Itron

2019 EDITION

DISASTER PREPAREDNESS

AN ITRON RESOURCEFULNESS INSIGHT REPORT

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2019 EDITION

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CEO PERSPECTIVE

THE BIGGEST DISASTER WOULD BE FAILING TO PREPARE

Welcome to the *2019 Itron® Resourcefulness Insight Report*, the latest installment in the *Itron® Resourcefulness Report* series. Seven years ago, Itron began commissioning independent research to gain clear and timely insights into the thoughts of utility executives and consumers around the management of energy and water.

In reviewing the survey responses from our 2018 report, we noticed that just over half (57%) of utility executives surveyed responded that they were "very" or "extremely" equipped to recover from man-made or natural disasters.[1] While at first that seemed reassuring, we began to wonder: What about the other 43%? Why don't they feel prepared? What are they lacking?

Unfortunately, this topic could not be more timely. In parallel with the survey responses to last year's questions, entire regions of the United States were struggling to recover from hurricanes Harvey, Irma, and Maria—as well as the catastrophic wildfires in Northern California. If ever there was a year for natural disasters, it seemed as though 2017 was it.

That is, until 2018 arrived, when the United States alone experienced 14 separate billion-dollar disasters.[2] And that's not counting cyberattacks on utilities—an emerging and increasingly serious threat to continuity of service.

In this year's report, we decided to take a closer look at how technology assists in disaster preparation, response and recovery from the perspective of both consumers and utility executives in the United States.

The results are summarized in the following *2019 Itron Resourcefulness Insight Report*. This report includes a summary of innovative technology that can help any utility "keep the lights on and the water flowing."

By no means is this report intended to be the final word on the subject of disaster preparedness, response, and recovery. Instead, please consider it a down-payment towards modernizing your own plans and procedures. We hope you'll find information that can help you identify cutting-edge technologies or planning concepts you may wish to implement to ensure that, should the next disaster hit, damage and disruption are as minimal and as time-bound as possible.

Unfortunately, disasters are inevitable. And they appear to be happening with greater frequency and intensity. As a community of energy and water providers, we have no choice but to prepare for what is coming. The consequences are too great not to.

Sincerely,

Tom Deitrich

President and CEO, Itron

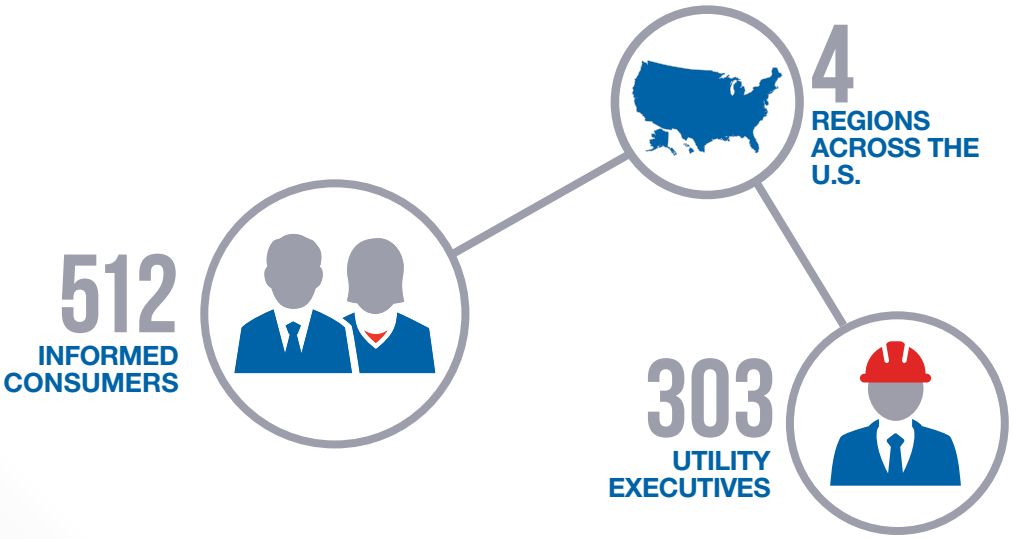
1 2018 Itron Resourcefulness Report
2 NOAA

ABOUT THIS STUDY

This report spotlights concerns about disaster preparedness that surfaced in the survey results from the 2018 Itron Resourcefulness Report. Inspired by those original findings, Itron commissioned additional research to explore the topic further.

The report consolidates perceptions of consumers and utility executives on an array of topics relating to disaster preparation, response and recovery. A total of 815 online surveys were completed by 512 consumers and 303 utility executives in July of 2019.

- **Utility executive respondents** were mid-level managers or higher who have input on decision making for energy and water utilities representing every region of the United States. Their areas of responsibility ranged from sales and operations to strategic planning, customer service and administration.
- **Consumer respondents** who completed this survey are responsible for paying for utilities in their household. All are representative of U.S. census demographics across gender, age and geography. They represent all regions of the United States.



The results of these surveys provide a unique view of disaster preparedness, response and recovery, and what it means to stakeholders throughout the United States at a time when disasters are increasingly costly and frequent.

EXECUTIVE
SUMMARY

EXECUTIVE SUMMARY

This report looks at how technology assists in disaster preparation, response and recovery from the perspective of 512 consumers and 303 utility executives in the United States. It is intended to serve as a starting place for utilities looking to modernize their own plans and procedures.

HOW UTILITIES AND CONSUMERS VIEW A GROWING PROBLEM

Disasters are deadly and costly—and happening more often. Hurricanes, floods, tornadoes, drought, wildfires and other natural disasters are becoming more frequent, intense and costly. Since 1970, the number of natural disasters worldwide has more than quadrupled to around 400 a year, causing nearly $1 trillion of economic losses in the United States alone. Meanwhile, millions of times a day, utilities across the United States fend off cyberattacks. For utilities, the consequences of these events can range from service disruption to massive fines and bankruptcy.

Worries about disasters are growing. Most utility executives and consumers are more worried about a disaster hitting them today than five years ago. 53% of utility executives say they are very or extremely concerned about the likelihood of a disaster in the next five years, compared to just 40% of consumers. Top concerns vary by region, with earthquakes a key concern in the West and flooding topping the list in the Northeast.

By a nearly two-to-one margin, older consumers are less concerned about disasters than younger consumers. Younger consumers tie the increase in weather-related disasters to climate change. Cyberattacks are the top concern among utility executives overall.

Most people have lived through some kind of disaster, with 87% of consumers saying they've been impacted by one in the last five years. Yet while three out of four utility executives say they're prepared for the next disaster, only one in three consumers agrees.

UNDERSTANDING THE DISASTER PREPAREDNESS LIFECYCLE

In the face of uncertainty, resilience is everything. A resilient power grid or water distribution system can mean the difference between a brief outage and a lasting, catastrophic failure.

Because disaster planning is an ongoing event, it requires a self-reinforcing lifecycle. The three key stages of disaster management—*prepare*, *respond* and *recover*—make up a continuous cycle. The stages exist as parts of a whole, and several share common technologies and processes.

PREPARE

Utilities believe they're preparing consumers for disasters, but consumers disagree. 82% of utilities have distributed educational resources to help consumers prepare for disaster. Yet four out of 10 consumers say they have not received any such materials, and only 26% feel very or extremely prepared for future disasters. It's apparent that utilities must do better to connect with consumers at the moment they're thinking about disasters.

