Hurricane Beryl After-Action

Final Report

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Executive Summary

In July 2024, PA Consulting Group, Inc. (PA) was engaged by CenterPoint Energy, Inc. (CenterPoint, CNP, or the Company) to conduct an independent assessment and prepare an after-action review of the Company's storm preparedness and restoration efforts associated with Hurricane Beryl. This report is intended to provide CenterPoint Energy with recommendations to enhance resiliency and be better prepared for future extreme weather events and other emergencies. In certain areas, it may provide specific context from CenterPoint's response in Hurricane Beryl, but it is not intended to be a comprehensive review of CenterPoint's performance during Hurricane Beryl. The report focuses on areas of improvement since CenterPoint commissioned PA to help it understand areas of improvement, and as such, this report does not conclude that CenterPoint's overall preparation and response was insufficient.

This report focuses on go-forward improvements. Furthermore, we understand that CenterPoint is already underway on many of the recommendations as part of its Greater Houston Resiliency Initiative, and we anticipate that CenterPoint will proceed to consider all of the recommendations with its regulator and other key stakeholders.

Hurricane Beryl made landfall as a Category 1 storm on July 8 at 4:00 AM, sweeping directly through the CenterPoint Energy Houston Electric (CEHE)[1] service territory. As the storm slowly weakened, it caused extensive damage, particularly northeast of the eye (the "dirty side"), severely impacting the Greater Houston area and its dense tree canopy. Although the transmission system was generally not impacted, thousands of trees were uprooted, many of which fell on CenterPoint's overhead electric lines, resulting in widespread damage to the Company's distribution system and those of neighboring electric utilities.

CenterPoint's emergency preparedness and restoration efforts during Hurricane Beryl came under intense scrutiny from customers, local governments, and other public officials. Public frustration in Houston grew quickly due to the lack of a customer outage tracker and the absence of timely Estimated Time of Restoration (ETR) information. This issue will be explored in detail throughout the report. In contrast, CenterPoint demonstrated effective application of lessons learned from past wind events, such as Hurricane Ike in 2008. Notably, its transmission system largely withstood the storm, highlighting the success of CenterPoint's system hardening initiatives.

Aligned with CenterPoint's commitment to building the most resilient coastal grid in the country and enhancing its storm restoration efforts, PA developed this report to assess the utility's storm preparedness and restoration performance. The report offers detailed recommendations to enhance CenterPoint's standard practices, including near-term actions to improve the utility's response to potential storm events in 2024. It also outlines mid-term strategies for action ahead of the 2025 storm season, as part of Phase 2 of the Greater Houston Resiliency Initiative, with additional actions planned for subsequent beyond Phase 2. CenterPoint has implemented, or has already begun planning to implement, a number of the strategies and recommendations contained in this report.

[1] CenterPoint Energy Houston Electric is the electric transmission and distribution subsidiary for the Houston area of CenterPoint Energy, which operates across several states. While CenterPoint Energy as a whole manages a wide range of utility services, including natural gas distribution, CenterPoint Energy Houston Electric specifically handles the delivery of electricity to customers in the Houston area. References to CenterPoint Energy generally relate to CenterPoint as a whole including CEHE, but where the context requires, references to CenterPoint Energy may relate solely to CEHE.

Hurricane Beryl

Hurricane Beryl began as a tropical depression in the Atlantic on June 28, 2024, and rapidly strengthened into a Category 4 hurricane by June 29. On July 1, Beryl made landfall on Carriacou Island in Grenada. Beryl made history as the first Category 4 hurricane ever recorded in the month of June and later escalated to a Category 5.

As Beryl moved through the Caribbean, it weakened, making a second landfall on the Yucatán Peninsula as a Category 2 hurricane on July 5. After reentering the Gulf of Mexico, Beryl regained strength and made its final landfall in the Greater Houston area on July 8 as a Category 1 storm. The hurricane swept across 80% of CEHE's service territory, with its ‘dirty side’ delivering wind gusts up to 84 mph and sustained winds up to 58 mph. As Beryl moved further inland, it retained its strength, with gusts reaching up to 83 mph and sustained winds peaking at 62 mph. This resulted in extensive damage in the Greater Houston area, particularly to the urban tree canopy and forested areas.

