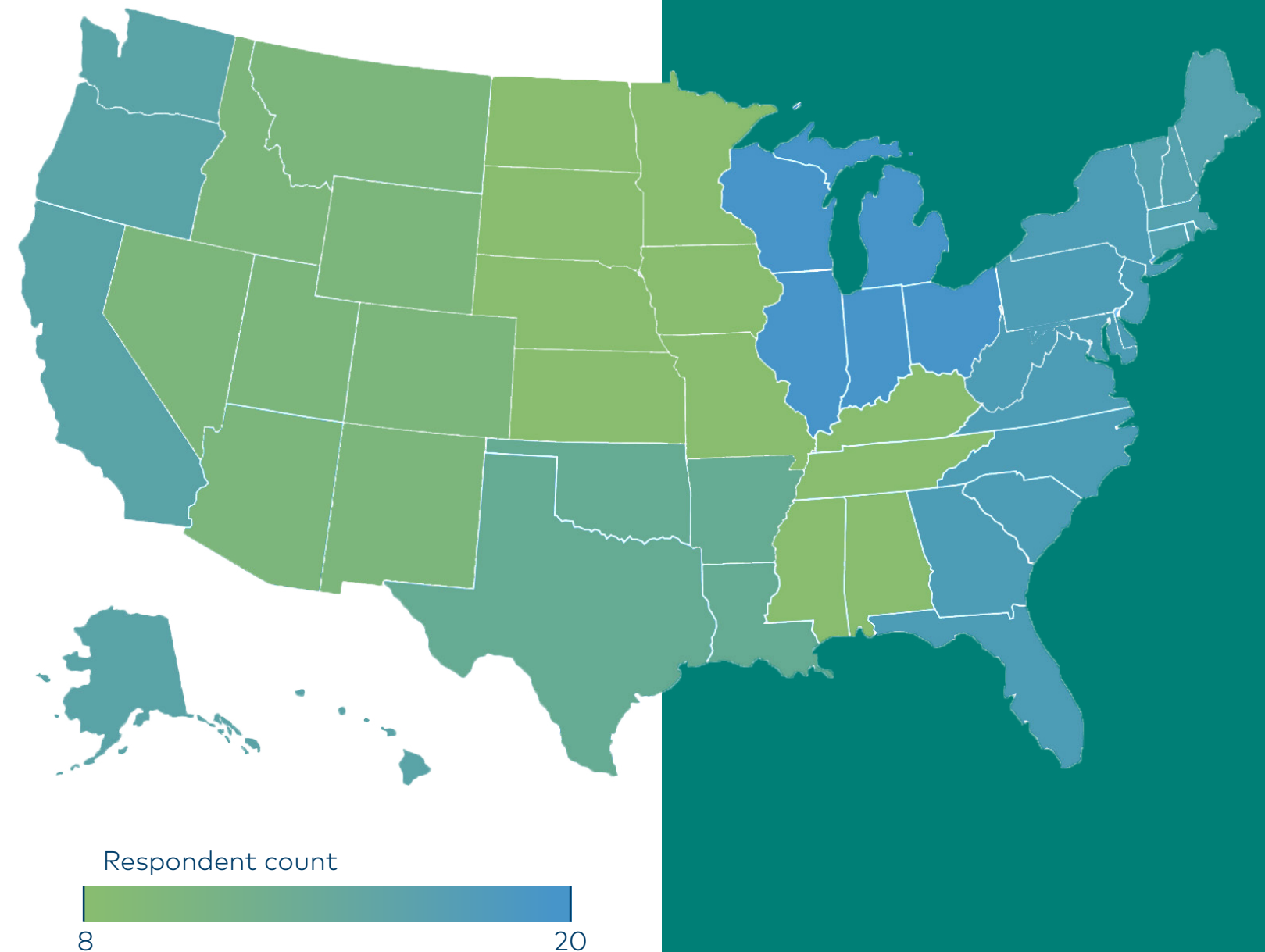
Respondent count

8   20

Warming up to Weather Predictive Technology

Likelihood to adopt technology solutions. Nearly three out of four utilities welcome technological solutions if they are easy to implement and use. Also, very important is recognizing cost savings, which is usually observed when a weather-event crisis is identified and warned and been reduced or averted.

- 74% Yes, if integration is simple
- 72% Yes, if technology is simple to use
- 69% Yes, if ROI is recognized

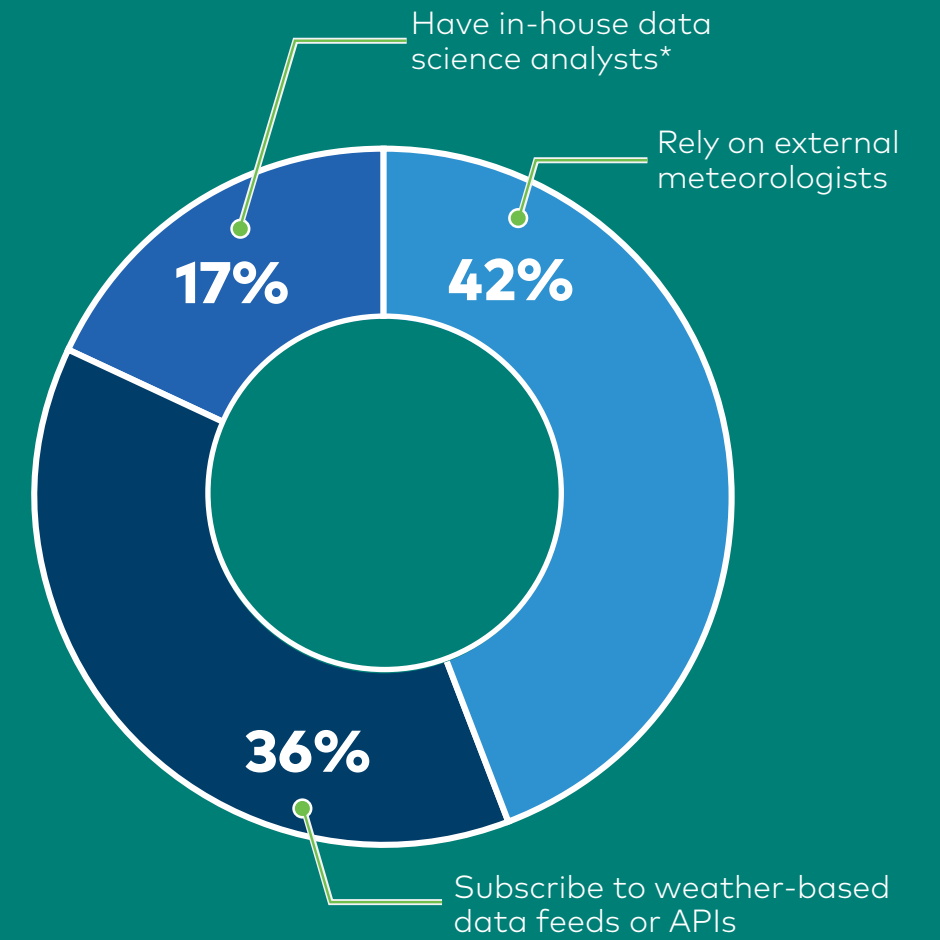## Benefits of weather prediction technology