EXECUTIVE SUMMARY

Utilities have deployed smart technology to protect infrastructure and improve grid awareness, but they still want more. Priorities are the same for past and future investments, with smart metering and monitoring systems, leak detection technologies and remove service disconnect leading the pack. Options for future investments include a growing array of monitoring, sensing, and simulation and analysis solutions.

Preparation is the key to keeping a step ahead of cyberattacks. The No. 1 concern among execs overall, cyberattacks represent a looming threat. Best practices to reduce the likelihood or impact of exploits include creating a security culture, conducting regular self-assessments, timely reporting of breaches, keeping a ransomware checklist and investing in military-grade security.

RESPOND

Remotely detecting damage and outage severity can accelerate response times. Rather than sending crews out to "drive the lines" to discover problems, utilities can use remote disconnect devices and line and fault sensors to acquire much-needed intelligence and send repair crews with the equipment needed to restore service quickly.

Faster response times lead to more rapid recovery. Options for future technology investments include solutions that improve visibility into the status of networks and devices, and strengthen communication with customers. Priorities stated by utility executives reflect this reality, with real-world examples showing that faster recovery can save millions in operational costs.

RECOVER

Rapid recovery requires modern tools. How promptly a utility manages to recover from a disaster often defines how customers view the utility's brand and reputation. Utility exec priorities for future investment match those they've already deployed, with outage restoration and advanced metering infrastructure solutions leading the list.

Most technologies used for recovery are flexible—and foundational. While some tech solutions that play a role in disaster recovery are specifically designed for it, the majority are the same technologies that utilities use to run their energy and water distribution business from one day to the next.

WHAT TO DO NEXT

Prioritizing investments for hardening systems isn't always easy—but it's critical. Utility executives cite the difficulty of prioritizing investments as their primary barrier to acquiring new disaster preparedness technology.

Here are a few suggestions:

1. Identify likely hazards.
2. Assess your vulnerabilities.
3. Calculate outage impacts.
4. Determine steps you can take now.
5. Assess where future investments are needed.
6. To help justify investments to state regulators and consumers, consider technologies that pay dividends year-round.

INTRODUCTION

Assessing the Impact of Catastrophes

Since **1970**, the number of disasters worldwide **has more than quadrupled**

Disasters are deadly and costly—and happening more often.

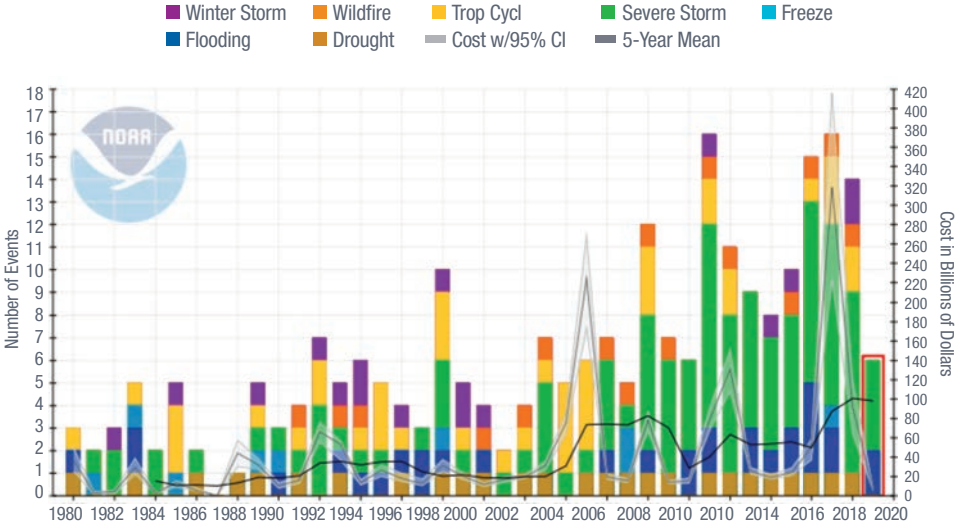
It may come as a relief for people living along the Gulf Coast to learn that they will never see another Hurricane Harvey.

That sense of calm, however, isn't likely to last. It's true there never will be another Hurricane Harvey, but only because the record-setting Category 4 storm that pummeled the Gulf Coast in 2017 was so relentless (it made five landfalls and raged for two weeks) and so costly ($125 billion[3]) that forecasters have retired "Harvey" as a storm name forever.

The next hurricane to hit the Gulf Coast may be even worse. It just won't be named Harvey.

Natural disasters—from hurricanes, floods and tornadoes to drought and wildfires—are becoming more frequent, intense and costly. Since 1970, the number of disasters worldwide has more than quadrupled to around 400 a year[4] , according to the United Nations.

Billion-Dollar Disaster Event Types by Year (CPI-Adjusted)[5]



Number of events as of July 9, 2019

3 National Hurricane Center, Costliest tropical cyclones tables updated, Jan. 26, 2018
4 https://www.economist.com/graphic-detail/2017/08/29/weather-related-disasters-are-increasing
5 NOAA https://www.ncdc.noaa.gov/billions/time-series

Assessing the Impact of Catastrophes

From 1998 to 2017, **natural disasters** around the world have **killed 1.3 million people**

In the United States, the increasing frequency and cost of these disasters is readily apparent in data compiled by the National Oceanic and Atmospheric Administration (NOAA), which tracks billion-dollar disaster events. This isn't a complete picture of the rising tide of devastation (a wildfire causing $790 million in economic losses, for instance, wouldn't even make NOAA's billion-dollar list), but it bears out what scientists, civic leaders, utility executives and citizens have all recognized as a troubling pattern.

In the U.S., nearly $1 trillion in losses

And troubling it is. From 1998 to 2017, natural disasters around the world have killed 1.3 million people and left another 4.4 billion injured, homeless, displaced or in need of emergency assistance.[6] During that time, natural disasters caused more than $2.9 trillion in direct economic losses (nearly $1 trillion in the United States alone).

For utilities, the consequences of these events can range from a few hours or days of interrupted service to something far more lasting. The historic 2017 wildfires in Northern California triggered capital and liability costs so massive that Pacific Gas & Electric, the state's largest utility, was forced into bankruptcy.[7]

Cyberattacks join the landscape

Millions of times a day, utilities across the United States are subjected to hacking attempts, denial of service (DOS) attacks, and other cyber threats.[8] And though attempted attacks are increasingly common (bad actors, including state-backed hacking groups, often infiltrate utility systems via contractors and subcontractors[9]), it wasn't until March of 2019 that one of these attacks disrupted service in a U.S. utility. Fortunately, no blackouts occurred, and the most likely impact was a lack of visibility into operations.[10]

One of the most insidious—and rapidly growing—forms of cyberthreats involves ransomware, which shuts down computing systems until attackers are paid a ransom, usually in cybercurrency to make the transaction difficult to trace. Intelligence agencies say ransomware attacks in particular are often sponsored by hostile nation-states.[11] Recent attacks on major cities have earned headlines, with an attack on the Fort Collins-Loveland Water District in Colorado prompting utility execs to call in the FBI.[12] But attacks on managed services providers (outfits that serve smaller cities and utilities who can't afford robust IT security defenses) worry experts that one or two infiltrations could impact dozens, even hundreds of utilities.[13]

None of this is lost on utility executives. In the survey for this report, cyberattacks emerged as the disaster executives are most worried about. The question is: What can they do about it? (See sidebar on the following pages.)

