Distribution Sector Resilience and Responsiveness

December/4/2024

Contents

Executive Summary

The electricity sector in Ontario is facing increasing challenges related to climate change and extreme weather events. As the frequency and severity of major storms and other climate-related disruptions grows, there is mounting pressure on distributors to assess and enhance the resilience and responsiveness of their systems while maintaining cost efficiency.

In response to the recent requests from the then Minister of Energy and considering the increasing urgency around climate resilience in the electricity sector, the Ontario Energy Board (OEB) undertook a survey of distributors across four topic areas: (1) **Operations Planning**, (2) **System Hardening**, (3) **Restoration Performance**, and (4) **Customer Communications**.

The objective of this study is to obtain an understanding of the current state of Ontario's electricity distribution sector with respect to addressing the challenges of extreme weather events while maintaining reliable, affordable service for all customers as the province pursues its clean energy and economic growth objectives.

Effective Industry Practices and Adoption

ICF identified effective Industry practices for each topic area. ICF subject matter experts identified these practices based on their knowledge of electric utility practices gained from working at electric utilities for decades as well as consulting with electric utilities after having worked for them. For each effective industry practice, ICF captured the **level of adoption** amongst Ontario distributors based on survey responses:

- **Very high** (●) – between 75-100%,
- **High** (◕) – between 50-74%,
- **Low** (◑) – between 25-49%, and
- **Very low** (◔) – between 0-24%.

Operations Planning

ICF identified nine effective industry practices for Operations Planning. A description and adoption level for each effective industry practice, amongst Ontario distributors, are outlined.

Effective Industry Practices	Description	Adoption Level
Command structure	Clear hierarchy, defining roles and responsibilities for effective emergency response. Enables swift decision-making and facilitates coordinated action during complex restoration efforts.	◕
Communication protocols	Guidelines dictating information flow within an organization, external partners, and the public during an emergency, to ensure that all	◕

Effective Industry Practices	Description	Adoption Level
	stakeholders are kept informed with accurate and timely updates.	
Mutual aid	Sharing of resources, such as personnel, equipment, and expertise, when distributors' own capabilities are stretched thin, to quickly access additional resources and specialized skills that may be necessary to restore services more rapidly.	◕
Critical loads tracking	Identify and prioritizing critical loads, to effectively allocate resources and protect public health and safety	◕
Tiered emergency and/or activation levels	Match the intensity and impact of the emergency, ensuring that the appropriate resources are deployed.	◕
Multiple communication channels	Ensure that information is reliably transmitted across all departments and with external partners, even if one channel fails.	◕
External organization coordination	Fosters a collaborative environment where all participants (i.e., local governments, first responders, etc.) can practice working together, identify potential issues, and improve their coordination.	◑
Risk-based methodologies for determining spare equipment levels	Optimize the level of spare equipment needed to maintain service reliability under various conditions, thereby more effectively balancing preparedness and cost-efficiency.	◑
Weather prediction software	More accurate and timely forecasts allow distributors to prepare more effectively for impending weather events.	◔

System Hardening

ICF identified five effective industry practices for System Hardening. A description and adoption level for each effective industry practice, amongst Ontario distributors, are outlined.

Effective Industry Practices	Description	Adoption Level
Restoration activities and expenditures tracking	Enhances decision-making by keeping a historical record of past weather events and evaluating the effectiveness of system hardening measures.	◕
Climate risk assessment and adaptation planning	Climate vulnerability assessments that incorporate both qualitative and quantitative analyses of asset vulnerabilities support the development of more targeted and effective system hardening strategies.	◔
Incorporating resilience into system planning	Assessing distribution investments that will incorporate considerations of system resilience to extreme weather events.	◑
Value of service investment prioritization	Enables more informed decision making about where to allocate resources based on the value of service to customers, ensuring that system hardening investments target areas where the impact of outages is highest.	◕
Value of lost load (VoLL) studies	Quantify the financial cost of outages to utility customers, providing a clear, data-driven basis for prioritizing investments, improving the efficiency of investments and the ability to justify expenditures to regulators and stakeholders.	◔

Restoration Performance

ICF identified five effective industry practices for Restoration Performance. A description and adoption level for each effective industry practice, amongst Ontario distributors, are outlined.

Effective Industry Practices	Description	Adoption Level
Advanced fault detection technologies	Use advanced fault detection technologies (e.g., systems with remote fault location functionality) to enable the rapid identification of faults, reducing the need for manual inspections and minimizing system downtime.	●
Distribution automation	Expanding distribution automation (i.e., fault direction indicators, reclosers, sectionalizers, remote terminal units, etc.) to cover a larger percentage of their customer base would further	◕

Effective Industry Practices	Description	Adoption Level
	enhance system resilience and ensure faster restoration, particularly during widespread outages.	
Advanced damage assessment techniques	Use mobile apps, GIS integration, and drones (where necessary) for more efficient and accurate damage assessments to inform restoration strategies.	◑
Fully deployed smart devices and systems	Fully deployed smart technologies that are more responsive. Allows distributors to manage the grid in real time, prevent outages, and restore service faster when issues arise.	◑
Assess restoration performance	Post-event reviews, including after-action reports, lessons learned, and metrics help identify gaps in the response process and lead to continuous improvements in restoration strategies. Regularly update plans based on recent events.	◕

Customer Communication

ICF identified five effective industry practices for Operations Planning. A description and adoption level for each effective industry practice, amongst Ontario distributors, are outlined.

Effective Industry Practices	Description	Adoption Level
Multi-channel strategy for customer communications	Accounts for the fact that different customer segments may prefer or have access to various communication methods and enables distributors to effectively reach more customers even if one method fails.	◕
Communication ahead of anticipated weather events	Early alerts about potential weather events and power interruptions, safety tips, and instructions for accessing real-time updates educate and inform customers, helping them to prepare.	◕
Communication with critical/vulnerable customers	Expedited communication processes and a variety of personalized communication methods	◑

Effective Industry Practices	Description	Adoption Level
	to prioritize the safety and well-being of the most vulnerable customers.	
Communications during and after major weather events	Notify distributor customers when power has been interrupted. Communicate Estimated Time of Restoration (ETR) after damage assessment is complete. Provide consistent and timely/scheduled updates, until power restoration is confirmed.	●
Service restoration and communications questions in customer survey	Questions related to the accuracy, adequacy, and effectiveness of communications with customers during service interruptions included in distributors customer surveys.	◔

Background

The electricity sector in Ontario is facing increasing challenges related to climate change and extreme weather events. As the frequency and severity of major storms and other climate-related disruptions grows, there is mounting pressure on distributors to enhance the resilience and responsiveness of their systems while maintaining cost efficiency.

In October 2022, Ontario's then Minister of Energy sent a Letter of Direction (LOD) to the OEB highlighting its critical role as the energy regulator in an environment of increasing electrification and transition to cleaner energy sources. The letter emphasized that "the push for further electrification and the transition to cleaner energy sources will require innovation and leadership from the OEB." It outlined the government's vision for the energy system to leverage Ontario's clean energy grid to promote electrification and job creation while continually enhancing reliability, resiliency and customer choice.

The 2022 LOD requested the OEB to provide advice and proposals to improve distribution sector resiliency, responsiveness, and cost efficiency by June 30, 2023. The Minister noted that Ontario's electricity distribution sector will play a crucial role in the province's electrification transition, and that distributors will face pressure to:

1. Continue to provide high levels of reliability and resiliency to their customers.
2. Be responsive to changing customer expectations and new government mandates.
3. To do it all at an affordable price.

In addition, the LOD highlighted recent extreme weather events that affected distributor infrastructure across Ontario, noting that "As our climate changes, the OEB will have an important role to play in ensuring LDCs are preparing their distribution infrastructure for these kinds of events."

In response to the LOD, the OEB submitted a report to the Minister in June 2023 titled **"Improving Distribution Sector Resilience, Responsiveness and Cost Efficiency."** This comprehensive report provided a framework and recommendations for enhancing the electricity distribution sector's ability to withstand and rapidly recover from major disruptions. Key aspects of the report included:

1. A proposed definition of resilience for the sector.
2. A resilience framework focused on customer needs.
3. Specific proposals for improving resilience and responsiveness, including enhancing restoration and customer communications.
4. Recommendations for cross-sectoral coordination.
5. Strategies for enabling capacity through cost efficiency.

The report emphasized that resilience is more than just a distribution system challenge - it requires coordinated efforts across the energy sector, various levels of government, and engagement with customers. It noted that a cohesive approach to resilience is critical in the context of the energy transition, as customer confidence in reliable electricity services is key to supporting commitments to low carbon pathways.

A November 2023 LOD built on this work, reiterating the increasing importance of the OEB's role within the context of growing electrification and clean energy transition. It referenced the governments recently released "Powering Ontario's Growth" plan, which aims to meet increasing electricity demand driven by strong economic growth and electrification through the 2030s and 2040s.

In the 2023 LOD, the Minister endorsed several actions identified in the OEB's June 2023 report and requested that the OEB begin developing and implementing policies to require distributors to:

- Provide details and report on their current storm recovery planning and preparation activities;
- Incorporate climate resiliency into their asset and investment planning;
- Engage in a regular assessment of the vulnerabilities in their distribution system and operations in the event of severe weather;
- Prioritize value for customers when investing in system enhancements for resilience purposes; and
- Satisfy minimum targets for customer communication regarding interruptions and restoration of service following major weather events and measure and report on restoration of service following such events.

Of note, the Minister requested that the OEB make “significant progress on development and implementation of its recommendations by the end of 2024.”

In response to the Minister’s request and considering the increasing urgency around climate resilience in the electricity sector, the OEB has undertaken this study to assess the current state of Ontario's electricity distribution sector with regards to extreme weather preparedness, system hardening, restoration performance, and customer communications. The goal is to identify effective industry practices and summarize the adoption level for each effective industry practice, amongst Ontario distributors. The findings presented in this report are intended to inform OEB’s subsequent policy work, in relation to the Distribution Sector Resiliency, Responsiveness and Cost Efficiency initiative. This initiative aims to improve the overall resilience and responsiveness of the province's electricity distribution infrastructure in the face of a changing climate.

This report presents the findings of a comprehensive survey of Ontario distributors, analyzing their current practices across four key areas:

1. Operations Planning
2. System Hardening
3. Restoration Performance
4. Customer Communications

By summarizing Ontario distributors current practices and incorporating expert opinions from ICF, with its extensive experience in other jurisdictions, this repot aims to identify effective industry practices and areas with opportunities for improvement. The insights provided with help inform future regulatory policies and distributor practices. The ultimate objective is to ensure Ontario's electricity distribution sector is well prepared to meet the challenges of extreme

weather events while maintaining reliable, affordable service for all customers as the province pursues its clean energy and economic growth objectives.

Methodology

The OEB conducted a comprehensive survey to understand the current practices of Ontario distributors regarding operations planning, system hardening, restoration performance, and customer communication following extreme weather events. The OEB invited all 54 licensed electricity distributors to the survey. The distributor survey received 49 completed responses. Data collection took place from May 22, 2024, to June 24, 2024. A follow-up survey was conducted between June 17, 2024, and June 20, 2024, to ensure that critical questions were addressed. Participants were contacted up to three times by the OEB to maximize response rates.

The survey duration ranged from 15 minutes to 4 hours, with an average completion time of 56 minutes. Responses were collected from a diverse group of Ontario distributors, allowing for a broad perspective on the four topic areas covered in the survey. These findings provide insights into the current operational strategies of distributors across Ontario.

Distributors were categorized based on size, with three main classifications: very small (distributor serving fewer than 5,000 customers), small (distributor serving fewer than 30,000 customers), and large (distributor serving 30,000 or more customers). Among the 49 completed responses, 6 were from very small distributors, 21 from small distributors, and 22 from large distributors. The service areas covered by these distributors ranged widely, from small urban regions to vast rural areas. This diversity in respondent characteristics provided an overview of the different approaches and challenges faced by distributors in preparing for, withstanding, recovering from and adapting to extreme weather events.

Findings and Insights

Operations Planning

The increasing frequency and severity of extreme weather events pose significant challenges to Ontario's electricity distribution sector. Effective operations planning is crucial for distributors to maintain service reliability and respond efficiently to major disruptions. This section analyzes current practices among Ontario's distributors in operations planning, highlighting key findings from our comprehensive survey, identifying effective industry practices, and suggesting areas with opportunities for improvement.

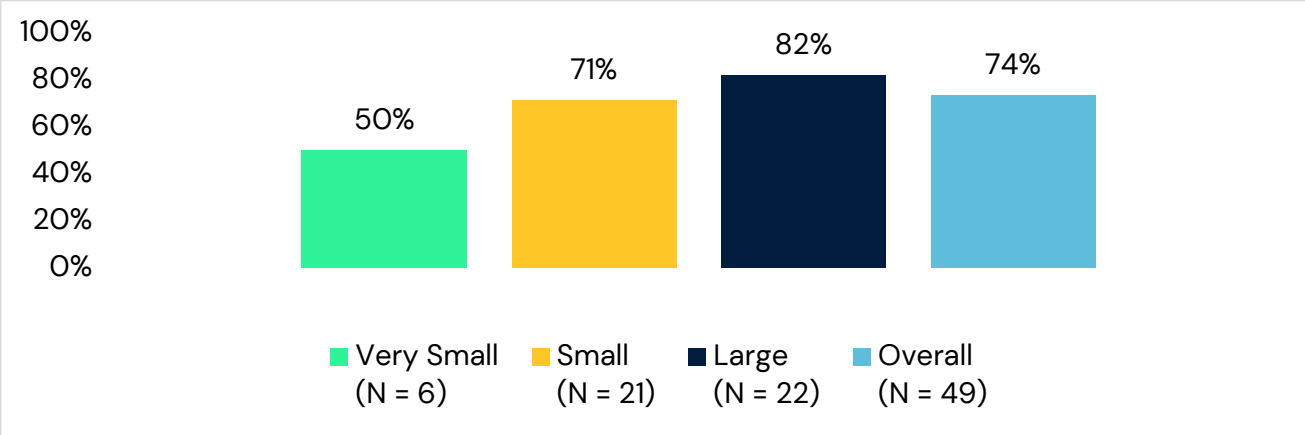
Results for Operations Planning

Recovery Planning

Operations planning in the survey emphasized various strategies for preparation, response, and communication. A substantial number of distributors (74%) have emergency plans that include restoration activities specifically for major weather events, though larger distributors (82%) are more likely to have these plans compared to smaller ones (71%). These plans typically involve a

command structure, communication protocols, and mutual aid agreements with other organizations. This ensures coordinated efforts during emergencies. However, certain elements such as training for incoming line crews and coordination with equipment suppliers are less frequently included, particularly among smaller distributors.