There are practical advantages gained from predictive weather technology. Of those who had recently made technology investments.

- 62% reported reduced outage times
- 58% reported improved workforce/ resource deployments
- 58% reported increased restoration times

When asked about the unexpected benefits of technology investments, 39% reported improved customer satisfaction due to improved outcomes.

Most utilities have a long way to go. While investment in hardening programs continues to be a priority, there's an opportunity for utilities to enhance their preparedness for severe weather events through advanced weather technology, especially as artificial intelligence models improve predictive accuracy and reliability.

How Utilities Monitor Weather Events

Have in-house data science analysts*

Rely on external meteorologists

17%

42%

36%

Subscribe to weather-based data feeds or APIs

* Note: Of these, 72% are large utility companies, over 1M customers

Utility investments to meet regulatory requirements:
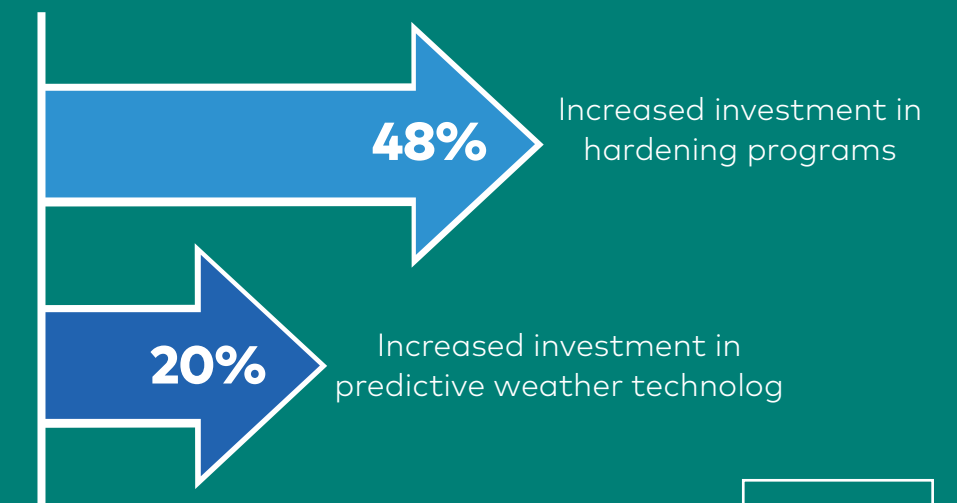
48% — Increased investment in hardening programs

20% — Increased investment in predictive weather technolog

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 prediction, it's not surprising that achieving a return on investment and managing costs are two of the most important considerations for utilities when making decisions on infrastructure and technology investments.
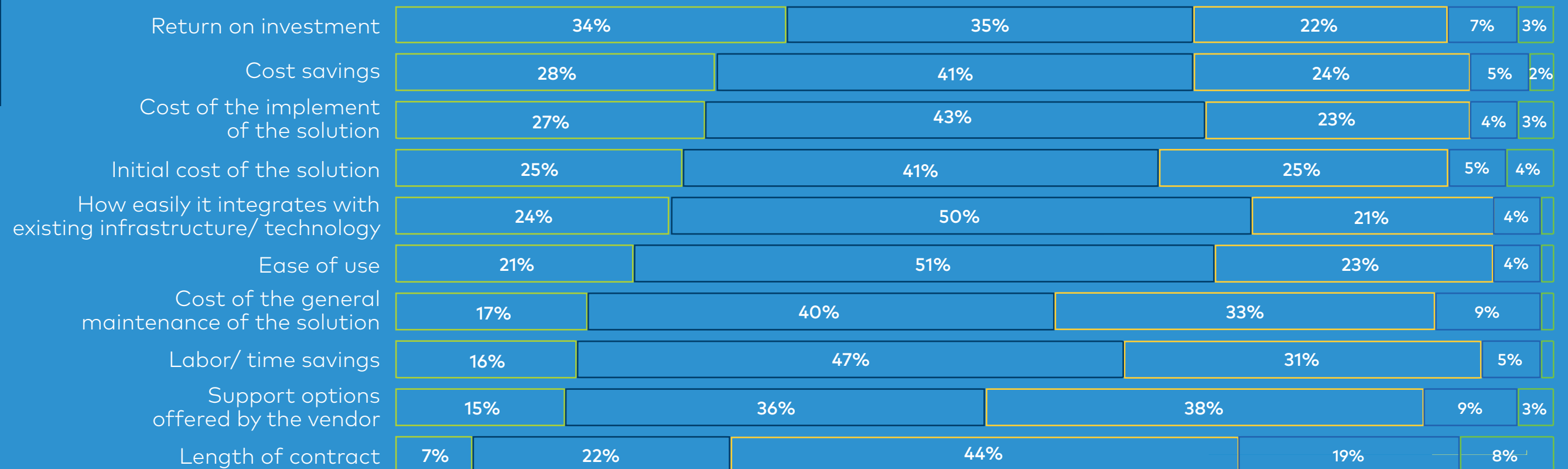
Utilities are highly conscious of the economic pressures facing their customers and must balance investments with reasonable rate increases.