6 Economic Losses, Poverty & Disasters, Centre for Research on the Epidemiology of Disasters (CRED), United Nations Office of Disaster Risk Reduction, 2018.
7 A PG&E bankruptcy timeline: The road to Chapter 11 and beyond, UtilityDive, June 11, 2019
8 Experts assess damage after first cyberattack on U.S. grid, E&D News, May 6, 2019
9 Reported Cyber Attacks on U.S. Utilities and Government Agencies, Hunton Andrews Kurth Privacy & Information Security Law Blog, Jan. 23, 2019
10 E&D News, May 6, 2019
11 Krebs: Companies need 'military-grade' investments to defend against foreign government hackers, Cyberscoop, June 27, 2018
12 Hackers force water utilities to sink or swim, E&E News, March 28, 2019
13 Texas ransomware attacks show big gaps in cyber defenses—expect more like them, CNBC.com, Aug. 22, 2019

UTILITY EXECUTIVES ARE WORRIED ABOUT CYBERATTACKS. BUT WHAT CAN THEY DO?

Here's the quandary for utility executives when it comes to cybersecurity: You have to be right 100% of the time, but the hacker only has to be right once. No wonder 50% of executives surveyed say they are more worried about cyberattacks than any other type of disaster—more than earthquakes, severe winds, floods. Anything.

So how do you ensure that you're right 100% of the time—or just enough of the time?

STAYING AHEAD OF A MOVING TARGET

Since cyberthreats are constantly evolving, the key to keeping one step ahead is staying prepared. An array of government agencies, industry groups and security experts have published guidance that utilities will find helpful.

Create a security culture. Consolidated Edison, which serves some 3.4 million customers in the New York City area, has created a dedicated security team aimed at helping every employee understand the importance of following security best practices. "It's important to create a culture of awareness and vigilance throughout the entire company, not just with the cyber experts," notes Allan Drury, a spokesman for ConEd.[14] For instance, teaching employees not to click on hyperlinks or images embedded in emails is an inexpensive and highly effective way to prevent malware and infiltrations.

Engage in annual self-assessment. The Edison Electric Institute, through its Culture of Security Initiative, offers its members an annual Self-Assessment Tool to assess weak points and areas for improvement and investment.[15]

Plug into Fusion Centers. With guidance and national-level coordination from the Department of Homeland Security (DHS), state- and locally-controlled fusion centers throughout the nation collect, analyze and disseminate threat intelligence to critical infrastructure stakeholders.[16]

Join the Cyber Mutual Assistance (CMA) Program. Established by the Electricity Subsector Coordinating Council (ESCC), CMA creates a framework for mutual assistance across a voluntary network of electricity and gas utilities to achieve a resilient critical infrastructure.[17]

14 5 ways the utility industry can mitigate cyber incidents, Utility Dive, May 21, 2018
15 Cultivating a Culture of Security, EEI.org, August 2019
16 Department of Homeland Security, Fusion Centers and RISS Centers
17 The ESCC's Cyber Mutual Assistance Program, Electricity Subsector Coordinating Council, January 2018

UTILITY EXECUTIVES ARE WORRIED ABOUT CYBERATTACKS. BUT WHAT CAN THEY DO?

Report attacks. In 2018, the Federal Energy Regulatory Commission (FERC) issued new rules that utilities must report any attack that could make it easier to "harm reliable operation of the nation's bulk energy system"—not just attacks that result in actual compromises or disruptions.[18]

Get the ESCC's ransomware preparedness checklist. In 2017, the ESCC published a list of precautions every utility should be taking to minimize the impact of ransomware. Find it at www.eei.org

Invest in military-grade security. Security experts at DHS are advising organizations that supply the nation's critical infrastructure to make a "military-grade level of investment" to defend against the most sophisticated hacking and ransomware attacks. Military-grade security, in part, means AES encryption. But don't stop there. Look for solutions that take a "defense in depth" approach with security built into every layer of your infrastructure. Protections should extend from devices in the field to Wide Area Networks and Neighborhood Area Networks, and finally to enterprise and customer data.

Hone your response procedures by participating in GridEx. Every two years, the North American Electric Reliability Corporation (NERC) hosts a simulated, large-scale attack on the North American electricity grid. GridEx offers utilities an opportunity to run their incident response protocols, learn new best practices and engage senior leadership as they experience a worst-case-scenario involving both cyber and physical security breaches. And because it focuses on response, GridEx is one of the best ways to hone procedures utilities may have to rely on when the attack isn't just a drill. Hundreds of utilities participated in GridEx V in 2017.Thousands more could join them.[19]

18 Utilities will have stricter cybersecurity reporting requirements under new ruling, Cyberscoop, July 19, 2018
19 This is a test: How NERC plans to up the stakes for this year's GridEx disaster exercise, Utility Dive, Nov. 13, 2017.

A Growing Concern

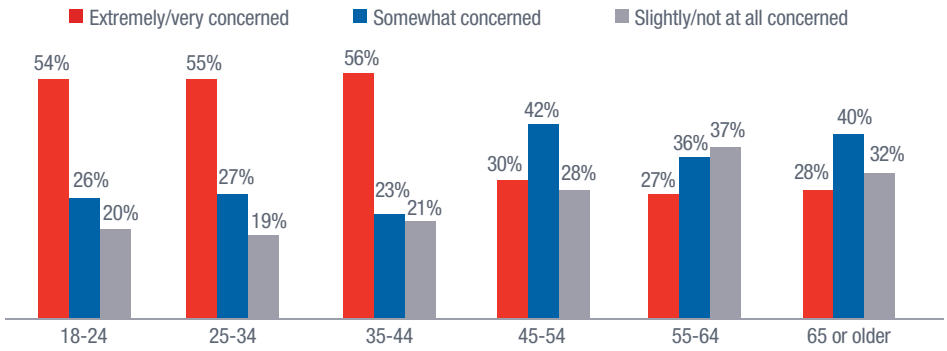
69% of utility executives and **55%** of consumers are **more worried about a disaster** hitting them **today** than 5 years ago.

Most utility executives are worried about disasters.

The frequency and intensity of recent disasters appear to be making an impression on utility executives. Most (53%) say they are very or extremely concerned about the likelihood of a disaster in the next five years, while just 40% of consumers are as concerned. (Of course, utilities are responsible for keeping critical infrastructure operating and consumers aren't—this may help explain the differing results.)

Meanwhile, both groups are more worried about disasters today than they were five years ago, though they're worried about different things. Consumers are primarily worried about high winds from hurricanes and tornadoes, extreme temperatures and flooding. Utility executives are mostly concerned about cyberattacks and earthquakes—perhaps because unlike most weather systems, these threats are virtually impossible to forecast.

How concerned are you about likelihood of a disaster?



WHAT, WE WORRY?

Older consumers are less worried about future disasters.