Exhibit 1. Emergency restoration activities specified in the company's Emergency Plan

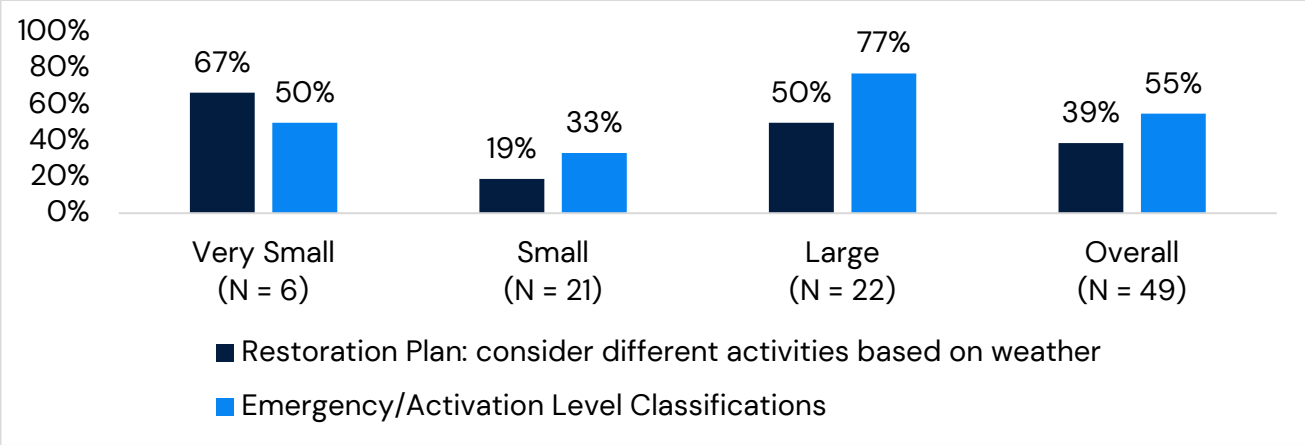


3. Does your company's Emergency Plan (Section 4.5.6. of the Distribution System Code) identify emergency restoration activities specifically related to major weather events? (N = 49)

One of the key components of operations planning is staff preparation. Activities include monitoring weather forecasts, notifying staff of potential weather events, and activating emergency response plans as needed. Many distributors conduct regular training, mock drills, and tabletop exercises to ensure staff are well-prepared for emergencies. Coordination with contractors, neighboring distributors, and local first responders is also a vital aspect of these plans, with morning meetings and safety briefings commonly held to assess weather conditions and availability of resources.

In terms of recovery planning, 55% of distributors have emergency/activation level classifications that trigger different responses based on the severity of damage. These levels range from local problems that can be managed internally to regional and provincial problems that require external assistance, including mutual aid. Larger distributors (77%) are more likely to implement such classifications than smaller and very small distributors.

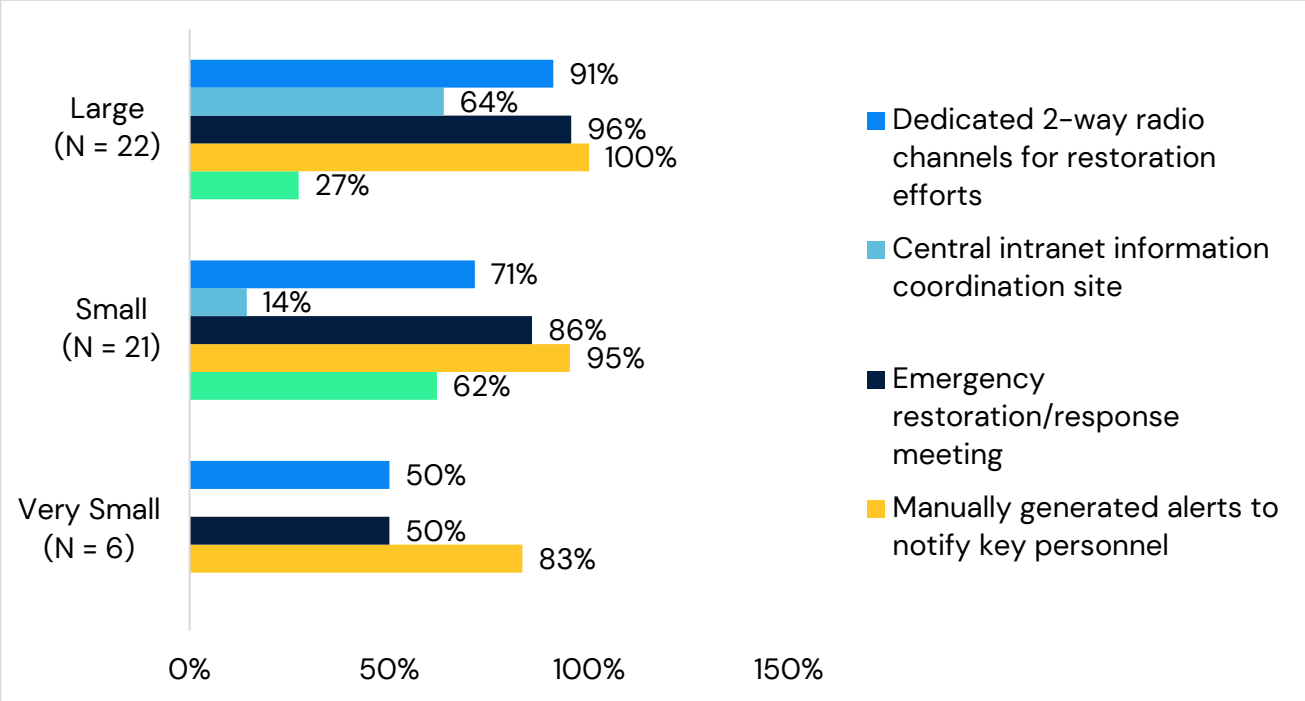
Exhibit 2. Planning Considerations



7. Does your company's restoration plan consider different activities depending on the type of weather events (flooding, ice storm, tornado, fire, etc.). (N = 49)
8. Does your company have emergency/activation level classifications based on the projected severity of damage, such as duration of interruptions or number of interruptions following major weather events? (N = 49)

Communication efforts play a crucial role in restoration activities. Distributors use various methods, including two-way radio channels, automated alerts, and emergency restoration meetings, to coordinate efforts across departments. Larger distributors are more likely to use advanced communication tools, such as automated notifications and central intranet sites for coordination, while smaller distributors rely more on manually generated alerts. Additionally, technology for weather prediction is primarily outsourced, with 98% of distributors relying on Environment Canada's weather alerts. Some distributors also use weather service subscriptions and weather prediction software to enhance their forecasting capabilities.

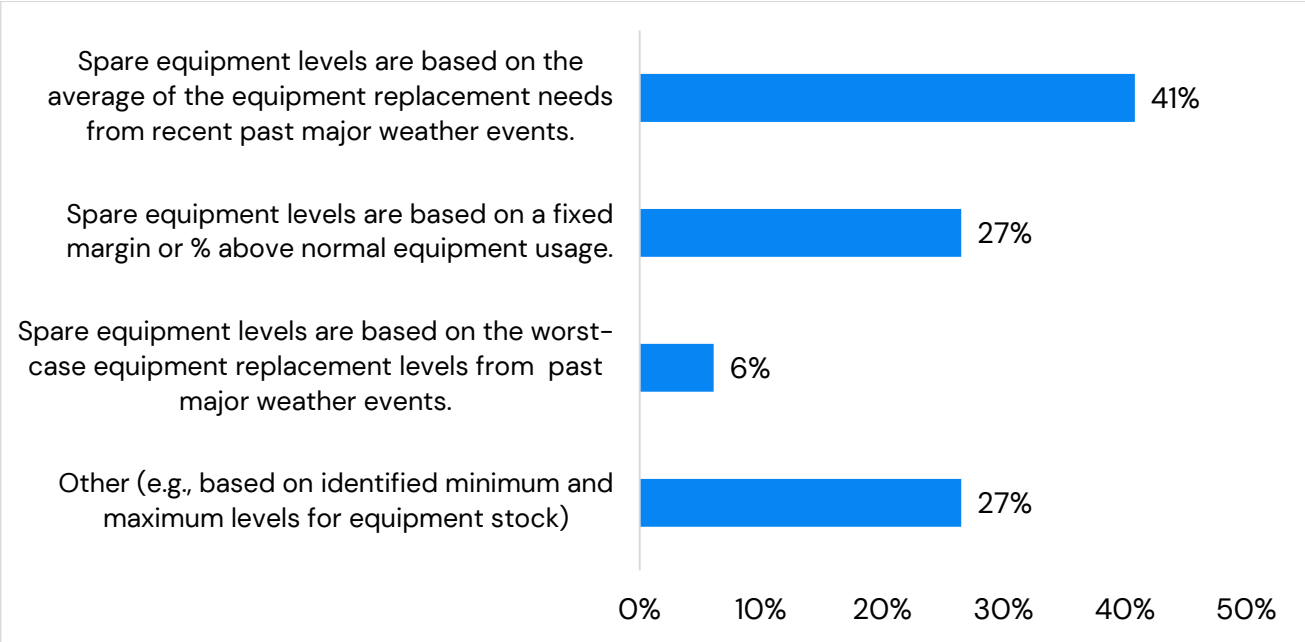
Exhibit 3. Company Communication



10. Please tell us if your company uses each of the following communication strategies to coordinate restoration activities across departments. (N = 49)

Lastly, spare equipment levels are determined by several factors, with most distributors basing their spare inventory on the average replacement needs from recent major weather events. This approach is common across distributors, but there are variations, with some distributors using worst-case scenarios, a fixed margin above normal usage or historical minimum and maximum levels to guide their spare equipment planning.

Exhibit 4. Determining Spare Equipment Levels

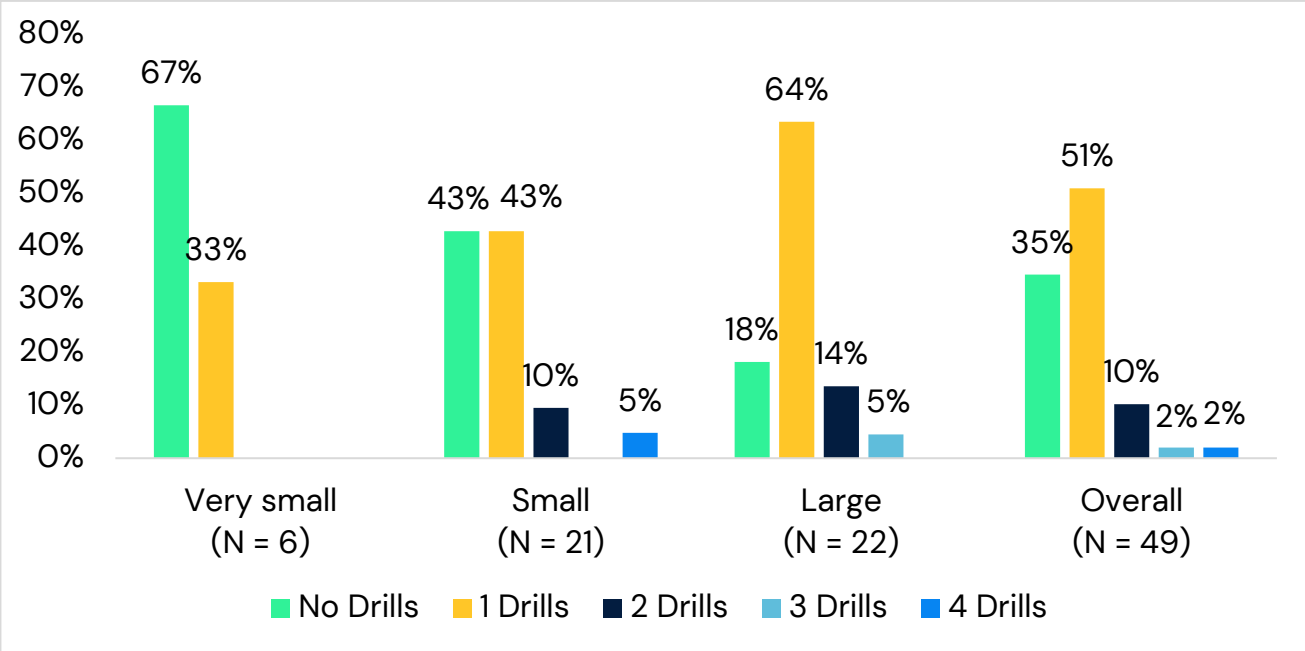


14. How do you determine spare equipment levels, particularly for equipment likely to be damaged during major storms? (N = 49)

Training and Preparation Activities

The survey revealed that most distributors engage in various training and preparation activities to ensure readiness for major weather events. Over half of the distributors (51%) conduct at least one emergency response drill each year, with larger distributors being more likely to participate in multiple drills. These drills are designed to simulate extreme weather conditions, assess response strategies, and assess the effectiveness of communication and resource allocation. Despite the importance of these drills, only roughly 40% of the respondents involve outside organizations, such as local governments or first responders, in their exercises. Larger distributors are more inclined to collaborate with external entities during these drills compared to smaller distributors.

Exhibit 5. Emergency Response Drills per Year



15. How many emergency response drills does your company conduct each year to prepare for major weather events? (N = 49)

Coordination with municipalities and the province is also an important aspect of preparation. During a government-declared emergency, most distributors maintain direct communication lines with municipal officials and emergency control groups. These collaborations ensure that the efforts of distributors are aligned with local emergency services, police, and fire departments to streamline the restoration process and manage community resources effectively.

Effective Industry Practices: Operations Planning

In Ontario's rapidly changing energy landscape, effective operations planning is essential for distributors to ensure resilience, responsiveness, and cost efficiency in the face of increasing extreme weather events. This section consolidates effective industry practices, as identified via survey results and practices in the utility industry, to provide distributors with a robust repository of information to support their operations planning processes.

Restoration plans are strategic documents developed by distributors to guide their response to disruptions caused by extreme weather events, natural disasters, or other emergencies that impact their ability to provide services. These plans outline the steps and procedures that need to be followed to restore normal operations as quickly and efficiently as possible. Effective industry practice in restoration plans incorporate elements such as command structures, communication protocols, mutual aid arrangements, critical load lists, and damage assessment procedures.

A command structure provides a clear hierarchy, defining roles and responsibilities for effective emergency response. It eliminates ambiguity by clarifying the chain of command, reporting lines, and specific duties for all responders. This enables swift decision-making and facilitates coordinated action across teams and partners during complex restoration efforts. By streamlining communication and processes, distributors can respond efficiently to rapidly evolving situations, crucial in time-sensitive scenarios where delays could worsen the impact of

extreme weather events. This practice thus helps distributors minimize disruptions and accelerate recovery efforts.

Communication protocols establish guidelines that dictate how information is shared within an organization, with external partners, and with the public during an emergency. These protocols ensure that all stakeholders are kept informed with accurate and timely updates, which is critical for coordinating a unified response. The benefits of well-defined communication protocols include reducing the risk of misinformation, ensuring that all teams are aligned with the same objectives, and maintaining clear and consistent messaging throughout the restoration process. By facilitating seamless information flow, distributors can enhance operational efficiency and improve the overall effectiveness of their emergency response efforts.

Mutual aid arrangements are pre-established agreements between distributors and other utilities or organizations to aid during emergencies. These arrangements typically involve the sharing of resources, such as personnel, equipment, and expertise, when a distributor's own capabilities are stretched thin by a major disruption. The primary benefit of mutual aid arrangements is that they enable distributors to quickly access additional resources and specialized skills that may be necessary to restore services more rapidly. This collaborative approach enhances overall sector resilience, ensuring that distributors can meet the demands of extreme events without overburdening their internal resources.

Critical load lists: Lists that identify the most essential infrastructure and services—such as hospitals, emergency services, and water treatment facilities to facilitate prioritizing power restoration, minimizing the broader societal impact of a disruption. By prioritizing these critical loads, distributors can effectively allocate their resources to where they are most needed, ensuring that the most vulnerable and crucial services are restored first, where possible. This practice not only protects public health and safety but also supports community resilience during extreme events.

Tiered Emergency or Activation Levels: Activation levels that are based on the projected severity of a major weather event, are designed to match the intensity and impact of the emergency, ensuring that the appropriate resources are deployed, whether they involve internal staff, contractors, or mutual aid agreements. By aligning the response with the severity of the disruption, distributors can enhance their ability to maintain service continuity and protect public safety.