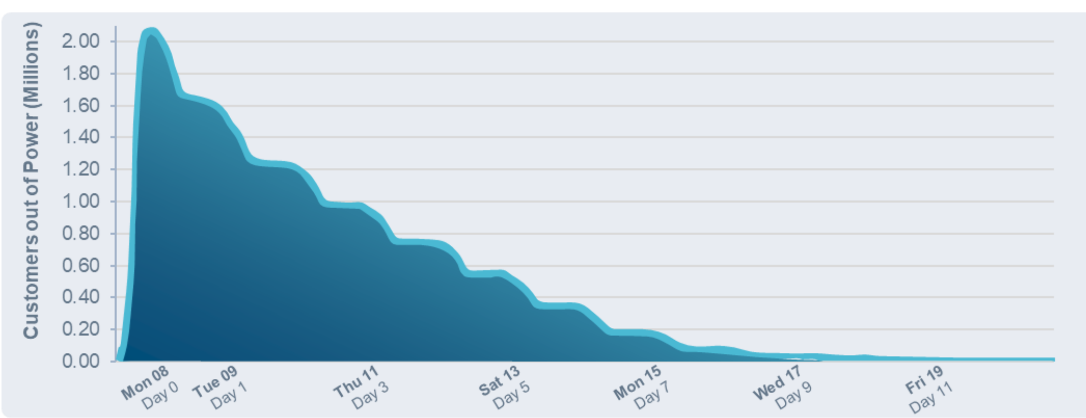
For CenterPoint and the Houston area, the storm's potential severity remained uncertain almost until Beryl made landfall in Texas on July 8. From July 1 to July 4, weather forecasts indicated that the storm would strike Northeast Mexico, suggesting minimal to no impact on Houston. However, on the morning of July 6, the forecast shifted to project Beryl’s landfall near Rockport, Texas, with a post-landfall path west of Houston, resulting in moderate impacts expected in Houston. By July 7, the forecast evolved further, placing the Greater Houston area directly in Beryl’s path.

CenterPoint’s Response to Hurricane Beryl

Hurricane Beryl caused extensive damage to CEHE’s electric infrastructure but primarily impacted the distribution system. The impact was intensified as the storm hit the city’s most densely populated service area, with a high number of tree falls—many from outside CenterPoint’s easements—in part, due to weakened roots and saturated soils from recent heavy rains, making trees more likely to topple. Over 75% of overhead distribution circuits experienced lockouts, leaving more than 2.1 million CenterPoint Energy customers (~75%) without power. The last windstorm of a similar magnitude that CenterPoint experienced was Hurricane Ike in 2008.

While the distribution system was significantly impacted, the transmission system proved resilient. CenterPoint experienced 6 substation outages (2.0%) and 15 customer substation outages (8.0%),[2] all of which were restored to service quickly. Only 31 transmission line segments (8.0%) experienced outages, 16 transmission structures (0.05%) required replacement, and 4 others (0.01%) needed repairs. Figure ES - 1 shows CenterPoint’s restoration curve for Hurricane Beryl. The blue line represents the number of customers without power due to Hurricane Beryl on each specific day.

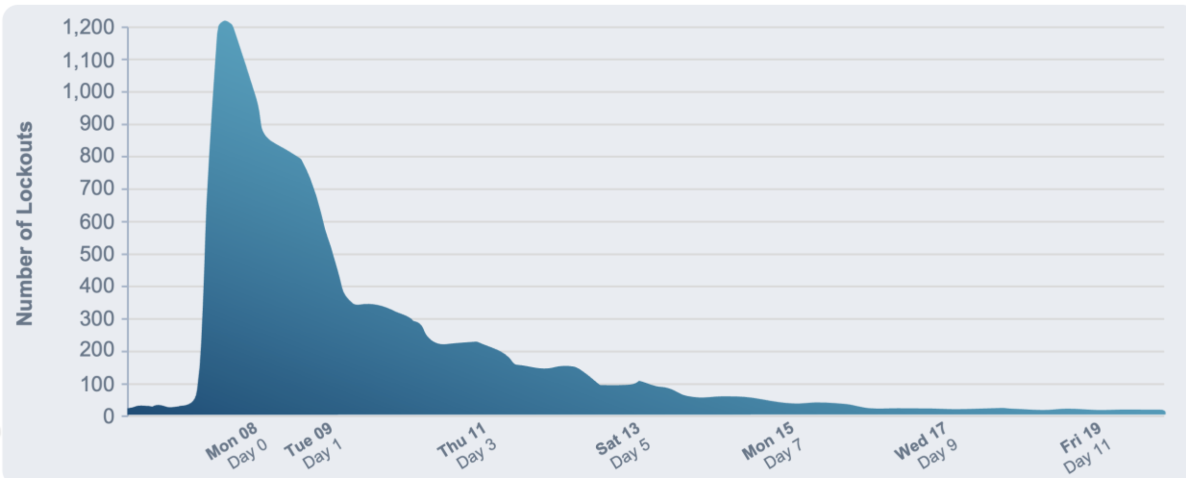
Figure ES - 1: CenterPoint’s Restoration Curve for Hurricane Beryl



[2] CenterPoint substations that experienced an outage include Intercontinental, Treaschwig, Kingwood, Pinehurst, and West Bay. In addition, a customer owned substation, Inteq, also experienced an outage.