By a nearly two-to-one margin, older consumers are less concerned about disasters than younger consumers. In fact, among consumers older than 45, nearly one-third are only slightly or even not at all concerned about the likelihood of a disaster.

Do disaster-related concerns correlate with beliefs about climate change? Among those 25-34 years old, 79% believe the increase in weather-related disasters is a result of climate change, suggesting a sense of urgency among young consumers that isn't felt quite as intensely in their older counterparts.

Different Regions, Different Risks

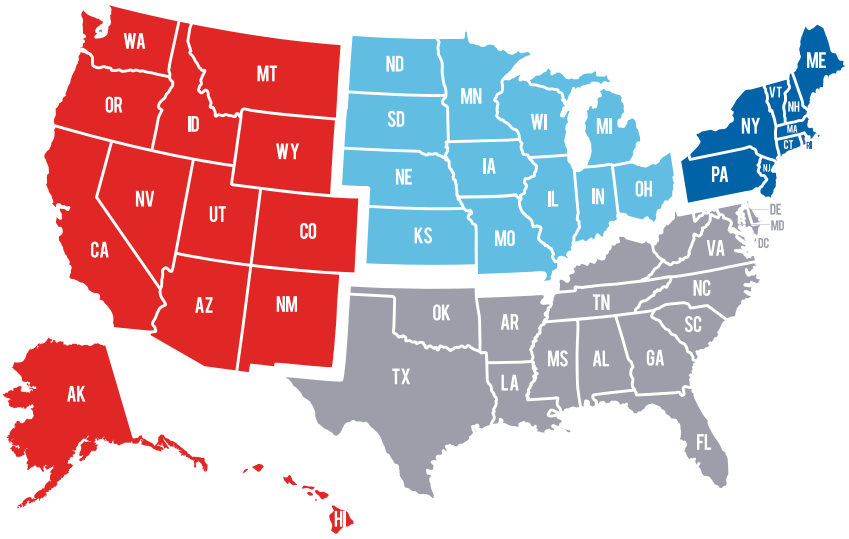
Utility executives ranked **cyberattacks as their #1 concern**

Concerns about specific disasters vary by geographic region.

It makes sense that the type of disasters that consumers and utilities find most worrisome would be largely dictated by geographic location. After all, Midwesterners needn't worry much about earthquakes, but in the West, earthquakes understandably are an ever-present concern.

For utility executives, cyberattacks are top of mind. Utility executives overall are worried about a similar set of natural disasters as consumers, except in one area. For utilities, cyberattacks are a much greater concern.

TOP CONCERNS



CONSUMERS

WEST	SOUTH	MIDWEST	NORTHEAST
Earthquake	Wind	Wind	Flooding
Wildfire	Flooding	Temperatures	Temperatures
Drought	Temperatures	Flooding	Wind

UTILITIES

WEST	SOUTH	MIDWEST	NORTHEAST
Cyberattack	Wind	Cyberattack	Cyberattack
Earthquake	Cyberattack	Flooding	Drought
Wildfire	Temperatures	Temperatures	Temperature

But How Ready are Utilities?

READY FOR NEXT TIME?

71% of utility execs say they are **very or extremely equipped** to prepare for, respond to and recover from future disasters.

Consumers know disasters firsthand, and they're not entirely confident that utilities are prepared for the next one.

Most people have lived through some kind of disaster. Nearly nine out of 10 consumers (87%) say they've been impacted by at least one in the last five years, with roughly a third experiencing extreme winds and extreme temperatures, and a quarter experiencing flooding.

Yet while utilities overall say they are prepared, consumers aren't so sure. Overall, nearly three out of four utility execs say they are very or extremely equipped to prepare, respond to and recover from the next disaster. Only one in three consumers, however, are equally as confident.

This suggests utilities have more work to do to educate their customers on what they're doing to prepare for future disasters.

Is climate change a factor in weather disasters?

If so, utilities can help. More than two-thirds (68%) of all consumers surveyed believe the increase of weather-related disasters is the result of climate change. This viewpoint is not exclusive to young people: 63% of consumers 55 and older agree.

If they're right, then utilities can help. Eliminating waste, delivering energy and water more efficiently, and helping customers reduce their consumption can all play a role in creating a more resourceful world—with utilities serving as a guiding force in those efforts.

For more information on how, and to take a deeper dive into consumer viewpoints about energy and water use, read the 2018 Itron Resourcefulness Report.

UNDERSTANDING THE DISASTER PREPAREDNESS LIFECYCLE

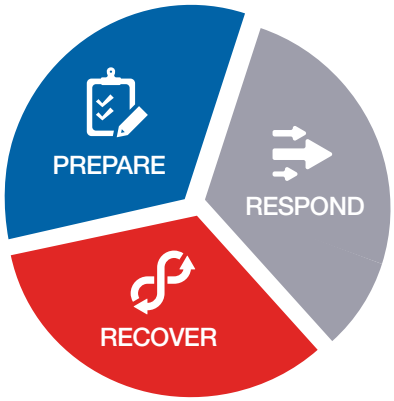
Resilience is Everything

Disaster preparedness is a broad topic. It encompasses an array of recognized and proven best practices for mitigating risk to energy and water delivery infrastructure. There is no shortage of resources available to help utilities establish or update their own protocols. We have featured links to some of these later in this report.

Protocols and practices may differ, but their goal is the same: resilience. A resilient power grid, water distribution system or gas network can mean the difference between a brief outage and a lasting, catastrophic failure.

As utilities have learned in recent years, improving resiliency requires an ongoing, holistic effort. It demands an increasingly comprehensive approach to protecting the end-to-end utility environment, including:

- Reviewing a utility's entire infrastructure and identifying vulnerabilities or gaps that could invite catastrophic damage
- Taking stock of the technology it relies on to sense, diagnose and respond to outages
- Hardening assets against both physical damage and cyber threats, from trimming trees and upgrading wooden power poles to implementing aggressive software management policies
- Evaluating new solutions that can support and enable all of these efforts



Disaster planning isn't a one-time event. It's helpful to think of the three key stages of disaster management—*prepare*, *respond* and *recover*—as a continuous cycle rather than a linear progression. The stages exist as parts of a whole, and several share common technologies and processes.

The Disaster Preparedness Lifecycle is self-reinforcing.
A comprehensive approach to preparing for disasters can lead to much more rapid response. And more rapid response leads to faster recovery. And a more successful response-recovery cycle can help inform future preparation.

Each stage is viewed uniquely by consumers and utility executives. But their perceptions are illuminating all the same.

Differing Views on Preparation

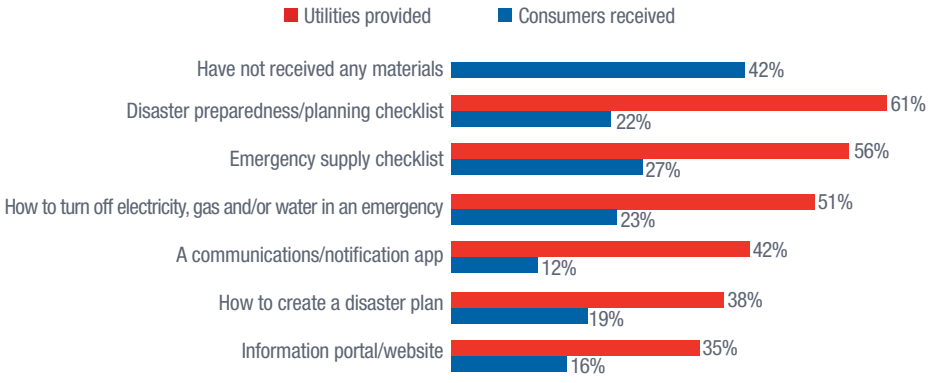
47% of executives say the disaster prep programs they have provided consumers **have been extremely or very effective**

Utilities believe they're doing a good job preparing consumers. But do consumers agree?