Multiple Communication Channels: Effective communication and coordination are crucial during emergencies. Utilizing multiple communication channels and training and integrating external partners enhances a distributor's ability to manage and recover from disruptions. It is beneficial for the distributor to deploy various methods to share information during an emergency. These channels may include manually generated alerts, two-way radio channels, central intranet sites, and automated systems. By employing a range of communication methods, distributors ensure that information is reliably transmitted across all departments and with external partners, even if one channel fails.

External Organization Coordination: Effective training involves regularly including external organizations, such as local governments and first responders, in emergency response drills. This practice ensures that all stakeholders are familiar with their roles and responsibilities in a crisis.

When external partners are integrated into training exercises, it fosters a collaborative environment where all participants can practice working together, identify potential issues, and improve their coordination.

Risk-based Methodologies: Proactive management of resources and spare equipment is crucial for minimizing downtime and ensuring a swift response during restoration efforts. This aspect of operations planning focuses on the strategic allocation and availability of critical resources needed to restore service following a disruption. Building on this foundation, distributors may benefit from adopting risk-based methodologies to inform their spare equipment management strategies. This approach uses statistical analysis to consider both average and extreme events. The goal is to determine the optimal level of spare equipment needed to maintain service reliability under various conditions, thereby more effectively balancing preparedness with cost-efficiency.

Weather Prediction: While most distributors rely on Environment Canada for weather alerts, good industry practices include subscribing to advanced weather prediction services and utilizing specialized software. These tools provide more accurate and timely forecasts, allowing distributors to prepare more effectively for impending weather events and expand early warning systems which can alert personnel as well as customers.

Areas with Opportunities for Improvement: Operations Planning

While Ontario's distributors have made significant strides in operations planning to address the challenges posed by extreme weather events, there are several key areas where further improvements can enhance their resilience, responsiveness, and overall effectiveness. This section offers potential actions to address existing gaps.

Better standardization of emergency plan structures:
The survey asked whether each of 12 elements, related to service restoration, were included in each distributor's emergency plan. While all distributors emergency plans addressed mutual aid (a requirement of the Distribution System Code), command structure and communications, other areas such as training of incoming line crews and coordination with equipment suppliers were less well covered. Having a comprehensive emergency plan structure would help distributors to better prepare for disruptions resulting from severe weather events.

Including factors such as event severity, activation levels, resources required and coordination with outside agencies in emergency plans:
While a majority of distributors have incorporated specific restoration activities related to major weather events into their emergency plans, a disparity exists between larger and smaller utilities. While many distributors have general restoration plans, tailoring emergency plans to specific types of weather events, such as flooding, ice storms, and tornadoes would increase their effectiveness**.** Event-specific plans can ensure that responses are optimized for the unique challenges each event presents. Having activation levels that identify the expected resources for the response (employee, contractor, and mutual aid) as well as whether the response will be managed internally or via coordination with municipalities will also improve emergency plans.

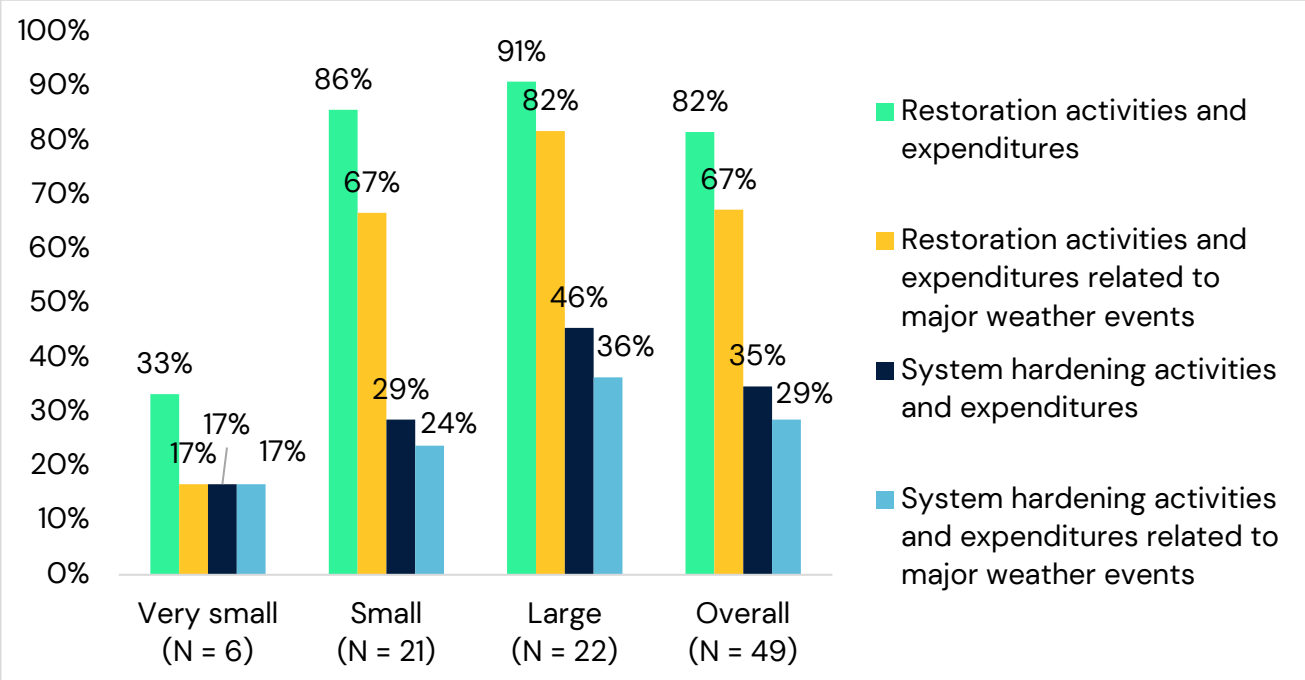
Performing annual emergency response drills that includes outside agencies:
While 51% of distributors conduct at least one emergency response drill each year to prepare for major weather events, 59% of distributors indicated that these drills do not include outside organizations such as local government or first responders. Annual drills that include outside organizations have several benefits, including improved coordination and communication and collaboration between utility staff and emergency responders, increasing preparedness by finding gaps in response plans and ensuring that teams are prepared to handle emergencies effectively.

Systems Hardening

Results

System hardening, a critical focus area for distributors, is essential for ensuring infrastructure resilience during extreme weather events. However, the survey indicated that only 29% of distributors actively track their system hardening activities and related expenditures, leaving many distributors without a formalized approach to evaluating the impact of such investments. Larger distributors were more likely to track and implement system hardening measures, while smaller distributors often relied on historical weather data to guide their decisions. Common system hardening strategies across distributors included regular system inspections, pole testing, and enhanced vegetation management to mitigate damage from severe weather events.

Exhibit 6. Tracking Activities



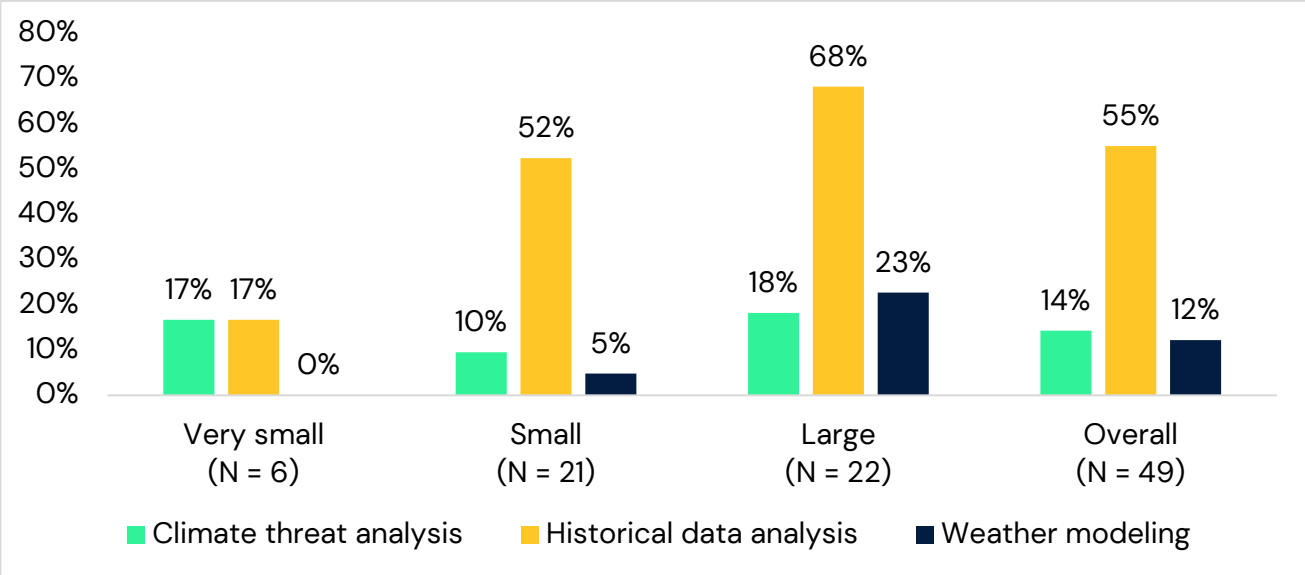
18. Does your company separately plan and track the following items? (N = 49)

In addition to these foundational strategies, some distributors used advanced simulation software to assess infrastructure resilience against potential extreme weather scenarios. Only a small number of distributors have adopted this technology as part of their investment planning process. More generally, many distributors do not differentiate between reliability and resilience

in their planning. For those that do, based on a summary of survey responses, reliability is seen as proactive efforts to prevent outages, such as infrastructure upgrades and maintenance, while resilience focuses on reactive strategies to minimize outage impacts once they occur. These distributors often use separate investment metrics and strategies for each, although the two concepts frequently overlap.

When assessing the potential for service interruptions due to major weather events, 52% of small distributors and 68% of large distributors analyzed historical data to anticipate future interruptions. Very small distributors, however, were less likely to conduct such analyses or engage in weather modeling. Larger distributors also conducted more detailed climate vulnerability assessments, often integrating both qualitative and quantitative analyses of asset vulnerabilities, weather projections, and investment adaptation needs. Despite this, the majority of distributors, especially smaller ones, have not completed a climate vulnerability assessment within the last five years.

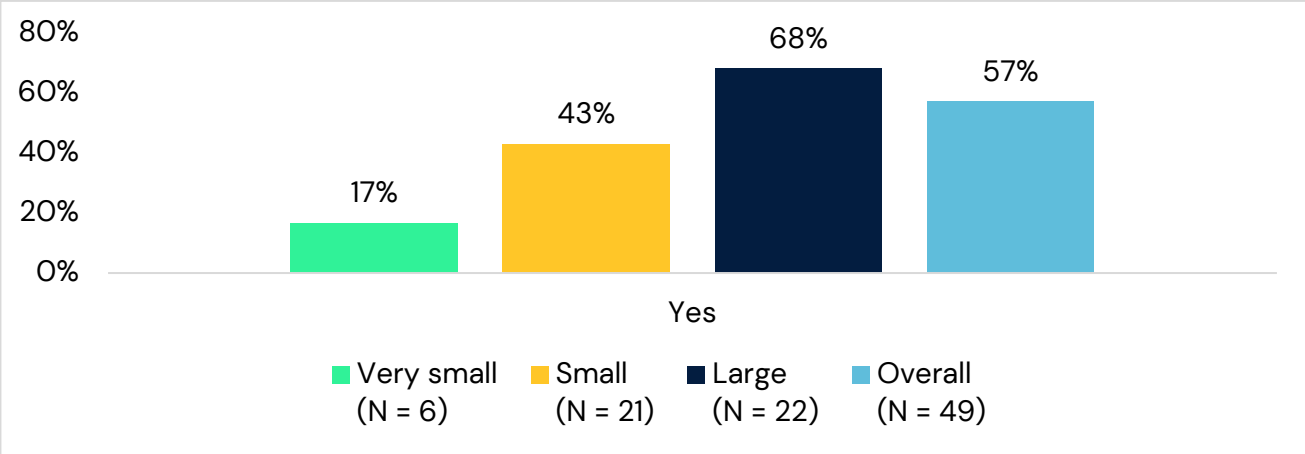
Exhibit 7. Activities Conducted to Assess Service Interruptions from Major Storm Events



26. Please tell us if your company conducts each of the following activities to assess the potential for service interruptions from major storm events. (N = 49)

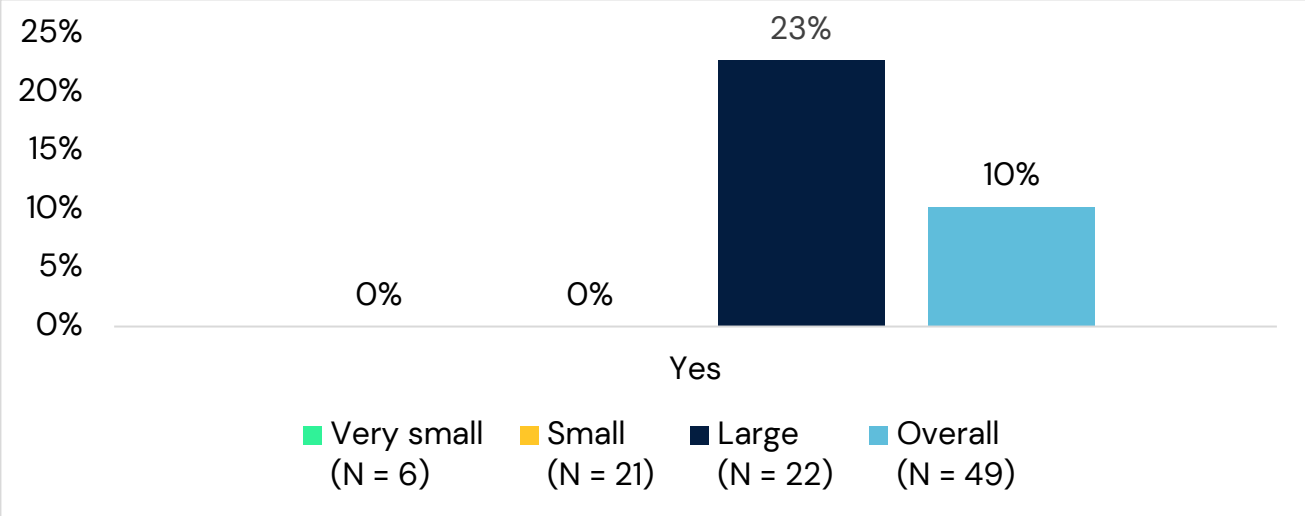
The value of service to customers plays a significant role in investment decisions for distributors, with 57% considering customer input through surveys or strategic planning when justifying investments in reliability and resilience. However, only 10% of distributors overall use Value of Lost Load (VoLL) studies to quantify the financial costs of outages and the benefits of system investments. VoLL studies were more commonly utilized by larger distributors, providing a structured method for evaluating the trade-offs between investment costs and the value of service reliability to customers.

Exhibit 8. Incorporate Value of Service to Customers



32. Does your company incorporate value of service to customers when justifying reliability/resilience investments? (N = 49)

Exhibit 9. Distributors Using Value of Lost Load



34. Does your company currently use value of lost load (VoLL) studies to evaluate the cost and benefits of your investment plans related to reliability and resiliency? (N = 49)

Effective Industry Practices: System Hardening

This section summarizes effective industry practices related to system hardening. The section notes where such practices are already in use among distributors and includes the percentage of distributors using such practices, as reported in the survey.