Utilities also factor in implementation and ongoing maintenance costs, with 70% and 57% respectively rating this important to their decision process.

Overall technology and infrastructure investments that deliver cost-savings remain important to 69% of the utilities surveyed. Following suit, only 3% said ROI was not important at all.

When deciding to invest in your infrastructure/technology, how important are the following in making your decision?

Extremely important □ □ □ □ □ Not at all important

	Extremely important		Middle		Not at all important
Return on investment	34%	35%	22%	7%	3%
Cost savings	28%	41%	24%	5%	2%
Cost of the implement of the solution	27%	43%	23%	4%	3%
Initial cost of the solution	25%	41%	25%	5%	4%
How easily it integrates with existing infrastructure/ technology	24%	50%	21%	4%	
Ease of use	21%	51%	23%	4%	
Cost of the general maintenance of the solution	17%	40%	33%	9%	
Labor/ time savings	16%	47%	31%	5%	
Support options offered by the vendor	15%	36%	38%	9%	3%
Length of contract	7%	22%	44%	19%	8%

Investment in weather prediction technology increases customer satisfaction, more favorable media coverage

Among utilities that have installed technology to help with severe weather prediction or response, 39% reported increased customer satisfaction as an unexpected benefit: 51% from large utilities (more than 1M customers) and 49% from mid-sized and smaller utilities (fewer than 1M customers).

Regarding media coverage, one-third of utilities report that they received negative media attention in response to an outage, and 25% have received positive media coverage. For utilities whose customer satisfaction improved [after technology investments], 34% have enjoyed more positive coverage to outages within the last year.

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

39%
Increased
customer
satisfaction

26%
More favorable
news coverage of
your utility

19%
Improved relations
with regulators
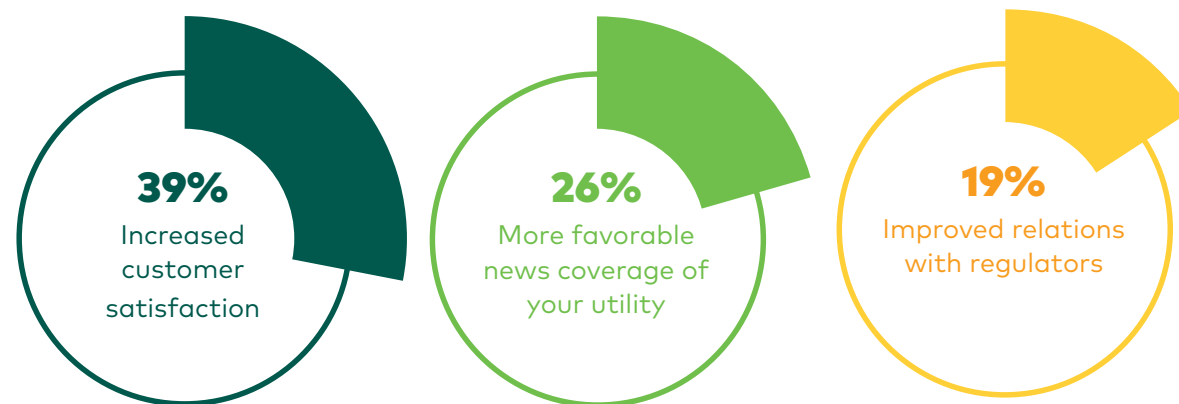
The utility sector favors resiliency over prediction capabilities

When power goes out, utilities want to restore it as quickly as possible. When faced with only two options – the ability to respond quickly or the ability to accurately predict outages – a fast response is favored two-to-one.

The reality is utilities are heavily influenced by regulatory commissions taking increased action because of service disruptions. The threat of fines and retaliatory actions has resulted in 39% shifting their investment efforts toward hardening. To illustrate this, 50% are in locations prone to severe weather and 50% are not, indicating that infrastructure hardening has been decidedly important regardless of severe weather likelihood.

Looking at the biggest benefits from a recent technology investment, 62% report reduced outage times, while 58% confirm improved workforce deployments and faster restoration times. Further, 42% report outage prevention as a benefit.
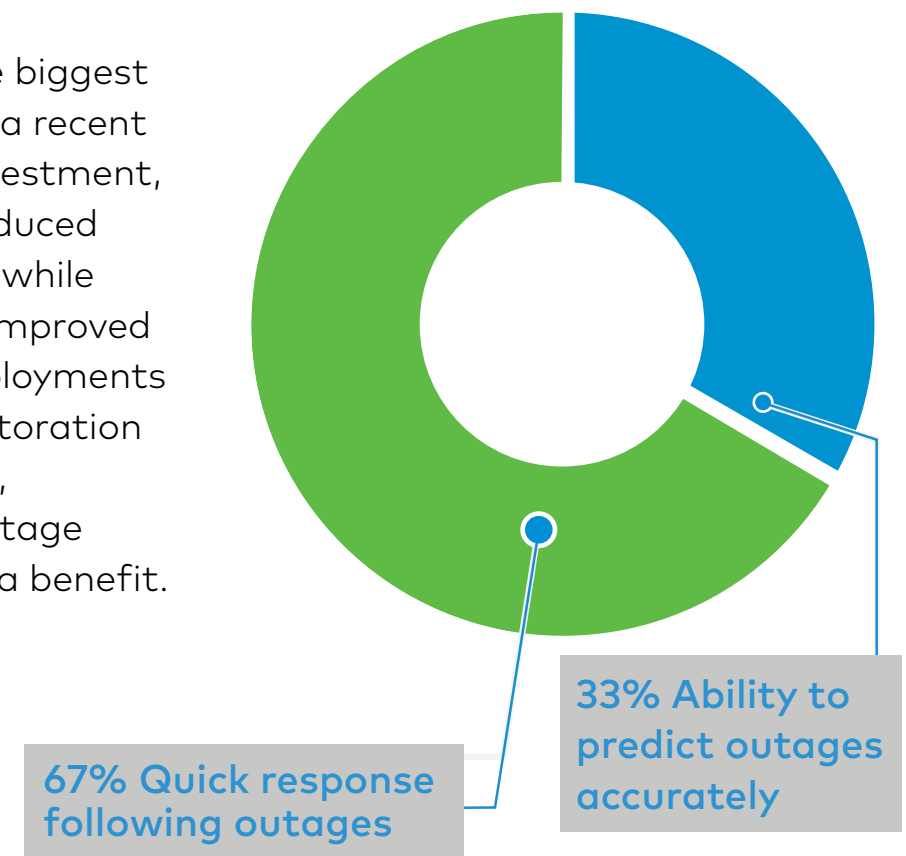
33% Ability to predict outages accurately