It's an old but relevant adage: *By failing to prepare, you're preparing to fail*. When it comes to disaster planning, failure isn't much of an option. So it pays to make sure everyone in the energy and water delivery-consumption cycle is as prepared as possible.

Utilities and consumers, however, don't agree on how well utilities are preparing consumers. Eight out of 10 (82%) utilities have distributed educational resources to help consumers prepare for disaster. And just under half (47%) of executives say they've been effective or very effective. Yet four out of 10 consumers say they have not received any disaster preparation materials.

What utilities say they provided vs. what consumers say they received



PREPARE

Differing Views on Preparation

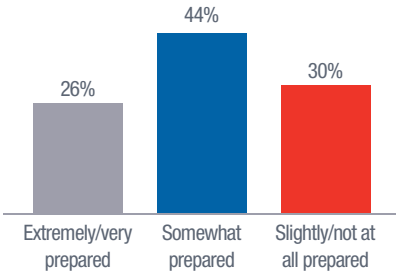
30% of consumers feel slightly or **not at all prepared** for a disaster

The result? Just 26% of consumers feel very or extremely prepared for future disasters. Thirty percent feel just slightly prepared, or not at all.

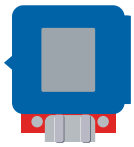
For utilities, the message is clear: Current efforts to educate and prepare consumers are only partially effective. Simply disseminating preparation materials isn't enough, and likely requires even more promotion than many utilities engage in today.

One option: Meet consumers in the moment by communicating preparedness measures when they are top-of-mind and likely to get attention (such as when major storms are approaching or when disasters strike other regions).

How prepared do customers feel?



Detecting Trouble Before it Starts



Natural gas sensors **quickly detect leaks and alert crews** through the AMI network

Con Edison operates one of the world's largest energy delivery systems, serving over 9 million people in New York City and Westchester County.

In 2018, ConEd began deploying 9,000 natural gas detectors and battery-optimized communications modules. The goal: To improve the safety of customers by detecting gas leaks and quickly alerting emergency crews. The natural gas detectors work as part of a larger Advanced Metering Infrastructure (AMI) environment, which Con Edison has used to streamline a part of their gas leak process, automatically issuing trouble tickets and sending them to the utility's Gas Emergency Response Center.

"The company already has procedures with local fire departments when we get a gas leak," says Magdalena Michniuk, project specialist on Con Edison's AMI implementation team. "Now we're actually able to tell them where the leak is and send them to a confirmed location. So we've updated response protocols with our fire departments."

PREPARE

Technology Perspectives

Smart metering is the **top technology deployment**

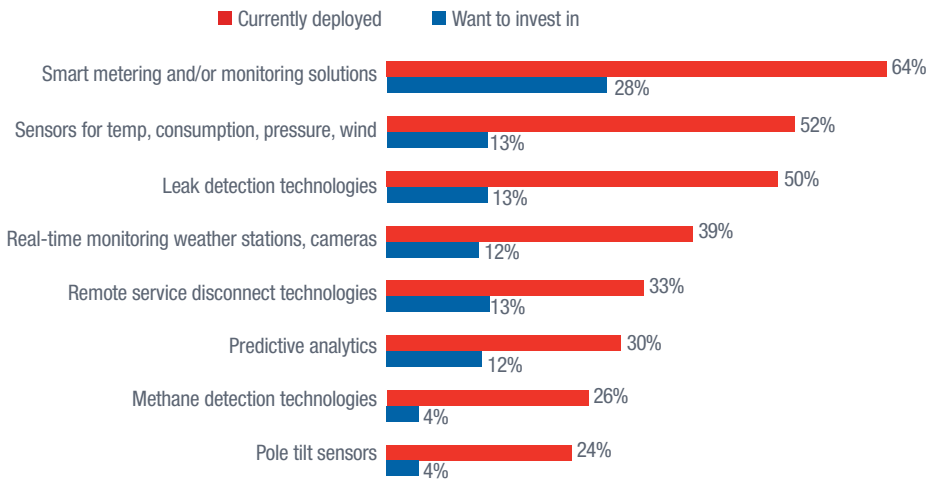
To protect their infrastructure and improve grid awareness, utilities have deployed smart technology and sensors. But they still want more.

Utilities throughout the United States rely on technology to help harden the grid, detect potential problem areas, remotely monitor activities across the distribution network and ultimately make it more resilient.

Smart metering and monitoring systems top the list of deployed technology—and it remains a priority for future investment. Identifying weak points is clearly a preparation priority, and this is reflected in where utilities have chosen to invest in technology in the past, and where they want to invest in the future.

The top technology deployments, both past and future? Smart metering and monitoring solutions, including voltage analysis, outage detection and restoration, and distribution transformer monitoring solutions.

PREPARE: Utility technology deployments and technology investment goals



PREPARE

Technology Options

Disaster preparedness is growing more digital by the day.

In recent years, disaster preparation technology has evolved to the point where cutting-edge tech can help:

- Predict issues before forecasted disasters arrive
- Enable greater grid awareness to understand the state of distribution systems
- Spot and fix issues before they create unsafe conditions—either for communities or utility crews
- Anticipate where to pre-stage service crews as severe weather systems approach

Technology options available to utilities are growing. Depending on the preparation priorities of key decision makers—often driven by the nature of the disasters common to their region—utility executives increasingly choose from any of these popular solutions.

DISASTER PREPAREDNESS LIFECYCLE TECHNOLOGY

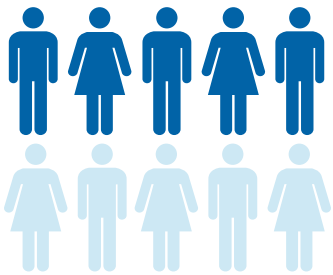
	PREPARE
Advanced metering infrastructure (AM)	X
Advanced analytics applications	
Customer communication systems	
Disaster prep education / resources	X
Disaster simulations	X
Distribution automation (DA) devices	X
Intelligent notification / evacuation solutions	
Leak detection technologies	X
LiDAR mapping systems	
Line / fault sensors	X
Methane detection	X
Outage detection systems	
Outage restoration systems	
Pole tilt sensors	X
Predictive analytics	X
Real-time monitoring weather stations / cameras	X
Remote service disconnect devices	
Remote service reconnect devices	
Sensors for temperature, consumption, pressure, wind	X

Planning for When Every Minute Counts

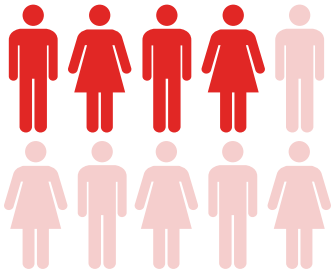
For many utilities, the way they respond to disasters is a make-or-break moment.