System hardening practices among Ontario's distributors show a range of approaches to enhancing grid resilience in the face of increasing extreme weather events. The survey data reveals both widespread practices and emerging trends that could shape future hardening efforts.

At the foundation of these practices is the **tracking of restoration activities and expenditures related to major weather events**. This approach has been widely adopted, with 82% of large distributors and 67% of small distributors implementing such tracking systems.

Data from tracked restoration activities enhances decision-making by providing a historical record of past weather events and their financial impacts. This helps distributors not only to

respond better to future events but also to make and justify future investments to regulators and stakeholders. By presenting detailed records of costs and outcomes, distributors can demonstrate the effectiveness of system hardening measures, thereby securing necessary funding and regulatory approvals for ongoing resilience efforts.

Additionally, tracking facilitates the integration of lessons learned from previous weather events into future planning. As the frequency and severity of extreme weather increases, this practice can help distributors remain adaptable and forward-thinking, using past performance data to continuously refine their approach to system hardening.

A small subset of distributors is beginning to embrace more comprehensive **climate risk assessment and adaptation planning**. These distributors conduct climate vulnerability assessments that incorporate both qualitative and quantitative analyses of asset vulnerabilities. While not yet widespread, this practice shows promise in developing more targeted and effective system hardening strategies.

By leveraging a combination of historical weather data, climate projections, and asset vulnerability studies, distributors can anticipate how future extreme weather events might impact specific components of the grid, from substations to distribution lines. This enables a more targeted investment strategy, where resources are allocated to the most vulnerable and critical areas of the infrastructure.

Incorporating resilience into system planning is a growing and effective practice. About half of distributors reported that they incorporate resilience into their system planning as an investment driver. Recognizing the increasing frequency and intensity of extreme weather events requires specific types of investments will result in distribution infrastructure that not only provides adequate service level under normal conditions but is also resilient to extreme weather events.

Considering the value of service in investment prioritization is another effective practice. Most large distributors and half of small distributors incorporate value of service to customers when making reliability and resilience investment decisions.

Considering value of service during project prioritization ensures that investments will deliver the most significant benefit in terms of customer service, reliability, and resilience. This customer-focused approach aligns investment decisions with the real-world impact of outages, improving overall customer satisfaction and trust.

More advanced practices like **VoLL studies** are still limited, with only 10% of respondents using them to quantify the financial impacts of outages and prioritize investments. These studies quantify the financial cost of outages to utility customers, providing a clear, data-driven basis for prioritizing investments. By attaching a dollar value to outages, distributors can make more informed decisions about where to allocate resources, ensuring that their system hardening efforts target areas where the monetary impact of outages is highest. This approach not only improves the efficiency of investments but also enhances the ability to justify expenditures to regulators and stakeholders.

Areas with Opportunities for Improvement: System Hardening

Ontario's distributors have made progress in adopting system hardening measures to improve resilience against extreme weather events. However, several areas remain where further potential actions could be taken to enhance the overall preparedness and response capabilities of distributors.

Tracking of system hardening activities and expenditures related to major weather events: While system hardening is a critical component of resilience efforts, only 29% of distributors actively track their system hardening activities and expenditures. This lack of formalized tracking limits distributors' ability to evaluate the effectiveness of their investments and identify gaps in infrastructure protection. Implementing tracking systems for system hardening investments, including both expenditures and outcomes related to hardening efforts will help distributors better evaluate the impact of investments on system performance under extreme conditions.

Using historical and forecast weather data to assess the potential for service interruptions. For projecting service levels, overall, 55% of distributors reported that they already analyze historical data to assess the potential for future service interruptions from major storm events. Even fewer respondents conduct weather modeling or climate threat analysis. Using historical data to assess the potential for service interruptions could be expanded across the sector and the data to support this are likely already being captured. Additionally, distributors are also encouraged to utilize weather projections in their assessments and estimates for future service interruptions, rather than only relying on historical trends. Using weather projections will enable distributors to characterize how reliability performance may change in the future and support actions plans that will maintain adequate service levels. .

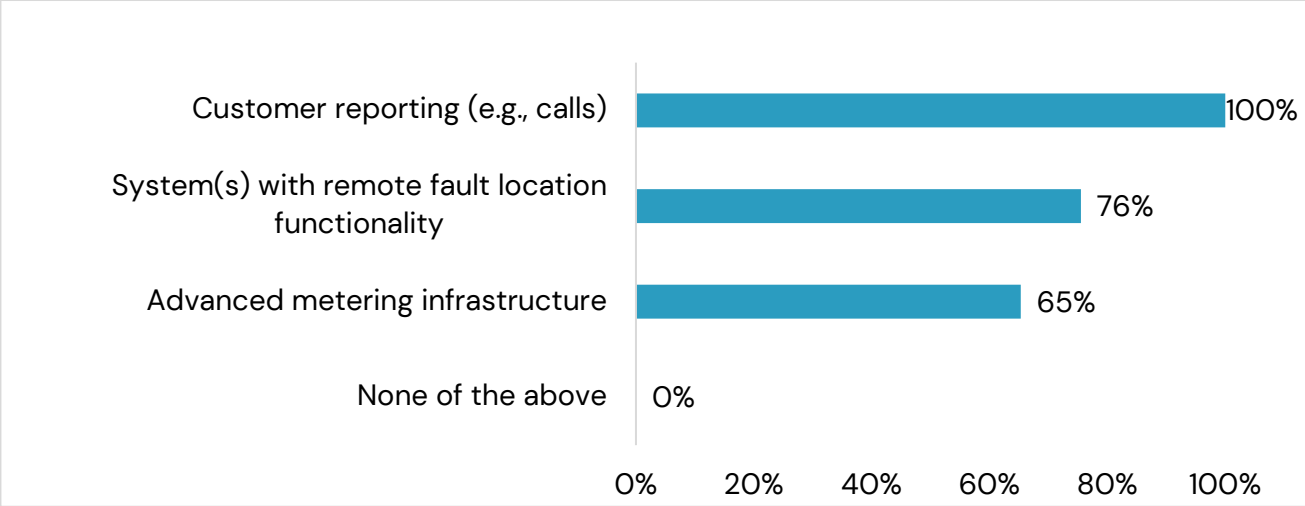
Restoration Performance

Results

Fault Identification and Damage Assessment

The identification of faults and assessment of damage are critical processes in restoring services after an extreme weather event. Most distributors in the survey use a combination of technologies and methods to identify faults in their systems. Approximately 76% of distributors reported utilizing systems with remote fault location functionality, while 65% rely on advanced metering infrastructure (AMI) to detect faults. Despite these technological advances, all distributors also rely on customer reporting as a method of identifying faults in the distribution system, demonstrating the importance of communication with the public in the fault identification process.

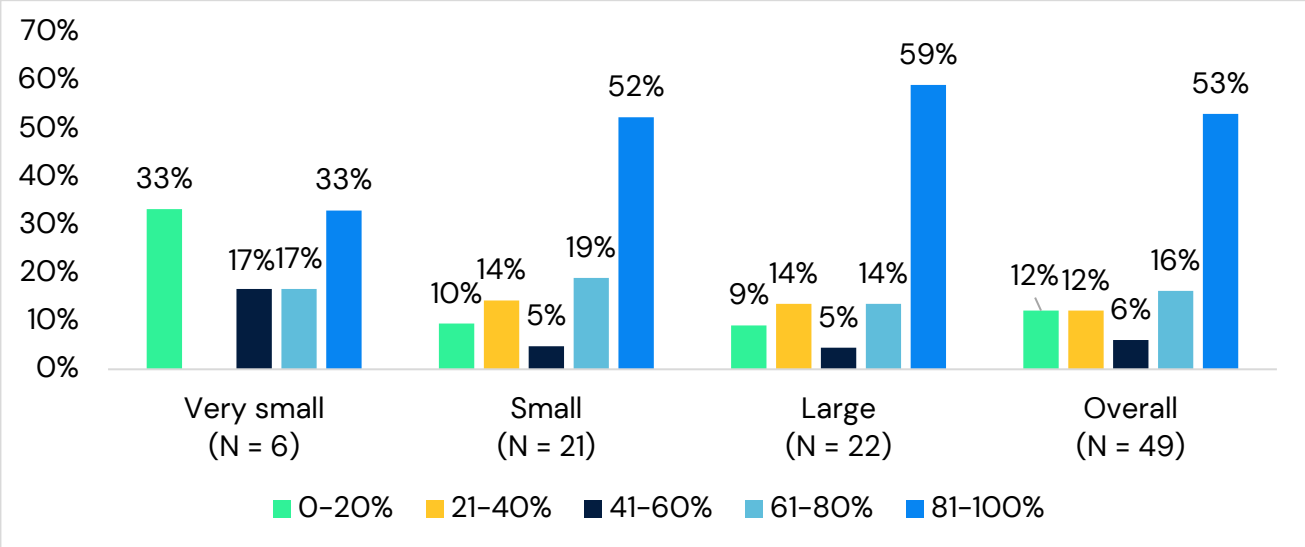
Exhibit 10. Methods for Identifying Faults



38. Which, if any, of the following does your company use to identify faults in your distribution system? Select all that apply. (N = 49)

The ability of distributors to identify faults in the distribution system is enhanced by using advanced technologies. According to the survey, 53% of distributors reported that more than 80% of their customers are served by systems with distribution automation.

Exhibit 11. Percent of Customers Served by Systems with Distribution Automation

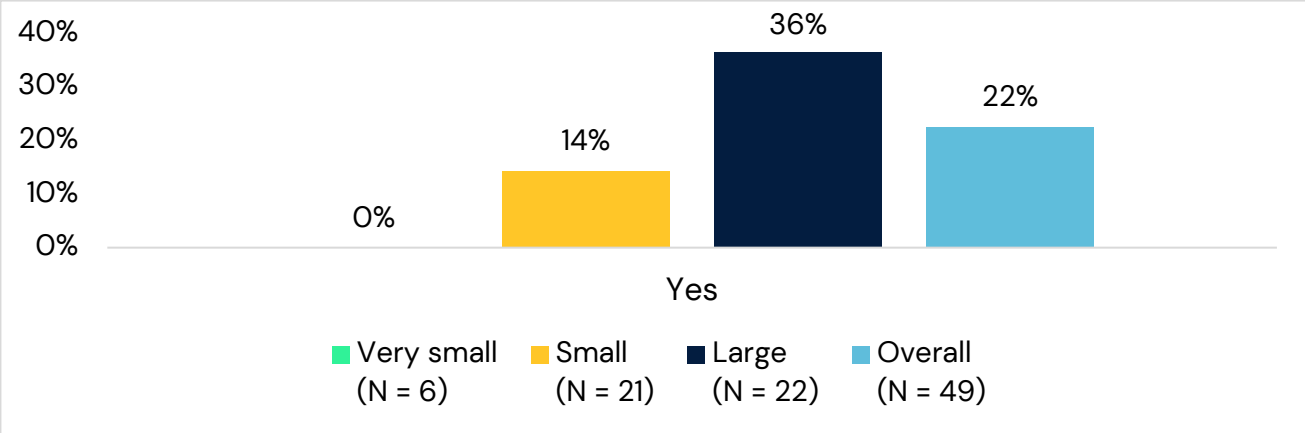


40. Roughly what percentage of your customers are served by systems with distribution automation (e.g., advanced technologies such as Fault Direction Indicators, reclosers or sectionalizers, remote terminal units, etc.)? (N = 49)

In terms of damage assessment, most distributors gather information directly from the field to inform their recovery efforts. Approximately one-third of large distributors take additional factors, such as system design, customer density, and prior damage profiles, into account when predicting damage levels. The use of Supervisory Control and Data Acquisition (SCADA), Geographic Information Systems (GIS), and Outage Management Systems (OMS) has become widespread among distributors to anticipate and assess damage levels. In addition, mobile technologies, such as field workers capturing photos and notes on site, are used to document

damage in real-time. Distributors also employ damage assessment patrols, which are mobile units equipped with software tools that allow for real-time damage evaluation and reporting.

Exhibit 12. Considering Factors Beyond Field Information



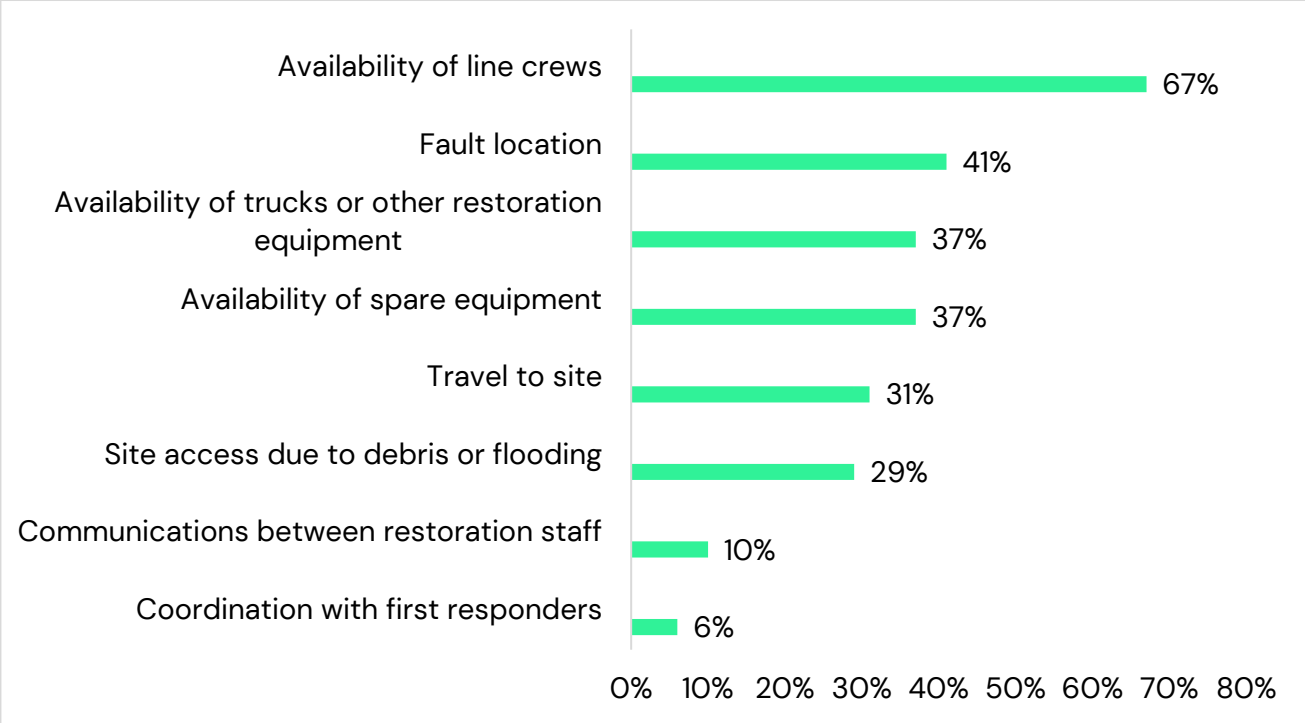
41. In addition to information on damage level collected from the field, does your company take other factors into consideration (e.g., prior profiles, system design, customer density) or use other technologies to predict damage levels? (N = 49)

Several distributors also incorporate predictive models, including outage prediction models and failure prediction curves, to forecast the number of incidents and level of damage expected during extreme weather events. These models are updated regularly based on weather forecasts and help to better prepare and allocate resources during restoration efforts.