The extensive number of distribution circuits lockouts was the major technical restoration challenge Beryl presented. CenterPoint's long overhead circuits with few field sectionalizing devices,[3] resulted in distribution circuit breakers protecting large areas of the system. Patrolling for and repairing damage to such large areas contributes to longer restoration times. As shown in Figure ES - 2, distribution circuit breaker lockouts peaked at 1,202, these being almost exclusively from the 1,675 overhead circuits on the CEHE system. Circuit re-energization results from Monday afternoon and Tuesday show significant progress, but also show the magnitude of the challenge, as 316 distribution circuits remained deenergized on Tuesday night, 36 hours after Beryl left CEHE's territory.

Figure ES - 2: Distribution Feeder Lockouts During Hurricane Beryl



Due to the extensive damage caused by Hurricane Beryl, CenterPoint did not identify and issue a global ETR that first day. Daily press releases containing information regarding restoration expectations began on July 10. For example, the July 10 press release indicated that CenterPoint expected to have 400k customers restored by Friday, July 12, and another 300k customer restored by Saturday, July 13. Additionally, CenterPoint provided a map of outages, restoration status, and circuit based ETRs, that was updated at least daily.

This approach falls short of industry-leading practices, as global ETRs help shape customer expectations and inform them of necessary actions, if any. Furthermore, these estimates aid external stakeholders, such as municipalities, water districts, and other agencies, in coordinating their responses. The absence of this information limits customers' ability to plan and manage their activities during outages, heightens uncertainty, and undermines communication between the utility and its customers. CenterPoint's customers quickly voiced their frustration over the lack of restoration information.

CenterPoint's external communications and overall narrative regarding the storm quickly deteriorated due to its inability to provide sufficient outage information to customers. The customer-facing Outage Tracker was unavailable during Hurricane Beryl because of technical issues that had been identified during the May 2024 derecho. While CenterPoint's outage tracking systems typically perform well under normal conditions, it's important to acknowledge that similar challenges have been encountered by other utilities during major storm events, particularly when faced with unprecedented volume and demand. Additionally, CenterPoint's Power Alert Service® (PAS) failed to consistently notify customers that the Company was aware of their outages or to deliver timely updates, primarily due to bandwidth limitations. Furthermore, as only 42% of customers were enrolled in PAS prior to the storm, only that percentage of customers would have received critical information even if the service had been

[3] When originally conceived, CenterPoint's distribution design philosophy was intended to be the most cost-effective solution for rate payers.

functioning properly. It's important to highlight that the legally mandated involvement of Retail Electric Providers (REPs) as intermediaries between the distribution provider and customer creates a communication barrier not typically encountered in the industry. Bridging the gap between CenterPoint and its end users will significantly enhance storm preparedness, response, and the overall customer experience in future storms, and will be discussed in detail in this report.

Beryl's restoration ultimately took 11 days, which was significantly shorter than the 17 days required for the Company to restore power after Hurricane Ike and on par with peers during Hurricane Beryl in spite of the direct storm impact to CenterPoint. However, even after 8 days of efforts, approximately 78,000 customers were still without power, resulting in a prolonged outage that posed significant challenges for many customers in the Greater Houston area.

Overall Conclusions

CenterPoint's preparation and response to Hurricane Beryl were found to be generally consistent with industry standards, and its overall restoration time was comparable to its neighboring utilities. While the report highlights a number of recommendations and areas of improvement, it purposely does not try to describe the many instances where CenterPoint's actions were typical and/or leading practices in the industry. Examples of these include the timely acquisition of roughly 15,000 mutual assistance resources, and the rapid deployment of staging sites and associated logistics.

As detailed in the Customer Experience segment of the 'Findings & Recommendations' section of this report, customer sentiment declined from before the storm to after its impact. This negative feedback primarily arose from the communication challenges CenterPoint encountered throughout the storm. While proactive and frequent communication is crucial during major events, specific key information—particularly the status of customer outages and associated estimated restoration times—is essential to the communication's effectiveness. Additionally, CenterPoint did not provide a global ETR within 48 hours, which is the common industry practice, leaving customers uncertain about when their power would be restored. Ultimately, it was not the communication itself that was the issue, but rather the lack of information provided within those communications.