Natural disasters expose utilities in a number of ways—physical, financial and reputational. At no moment is this more evident than when utilities are called upon to respond to disaster events. They are judged, fairly or otherwise, on their ability to restore service rapidly, efficiently and safely.

It's little wonder, then, why utilities invest in programs and technologies that help them act fast when every minute counts—including and especially with regard to customer communications. That's because in addition to orchestrating repairs, utilities must communicate to customers critical information such as service status and restoration estimates.



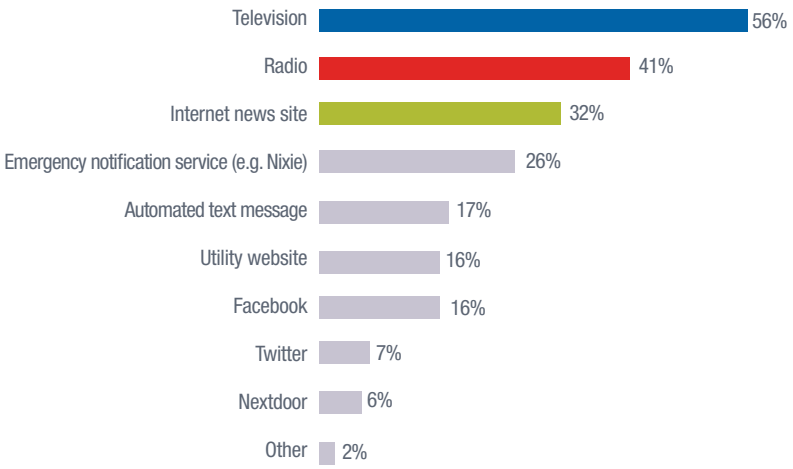
5 in **10** turn on the TV



4 in **10** look to radio

3 in **10** look to online news

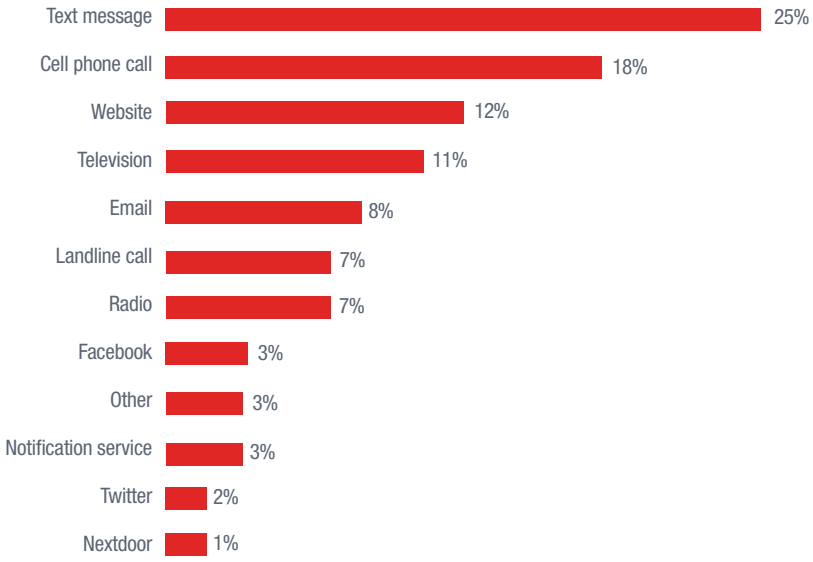
When a disaster strikes, consumers seek both traditional and online communication channels.



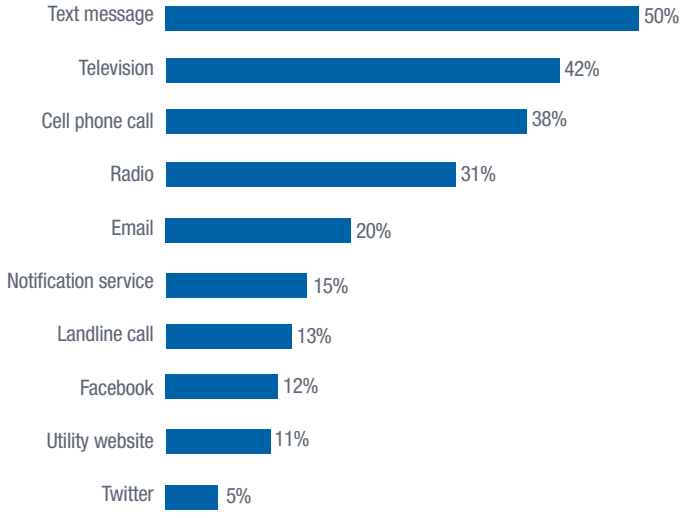
Planning for When Every Minute Counts

Both utilities and consumer prefer **updates by text message** and **cell phone** call; **consumers also rely on television** updates

Utilities: Preferred communication method for updates during disaster



Consumers: Preferred communication method for updates during disaster



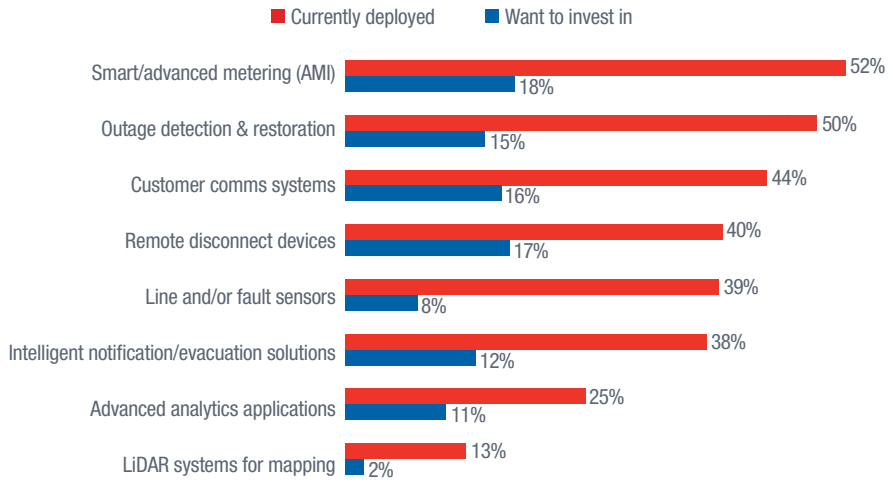
Technology Perspectives

Remotely detecting meter damage and outage severity is a lynchpin for response.

To respond to and recover from outages quickly, repair crews often "drive the lines" to assess and make repairs even before severe weather systems fully leave their service area. (Florida Power & Light sends crews out once winds ease to 35MPH.[20]) By using technology like advanced metering infrastructure and outage detection technologies, utilities can often diagnose problems remotely, thus saving a potential diagnostic truck roll and leading to faster restoration.

Utilities have deployed response-accelerating technology solutions, with many eyeing additional investments. Solutions like remote-disconnect devices and line and fault sensors help drive much-needed intelligence to where it's needed most.