Restoration Efforts

Restoration efforts following major weather events are a critical aspect of the operations of distributors. Based on the survey, the top three challenges identified during post-storm service restoration were the availability of line crews (67%), fault location (41%), and the availability of restoration equipment (37%). Smaller distributors often faced additional challenges due to resource constraints, such as budget limitations, small staff sizes, and a lack of specialized equipment. Logistical challenges, such as access to materials and coordination among multiple crews, were also frequently cited by respondents. These difficulties were exacerbated by communication issues between restoration staff and with first responders, as well as infrastructure-related issues like automation not being fully deployed.

Exhibit 13. Top Three Challenges

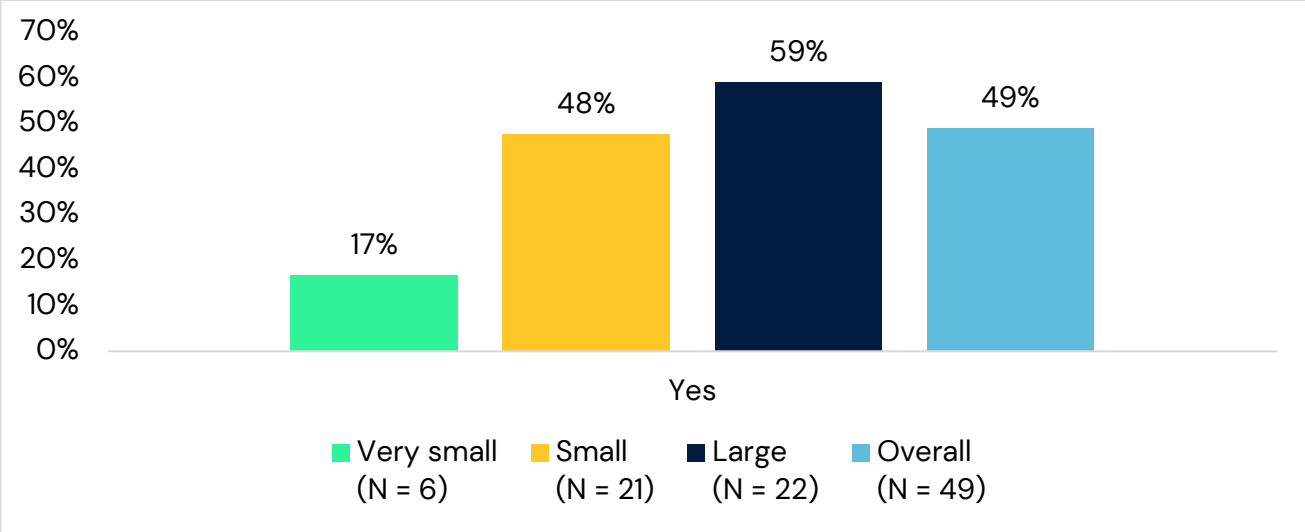


43. Which of the following are your top three challenges related to post-storm service restoration? Select up to three options. (N = 49)

To mitigate these challenges, many distributors employed a range of strategies. These included the use of specialized equipment such as off-road vehicles, helicopters, and drones to access hard-to-reach areas and identify fault locations. In addition, maintaining effective communication with municipalities, road crews, and emergency responders was vital for ensuring a coordinated and efficient response. Several distributors also had mutual aid agreements in place with other utilities and contractors to provide additional support when needed. Furthermore, robust vegetation management programs were utilized by some distributors to minimize disruptions caused by fallen trees and other debris.

In instances where customers were expected to be out of service for more than 48 hours, many distributors (49%) undertook additional activities to assist those customers. These activities often included at least daily communication through text messages, phone calls, and collaboration with local organizations to provide support. Larger distributors were more likely to conduct these extended support efforts than smaller ones.

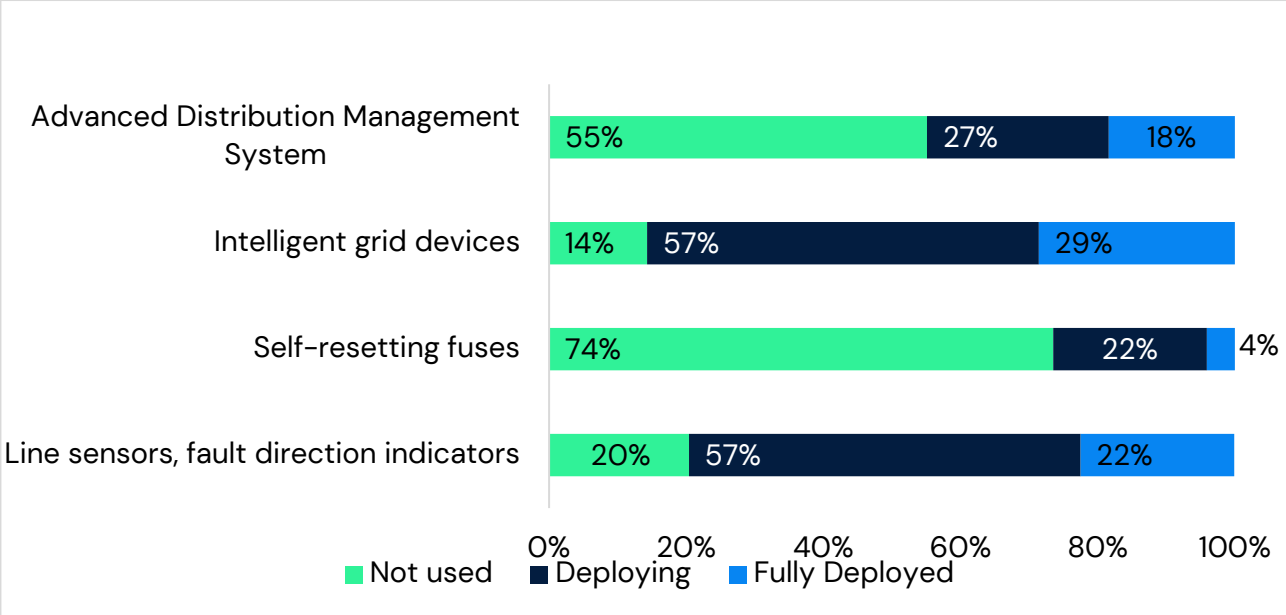
Exhibit 14. Additional Activities to Assist Customers



46. For customers who are expected to be out of service for an extended period of time after a major storm (such as more than 48 hours), does your company carry out any additional activities to assist these customers? (N = 49)

The deployment of smart devices and systems played a role in improving restoration efforts. Nearly 79% of distributors were deploying or had fully deployed line sensors and fault direction indicators, while advanced distribution management systems were also being implemented. These technologies enabled faster detection of issues and streamlined the restoration process.

Exhibit 15. Usage of Smart Devices and Systems

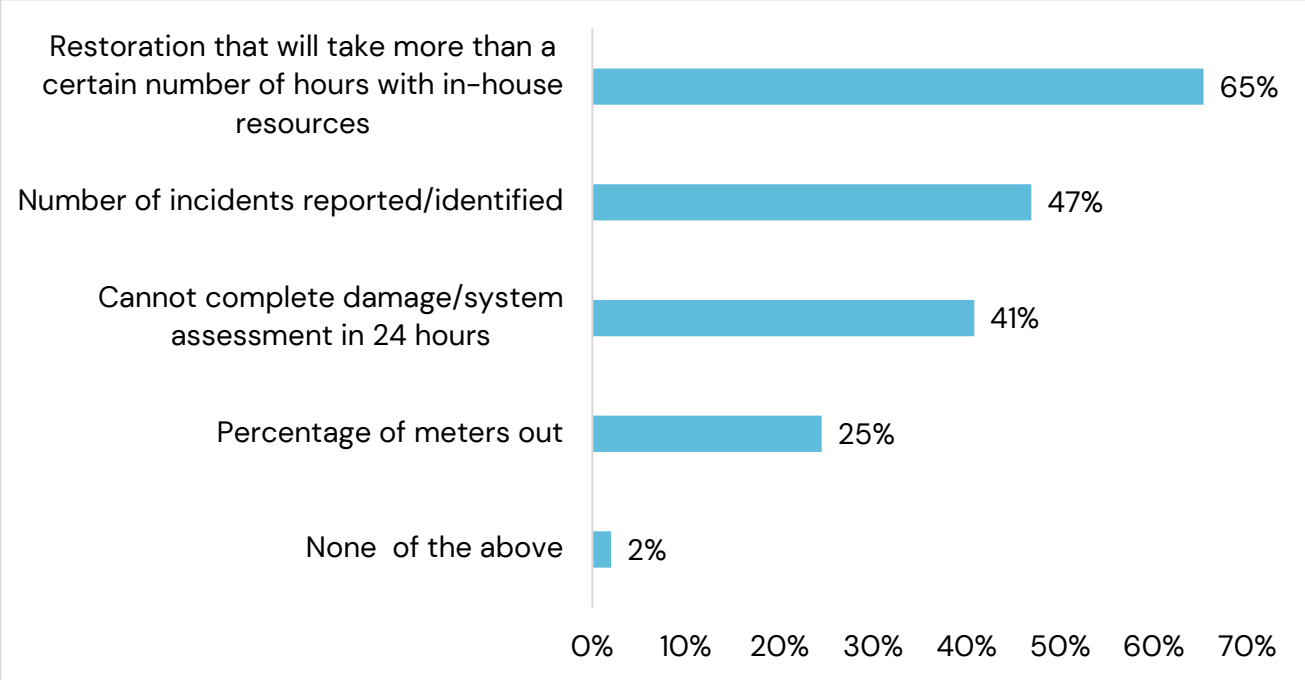


48. For each of the following smart devices and systems please indicate the level of deployment. (N = 49)

Another challenge of restoration efforts is allocating the right number of resources to assist with restoration and having clearly defined triggers for escalating response capabilities. The survey revealed that the top three determinants for escalating response capabilities include restoration that will take more than a certain number of hours with in-house resources (65%), the number of incidents reported/identified (47%), and if a damage system assessment cannot be completed in 24 hours due to the extent of the damage (41%). In these instances, distributors would activate

additional resources, such as contractors, mutual aid agreements, equipment sharing agreements, with the goal of reducing the amount of time needed to reconnect all customers following a major weather event.

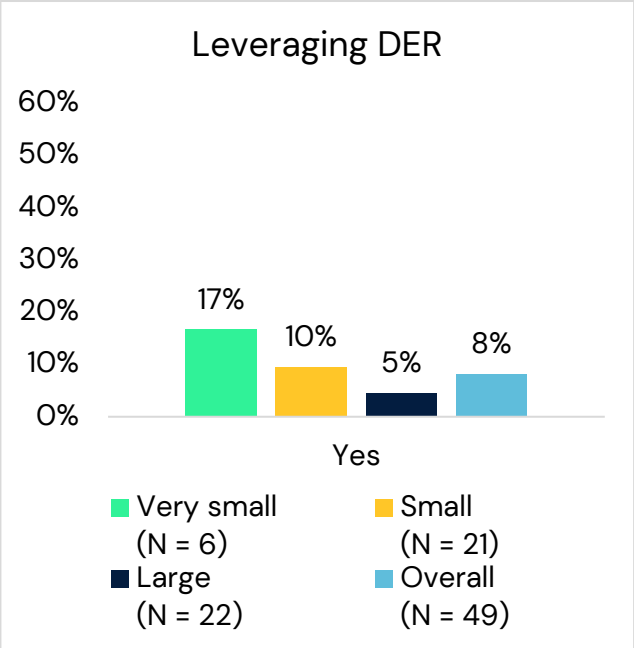
Exhibit 16. Escalating Response Capabilities

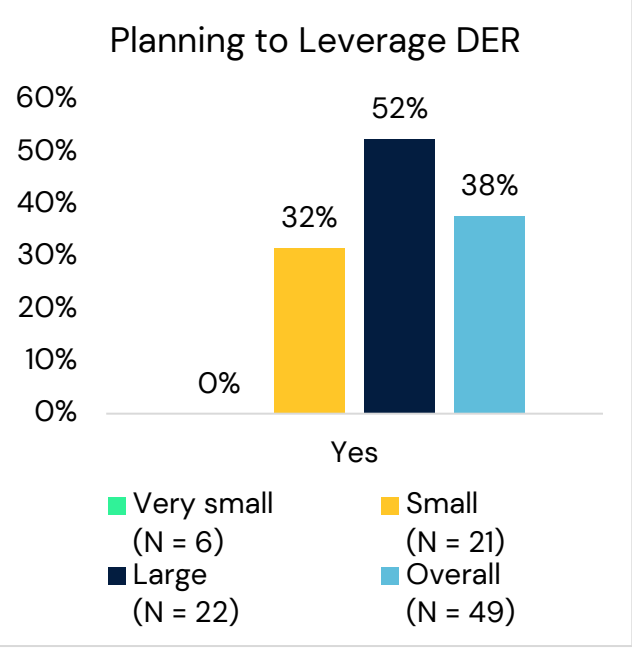


50. Which, if any, of the following determine when to escalate response capabilities for additional staff or request mutual assistance? Select all that apply. (N = 49)

In addition to these practices, the survey highlighted the increasing role of Distributed Energy Resources (DERs) in enhancing system resilience. While only a small portion of distributors currently leverage DERs, such as local waterpower generation and grid-scale batteries, their use is expected to grow. Large distributors are more likely to plan for future DER integration as part of their restoration strategy during extreme weather events. This integration of DERs offers a promising way to improve restoration speed and minimize disruptions, particularly in areas where conventional resources may be delayed.

Exhibits 17 & 18. Leveraging and Planning to Leverage DER





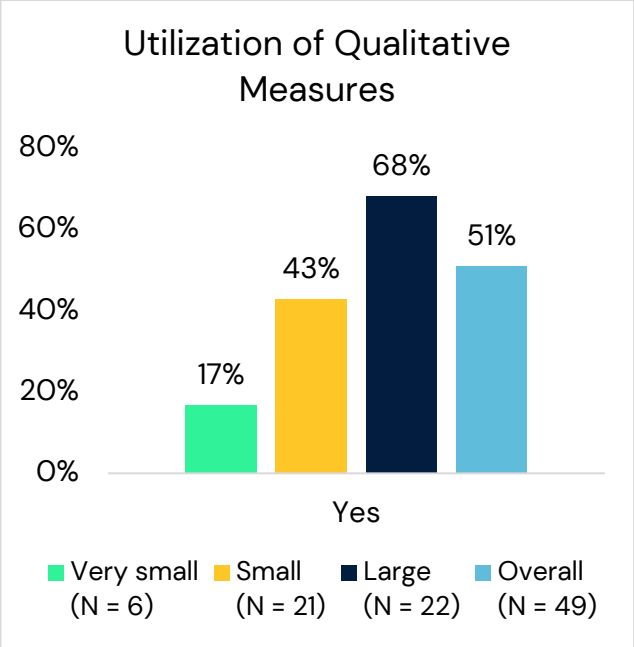
52. Does your company leverage Distributed Energy Resources (DER) to enhance system resilience during extreme weather events? (N = 37)
54. Does your company plan to leverage DER to enhance system resilience during extreme weather events in the future? (N = 35)

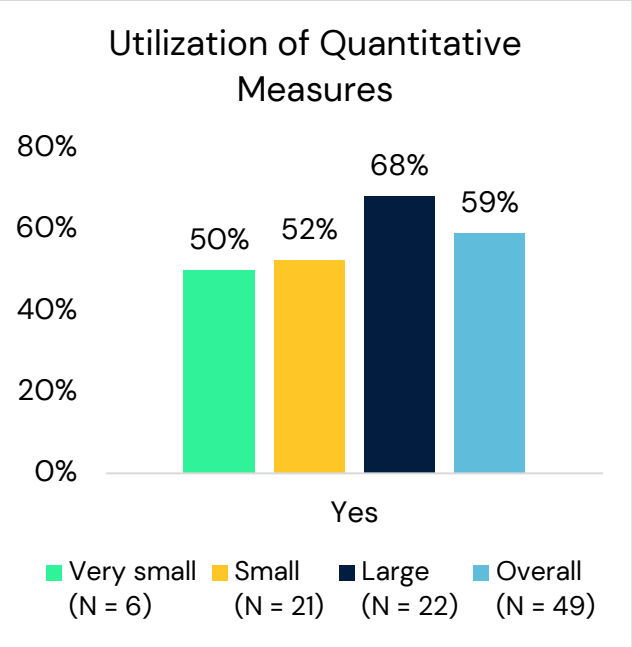
Post-Event Debrief

Following major weather events, distributors conduct post-event debriefs to evaluate their restoration efforts and identify areas for improvement. A substantial portion of distributors, especially larger distributors, engage in both qualitative and quantitative reviews. These debrief sessions often involve After-Action Reviews (AARs) where teams assess what worked, what did not, and potential improvements to future restoration efforts. Common topics discussed during these reviews include the efficiency of resource deployment, the effectiveness of internal and external communications, and the performance of restoration activities, such as damage assessment and crew coordination.

