IBM + Zpryme
White Paper

December 2020

Improving Utility Resilience

Insights into Outage Management

IBM

zpryme

Contents

1 Introduction
2 Key Findings
3 Utility Preparedness
5 Sensing Critical Events
7 Creating an Ecosystem that can Weather the Storm
8 Reduce Costs by Investing in the Future of the Utility
9 Conclusion

Introduction

2020 has been a year for the ages, but not for all the right reasons. If the deadly coronavirus pandemic and seriously deep political discord were not enough, August saw Hurricane Isaias make landfall bringing the strongest winds New York City has seen since Hurricane Sandy. The storm thrashed the mid-Atlantic and Northeast leaving more than 2.5 million customers without power from North Carolina to Maine, with New Jersey, Connecticut and New York City the hardest hit. Con Edison's service territory was impacted to the point where the utility announced the restoration effort was like "building a whole new distribution system from scratch" with 3,500 trees needing to be removed and 137 miles of power lines needing to be rehung or replaced.

Irrespective of the year or season, utility resilience is what keeps the industry up at night. Severe weather will continue to affect the electric grid in perpetuity on top of other maintenance issues that affect asset health. Managing countless miles of power lines poles and critical assets in an ever-changing ecosystem of vegetation and tree growth is a monumental undertaking. When combined with an increasingly digital utility business model, the need for modern resilience solutions that optimize operational efficiency is apparent.

Zpryme surveyed over 170 utility professionals to further explore improving utility resilience in the age of digitalization and the growing benefits of A.I. technologies. Those findings serve as the basis for this white paper which addresses the following areas:

- **Why it is critical for utilities to focus on weather forecasting, vegetation management, and resilience.**
- **How utilities are working to improve asset health and maintenance.**
- **Challenges related to improving forecasting and asset management.**
- **Who is leading the digital transformation of weather forecasting and outage prediction.**
- **Benefits of using predictive analytics, AI, and digital tools to improve outage predictions.**

Utility Type

Investor-owned utility (40%)
Municipal or public-owned utility (37%)
Cooperative (20%)
District/federal (3%)

Region(s) Served*

Southwest (26%)
Southeast (23%)
Midwest (22%)
West (16%)
Northeast (11%)
International (14%])

Annual Revenue

Over US$1 Billion (41%)
US$500 Million to US$1 Billion (12%)
US$100 Million to US$500 Million (26%)
Below US$100 Million (21%)

Primary Role within Organization

Operations (23%)
Engineering (27%)
Emergency Preparedness (1%)
Transmission and Distribution (7%)
IT (14%)
Finance (5%)
CEO (5%)
COO (3%)
CIO (0%)
CTO (1%)
Other (13%)

*(Respondents were instructed to select all that apply)

Key Findings

Survey findings revealed that utilities are acutely aware of resilience issues and have prioritized them as part of their operations. Most believe that their approach to critical events is more predictive than reactive. There is divergence though, between how utilities self-categorize their preparedness for daily weather events vs. the actual frequency and duration of the outages being experienced each year.

Integrating multiple data sources for a more centralized view of outage factors is a primary goal of respondents and one that aligns with growing importance of big data in energy generation and transmission. Current methods in use to sense and predict outages are, contrary to popular belief, not all fully reliant on formal outage management systems. Often a mix of tools are in use across the spectrum of investor owned utilities (IOUs), smaller cooperatives and municipally-owned utilities. Those include the use of experienced employee insights, local weather forecasts and other outage prediction models.

Integrating outage data with asset health data, a more advanced integration requiring a highly focused digital strategy as a prerequisite, was top of mind for a little more than half of respondents. Analyzing vegetation on the grid and integrating that data into outage analysis did not rank as a top priority for most utilities surveyed. With mother nature's guarantee of either tropical storms, hurricanes or brush fires coming to a locale near you, better vegetation analysis is a chance for both utilities and vendors to help each other succeed in an area that has been overlooked.