RESPOND: Utility technology deployments and technology investment goals



20 FPL preparing for massive power outages from Hurricane Dorian, WPTV, Aug. 30, 2019

Technology Options

Improving response times means improving visibility into the status of networks and devices.

In recent years, disaster response solutions have evolved to the point where cutting-edge technology can significantly accelerate response times. And faster response times lead to more timely recovery.

Technology investments can save money. While Hurricane Dorian was inching toward Florida in August 2019, Florida Power & Light staged 16,000 people from 34 states for response and recovery operations across the state.[21] Staging operations of this magnitude can cost millions of dollars a day, so any technology that reduces the number of truck rolls (such as outage detection systems, leak detection technology, and pole or line sensors) makes response operations more efficient—which in turn can represent significant savings.

DISASTER PREPAREDNESS LIFECYCLE TECHNOLOGY

	PREPARE	RESPOND
Advanced metering infrastructure (AM)	X	X
Advanced analytics applications		X
Customer communication systems		X
Disaster prep education / resources	X	
Disaster simulations	X	
Distribution automation (DA) devices	X	X
Intelligent notification / evacuation solutions		X
Leak detection technologies	X	
LiDAR mapping systems		X
Line / fault sensors	X	X
Methane detection	X	X
Outage detection systems		X
Outage restoration systems		
Pole tilt sensors	X	X
Predictive analytics	X	
Real-time monitoring weather stations / cameras	X	
Remote service disconnect devices		X
Remote service reconnect devices		
Sensors for temperature, consumption, pressure, wind	X	X

21 WPTV

SOCIAL MEDIA: The Good and the Bad

By establishing the utility as the most trusted source of information, utilities can **keep social media misinformation from turning into a disaster**

Twitter, Facebook and other social media platforms have evolved from lifestyle tools to critical communication channels for government and utility public affairs offices.

Consumers, younger ones in particular, want to be reached directly with important updates. And it helps that social media is accessible from mobile devices that can still be operated during a power outage.

Yet while digital communications can play a crucial role before, during and after disasters, social media's viral nature can create unwanted complexity. At the most recent GridEx security exercise in 2017, participating utilities practiced how word would get out about a blitz of simulated cyber and physical attacks. With social media in the mix, executives saw how quickly misinformation could spread.[22]

How can utilities head off viral misinformation? It's not easy when virtually anyone with a mobile phone and social media account has a platform for disseminating "news." But one best practice is to dedicate digitally-savvy resources to managing social media communications throughout the lifecycle of a disaster. (When the power goes out, consumers will resort to wireless communications where available, with forward-thinking wireless providers dispatching "Cells on Wheels" to serve as mobile cell towers—some even mounted on airborne drones.[23])

By staying ahead of the story and establishing the utility as the primary and most trusted source of information (and by acting quickly to correct inaccurate rumors and speculation), utilities can keep social media misinformation from turning into a disaster of its own.

22 Experts assess damage after first cyberattack on U.S. grid, E&E News, May 6, 2019
23 What do know about your cell service during Hurricane Dorian, USA Today, Aug. 30, 2019

Getting Back to Normal

Technology solutions **speed the recovery process**

Restoring service promptly is everyone's goal. Technology helps.

How promptly a utility manages to recover from a disaster often defines how customers view the utility's brand and reputation, potentially for years to come.

Utilities, however, are bound by accepted service restoration protocols. Certain customers, such as police departments and hospitals, naturally receive priority treatment when it comes to restoring power and water should their own backup systems fail. Residential customers are further down the priority list, simply because entire communities aren't counting on whether or not a specific household is able to function.

The challenge for utilities is to find ways to speed the recovery process for all customers. Technology can help.

Spotlight: Ready, Set, Recover

When Hurricane Irma hit in September 2017, Florida Power & Light (FPL) wasn't taking chances. The utility invested billions in a hardened and modernized grid, including deploying 5 million smart meters and installing 19,000 remote fault indicators. "The unprecedented scope of Hurricane Irma tested every piece of equipment across our 27,000-square-mile service area," recalls Eric Silagy, president and CEO of FPL. "That said, we were able to restore service to 1 million customers before the storm even exited our system, and 2 million customers after one full day of restoration."

RECOVER

Technology Perspectives

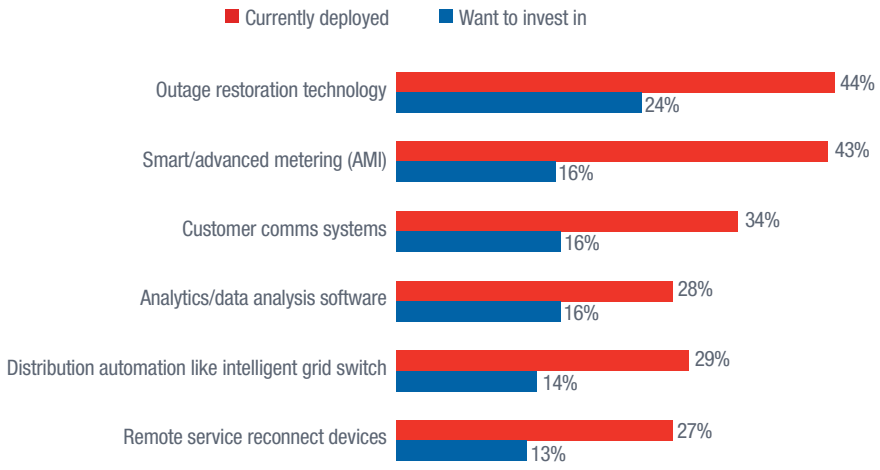
Utility executives want more smart systems to **aid in disaster recovery**

Rapid recovery requires modern tools.

Recent disasters have produced complex and extensive damage to energy and water distribution systems. Faced with these challenges, many utilities have turned to technology solutions to speed the recovery process.

Smart systems are aiding recovery, and execs want more of them. Utilities already rely on outage restoration technology to bring services back online. For instance, they use AMI systems to verify that service has returned to a specific area and analytics software to assess their progress. Executives surveyed for this report want to continue to invest in the same solutions they've been deploying.

RECOVER: Utility technology deployments and technology investment goals



Technology Options

Year-round technologies can optimize operations and **aid in disaster recovery**

Technology used year-round can make all the difference for disaster recovery.

While most utilities would find smart technology to be a worthy investment just for the operational efficiencies and system visibility they bring on a day-to-day basis, CenterPoint Energy found it paid off in other ways in August of 2017 when Hurricane Harvey came to call. More than 250,000 people in Texas lost power in the historic Category 4 storm, but CenterPoint was able to leverage distribution automation (DA) devices such as intelligent grid switches to quickly isolate problems on its grid. By recovering and reconnecting people to power quickly, CenterPoint avoided an estimated 45 million outage minutes for customers.

Most technologies used for recovery are flexible—and foundational. While some tech solutions that play a role in disaster recovery are specifically designed for it, the majority are the same technologies that utilities use to run their energy and water distribution business from one day to the next.