Quantitative measures used to track restoration performance are prevalent, with most distributors monitoring restoration times, outage durations, and customer minutes interrupted. These metrics are essential for evaluating overall system resilience and planning future improvements. In addition to performance metrics, distributors also assess restoration time for critical infrastructure and track the material and labor costs associated with restoration efforts.

Exhibits 19 & 20. Utilization of Qualitative and Quantitative Measures

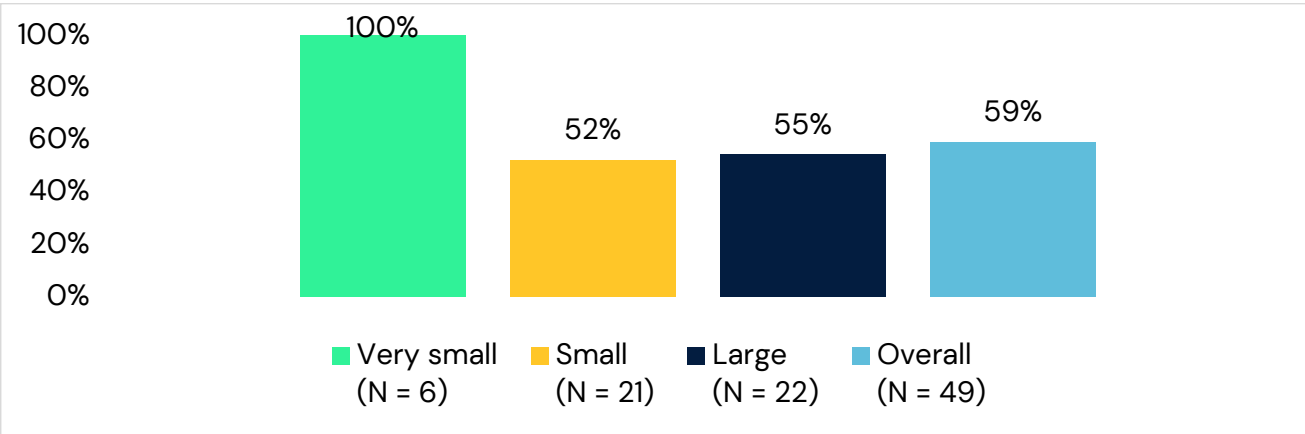




55. Does your company have any qualitative measures in place to track and assess its performance of restoration activities (e.g., deviation from the restoration plan, resource deployment, human errors)? (N = 49)
57. Does your company have any qualitative measures in place to track and assess its performance of restoration activities (e.g., time to inform customers, restoration time, cost of recovery)? (N = 49)

Most distributors have established processes for tracking the restoration time of essential services, such as hospitals and emergency response facilities, in addition to meeting the reporting requirements under the Major Event Response Reporting (MERR) standards. Many distributors also collect event-specific data, including the time of crew response, customer interruptions, and restoration times for critical infrastructure. This information helps assess the effectiveness of the restoration process and ensures that priority is given to critical loads during outages. Some distributors further enhance their reporting by conducting internal reviews to improve future restoration strategies and ensure that lessons learned are incorporated into preparedness plans.

Exhibit 21. Tracking Restoration Time



59. Does your company track restoration time for critical loads? (N = 49)

Effective Industry Practices: Restoration Performance

This section summarizes effective industry practices related to restoration performance. The section notes where such practices are already in use among distributors and includes the percentage of distributors using such practices, as reported in the survey.

The ability to restore power quickly and efficiently after extreme weather events is critical for Ontario's distributors. Restoration performance depends on effective strategies for fault identification, damage assessment, resource mobilization, and customer communication. This section outlines effective industry practices observed among distributors in Ontario.

One of the foundational practices for improving restoration performance is the use of **advanced fault detection technologies**. Currently, 65% of distributors utilize AMI, and 75% use remote fault detection systems, such as Smart Faulted Circuit Indicators and digital relays, to identify issues within the distribution system. These technologies enable the rapid identification of faults, reducing the need for manual inspections and minimizing customer downtime.

Resource management is another critical element of restoration performance. As previously discussed in Effective Industry Practices: Operations Planning, distributors that participate in mutual aid programs can access additional line crews and equipment during large-scale outages. Approximately 65% of distributors request mutual assistance when restoration time exceeds a predetermined threshold, ensuring that severe events are managed efficiently without overextending internal resources.

Establishing pre-arranged mutual assistance agreements better ensures that additional resources are available quickly when needed. Distributors can set clear criteria for when to escalate response capabilities, such as restoration times exceeding a specific number of hours or the number of incidents reaching a certain threshold. This allows for better coordination and faster mobilization of external support.

Distribution automation is increasingly recognized as a best practice for enhancing restoration performance. Currently, 75% of distributors report that over 40% of their customers are served by systems with automated technologies, including reclosers, sectionalizers, and fault indicators. Automated systems allow for remote switching and isolation of faulted sections, significantly reducing the need for manual interventions and shortening restoration times.

Expanding distribution automation to cover a larger percentage of their customer base would further enhance system resilience and ensure faster restoration, particularly during widespread outages.

Effective **restoration performance assessment** can be enhanced by comprehensive tracking and measuring of restoration activities. The majority of distributors track both qualitative and quantitative metrics, which are essential for assessing the effectiveness of restoration efforts and identifying areas for improvement.

Conducting post-event reviews is a widely adopted effective practice; 68% of large distributors use qualitative measures such as resource debriefs, and post-event lessons learned to assess the effectiveness of their restoration efforts.

Advanced **damage assessment techniques** are increasingly being adopted: Some distributors use drones, mobile apps, and GIS integration for more efficient and accurate damage

assessments. Implementing a multi-faceted approach to damage assessment, combining field reports with advanced technologies such as drone surveys and AI-powered image analysis, and integrating these tools with GIS and OMS to provide real-time, comprehensive damage data can inform restoration strategies.

Smart devices and systems are becoming increasingly important in restoration efforts. Many distributors are adopting these technologies, with 45% deploying Advanced Distribution Management Systems (ADMS), 86% deploying intelligent grid devices and 80% deploying line sensors and fault direction indicators. These technologies enhance real-time monitoring and control capabilities. Additionally, while current adoption is low, some distributors, particularly larger ones, are developing strategies for DER integration to enhance system resilience during extreme weather events.

Each of these technologies contributes to a smarter, more responsive grid, which not only improves operational efficiency but also significantly enhances resilience against extreme weather events. Their integration allows distributors to manage the grid in real time, prevent outages, and restore service faster when issues arise, making them essential components of a modern, resilient energy system.

- ADMS: provides a centralized platform for real-time monitoring, control, and optimization of the grid. This enhances a distributor's ability to respond quickly to issues, automate decisions, and improve overall grid efficiency. By integrating data from various sources, ADMS allows distributors to optimize resource allocation during outages, reduce downtime, and improve the overall resilience of the system. This capability is especially important during extreme weather events when system performance is strained.
- Intelligent Grid Devices: The deployment of intelligent grid devices, such as automated switches and sensors provides real-time data on grid performance. This data allows distributors to detect faults quickly, isolate them automatically, and reroute power, when necessary, which reduces the duration and impact of outages. Intelligent devices enable distributors to transition from reactive to proactive management, improving grid reliability by preventing small issues from escalating into larger system failures.
- Line Sensors and Fault Direction Indicators: These devices enhance the grid's diagnostic capabilities by pinpointing the location of faults more accurately. They allow distributors to quickly identify problem areas during outages, reducing restoration times and operational costs. This real-time fault detection and isolation are critical in extreme weather situations, enabling faster recovery and minimizing the impact on customers.
- DER Integration: While adoption is still low, the integration of DERs (such as microgrids, solar panels, and energy storage systems) is a forward-looking best practice because it enables greater grid flexibility and resilience. DERs can provide localized power during outages, reducing reliance on centralized infrastructure and improving the grid's ability to withstand and recover from extreme weather events. During weather-related disruptions, DERs can maintain power supply to critical areas, preventing widespread blackouts and enhancing community resilience.

Areas with Opportunities for Improvement: Restoration Performance

While Ontario's distributors have made significant strides in their restoration performance following major weather events, there are several key areas where further improvements could enhance the sector's overall resilience and responsiveness. This section outlines potential actions to address existing gaps and elevate restoration performance across the province.

Increase the percentage of customers served by distribution automation systems: As discussed above, distribution automation is an effective industry practice for enhancing restoration performance. Currently, 75% of distributors report that over 40% of their customers are served by systems with automated technologies, including reclosers, sectionalizers, and fault indicators. Expanding distribution automation has the potential to allow more customers to benefit from reduced manual interventions and decreased restoration times. ICF recognizes that distribution automation may be capital intensive and should be implemented gradually. In some cases, it may be cost prohibitive for some distributors.

Periodically communicate with customers expected to be out of service for more than 48 hours after a major storm: Almost half of the survey respondents indicated that they carry out additional communications to assist customers expected to be out of service for an extended period, such as 48 hours. These additional communications could include texts, phone calls, as well as updating information on distributors' websites. Communicating with customers who may be out of service for an extended period can help those customers better cope by perhaps temporarily relocating or obtaining a backup power source.

Evaluate storm restoration performance via after-action reviews that include metrics: Conducting post-event reviews is a widely adopted practice with 68% of large distributors using qualitative or quantitative metrics to assess the effectiveness of their restoration efforts. It is beneficial to identify a standard set of metrics to evaluate restoration performance and formally conduct after-action reviews, using those metrics. To minimize regulatory burden, metrics could be chosen that would not require additional technology or systems.

Some potential dimensions for qualitative metrics are listed below:

- Resource and Operations Review: Evaluating resource use, operational and material issues, restoration times, and adherence to Emergency Response Plans.
- Communication Effectiveness: Assessing internal/external communication, customer feedback, and quality of service updates.
- Post-Event and Lessons Learned Reviews: Conducting post-event sessions, updating plans with lessons learned, detailed investigations of major outages and presenting reports to the distributor's Board.
- Incident and Safety Reviews: Investigating human errors, safety issues, and plan deviations.
- System and Technology Assessment: Reviewing outage management systems and suggesting improvements.

Some potential dimensions for quantitative metrics are listed below:

- Restoration Time and Outage Duration: Monitoring outage periods alongside corresponding restoration intervals, including the time required to restore service to 90% of customers, the average time to the first ETR.
- System Reliability Indices: Measuring SAIDI (System Average Interruption Duration Index), and SAIFI (System Average Interruption Frequency Index)
- Cost Tracking: Documenting recovery costs (both capital and O&M), tracking storm-specific expenditures and recovery strategies, utilizing subledgers for expenses related to significant weather events.
- Communication and Performance Metrics: Recording response times for answering calls during outages, customer notifications through digital channels, social media engagement, website activity, call center performance evaluations, and a comprehensive checklist of communication tasks.
- Incident and Resource Management: Counting affected customers, documenting incidents and their occurrence hours, addressing and improving performance of the least reliable feeder, and using geo-tracking for trucks to minimize travel times.
- Performance and Improvement Reviews: Conducting internal evaluations of storm response efficiency and identifying enhancements for future storm responses.

Maintain lists of specified critical customers and track restoration time for those customers during events: A significant number of distributors maintain lists of critical customers and have established processes for tracking the restoration time of these customers, such as hospitals, water treatment facilities, etc. in addition to meeting the reporting requirements under the Major Event Response Reporting (MERR) standards. Expanding this practice could help minimize the societal impact of outages and improve public safety during emergencies.

Customer Communications

Results

Before a Major Weather Event

Before major weather events, distributors in Ontario focus on proactive communication strategies to inform and prepare their customers. Social media and distributor websites are the primary communication channels, with 86% to 90% of distributors using these platforms to provide updates and preparedness tips to customers. These channels are essential for ensuring widespread outreach across different customer segments, including both small and large distributors. In addition to social media and websites, about 39% of distributors also utilize news media to share information with their customer base, while a small number of distributors rely on email, bill inserts, and text message/SMS notifications.

While automated voice messages and community events are less frequently used for pre-event communication, a few distributors have adopted them to ensure that customers receive vital information, especially those in vulnerable areas. As an effective industry practice, larger distributors often incorporate emergency notification systems, utilizing a combination of communication channels to ensure broad coverage and efficient customer engagement.