The drivers for better outage management and resilience from a business and end-user perspective are the key pillars of:

- **Improving customer satisfaction**
- **Continuity planning**
- **Reducing operations and maintenance spend (O&M)**

Key Insights:

- **To increase resilience, utilities are prioritizing accurate real-time operations data for both internal consumption and end-customer use.**
- **Only half of utilities are currently using an outage prediction tool.**
- **Half of utilities surveyed continue to experience weather related outages multiple times a year.**
- **The utility need for better outage prediction and weather forecasting is driven by the urgency to improve customer satisfaction and continuity planning, while reducing O&M spending.**
- **The primary decision makers for weather forecasting and outage prediction tools are Director/Managers, Vice Presidents, and CEOs.**

Utility Preparedness

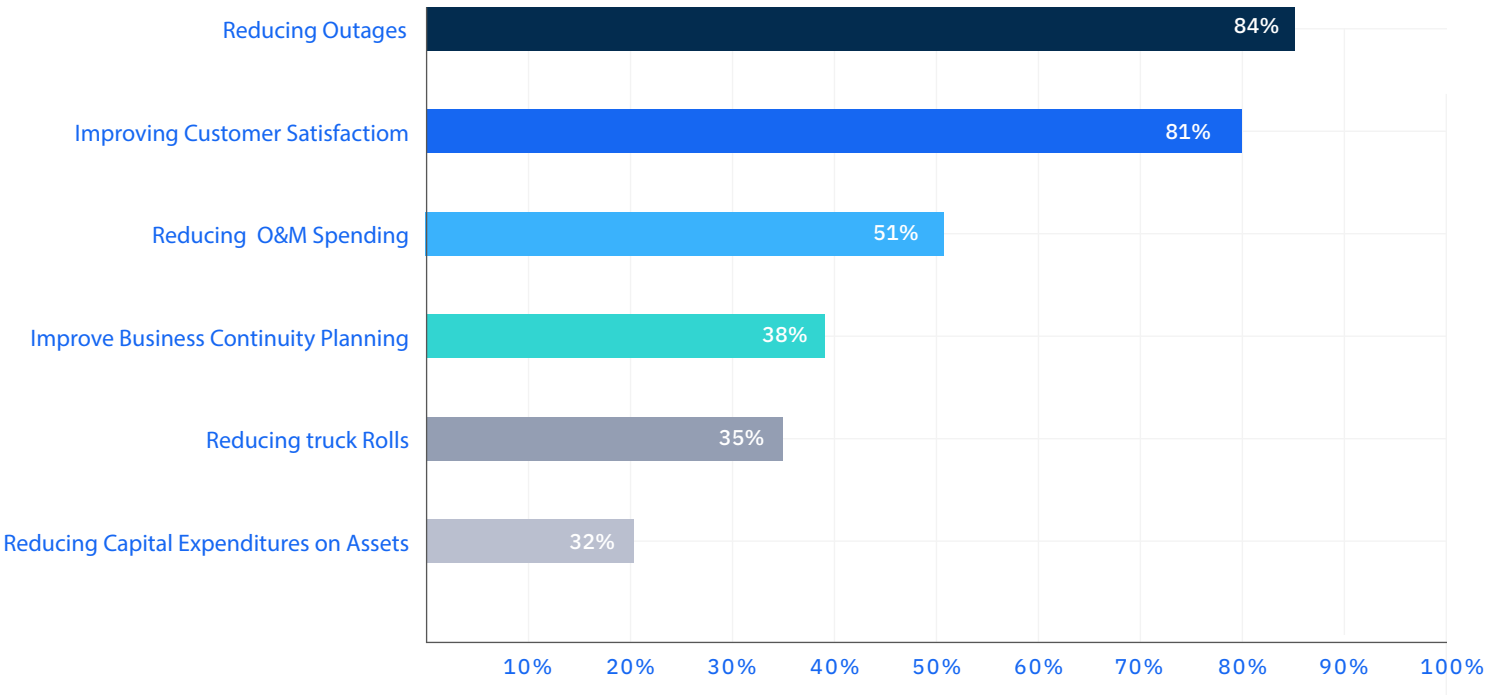
A utility's most mission critical goal is to keep the lights on (reliability). Then naturally, the efficient and safe restoration of that power (resilience) is next in line. How prepared is the industry for outages and how do resilience measures align with industry objectives?

Weather-related outages cost Americans between $20 to $55 billion per year, according to Climate central, though utilities have come a long way in managing severe events.