DISASTER PREPAREDNESS LIFECYCLE TECHNOLOGY

	PREPARE	RESPOND	RECOVER
Advanced metering infrastructure (AM)	X	X	X
Advanced analytics applications		X	X
Customer communication systems		X	X
Disaster prep education / resources	X		
Disaster simulations	X		
Distribution automation (DA) devices	X	X	X
Intelligent notification / evacuation solutions		X	
Leak detection technologies	X		
LiDAR mapping systems		X	
Line / fault sensors	X	X	
Methane detection	X	X	
Outage detection systems		X	
Outage restoration systems			X
Pole tilt sensors	X	X	
Predictive analytics	X		
Real-time monitoring weather stations / cameras	X		X
Remote service disconnect devices		X	
Remote service reconnect devices			X
Sensors for temperature, consumption, pressure, wind	X	X	

Preparedness Considerations

Understanding where to invest for **disaster preparedness** is essential

When it comes to hardening systems for the next disaster, understanding where you need to invest is essential—if not always easy. Start with these suggestions.

No one has an unlimited budget. So how do utilities decide where to place their bets when evaluating potential technologies that will help them prepare, respond to and recover from disasters? It's a fair question, since utility executives cite the difficulty of prioritizing investments as their primary barrier to acquiring new disaster preparedness technology.

The following are a few suggestions to get you started.

1. Identify likely hazards.

   Typically, the first step in disaster preparedness is to take stock of what disasters you're likely to face.

   - ✔ What are the probable disaster events in your region?
   - ✔ How frequently have these events occurred in your region, and is their frequency increasing?
   - ✔ What is the potential magnitude of each danger?

2. Assess your vulnerabilities.

   It's vital to know where you're vulnerable—and a proper assessment will help you minimize risk by helping to narrow down the processes and technologies most deserving of investment. By matching up the likelihood of a specific hazard (earthquake, severe storm, flooding, wildfire, cyberattack, etc.) with the relative risk posed by gaps in physical or security/information technology (IT) protection, you'll be better situated to shore up the weak points that matter most. Among the questions to ask:

   - ✔ What elements within your infrastructure are at risk?
   - ✔ What is the possible damage that different disaster events could cause to these elements?
   - ✔ What is the probability of damage in a disaster of highest potential magnitude?
   - ✔ What technology is in place to sense, diagnose and respond to outages? What are you missing?
   - ✔ Are consumers in your area educated enough to know what to expect from you when various disaster events occur?

Preparedness Considerations

3. Calculate outage impacts.

To weigh priorities, it's helpful to understand the impact of potential outages. For instance, how much fresh water is needed to serve your population for three days? How about seven? How about 14? And if water must be shipped in, will trucks have access? And what is the cost to provide fresh water before service can be restored?

To review a sample hazard and vulnerability analysis, see the Resources section later in this document.

4. Determine steps you can take now.

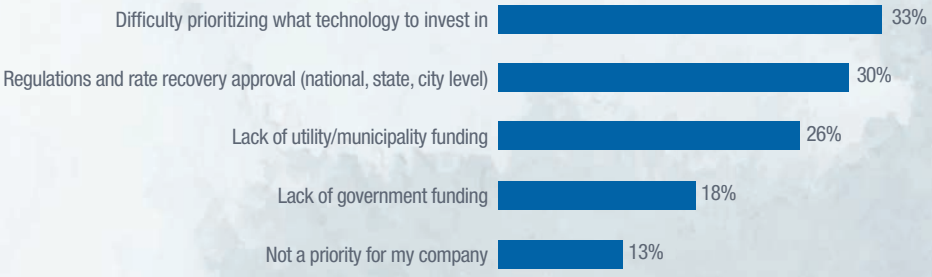
You can take some actions to harden your infrastructure without significant investment or regulatory rate approval. These might include:

- ✔ Keeping up with ongoing maintenance efforts, such as trimming trees around power poles.
- ✔ Updating disaster response procedures and staging strategies.
- ✔ Implementing aggressive software management and cybersecurity policies.
- ✔ Re-evaluating consumer communications programs to ensure you are reaching them when they are thinking about disasters and their impacts.

5. Assess where further investments are needed.

Filling certain gaps will likely require additional resources and investment. Prioritizing which technologies to invest in is the top barrier to investment cited by utility executives—with funding-related challenges following closely behind. (Interestingly, 13% said disaster preparedness investment is "not a priority" for their utilities.)

What are the major barriers to your utility deploying technology to prepare, respond and recover from disasters?



Preparedness Considerations

Would consumers help fund investments?

Assuming rate changes are approved, **half of consumers surveyed say they'd accept a 1%-5% bill increase every month to fund local disaster preparedness**. (Yet 38% said they wouldn't.) Consumers in the West (57%) and in large urban cities (59%) are the most willing to pay for investments.

6. Consider investing in technology that pays dividends year-round.

Finding money for any kind of investment can be a challenge, but utility executives may pave the road to success by focusing first on technologies that prove instrumental in disaster preparation, response and recovery—but also deliver a return throughout the year.

For instance:

- Distribution automation (DA) devices not only play a key role in all three stages of the Disaster Preparedness Lifecycle, but they increase grid resilience and reliability every day, help optimize grid operations and simplify integration of renewables.
- Automated metering infrastructure (AMI) solutions are crucial players during and after disasters, but their day job is to drive intelligent connectivity throughout the distribution network to improve decision making.
- Analytics solutions don't just help restore services faster, but they're an increasingly essential driver in maximizing operational efficiency, which cuts costs and improves productivity.
- Line sensors aren't just critical for disaster preparedness, but they also detect interference from vegetation, construction equipment and other potential problems on a day-to-day basis.

Refer to the Resources section later in this report for useful best practices guides and information portals.

CONCLUSION

A Growing Imperative

Creating a resilient infrastructure takes planning—and a sense of urgency.

The survey results on which this report is based show that many utilities in the United States have been taking action and making investments that will likely pay off with the next flood, storm, wildfire, earthquake or cyberattack.

These organizations have invested in smart, connected infrastructure that allows them to anticipate and detect problems and outages, remotely disconnect service to prevent major damage or ancillary catastrophes like fires, and quickly and safely bring customers back online.

They recognize that the disasters of the past few years have taught us a sobering but clear lesson: We can no longer plan for future worst-case scenarios based on past worst-case scenarios. The future is uncertain only to the extent that we don't know how bad it will be—just that it when it comes, it could well be worse than before.

Our only defense is to prepare.

RESOURCES

A sampling of guides and other resources available to utilities looking to improve their disaster preparedness.

Portals

Emergency Preparedness Portal, Department of Energy Office of Cybersecurity, Energy Security, and Emergency Response

Disaster Planning and Response Portal, American Public Power Association

Emergency Response for Drinking Water and Wastewater Utilities, Environmental Protection Agency

Sample Risk Assessments

Hazard, Risk and Vulnerability Assessment, Bowen Island Municipality, 2018.

Guides and Courses

Climate Change and the Electricity Sector: Guide for Climate Change Resilience Planning, US Department of Energy, September 2016

Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions, US Department of Energy, October 2015

Addressing Climate Vulnerability for Power System Resilience and Energy Security, USAID, May 2017

Energy Sector Cybersecurity Framework Implementation Guidance, US Department of Energy Office of Electricity Delivery and Energy Reliability, January 2015

Restoring Power After a Storm: A Step-by-Step Process, Edison Electric Institute

Disaster Management for Water and Wastewater Utilities, DHS/FEMA-Funded Classes, Texas A&M Engineering Extension Service

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