CenterPoint's Beryl response has highlighted critical areas for improvement in grid preparedness. Notably, the incidence of circuit lockouts during Hurricane Beryl was comparable to those experienced during Hurricane Ike, despite Beryl having wind speeds that were roughly 40% weaker than Ike's in part due to the difference in the storm's respective paths. Sustained winds inland for Beryl were 62 miles per hour and only 56 miles per hour for Ike. It is imperative that CenterPoint address the overall level of power loss, which affected more than 75% of customers during Beryl. Urgent action should significantly improve the resilience of distribution grid infrastructure. The reasons for feeder lockouts are varied, necessitating tailored solutions for each circuit based on specific damage assessments.

PA observed the need for more sectionalization on circuits. The current midstream devices and circuit end ties do not offer adequate sectionalization to prevent lockouts. To bolster the resiliency of the system, PA found that all circuits should be reinforced up to the first protective device located outside of the substation. This protective device should be placed at the first lateral off the backbone circuit. Enhancing circuits may require a combination of strategies, such as targeted vegetation management, the installation of covered conductors or tree wire, and the potential undergrounding of lines. A comprehensive analysis should be performed on a circuit-by-circuit basis, with the ultimate objective of significantly reducing feeder lockouts and improving overall grid stability.

The report recommends that CenterPoint improve its storm response by prioritizing key actions rather than addressing every recommendation in isolation. Users of this report should not take any one recommendation in isolation or out of context. Focusing on a strategic approach to planning and executing these recommendations is more critical than simply implementing as many as possible. By carefully selecting and aligning initiatives with existing programs, CenterPoint can ensure that its efforts are more effective and meaningful. This strategic prioritization allows for a more coherent and impactful response, ultimately leading to the enhancement of the customer experience and grid resilience.

Recommendation Summary

This report provides the findings of our analysis, with each section detailing specific insights relevant to CenterPoint's operations and performance. Accompanying these findings are tailored recommendations to address identified challenges and enhancing overall effectiveness. Below, you will find an index of these recommendations, designed to facilitate easy navigation through the proposed actions that will drive improvements and support CenterPoint's strategic goals. Each recommendation reflects a targeted approach to optimizing processes and bolstering resilience within the organization.

Table ES - 1: Index of Recommendations

Index ID	Recommendation	Timing	Section
CCH-1	Increase Call Center Resource Pool	Short-Term	3.15.2
CCH-2	Analyze Root Cause of IVR Containment Drop	Short-Term	3.15.2
CCH-3	Project Call Center Resource Needs	Mid-Term	3.15.2
CCH-4	Establish a Call Center Storm Response Plan	Mid-Term	3.15.2
COMMS-1	Update the Current Communications Plan	Short-Term	3.7.2
COMMS-2	Revise the Current Communications Strategy	Mid-Term	3.7.2
COMMS-3	Expand Relationships with External Stakeholders and Government Officials	Mid-Term	3.7.2
COMMS-4	Develop a Liaison Protocol	Mid-Term	3.7.2
COMMS-5	Establish Customer Experience Feedback Mechanisms	Mid-Term	3.7.2
CX-1	Implement Real-Time Customer Feedback during Major Events	Short-Term	3.9.2
CX-2	Increase Customer Enrollment and Customer Contact Database	Mid-Term	3.9.2
CX-3	Enhance Customer Communication Channels	Mid-Term	3.9.2
CX-4	Inform Customers of the Potential Need for Electrical Service Work	Short-Term	3.9.2
DER-1	Continue to Catalog DERs and Microgrids in CenterPoint Territory	Short-Term	3.17.2
DER-2	Leverage Capacity Maps	Mid-Term	3.17.2
DER-3	Use DERs during Restoration Efforts	Mid-Term	3.17.2
DM-AS-1	Integrate Damage Assessment and Vegetation Management Crews	Short-Term	3.12.2
DM-AS-2	Pre-Stage Materials/Equipment	Short-Term	3.12.2
DM-AS-3	Streamline Damage Assessment for Work Packages	Short-Term	3.12.2
DM-AS-4	Upgrade Damage Assessment Technology	Mid-Term	3.12.2
DM-AS-5	Revise Resource Utilization	Mid-Term	3.12.2
DM-PR-1	Gather Beryl Damage Data for Model Refinement	Short-Term	3.5.2
DM-PR-2	Refine Restoration Productivity Assumptions	Short-Term	3.5.2
DM-PR-3	Build, Develop, or Acquire more Comprehensive Damage Prediction Models	Mid-Term	3.5.2