That includes preparedness, streamlining information flows and consistent customer communication. But much remains to be done and a sustained commitment to resilience measures must be part of the strategy. After devastation caused by Hurricane Isais, several northeastern utilities are subjects of an investigation that could end up costing the industry millions of dollars. Survey results showed that after reducing outages (84%), improving customer satisfaction (81%), reducing O&M (Operations and Maintenance spending 51%) and improving business continuity planning (38%) rounded out the main stakeholder goals vis-à-vis improving outage prediction and forecasting (Figure 1).

Figure 1

What are the main reasons your utility is trying to improve outage prediction and weather forecasting systems?
Note: Respondents selected "all that apply"



Service territory outages that are either more frequent or more sustained than they should be are a surefire way to torpedo customer satisfaction (or trigger massive statewide investigations). And that notion of customer satisfaction in the industry today is more complex and dynamic than before. Linear communication flows between customers and their utility from the past have been upended over the years. Your local utility now regularly sends home energy reports, has a mobile app for bill pay and energy insights that feel just like other apps we use daily. Consumers even actively report outages through the same social media channels used to document every other notable life moment. In short, customers are engaging more with their utilities and asserting themselves. Reliability and resilience customer satisfaction metrics are a key part of that. But the divide between how prepared the industry thinks it is, and its actual state, is worth exploring.

Though 49% of respondents say they are very prepared for a major weather event (Figure 2), almost half (45%) are continuing to experience weather events that cause outages multiple times a year (Figure 3).

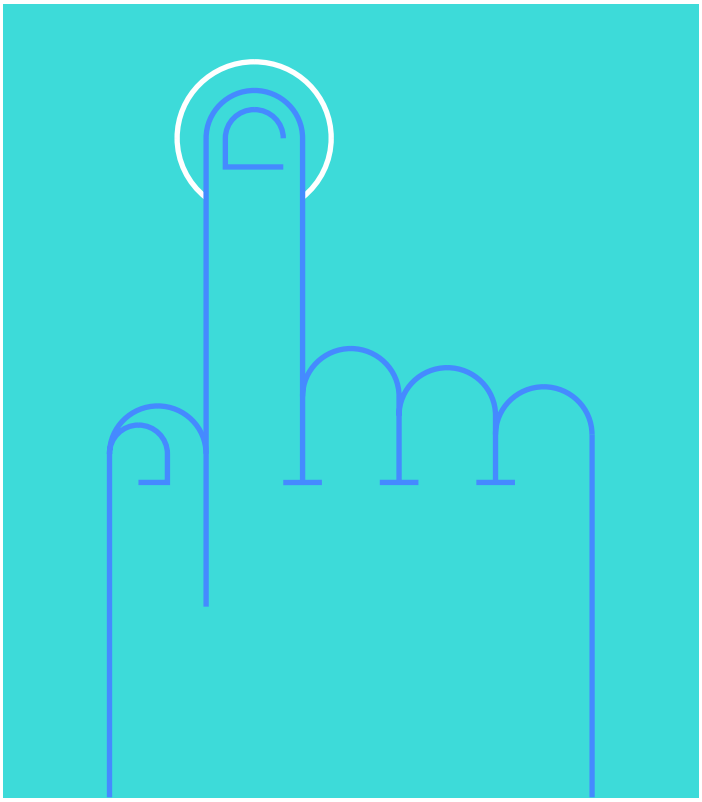


Figure 2

How prepared do you believe your utility is for a major weather event?

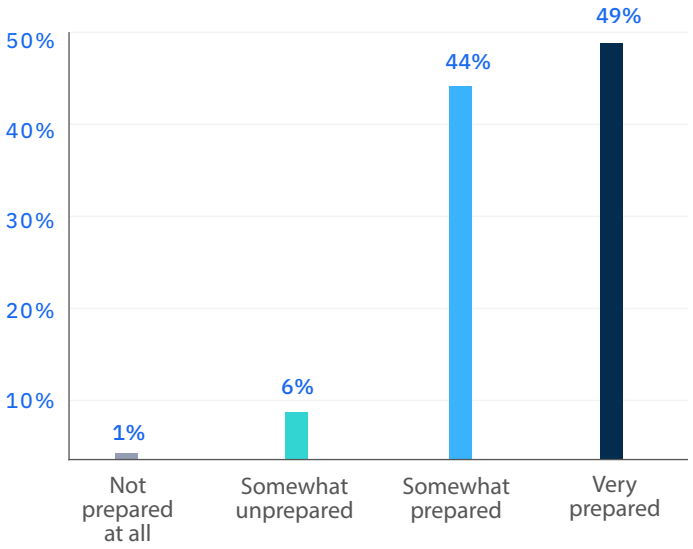


Figure 3

How often does your utility experience a weather event that causes outages for a significant percentage of your customer base?