67% Quick response following outages

8

Public utility commissions drive response policies

Public utility commissions (PUCs) are driving new policies and regulations to direct how utilities respond to severe weather.

For example, the toll on life and property due to increases in wildfires has increased wildfire risk regulations. California's PUC introduced regulations designed to protect the public from potential fire hazards associated with powerline and aerial communication facilities. Similarly in Connecticut, regulations adopted in 2021 requires utilities to pay consumers following lengthy power outages.

Utilities are taking note and 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.

Of note, 64% surveyed have been neither financially penalized nor rewarded for performance reliability, and only 7% confirmed their utility had been penalized for performance reliability, suggesting that regulatory commissions prefer to work with utilities toward minimizing outages and disruptions, using penalties as a last resort.
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To meet regulatory requirements, has your organization:

Increased investment in infrastructure hardening — **48%**

Increased investment in weather prediction solutions — **20%**

Conducted an internal audit or review to determine the long-term impacts of extreme weather on infrastructure or service delivery — **24%**

Assessed current and future vulnerabilities to plan for how to mitigate the risks — **55%**

None of the above — **19%**

Weather predictive technology, a smart investment

Outages from severe weather, and exacerbated by aging assets, are increasingly difficult to manage. They're also more costly as expectations rise and regulatory scrutiny intensifies.

Utilities must ask regulators for a customer rate increase to justify new capital expenditures. Meanwhile, technology investments are considered operational and therefore must be absorbed.

Utilities have made multibillion-dollar investments and commitments to modify their infrastructure and rebuilding, replacing, and extending their distribution systems. These commitments create varying levels of concern for credit-rating agencies assessing a utility's ability to meet its debt obligations.

However, utilities can only pass costs onto consumers so many times, limiting the impact hardening [alone] can have on outage prevention. And those efforts still do not eliminate outages. As example, after completing much of its $3 billion grid-hardening program, Florida Power & Light Co. still suffered more than $1 billion in damages during Hurricane Irma in 2017.

Intelligent operational expense investments, like predictive weather technology, reduce the need to continue increasing hardening capital investments. Hardening programs can take decades, while predictive weather technology can be deployed almost immediately. Plus, utilities can deliver pricing stability while helping to improve outage prediction and resource planning.

Is your organization planning investments in infrastructure hardening this year?

49%

74%

Investments in hardening coming from large utilities

Yes. Planning investments in infrastructure hardening this year
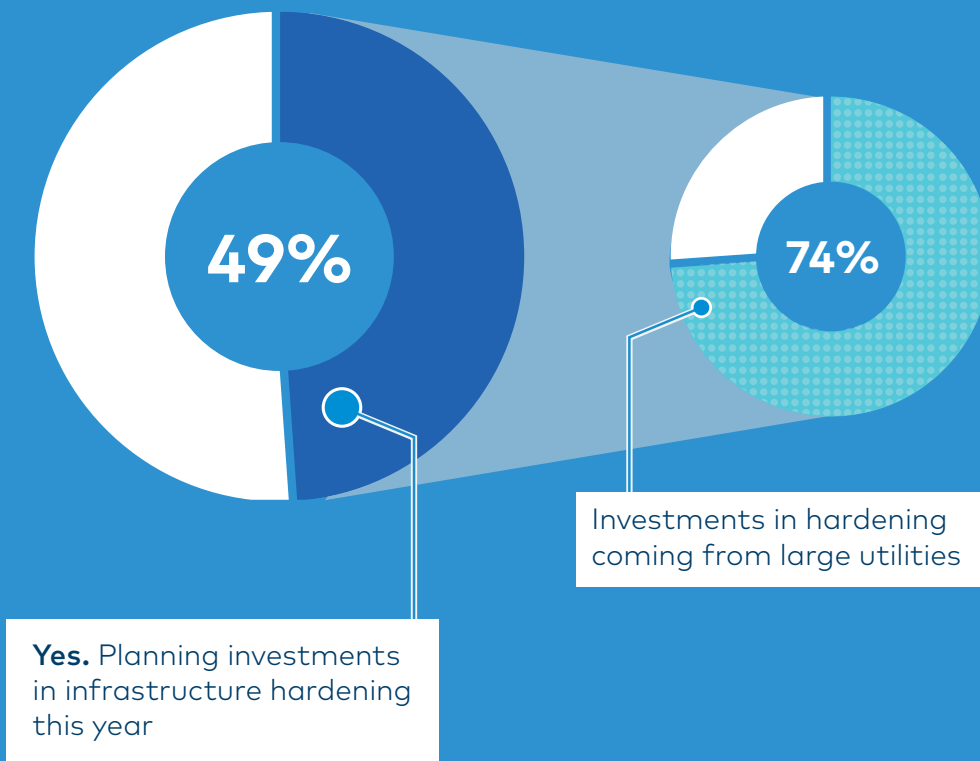
Challenging weather across the country

How weather challenges are playing out across the country

Across the United States, weather challenges differ. But one thing is clear: severe weather events are increasing. Draught intensified the 2022 wildfire season resulting in the highest fire intensity of the last 25 years. More than 28,000 wildfires burned over 1.9 million acres in the U.S., which is 112% above the average for the last 10 years. California recorded the most fires and acres burned in the U.S., with 6,473 fires and 365,140 acres, as well as 9 fatalities and 876 structures affected.