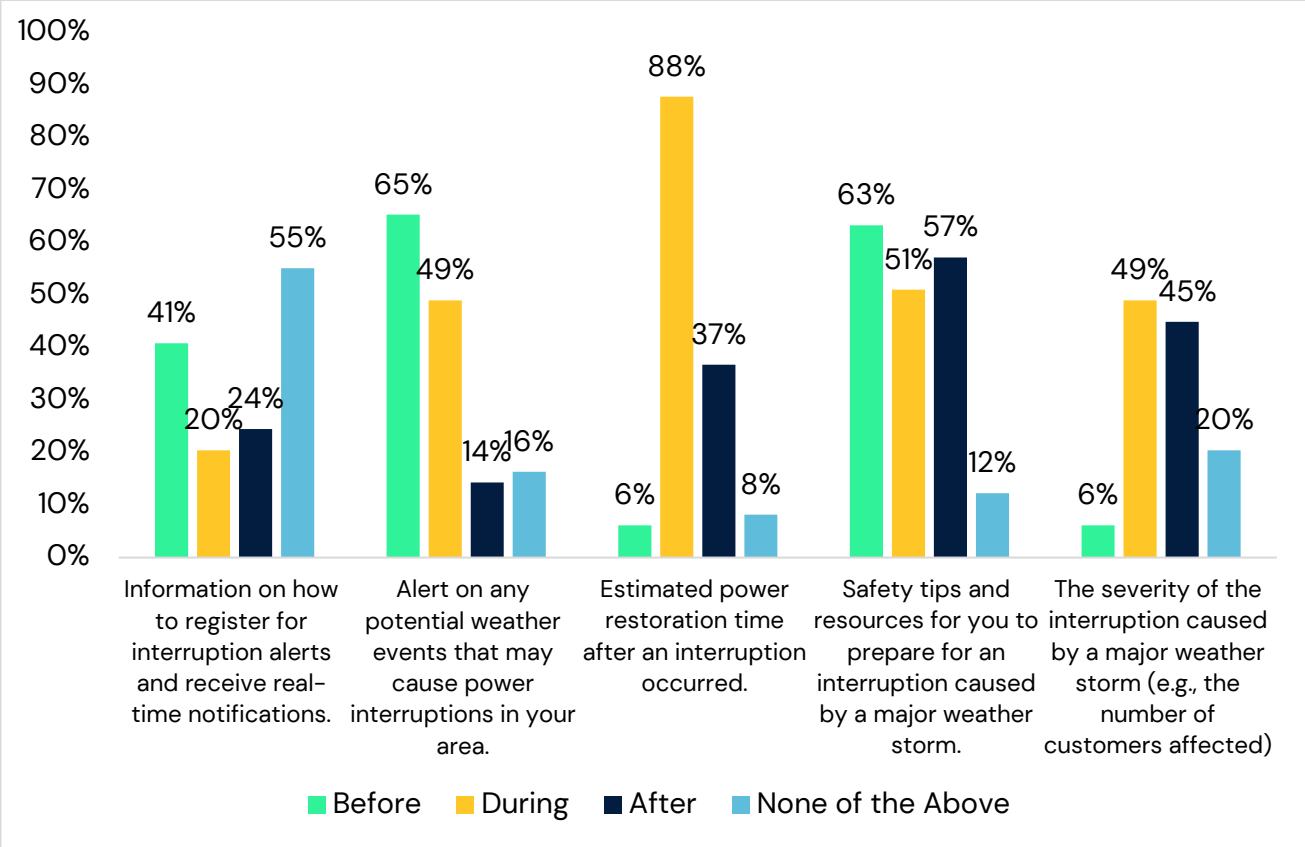
Exhibit 22. Methods to Inform Customers Before a Major Storm

Methods to Inform Customers Before a Major Storm				
	Very Small (N = 6)	Small (N = 21)	Large (N = 22)	Overall (N = 49)
Social media	50%	100%	91%	90%
Distributor website	50%	86%	96%	86%
News media	0%	29%	59%	39%
Bill inserts	17%	14%	32%	22%
Community events	0%	14%	27%	18%
Email	0%	10%	32%	18%
Text message/SMS	0%	14%	27%	18%
Automated voice message	17%	0%	5%	4%
Preparedness webinars/training	0%	5%	45%	4%

61. Please tell us if you use any of the following communications methods to inform customers on preparedness measures before a major storm? (N = 49)

The type of information shared with customers before a major weather event typically includes alerts about potential weather events that may cause power interruptions, instructions on how to register for interruption alerts, and general preparedness tips. Around 65% of distributors provide alerts about upcoming weather events, while 63% send information on how to register for real-time notifications. However, restoration time estimates and the severity of the interruption are more often communicated during or after the event, reflecting the evolving nature of communication as the weather event unfolds.

Exhibit 23. Information Sent About a Major Weather Event

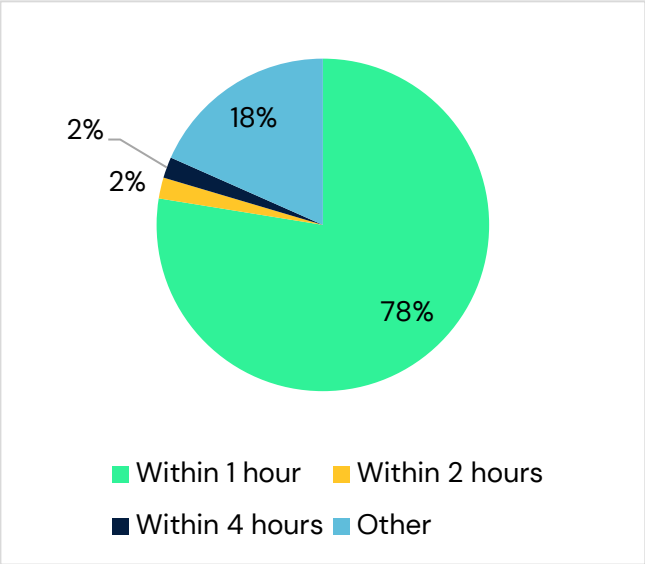


63. Please tell us if you send your customers before, during, and/or after a major weather event information on how to register for interruption alerts and receive real-time notifications. Select all that apply. (N = 49)

During a Major Weather Event

During a major weather event, distributors engage in continuous communication with their customers to keep them informed about the status of restoration efforts and any relevant updates. Almost all distributors communicate the status of service crews, the cause of outages, and the ETR to affected customers. Approximately 78% of distributors notify customers of an interruption within one hour of it occurring, while a smaller number of distributors can send updates even sooner, within 15 minutes. Some distributors also use outage maps to provide real-time information to customers.

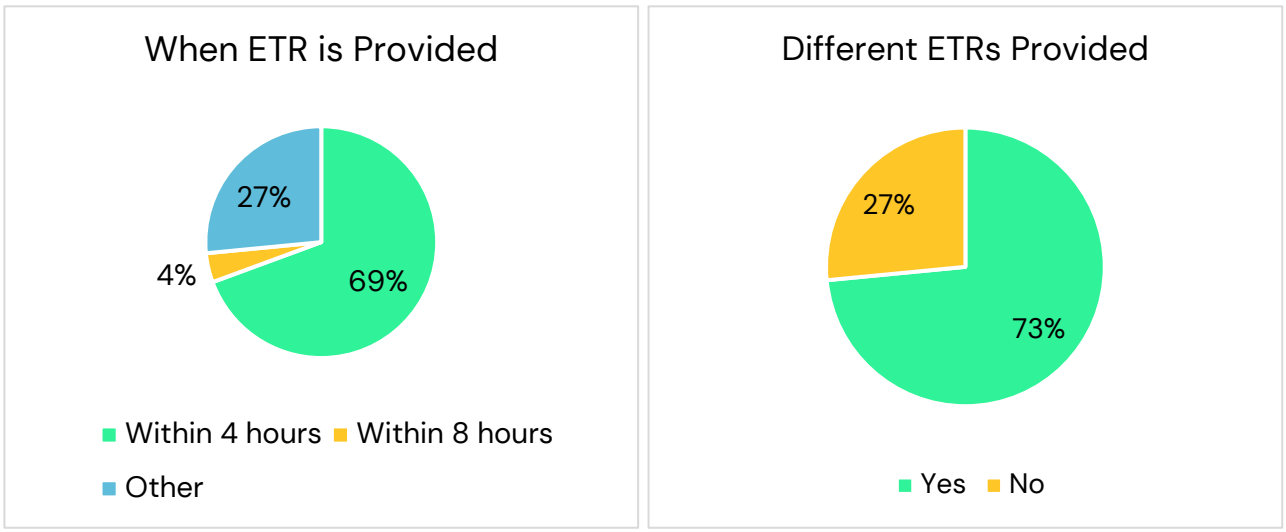
Exhibit 24. Alert to Customers of Interruption



74. On average, how soon after an interruption do you alert your customers that you are aware they have been interrupted? (N = 49)

In terms of ETRs, 69% of distributors can provide customers with an estimated restoration time within four hours of completing the damage assessment. Additionally, 73% of distributors can provide different ETRs to customers depending on their geographic location, allowing for more targeted and accurate information.

Exhibit 25 & 26. Providing Customers with ETR

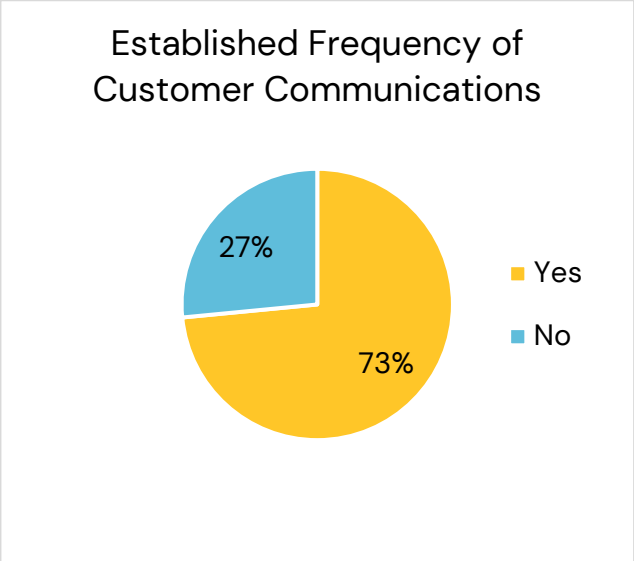


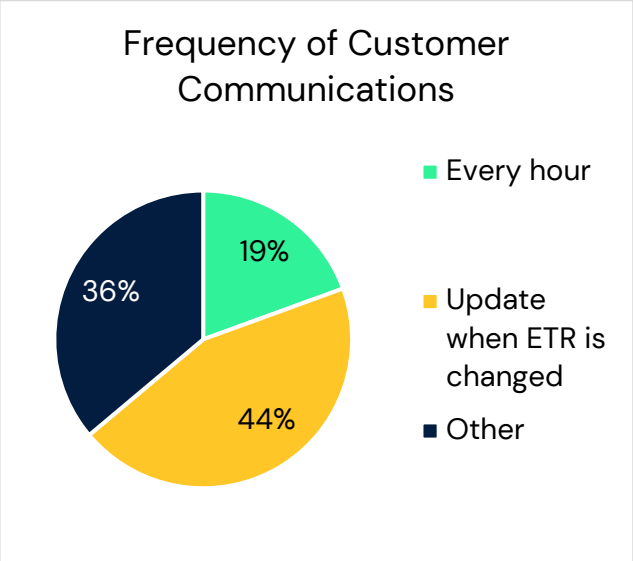
75. On average, how soon after the damage assessment can you provide your customers with the ETR? (N = 49)
76. When providing ETR to customers, do you provide different ETRs to affected customers based on their locations? (N = 49)

For extended interruptions, 73% of distributors follow an established communication frequency, with many providing updates based on changes in the ETR. About 44% of distributors update customers every time the ETR changes, while others communicate at specific intervals, such as every hour.

Some distributors also maintain expedited communication processes for targeted customer segments, particularly vulnerable customers who rely on electrically powered life-support equipment. These customers are often contacted directly via phone calls or automated systems to ensure they receive timely updates during outages.

Exhibits 27 & 28. Frequency of Customer Communications



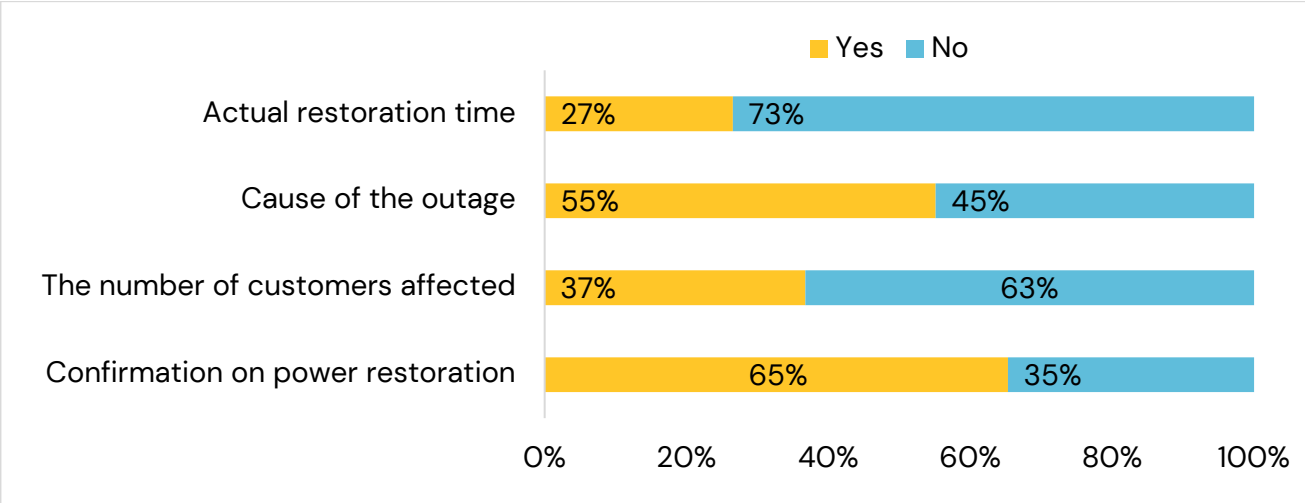


77. Do you have an established frequency of customer communications (e.g., daily) for extended interruptions following major weather events? (N = 49)
78. What is the frequency of customer communications for extended interruptions following major weather events? (N = 36)

After a Major Weather Event

After a major weather event, distributors focus on communicating key information regarding service restoration to their customers. According to the survey, 65% of distributors provide confirmation of power restoration to affected customers, while 55% offer details on the cause of the outage. Additionally, about 27% of distributors communicate the actual restoration time, and some also provide outage maps and instructions on how customers can check their breakers.

Exhibit 29. Information Sent to Interrupted Customers



79. Do you send any of the following information to interrupted customers after service restoration? (N = 49)

Interestingly, despite the importance of customer feedback in improving future responses, only 2% of distributors issue a targeted survey following a major weather event to gather customer insights about their experience. Most distributors rely on annual or biannual customer satisfaction surveys or monitor customer feedback through social media and direct interactions.

Effective Industry Practices: Customer Communications

Effective customer communications before, during, and after major weather events are crucial for maintaining public trust, managing expectations, and ensuring safety. Ontario's distributors have demonstrated several effective practices in this area, as evidenced by the survey results. This section highlights key strategies that have proven successful across the sector.

Multi-Channel Strategy: Distributors have widely adopted a multi-channel strategy for customer communications. A majority of distributors (90%) use social media platforms, 86% utilize their distributor websites, and 39% engage with news media for broader reach. Employing a diverse range of communication channels to ensure widespread information dissemination recognizes that different customer segments may prefer or have access to different communication methods. As such, critical updates are more likely to meet the diverse needs of various customer segments (e.g., urban vs. rural, young vs. elderly) and reach more affected customers, even if one communication method fails. Furthermore, different communication methods can serve different purposes.

Regularly assessing the effectiveness of each channel and adapting communication strategies based on customer feedback and technological advancements is beneficial. The goal is to create a robust, redundant communication system that ensures all customers have access to timely and accurate information during major weather events, regardless of their preferred communication method or technological capabilities.

Communication ahead of anticipated weather events: Before a major weather event, the majority of distributors share relevant preparedness and safety information with customers. Early alerts about potential weather events and power interruptions, safety tips, and instructions for accessing real-time updates allow customers to prepare by charging devices, gathering supplies, or making alternate arrangements, reducing safety risks and inconvenience.

Critical customer communications during and after major weather events: During and following a major weather event, several effective industry practices were identified. Distributors commonly notify customers when they are aware their power has been interrupted within one hour or less, provide an ETR within four hours of completing the damage assessment, and confirm power restoration once customer power is restored. These practices could be improved over time by decreasing initial response times and enhancing the use of multiple communication channels.

As both distribution networks and customer communications become more automated, communications related to outages could happen much more frequently. ICF recognizes that these automated systems may be capital intensive and prohibitive for some distributors. Updates could include a combination of direct customer communication channels and/or updates to online information (outage map, social media updates).

During extended outages, many distributors maintain a consistent schedule of updates, even when no new information is available. Once power is restored, most distributors confirm power restoration. This gives customers the ability to notify utilities if their power has not been restored.

Areas with Opportunities of Improvement: Customer Communications

While Ontario's distributors have made significant strides in customer communications related to major weather events, there are several key areas where further improvements could enhance the sector's overall effectiveness and customer satisfaction. This section outlines potential actions to address existing gaps and elevate communication practices across the province.