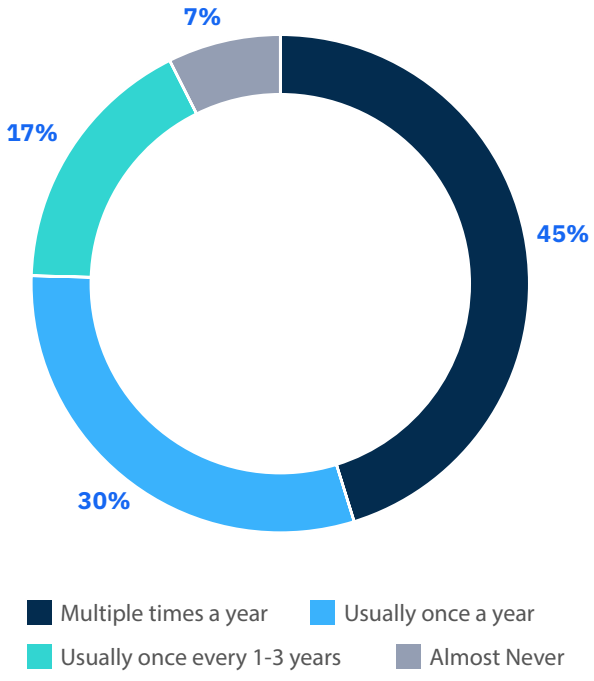
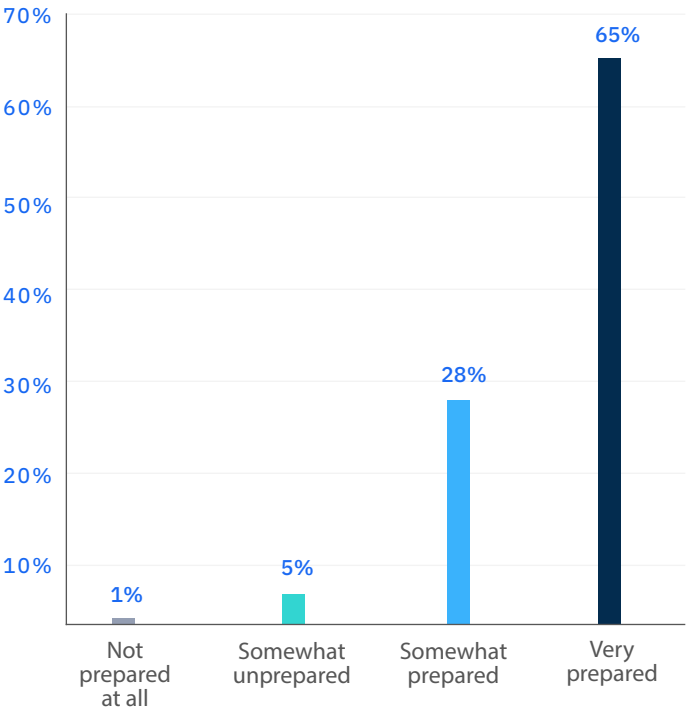


Figure 4

How prepared do you believe your utility is for daily weather conditions that cause outages?



With another 65% of respondents characterizing themselves as **very prepared** for the daily weather conditions that cause outages (Figure 4), utilities in hurricane or fire-prone areas can do more to translate that readiness into fewer and less sustained outages.