Index ID	Recommendation	Timing	Section
EP&R-1	Enact 24-Hour EOC/DOC Operations	Short-Term	3.3.2
EP&R-2	Reevaluate FCC Support	Short-Term	3.3.2
EP&R-3	Focus Planning Section on Strategic Functions	Mid-Term	3.3.2
ETR-1	Calculate and Disseminate Global ETRs	Short-Term	3.6.2
ETR-2	Develop ETR Strategy and Processes	Mid-Term	3.6.2
ETR-3	Integrate ETR Manager Role into IC	Mid-Term	3.6.2
ETR-4	Define and Track ETR Accuracy	Mid-Term	3.6.2
GRID-1	Develop a Program to Segment Less than 500 Customers per Remotely Controllable Circuit	Short-Term	3.18.2
GRID-2	Develop Laterals protection and sectionalizing strategy	Short-Term	3.18.2
GRID-3	Replace Composite Pole and Cross-arms	Mid-Term	3.18.2
GRID-4	Replace Open Wire with Covered Conductors	Mid-Term	3.18.2
IC-1	Streamline EOC Layout	Short-Term	3.2.2
IC-2	Revise IC Roles and Responsibilities	Short-Term	3.2.2
IC-3	Expand IC/EOC Training	Short-Term	3.2.2
IC-4	Continue to Streamline EOC Layout	Mid-Term	3.2.2
IC-5	Establish EOC-Sections Daily Meeting	Mid-Term	3.2.2
IT/OT-1	Factor Storm Volumes into All Systems	Short-Term	3.20.2
IT/OT-2	Ensure Data Quality and Robustness	Short-Term	3.20.2
IT/OT-3	Harden IT/OT	Mid-Term	3.20.2
LOG-1	Use Enhance Operational Efficiency through Alternative Staging Site and Logistics Solutions	Short-Term	3.11.2
LOG-2	Use Select Service Centers for Staging	Short-Term	3.11.2
MA-1	Reevaluate FCC Support	Short-Term	3.10.2
MA-2	Develop Mutual Assistance Tool	Short-Term	3.10.2
MA-3	Reevaluate Storm Rider Policy	Short-Term	3.10.2
MA-4	Supply Mobile Technology to Crews	Mid-Term	3.10.2
MA-5	Create Equipment Equivalents List	Mid-Term	3.10.2
MA-6	Utilize Mutual Assistance Crews in the Same Efficiency as Internal Crews	Mid-Term	3.10.2
OT-1	Replace Outage Tracker	Short-Term	3.8.2
OT-2	Revise Technology Selection and Testing Processes	Short-Term	3.8.2
OT-3	Expand Customer Reporting	Short-Term	3.8.2

Index ID	Recommendation	Timing	Section
OT-4	Use Positive Language in Outage Tracker	Mid-Term	3.8.2
OT-5	Host Software Platforms Reliably	Mid-Term	3.8.2
RM-1	Expedite IAP Completion	Short-Term	3.13.2
RM-2	Evaluate FCC Pool Size	Short-Term	3.13.2
RM-3	Use Substation Restoration Segmentation	Short-Term	3.13.2
RM-4	Test Processes and Technology	Mid-Term	3.13.2
RM-5	Change RTO/DCO Jurisdictional Boundary	Mid-Term	3.13.2
SAF-1	Expand Safety Standdowns	Short-Term	3.4.2
SAF-2	Revise Substation Breaker Reclose Policy	Short-Term	3.4.2
SAF-3	Bolster Safety Leadership Responsibility	Mid-Term	3.4.2
TG-1	Catalog Critical Load Customers	Short-Term	3.16.2
TG-2	Test Existing On-site Generation	Short-Term	3.16.2
TG-3	Establish Deployment Priority List	Short-Term	3.16.2
TG-4	Develop and Promote Interconnection Services for Temporary Generation	Mid-Term	3.16.2
TG-5	Procure Additional Distribution-scale Generation	Mid-Term	3.16.2
UG-1	Identify a Pilot to do Underground Replacement of Existing Overhead Rear Lot Construction	Short-Term	3.19.2
UG-2	Develop Worst Performing Feeder Underground Program	Short-Term	3.19.2
UG-3	Expand UG Priority Circuits	Mid-Term	3.19.2
VM-1	Revise Trimming Cycles	Short-Term	3.14.2
VM-2	Optimize Crew Coordination	Short-Term	3.14.2
VM-3	Enhance Tree Replacement Program	Mid-Term	3.14.2
VM-4	Develop a Digital Intelligence Program to Effectively Perform Condition-Based Trimming	Mid-Term	3.14.2