Use of social media, the distributors website and outbound email and SMS messaging to communicate with customers: About 90% of distributors already use social media and 86% already use distributor websites to communicate with customers. These effective industry practices can be expanded, as only 18% of distributors currently utilize text messaging/SMS, and 29% use email for customer communications during major events. Outbound emails and SMS messaging are used by many utilities across the industry. ICF recognizes that standing up outbound messaging capability may be capital intensive and prohibitive for some distributors.

Expedited communication process for critical/vulnerable customer segments: The registry can be used to implement dedicated communication protocols specifically designed for these critical customers. These protocols might include expedited communication processes and a variety of personalized communication methods. This prioritizes the safety and well-being of the most vulnerable customers. For individuals relying on electrically powered medical devices, prompt and accurate information about power outages can be lifesaving, allowing them to activate backup plans or seek alternative arrangements before their situation becomes critical.

Targeted service restoration and customer communications questions in surveys:
The survey revealed that only 2% of distributors issue targeted surveys after major weather events to understand customer experience. Questions related to the accuracy, adequacy, and effectiveness of communications with customers during service interruptions could be included in distributors customer survey. This will help distributors understand where their communication practices meet or exceed customer expectations and identify areas for improvement.

Appendix

Questionnaire

Operations Planning

Recovery Planning

1. Does your company's Emergency Plan (Section 4.5.6 of the Distribution System Code) identify emergency restoration activities specifically related to major weather events?
[ ]Yes [ ]No

[If yes to question 1]

1. Please tell us if you include each of the following key elements in your Restoration Plan [select Yes or No to the following]:

a. Command structure (roles & responsibilities) **[ ]Yes [ ]No**
b. List of critical loads **[ ]Yes [ ]No**
c. Damage assessment **[ ]Yes [ ]No**
d. Safety protocols **[ ]Yes [ ]No**
e. Coordination with local first responders **[ ]Yes [ ]No**
f. Communication protocols **[ ]Yes [ ]No**
g. Guidance on resource mobilization **[ ]Yes [ ]No**
h. Mutual aid plans with other organizations **[ ]Yes [ ]No**
i. Training/guidance for incoming line crews **[ ]Yes [ ]No**
j. Coordination with equipment suppliers **[ ]Yes [ ]No**
k. External communications **[ ]Yes [ ]No**
l. Documentation of activities **[ ]Yes [ ]No**
m. Other (please specify) **[Short Answer]**

2. Please explain what activities are conducted to prepare staff across the entire organization for major weather events. **[Open Answer]**

3. Does your company's restoration plan consider different activities depending on the type of weather events (flooding, ice storm, tornado, fire, etc.)?
[ ]Yes [ ]No

4. Does your company have emergency/activation level classifications based on the projected severity of damage, such as duration of interruptions or number of interruptions following major weather events? **[ ]Yes [ ]No**

[If yes to question 4]

1. Please describe each emergency/activation level and summarize the differences in activation (e.g., mutual aid is called above a given threshold of projected outages, etc.). **[Short Answer]**

5. Please tell us if your company uses each of the following communication strategies to coordinate restoration activities across departments [select Yes or No to the following]:

a. Automated alerts (email or text) to notify key personnel **[ ]Yes [ ]No**
b. Manually generated alerts (email or text) to notify key personnel **[ ]Yes [ ]No**
c. Emergency restoration/response meetings **[ ]Yes [ ]No**
d. Central intranet information coordination site **[ ]Yes [ ]No**
e. Dedicated 2-way radio channels for restoration efforts **[ ]Yes [ ]No**
f. Other (please specify) **[Short Answer]**

6. Which, if any, of the following sources/technologies does your company rely on for weather prediction? **[Multiple Choice] (Please select all that apply)**

a. Company-owned weather stations
b. Weather service subscriptions
c. Weather alerts/warnings from Environment Canada
d. Weather prediction software
e. Others (please specify) **[Short Answer]**

7. How do you determine spare equipment levels, particularly for equipment likely to be damaged during major storms? **[Multiple Choice]**

a. Spare equipment levels are based on the average of the equipment replacement needs from recent past major weather events.
b. Spare equipment levels are based on the worst case equipment replacement levels from past major weather events.
c. Spare equipment levels are based on a fixed margin or % above normal equipment usage.
d. Others (please specify) **[Short Answer]**

<u>Training and Preparation Activities</u>

8. How many emergency response drills does your company conduct each year to prepare for major weather events? **[Numeric Answer]**

9. Do those drills include organizations outside of the utility (such as local governments or first responders)? **[ ]Yes [ ]No**

10. How does your company coordinate with the municipality/province when there is a government declaration of emergency related to a major weather event?

[Open Answer]

System Hardening

11. Does your company's separately plan and track the following items?

a. Restoration activities and expenditures **[ ]Yes [ ]No**
b. Restoration activities and expenditures related to major weather events **[ ]Yes [ ]No**
c. System hardening activities and expenditures **[ ]Yes [ ]No**
d. System hardening activities and expenditures related to major weather events **[ ]Yes [ ]No**

[If (b) selected in question 11]

12. Please list the restoration activities related to major weather events that are planned and tracked by your company. **[Open Answer]**

13. How does your company determine the level of investment in system hardening to withstand major weather events and how is that level influenced by past events? **[Open Answer]**

14. Does your company currently differentiate between reliability and resilience in developing your system investment plan? **[ ]Yes [ ]No**

[If yes to question 14]

1. Please explain how your company differentiates between reliability and resilience in your system investment plan. **[Short Answer]**

15. Does your company currently incorporate resilience into your system planning as one of the investment drivers? **[ ]Yes [ ]No**

[If yes to question 15]

1. Please explain how you assess the probability of resilience-related risk and the financial consequence of identified risks, for investments for which risk analysis is required. **[Open Answer]**

16. Please tell us if your company conducts each of the following activities to assess the potential for service interruptions from major storm events [select Yes or No to the following]:

a. Climate threat analysis **[ ]Yes [ ]No**
b. Historical data analysis **[ ]Yes [ ]No**
c. Weather modeling **[ ]Yes [ ]No**
d. Other (please specify) **[Short Answer]**

17. Has your company completed a climate vulnerability assessment in the last five years? **[ ]Yes [ ]No**

[If yes to question 17]

1. Select which of the following best describes your most recent climate vulnerability assessment? **[Multiple Choice]**

a. Qualitative evaluation and planning (e.g., future change in heat characterized relatively as "high," "medium" or "low")
b. Quantitative assessment and/or modeling (e.g., developing specific climate projections, asset sensitivity thresholds and impacts)
c. Both qualitative and quantitative analysis

2. Which, if any, of the following elements were included in the climate vulnerability assessment? (Please select all that apply)

a. Weather projections

b. Vulnerability analysis of assets
c. Vulnerability analysis of processes
d. Selection of adaptation investments
e. Cost benefit analysis
f. None of the above
g. Other (please specify) **[Short Answer]**

18. Does your company incorporate value of service to customers when justifying reliability/resilience investments? **[ ]Yes [ ]No**

[If yes to question 18]

1. How does your company incorporate value of service to customers? **[Open Answer]**

19. Does your company currently use value of lost load (VoLL) studies to evaluate the cost and benefits of your investment plans related to reliability or resiliency?

[ ]Yes [ ]No

[If yes to question 19]

1. What is the source of the value of lost load numbers used? **[Short Answer]**

2. How was this utilized in decision making? **[Short Answer]**

20. What standards (CSA or other) does your company follow for the design and construction of electricity systems? **[Short Answer]**

Restoration Performance

Fault Identification and Damage Assessment

21. Which, if any, of the following does your company use to identify faults in your distribution system? **[Multiple Choice] Please select all that apply**

a. System(s) with remote fault location functionality (e.g., Outage Management System, Fault Location, Isolation, and Service Restoration software)
b. Advanced metering infrastructure

c. Customer reporting (e.g., calls)

d. Others (please specify) **[Short Answer]**

22. Roughly what percentage of your customers are served by systems with distribution automation (e.g., advanced technologies such as Fault Direction Indicators, reclosers or sectionalizers, remote terminal units, etc.)? **[Numeric Answer]**

23. In addition to information on damage level collected from the field, does your company take other factors into consideration (e.g., prior profiles, system design, customer density) or use other technologies to predict damage levels?

[ ]Yes [ ]No

[If yes to question 23]

1. Please describe the methods and technologies used to assess damage that has occurred. **[Short Answer]**

Restoration Efforts

24. Which of the following are your top three challenges related to post-storm service restoration? *Select up to three options.*

a. Travel to site (i.e., road accessibility)

b. Site access due to debris or flooding

c. Communications between restoration staff

d. Coordination with first responders

e. Availability of line crews

f. Availability of trucks or other restoration equipment

g. Availability of spare equipment

h. Fault location

i. Other (please specify) **[Short Answer]**

25. Please identify your company's typical practices used to mitigate the identified challenges in question 24? **[Short Answer]**

26. For customers who are expected to be out of service for extended period of time after a major storm, (such as more than 48 hours), does your company carry out any additional actives to assist these customers? **[ ]Yes [ ]No**

[If yes to question 26]

1. Please describe these activities.

27. For each of the following smart devices and systems please indicate the level of deployment:

a. Line sensors, fault direction indicators **[ ]Not Used [ ]Deploying [ ]Fully Deployed**
b. Self-resetting fuses **[ ]Not Used [ ]Deploying [ ]Fully Deployed**
c. Intelligent grid devices (reclosers, smart switches) **[ ]Not Used [ ]Deploying [ ]Fully Deployed**
d. Advanced Distribution Management System **[ ]Not Used [ ]Deploying [ ]Fully Deployed**
e. Other (please specify) **[Short Answer]**

28. Which, if any, of the following determine when to escalate response capabilities for additional staff or request mutual assistance? **[Multiple Choice] Please select all that apply**

a. Percentage of meters out
b. Number of incidences reported/identified
c. Restoration that will take more than a certain number of hours with in-house resources
d. Cannot complete damage/system assessment in 24 hours, due to extent of damage
e. Other (please specify) **[Short Answer]**

29. Does your company leverage Distributed Energy Resources (DER) to enhance system resilience during extreme weather events? **[ ]Yes [ ]No**

[If yes to question 29]

1. How does your company leverage DER to enhance system resilience during extreme weather events? **[Short Answer]**

[If no to question 29]

2. Does your company plan to leverage DER to enhance system resilience during extreme weather events in the future? **[ ]Yes [ ]No**

Post-Event Debrief

30. Does your company have any qualitative measures in place to track and assess its performance of restoration activities (e.g., deviation from the restoration plan, resource deployment, human errors)? **[ ]Yes [ ]No**

[If yes to question 30]

1. Please specify the qualitative measure(s). **[Short Answer]**

31. Does your company have any quantitative measures in place to track and assess its performance of restoration activities (e.g., time to inform customers, restoration time, cost of recovery)? **[ ]Yes [ ]No**

[If yes to question 31]

1. Please specify the quantitative measure(s). **[Short Answer]**

32. Does your company track restoration time for critical loads? **[ ]Yes [ ]No**

33. In addition to the requirements under Major Event Response Reporting (MERR), what information does your company collect regarding restoration activities after a Major Event? **[Short Answer]**

Customer Communications

Before a Major Weather Event

34. Please tell us if you use any of the following communications methods to inform customers on preparedness measures before a major storm? [select Yes or No to the following]:

a. Email **[ ]Yes [ ]No**
b. Bill inserts **[ ]Yes [ ]No**
c. Distributor website **[ ]Yes [ ]No**
d. Social media (e.g., Twitter, Facebook) **[ ]Yes [ ]No**
e. Text messaging

f. News Media **[ ]Yes [ ]No**

g. Special events out in the community to inform customers on major weather event preparedness. **[ ]Yes [ ]No**

h. Webinars/training on major weather event preparedness. **[ ]Yes [ ]No**

i. Others (please specify) **[Short Answer]**

35. Please tell us if you send your customers the following information before, during and/or after a major weather event [select all that apply to the following]:

a. Information on how to register for interruption alerts and receive real-time notifications. **[ ]Before [ ]During [ ]After**

b. Alert on any potential weather events that may cause power interruptions in your area. **[ ]Before [ ]During [ ]After**

c. Estimated power restoration time after an interruption occurred. **[ ]Before [ ]During [ ]After**

d. Safety tips and resources for you to prepare for an interruption caused by a major weather storm. **[ ]Before [ ]During [ ]After**

e. The severity of the interruption caused by a major weather storm (e.g., the number of customers affected) **[ ]Before [ ]During [ ]After**

f. Others (please specify) **[Short Answer]**

36. Please tell us if you use each of the following communications channel(s) to share information with customers before, during and/or after major weather events? [select all that apply to the following]:

a. Email **[ ]Yes [ ]No**

b. Website **[ ]Yes [ ]No**

c. Text messages **[ ]Yes [ ]No**

d. Social media (e.g., X, formerly Twitter, Facebook) **[ ]Yes [ ]No**

e. Distributor website **[ ]Yes [ ]No**

f. Others (please specify) **[Short Answer]**

<u>During a Major Weather Event</u>

37. Do you share the following information with customers who have been interrupted due to a major weather event? [select Yes or No to the following]:

a. The number of customers affected **[ ]Yes [ ]No**

b. Status of service crew (e.g., on the way to the site) **[ ]Yes [ ]No**

c. Cause of the outage **[ ]Yes [ ]No**

d. Estimated restoration time **[ ]Yes [ ]No**

e. Others (please specify) **[Short Answer]**

38. Does your company have an expedited communication process for any targeted customers segments (e.g., customers with electrically-powered life support equipment)? If yes, which customer segments, and how does the communication process differ? **[Short Answer]**

39. On average, how soon after an interruption do you alert your customers that you are aware they have been interrupted? **[Multiple Choice]**

a. Within 1 hour

b. Within 4 hours

c. We do not inform customers

d. Others (please specify) **[Short Answer]**

40. On average, how soon after the damage assessment can you provide your customers with the estimated restoration time (ERT)? **[Multiple Choice]**

a. Within 4 hours

b. Within 8 hours

c. We do not provide ETR to customers

d. Others (please specify) **[Short Answer]**

41. When providing ETR to customers, do you provide different ETRs to affected customers based on their locations? **[ ]Yes [ ]No**

42. Do you have an established frequency of customer communications (e.g., daily) for extended interruptions following major weather events? **[ ]Yes [ ]No**

[If yes to question 2]

1. What is the frequency of customer communications for extended interruptions following major weather events? **[Multiple Choice]**

a. Every few minutes,
b. Every hour
c. Once a day
d. Update when ETR is changed
e. Other

After a Major Weather Event

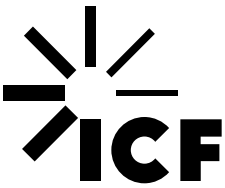
43. Do you send any of the following information to interrupted customers after service restoration?

a. Confirmation on power restoration **[ ]Yes [ ]No**
b. The number of customers affected **[ ]Yes [ ]No**
c. Cause of the outage **[ ]Yes [ ]No**
d. Actual restoration time **[ ]Yes [ ]No**
e. Others (please specify) **[Short Answer]**

44. Does your company issue a targeted survey after a major weather event to understand customer experience related to that event? **[ ]Yes [ ]No**

45. How does your company currently measure the accuracy, adequacy, and effectiveness of your communications with customers regarding major weather events? **[Short Answer]**

46. Is there anything else you would like to share regarding your current practices on operations planning, system hardening, restoration performance and customer communications related to major weather events? **[Open Answer]**

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