Sensing Critical Events

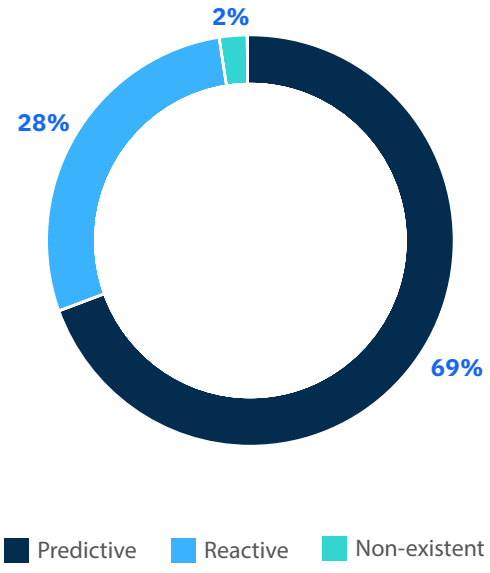
Grid modernization is an undertaking several decades in the making. Though service territories and topographies differ, to proactively manage unexpected events for any utility, a framework is needed that is both predictive and communicative. Outages are but one major area where grid operators want greater insights into the state of play. Other key areas include the integration of renewables or DERs (distributed energy resources), and advanced initiatives like demand response, and energy efficiency. The preceding requires long term planning and an appetite for capital expenditures today to enable more seamless operations tomorrow.

Since the onset of COVID-19, several "electric load shifts" have occurred, further underscoring the need for utilities to sense trends overall and act accordingly. A 5.7% contraction in electrical load for all of 2020 is forecast by the US Energy Information Agency (EIA). In addition, the overall load has become cleaner, made up of a greater share of renewables than before. Demand response has become more significant in providing demand-side flexibility for a more renewable-rich load that it can be delivered when it is needed the most.

For sensing outages, 69% of survey respondents considered themselves to be predictive in their approach to weather forecasting with only one-third categorizing themselves as reactive (Figure 5).

Figure 5

Which of the following best describes your organization's approach to weather forecasting and outage prediction?



Being predictive often starts with advanced metering infrastructure (AMI) in place.

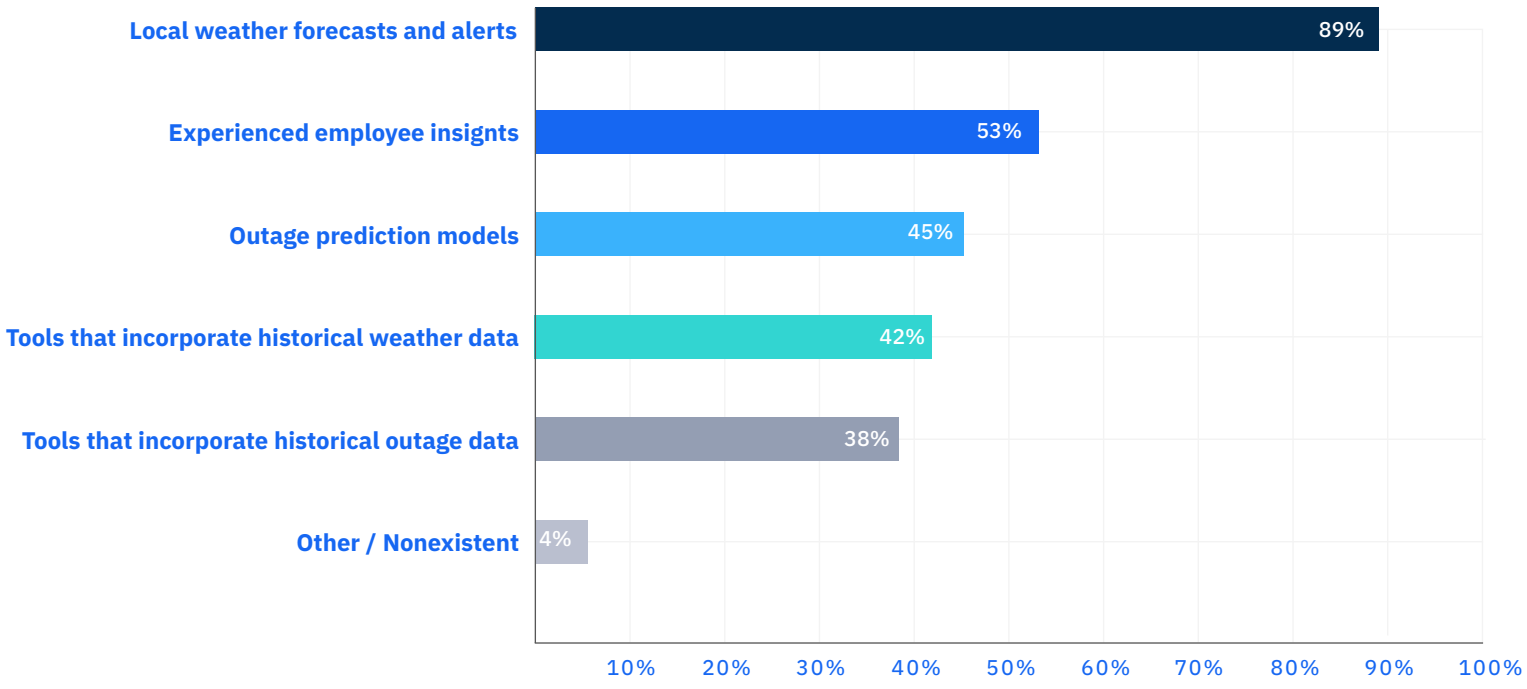
"There are no shortcuts to grid planning or setting up AMI," says Digaunto Chatterjee, Eversource's VP of System Planning. "For the digital utility, AMI is a must."