1. Introduction 01

1.1 Report Purpose & Objectives

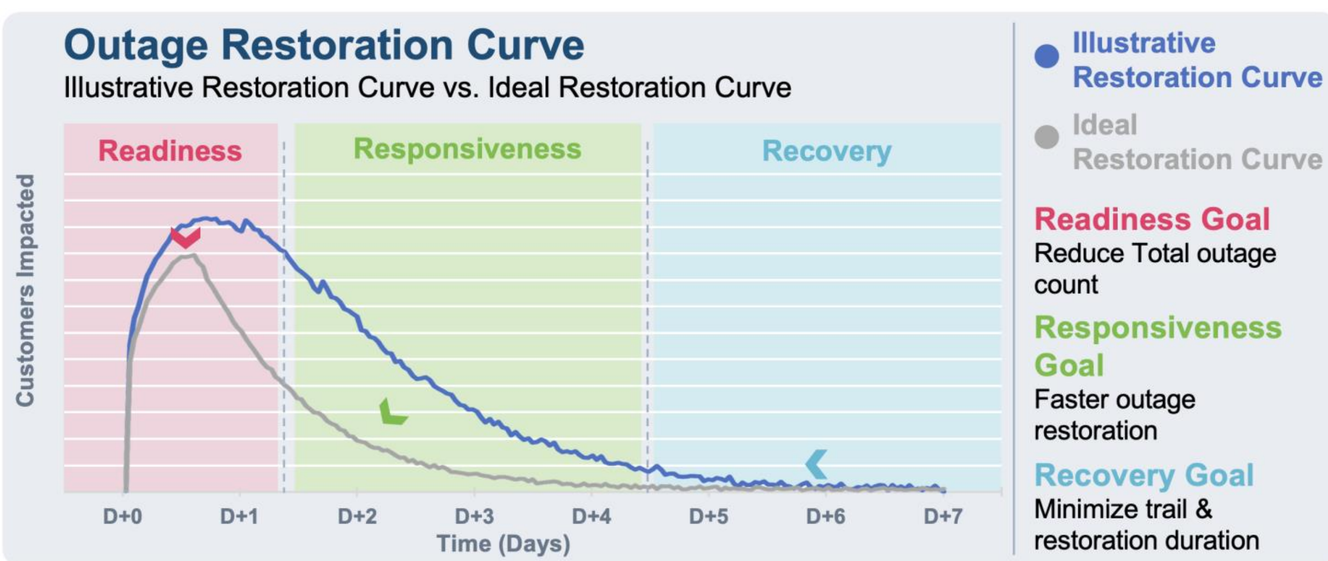
The purpose of this after-action review is to evaluate CenterPoint's preparedness and response efforts during Hurricane Beryl. It provides a detailed overview of the events surrounding the hurricane. Additionally, the report examines how CenterPoint designed and executed its emergency restoration plans across all phases of the restoration curve in response to Beryl. This report evaluated outage data, restoration timelines, communication effectiveness, and crew performance, incorporating insights from both frontline workers and management.

1.1.1 Resiliency

Beryl's storm restoration curve provided valuable context and a foundation for conducting an after-action review of the restoration effort. The storm restoration curve contains valuable customer experience information and demonstrates the resilience of the electric system, offering insights that can be leveraged to identify both process improvements and necessary investments in the system. This curve accurately portrays the overall customer outage experience during the event, distinguishing between those who are restored with minimal effort and those who experience prolonged outages, while also identifying areas that warrant targeted hardening or mitigation projects in the long term.

The restoration curve is divided into three key phases—readiness, responsiveness, and recovery. As illustrated in Figure 1 - 1, each phase begins and ends at distinct points within the overall restoration process, with specific goals and corresponding actions to achieve those goals. The readiness phase focuses on proactive measures, ensuring that systems and personnel are prepared to respond effectively. In the responsiveness phase, utilities optimize crew resources and implement immediate actions to address outages and restore service as quickly as possible. Finally, the recovery phase emphasizes restoring service to all customers (e.g., least accessible, single outages, etc.), completing the restoration effort.

Figure 1 - 1: Illustrative Restoration Curve



PA examined the sequence of events and processes that took place during the three restoration stages to understand how CenterPoint carried out their emergency restoration plans and to determine whether the stated objectives of those plans were sufficient to meet the challenges of a particular major outage event. These phases not only provide a structured approach to emergency restoration but also underscore the importance of strategic actions and planning at each stage. By understanding the unique characteristics and goals of each phase, utilities can optimize their efforts and investments, resulting in more efficient and effective restoration outcomes.

Readiness

For the readiness phase, PA evaluated how CenterPoint prepared through its planning and decision-making for the major event. The timeframe analyzed spanned from the initial identification of Hurricane Beryl up until the commencement of restoration activities, typically marked by the deployment of damage assessment resources. Specifically, PA examined:

- Actions taken within any established operational readiness processes and/or procedures in anticipation of Hurricane Beryl.
- Technology and systems readiness, including whether critical Information Technology/Operational Technology (IT/OT) systems (e.g., Outage Management System (OMS), dispatch software, outage maps) were sufficiently prepared, switched into storm mode, and verified to be operating optimally before Hurricane Beryl, and what, if any, mitigation actions were taken for identified issues or risks.
- Pre-event management of resources (contractor and mutual assistance), logistics, and operational preparedness activities (Incident Command Structure activation, securing resources, pre-staging crews and materials), along with mobilization efforts (e.g., staging site activations, fuel distribution, mutual assistance onboarding, and safety briefings) undertaken.
- Efforts made to understand and address the potential consequences of electric infrastructure and IT/OT system failures, along with associated contingency plan.
- Application of lessons learned from prior events and improvements committed to after previous storms (e.g., Hurricane Ike, May 2024 derecho), and how these lessons were incorporated into the emergency response plan used during Beryl's restoration planning.
- Development and customization of proactive messaging and associated customer communications/alerts created prior to the storm's arrival, as well as omni-channel information dissemination plans.
- Verification of updates, testing, configuration management, and patch management of mission-critical IT/OT systems completed.
- Coordination made with other local utilities (e.g., water districts), stakeholders (municipalities, first responders), and critical customers (e.g., hospitals, major customers).

Responsiveness

PA focused on CenterPoint's restoration activities, which included the strategies, decisions, and execution of the restoration plans. These efforts commenced with the decision to initiate damage assessments and extended until the majority of affected customers had their power restored. PA's examination included:

The quality of the emergency restoration plan, particularly in relation to:	How the plan was executed during the event, including:
• Restoration strategy and prioritization of jobs/tickets. • Resource management (internal and mutual assistance), including the line crew/vegetation crew mix and required support and logistics resources. • Stakeholder engagement (e.g., general customer base, critical customers, elected	• Allocation of restoration resources across districts, staffing of call centers and liaison organizations. • Integration and utilization of contractor and mutual assistance crews throughout the restoration process. • Accuracy and timeliness of resource dispatch and work management during restoration.

The quality of the emergency restoration plan, particularly in relation to:	How the plan was executed during the event, including:
officials, local and city governments, and key accounts). • Development and dissemination of public-facing messaging. • Customer communications (e.g., messaging, updates, channels), with a specific focus on ETR communications including initial estimates and updates. • Systems/technology utilization, performance, and associated contingencies.	• Information flow between various groups, and how data (e.g., assessed damage, customer counts, outage statistics) was collected and analyzed to inform decision-making. • Effectiveness of communications and coordination with stakeholders. • Timeliness and accuracy of ETR updates (global, regional, local, and ticket/job-based). • The effectiveness of system design, grid automation, and communications technology in supporting restoration operations.

Recovery

Lastly, PA examined how the utility executed the final phase of customer restoration, assessed the effectiveness of its after-action review processes, and explored how lessons learned were identified and integrated into future restoration plans. Specifically, PA analyzed:

How well nested outages were identified and addressed.	The prioritization of the final restoration efforts, the resources held over to complete these tasks, and the handling of emergent outages that were not storm related.	The decisions and execution of demobilization plans for mutual assistance/ contractor crews and internal resources.	Areas where system controls and management excelled, as well as opportunities for improvement.

1.2 After-Action Review Methodology

The after-action review is an independent assessment of CenterPoint's preparedness, response, and recovery efforts during Hurricane Beryl. This evaluation was carried out through multiple rounds of data requests, which thoroughly examined the Company's performance. The review covered customer outage data, logistics, Supervisory Control and Data Acquisition (SCADA) information, asset data, and internal and external communications. To supplement this data, discovery interviews were conducted with key personnel overseeing emergency preparedness and response efforts. PA held over 30 interviews with CenterPoint employees, including all leadership staff within CenterPoint's Incident Command (IC), using a combination of on-site and virtual discussions. By gathering both quantitative data from requests and qualitative data through interviews and primary source documents and analyzing both, the after-action report evaluates all aspects of the utility's response to the hurricane and provides recommendations for improvements to the three stages (readiness, responsiveness, and recovery) to improve performance during the next event.

In this review, PA independently developed the outage restoration curve using a "bottom-up" approach, based on source data provided by CenterPoint. This data covered all grid events in CEHE's territory, along with their associated outages, which were then aggregated to produce a territory-wide outage count throughout the storm. Although PA's calculated outage metrics closely align with CenterPoint's initially reported numbers, discrepancies exist in the maximum number of customers affected and the daily restoration counts. These differences stem from PA utilizing outage data that had undergone post-storm Quality Assurance (QA) at the end of July.