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.

In 2020 there was a record number of named storms across the Atlantic, with a record 12 storms making landfall in the continental United States.

Extreme weather, from wildfire, tornados, hurricanes, and snow/ice storms, is damaging an aging electrical grid. A major 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 previously not impacted by severe weather events have begun to see dynamic change as more 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, still adapting to the severity of wildfire

Wildfires are increasing in frequency, intensity, and season length. Once considered a four-month, high-alert season from July to October has become a year-round risk for western states.

Only 11% of West Coast utilities 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 increased intensity of fires will no doubt influence how media and consumers alike perceive utilities. However, if the trend for fire weather is now a year-round threat, affected utilities need to adapt.
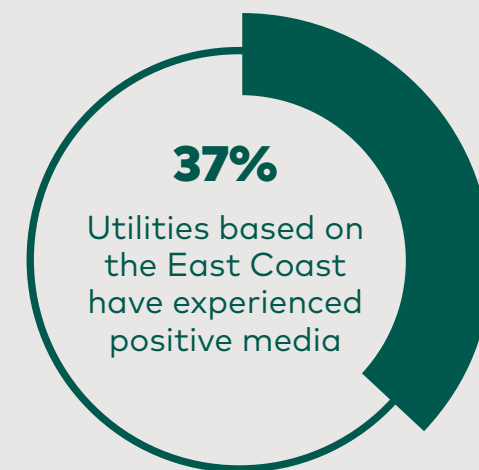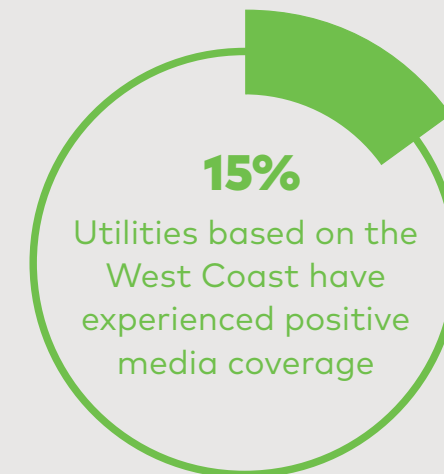
Hurricane-prone utilities, more prepared for severe weather

Hurricanes are an established phenomenon, meaning they have fewer unknowns compared to wildfires. Utilities on the East Coast are supported by additional safeguards, like suitable insurance policies and building regulations.
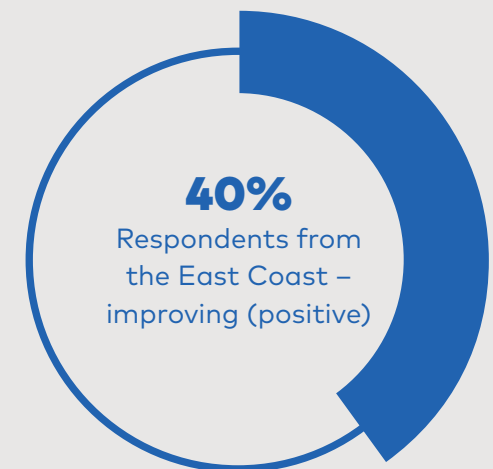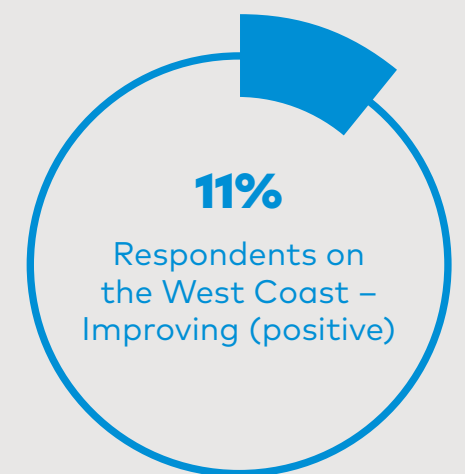
This trend is reflected with 86% of East Coast respondents reporting a reduction in outage times due to technology purchases to help with severe weather prediction or response. This figure is only 40% on the West Coast.

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

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

15%
Utilities based on the West Coast have experienced positive media coverage

37%
Utilities based on the East Coast have experienced positive media

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

11%
Respondents on the West Coast – Improving (positive)

40%
Respondents from the East Coast – improving (positive)

30%
All respondents – improving (positive)

Hardening vs. prediction

Switching to an integrated mindset

While nearly half of responding organizations chose to invest in traditional hardening solutions, compared with only 20% in weather-prediction solutions, this needn't be an "either/or" choice—especially when technology continues to improve outage and resource planning, which helps to reduce response times.

The industry is maturing towards more proactive measures. And with the addition of predictive weather technology, utilities jump from two tools in their toolbox (response + hardening) to three (response + hardening + prediction). Proactive and progressive utilities are choosing hardening and prediction.