Utilities that have invested in the more granular insights that AMI delivers are much better positioned to understand grid events and act on them including outages.

Across the spectrum of respondents, approaches to sensing and managing outages vary widely. For many, a mix of local weather, employee insights, established outages prediction models and tools that incorporate outage and historical weather data are in use. The underlying question is how cohesive are these different approaches from disparate data sources? How predictive are they?

Figure 6

What is your organization's current approach to weather forecasting and outage prediction?
Note: Respondents selected "all that apply"



Creating an Ecosystem that can Weather the Storm

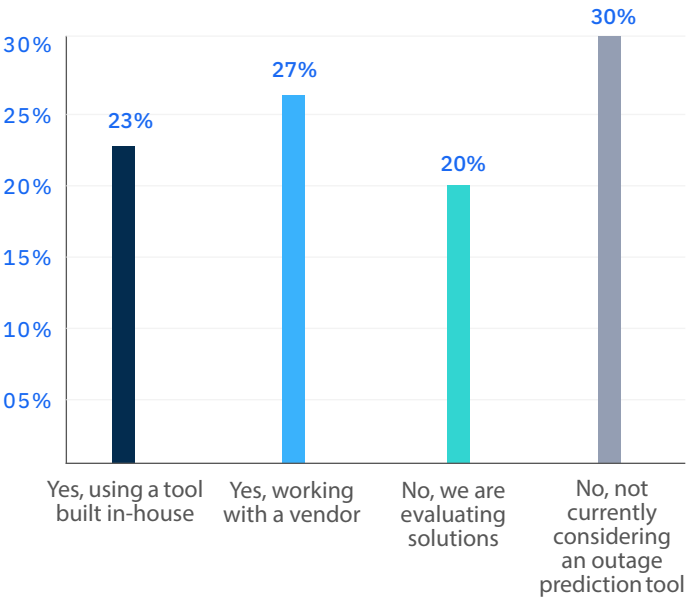
When mother nature begins throwing curveballs, mitigating those grid im-pacts is not only an operational issue, but increas-ingly a challenge for IT and AI systems to manage. Today's comprehensive outage prediction tools outage management systems (OMS) are focused on predicting the potential number of outages by location, in a way that optimizes mobilization plans and improves customer service and response.

Outage Prediction Systems work to:

- **Determine the extent and location of outages**
- **Predict outage type and assets impacted**
- **Allocate the right resources and equipment to improve restoration time**
- **Provide real-time ETR (estimated time of restoration)**
- **Optimize dispatch of crew**
- **Provide restoration statistics and analytics**

Figure 7

Is your utility currently using an outage prediction tool?



When integrated with customer information systems (CIS), AMI, and distribution automation, utilities can gain a clearer picture about their operations and how to adjust. Surprisingly, outage predictions systems are not necessarily deployed evenly across the entire sector.

Utilities have made great strides but are not nearly as predictive as they could be. Zpryme's survey revealed that 50% of respondents were not using an outage prediction tool though 20% of that group was in the process of evaluating solutions (Figure 7).

Unsurprisingly, predicting outages in advance based on weather data was something that one-third of respondents reported that they had no ability to do (33%). It is precisely the challenge of integrating weather data into operational processes that utility respondents report as the biggest hurdle to gaining cohesive, system-wide insights.

Solutions exist today that prioritize prediction through A.I. and can be smartly unified with current utility systems. Those solutions can predict outages 7 days in advance allowing for time to coordinate mutual assistance with repair crews across the country. A.I. technologies are also transforming utility approaches for what has been one of the mostly deadly and costly pain points in utility history: vegetation management on the grid.

The staggering ferocity of the wildfires that overwhelmed California will never be forgotten. The Camp Fire of 2018 in PG&E's service territory killed 85 people and caused upwards of $16.5 billion in damage was the worst U.S. wildfire in a century. In June of this year the company plead guilty to 84 counts of involuntary manslaughter stemming from the 2018 blaze. The grand jury report found that PG&E repeatedly ignored warnings about its aging power lines and faulty maintenance. A California Public Utilities Commission (PUC) report from February of 2019 showed that almost half of the fires attributed to Pacific Gas & Electric were caused by trees and vegetation coming into contact with power lines. The PUC requested that the utility take a harder look at its vegetation management program and use more metrics to analyze it for wildfire protection.

Thus, the industry is looking more closely at integrating asset health data with weather forecasting data. 16% of respondents were ahead of the curve currently integrating asset health with weather forecasting but the majority were not making this integration yet. Given the state of current events, this is no longer a nice-to-have capability but a necessity. The status of thousands of wooden utility poles, transmission lines, transformers, substations and critical equipment coexisting with complex vegetation is why A.I. is needed to close the gap between unexpected events and rapid mitigation.

Reduce Costs by Investing in the Future of the Utility

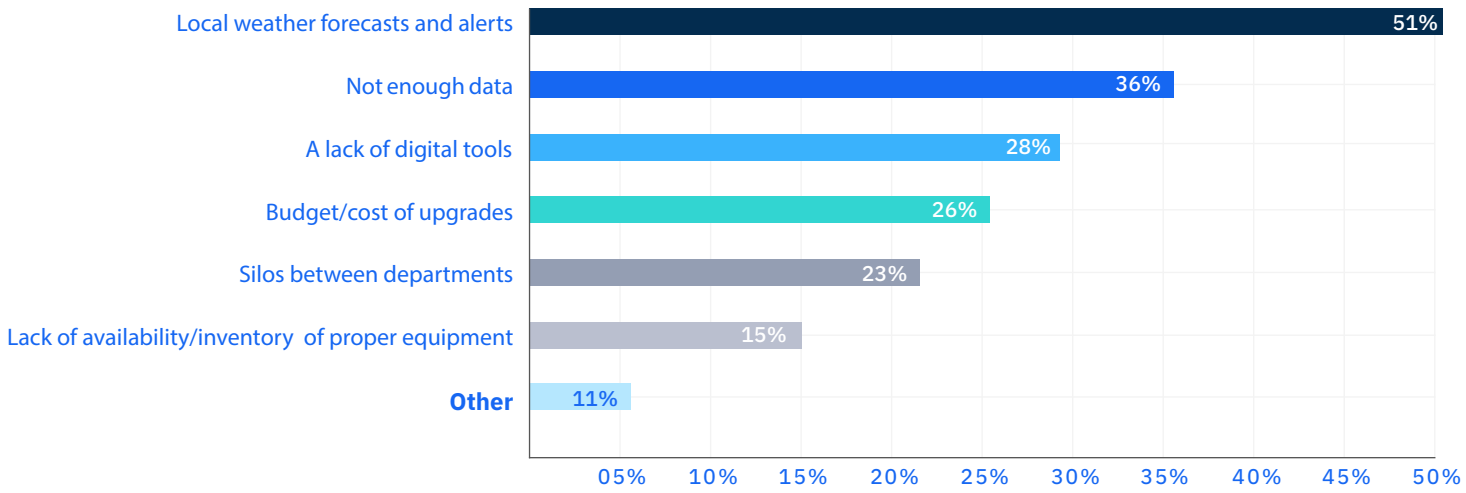
In the health insurance realm, we are often told to either pay now or pay later. Paying later usually means spending much more for preventative care that we should have invested in earlier. In energy, not having a digital strategy in place that can guide us on where maintenance needs to occur has been a risky and sometimes tragic proposition.