Most have multiple capabilities to anticipate weather-related incidents. The most-reported capability is an external meteorologist (42%); next is having forecast data feeds or APIs (36%).
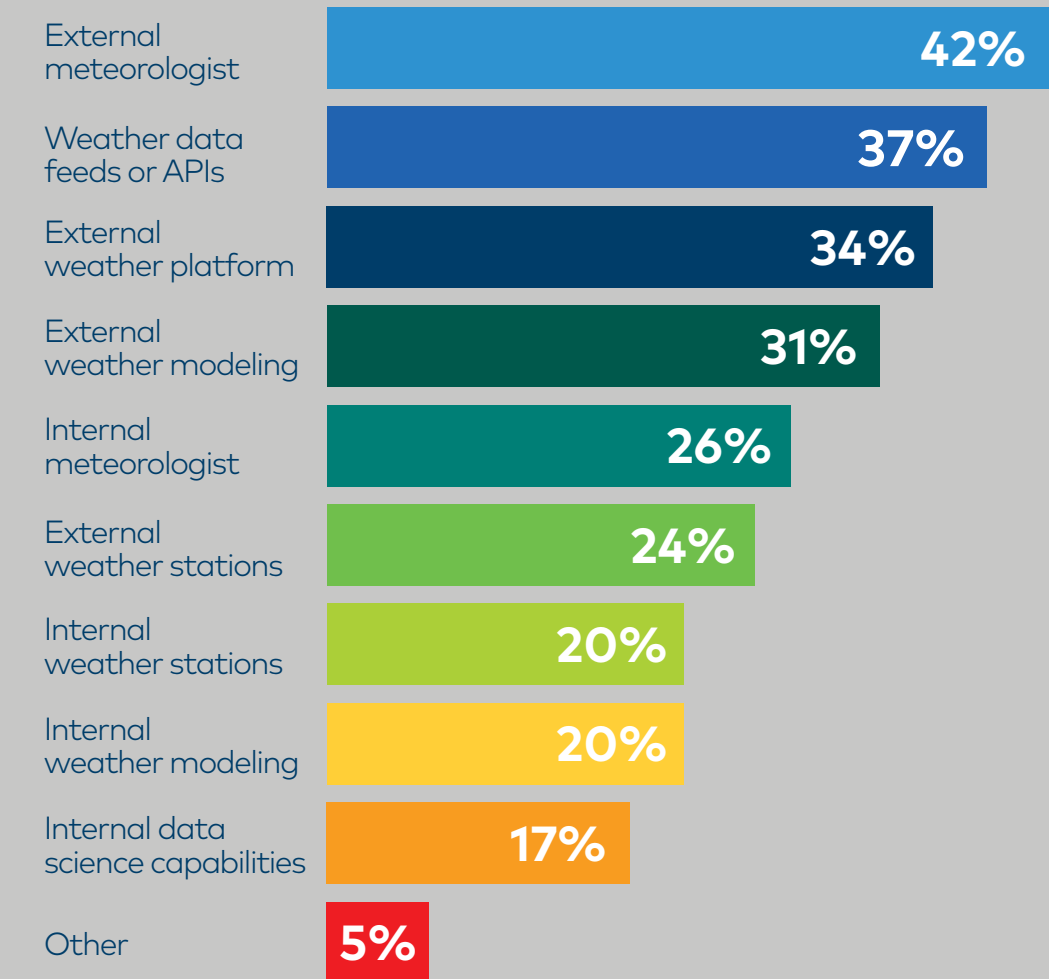
However, only 17% indicate data science capabilities in-house (i.e. data-based machine learning or artificial intelligence). With relatively low adoption, any breakdown of statistics should only be considered indicative rather than conclusive.

So, as we peel back the 17% with in-house data science capabilities, 72% of those are large utilities with over 1M customers. This indicates that larger organizations are more likely to budget for advanced capabilities, recognizing data science as an emerging technology will pay dividends.

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 allows for advanced planning for out-of-area resources to assist. It enables utilities to track storms in real-time, so they can stage crews at the right time and place to respond. Predictive technology also helps uncover whether an event is intensifying or subsiding.

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

Capability	Percentage
External meteorologist	42%
Weather data feeds or APIs	37%
External weather platform	34%
External weather modeling	31%
Internal meteorologist	26%
External weather stations	24%
Internal weather stations	20%
Internal weather modeling	20%
Internal data science capabilities	17%
Other	5%

Understanding organizational weather maturity

The DTN Weather Maturity Curve classifies organizations by its current technological stage in adopting the use of weather data and metric insights, assessing organizations' understanding, influence, and usage of weather data in decision-making, types and sources of tools, data used, and the recognition of weather's influence on business performance.

The five-stage Maturity Curve encompasses all phases organizations may pass through on the journey toward weather maturity.
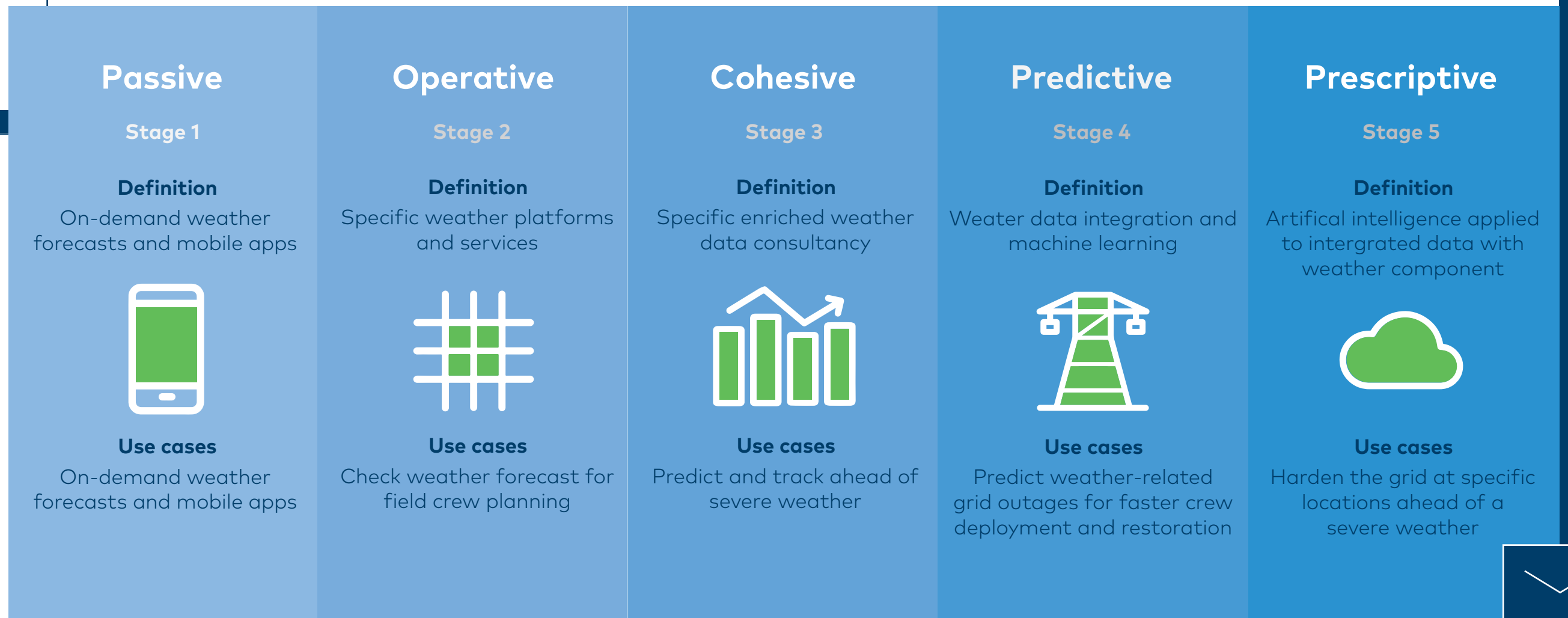
Organizations may have capabilities crisscrossing one (or more) stages.