Putting the brakes on critical software and grid asset spending can have calamitous downstream impacts. Potential savings from deferred maintenance is often cancelled out millions of times over when the industry is faced with billion-dollar lawsuits or forced to reimburse customers who were left without power. Worse still, when massive operational failures occur sometimes the only option is for more government oversight over a utility.

Even still, 26% of survey respondents say that is it the cost of weather forecasting tools and outage management that holds them back from required investments needed in those areas (Figure 8). Though 51% hope to save on long-term O&M spending as one of the main reasons they are willing to invest in and improve outage prediction and weather forecasting. But the impact of just one sustained outage completely recalibrates the industry's views on what is expensive and what is a permissible cost.

Figure 8

What are the biggest challenges related to weather forecasting and outage management?



For PG&E, the utility will exit bankruptcy with nearly $40 billion in debt, nearly twice the $22 billion it held before its January Chapter 11 filing. This is a necessary consequence of meeting California demands to boost fire-victim payments. New York based utilities will pay untold costs to rectify their shortcomings from Isaias.

Beyond cost, many in the industry are finding that their resilience investments have not paid off. Or that too many disparate systems mean less actionable intelligence or a dashboard to work from. What is needed is a partner to help with the end-to-end integration of resilience measures that include vegetation management at the forefront. When weather data, vegetation insights, asset health and outage data is combined effectively the results are customized prediction data that is relevant to a utility's digital and mobil-ization strategy.

"The massive value of data" that Abhay Gupta, founder of utility A.I. vendor Bidgely speaks of, is what utilities are looking to unlock.

Current approaches to vegetation manage-ment may involve the use of drones, or processing data manually from various sources. Tree and vegetation trimming may be happening but on a pre-set cycle. Leveraging A.I., today's more comprehensive solutions empower grid operators to identify vegetation that has breached predefined zones around power lines so that action can be taken.

Those same solutions use a combination of satellite imagery, weather forecasts plus robust vegetation insights to take the burden off inspection crews and to give utilities a better option. These solutions can be linked to existing operational systems to manage tree trimming and maintenance before a tree takes out an electric pole in a storm or before an asset in sub-optimal condition inadvertently starts an inferno on the grid.

Conclusion

The summer of 2020 has shown us that utilities are not immune to the types of sustained outages that can be both costly and deadly. Severe climate events remain the primary cause of outages nationwide. Whether originating from storms, lighting strikes, brush fires or blackouts from a heat index that does not seem to drop, resilience measure will continue to be tested. But today the industry has options that make the most of recent advancements in A.I., big data and new integration approaches. Nearly all grid planners are working from a foundation of legacy infrastructure and grid assets that were not designed to handle all that we ask of the grid today. In parallel, mother nature sends powerful reminders every season that our ecosystem is volatile and fragile. A digital strategy that emphasizes resilience and the management of vegetation as it interacts with grid assets is one that will take utilities far into the future.

- 1 Washington Post: Millions left in the dark and historic floods: Isaias by the numbers
- https://www.washingtonpost.com/weather/2020/08/05/isaias-power-outages/
- Power outages after Tropical Storm Isaias were a warning to utilities
- 2 https://www.theverge.com/21361751/tropical-storm-isaias-power-outages-tristate-utilities-energy-grid
- 3 Deloitte Midyear Outlook – 2020 Power and Utilities Industry Outlook
- https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-2020-power-utilities-midyear.pdf
- 4 Green Tech Media - GTM Focus Webinar Will COVID-19 Accelerate the Transition to a Digital Grid – Tuesday July 28th 2020 with Utility Executives from Con Edison, Pepco Holdings, Eversource and Bidgely
- https://www.greentechmedia.com/events/live/gtm-grid-edge-focus-will-covid-19-accelerate-the-transition-to-a-digital-grid?utm_source=7.23&utm_medium=email&utm_campaign=gefocus7.28
- 5 The California Fire That Killed 48 People Is the Deadliest U.S. Wildfire in a Century
- https://time.com/5453710/california-camp-fire-deadliest-wildfires-us-history/
- 6 PG&E to expand wildfire protection program, mark tress for removal
- http://www.calaverasenterprise.com/news/article_744ea918-406e-11e9-8db6-47e139310390.html
- 7 PG&E Emerges from Bankruptcy
- https://www.latimes.com/business/story/2020-07-01/pge-exits-bankruptcy