Among respondents, 85% have still capabilities rated at Stage 2 (see chart below), indicating their technology enables them to check weather forecasts to support hardening initiatives and inform resource planning.

Four in ten are in Stage 3 or higher on the Maturity Curve, which means they can forecast and track severe weather trajectory and deduce from basic impact predictions.

While less than one in five (17%) have Stage 4 capabilities that integrates weather data and insight capabilities to unlock advanced impact prediction. These organizations use data models to predict weather-related grid outages for faster deployments.

While no organization has achieved Stage 5 yet, it offers an idealistic destination that unlocks AI-driven response prediction, planning efforts, and infrastructure hardening.

Passive	Operative	Cohesive	Predictive	Prescriptive
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Definition On-demand weather forecasts and mobile apps	**Definition** Specific weather platforms and services	**Definition** Specific enriched weather data consultancy	**Definition** Weater data integration and machine learning	**Definition** Artifical intelligence applied to intergrated data with weather component
Use cases On-demand weather forecasts and mobile apps	**Use cases** Check weather forecast for field crew planning	**Use cases** Predict and track ahead of severe weather	**Use cases** Predict weather-related grid outages for faster crew deployment and restoration	**Use cases** Harden the grid at specific locations ahead of a severe weather

16

The customer benefits of weather technology

The customer benefits of weather technology

Modern utilities rely on reputation to grow the business. Word of mouth recommendations, online reviews, and testimonial feedback are essential for thriving, healthy organizations to grow customers and revenues.

Consumers expect their electric utilities to keep the power on — for a fair price. A major contributor in how utilities are judged is how much time it takes to restore power after an outage.

Of all respondents, 39% reported improved customer satisfaction as an unexpected benefit from adding a technology solution to help predict severe weather, and nearly an even split between large and small utilities, 52% and 48% respectively.
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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%

Collaborating on technology purchase decisions

Collaborating on technology purchase decisions

Peer collaboration and other utilities' experiences are influential in technology decisions. As a traditionally non-competitive industry, U.S. utilities can benefit from cooperating with each other to advise and assist in exploratory inquiries.

Survey respondents agree the collaborative approach is welcomed with 55% "agreeing or strongly agreeing" they are more likely to make technology investments when a peer utility reports a positive experience.

Likewise, 58% agree or strongly agree they are less likely to make a technology investment if they learn that a peer utility has had a negative experience [with the investment].
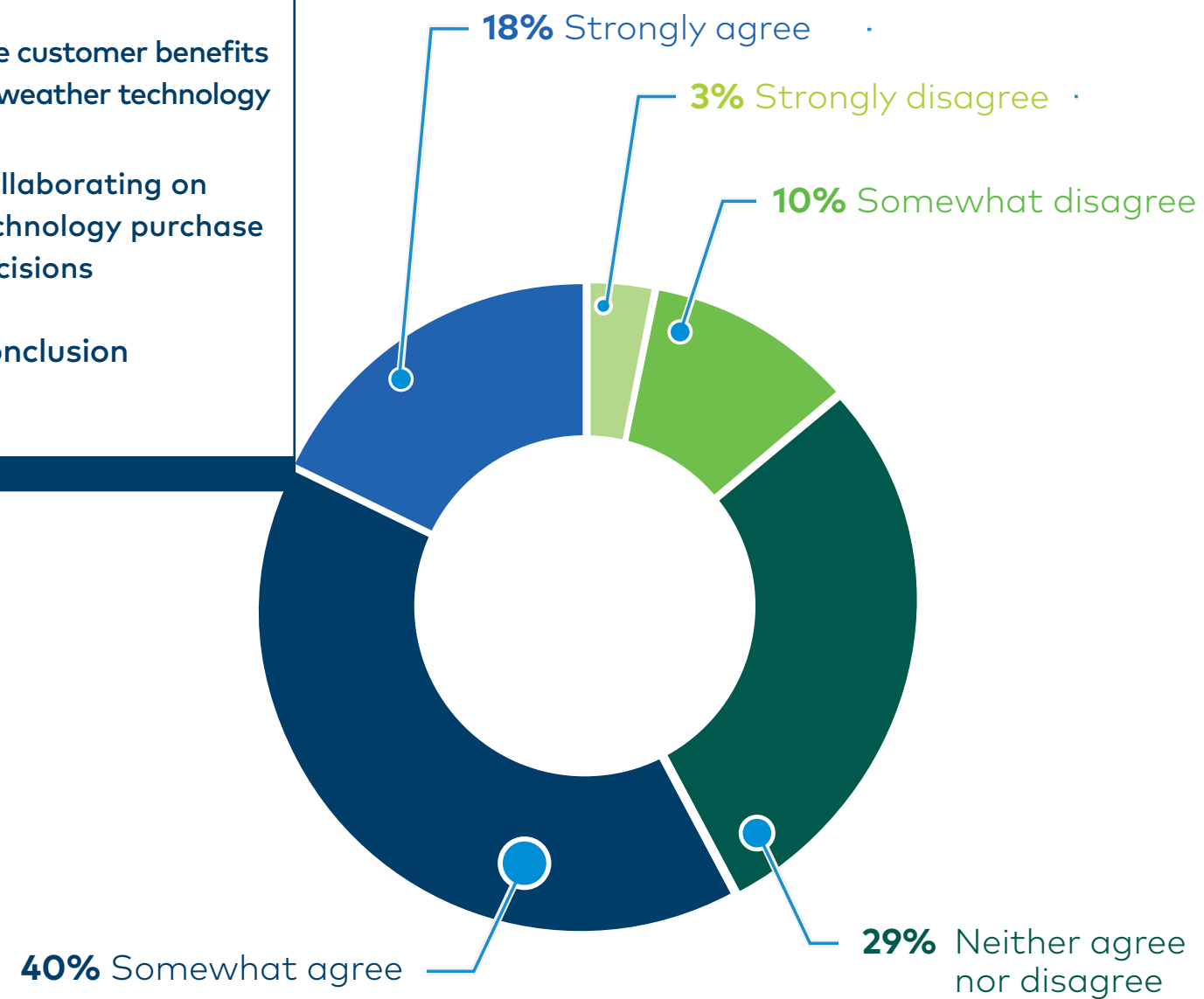
Through conferences and industry learning events, members of differing organizations network and form industry relationships. Utilities of all sizes gave comparable answers on their willingness to make investments when a peer has a positive outcome or results from a technology solution.

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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.

18% Strongly agree

3% Strongly disagree

10% Somewhat disagree

40% Somewhat agree
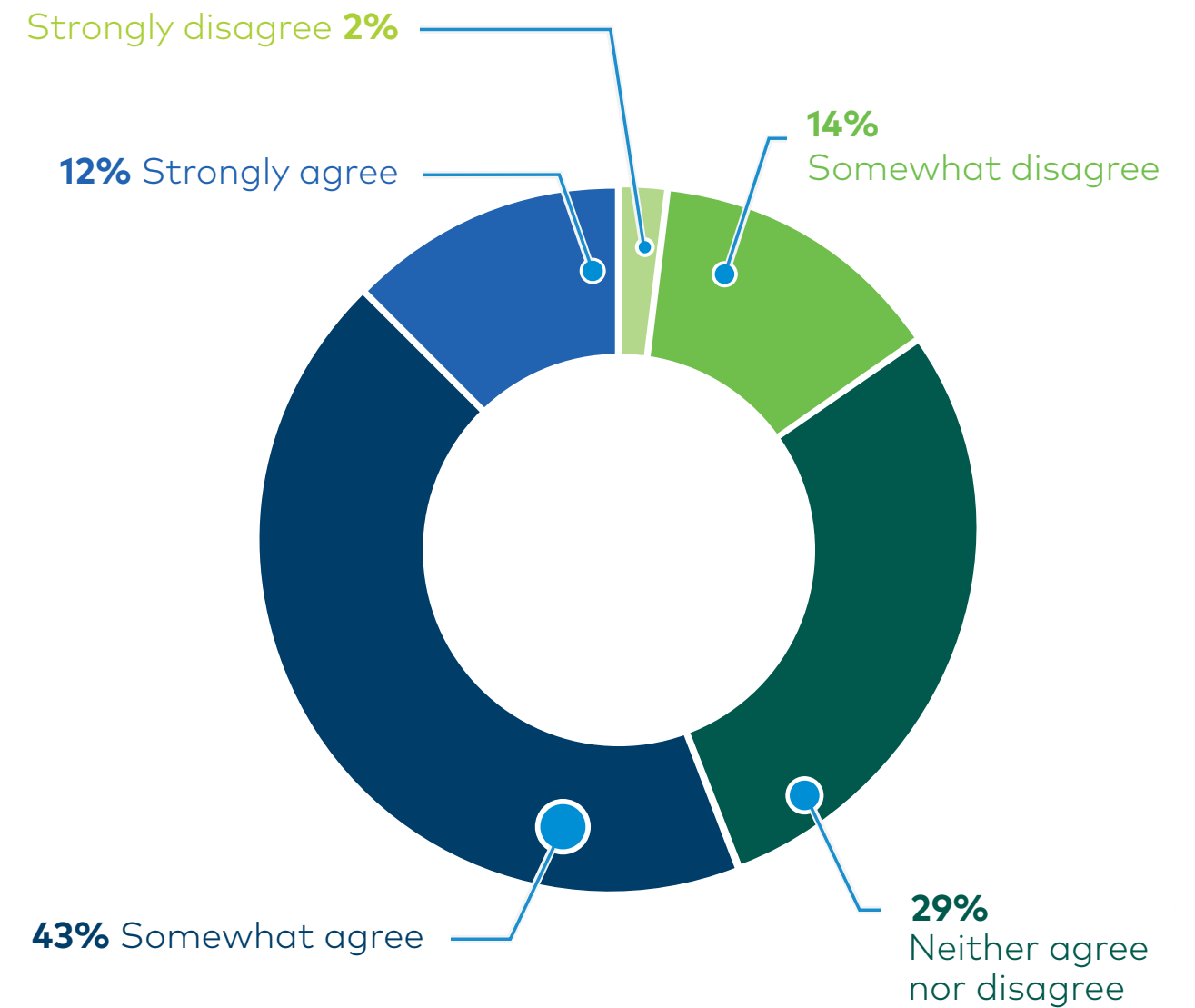
29% Neither agree nor disagree

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.

Strongly disagree **2%**

14% Somewhat disagree

12% Strongly agree

43% Somewhat agree

29% Neither agree nor disagree

Conclusion

Conclusion

As weather volatility continues to increase across all regions of the U.S., utility companies that focus on being weather-ready will be better equipped to meet regulatory requirements, provide a high level of service for their communities, and protect their profitability.

Survey responses prove investment in hardening programs continues to be a priority. Meanwhile, opportunities exist for utilities to enhance and improve their preparedness for severe weather events through advanced weather technology.

Advances in predictive weather models and data analytics enable utilities to forecast conditions, but also to anticipate outages and potential damage to infrastructure. These insights can significantly inform preparedness plans or even prevent the outages altogether.

Technology allows utility companies to have the right resources in the right place, to restore service fast following an outage.

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 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.

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