PA noted that CenterPoint's data lacked timestamps, which could result in inconsistencies in measurement timing. Utilities typically need to reconcile their outage data, especially after major events like hurricanes, to ensure accurate record-keeping matches restoration actions in the field. For example, three customers may be connected to a reportedly damaged distribution transformer, resulting in a reported customer impact of 3 but the field crew may have repaired a single service drop and not the transformer, with a real customer impact of 1. This can lead to inaccuracies in the reported extent of the damage and the number of customers and locations affected. In CenterPoint's Request for Information (RFI) responses to the PUCT as well as in its operational compendium related to Beryl, both of which are used as references throughout this report, outage statistics had not yet undergone this QA process. After the QA process was completed, CenterPoint's numbers align with PA's. PA's dataset included precise outage timestamps, allowing for consistent daily reporting. Consequently, when referencing outage metrics and event chronology in this report, PA's calculations are used.

2. Hurricane Beryl

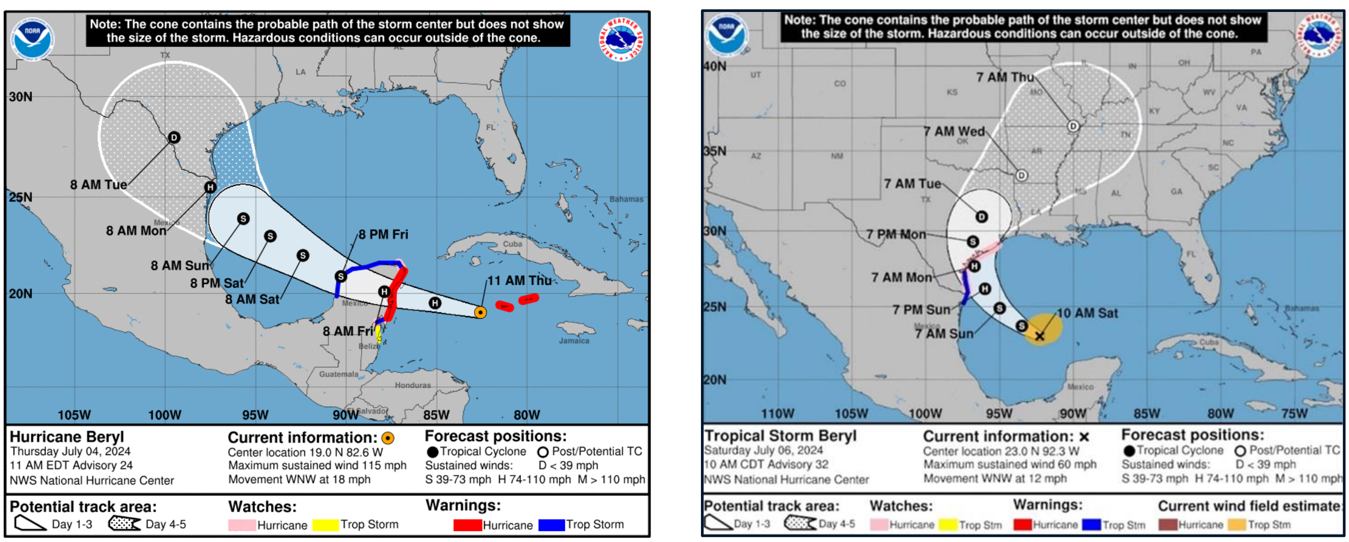
02

2.1 Hurricane Overview

Hurricane Beryl originated as a tropical depression in the Main Development Region of the deep tropical Atlantic on June 28, 2024, with winds of 35 mph. For the next week, the storm traveled across the Gulf of Mexico.[4]

After passing through Carriacou, Beryl continued to strengthen in the Eastern Caribbean Sea, becoming a Category 5 hurricane. Following this peak intensity, the storm began to weaken, passing south of Jamaica as a Category 4 on July 3. It further diminished before making a second landfall on the Yucatán Peninsula as a Category 2 on July 5. As Beryl moved over land, it lost strength but reemerged into the Southwest Gulf of Mexico later that day as a strong tropical storm. Despite its movement, Beryl struggled to regain intensity due to increased wind shear and dry air.[5] On July 6, Beryl's precise landfall location was still uncertain as it moved through the Gulf of Mexico. However, by July 8, the storm regained strength and made landfall in Texas.

Figure 2 - 1: Hurricane Beryl's Projected Track Area as of July 4 and July 6, 2024 (NOAA)



Prior to reaching Texas, Beryl's projected path had several possible trajectories based on various forecast models.[6] These potential paths included (shown in Figure 2 - 1):

- Gulf of Mexico: Initially, as Beryl reentered the Gulf of Mexico after crossing the Yucatán Peninsula, forecasts showed that it could take a more westward or northwestward path. This trajectory included potential landfalls anywhere along the Gulf Coast, from northern Mexico to the central Texas coastline.
- Northern Mexico: One possible path had Beryl moving towards northern Mexico, similar to previous storms that have crossed the Yucatán Peninsula and then curved westward. This would have resulted in a landfall near the Tamaulipas or Veracruz states.

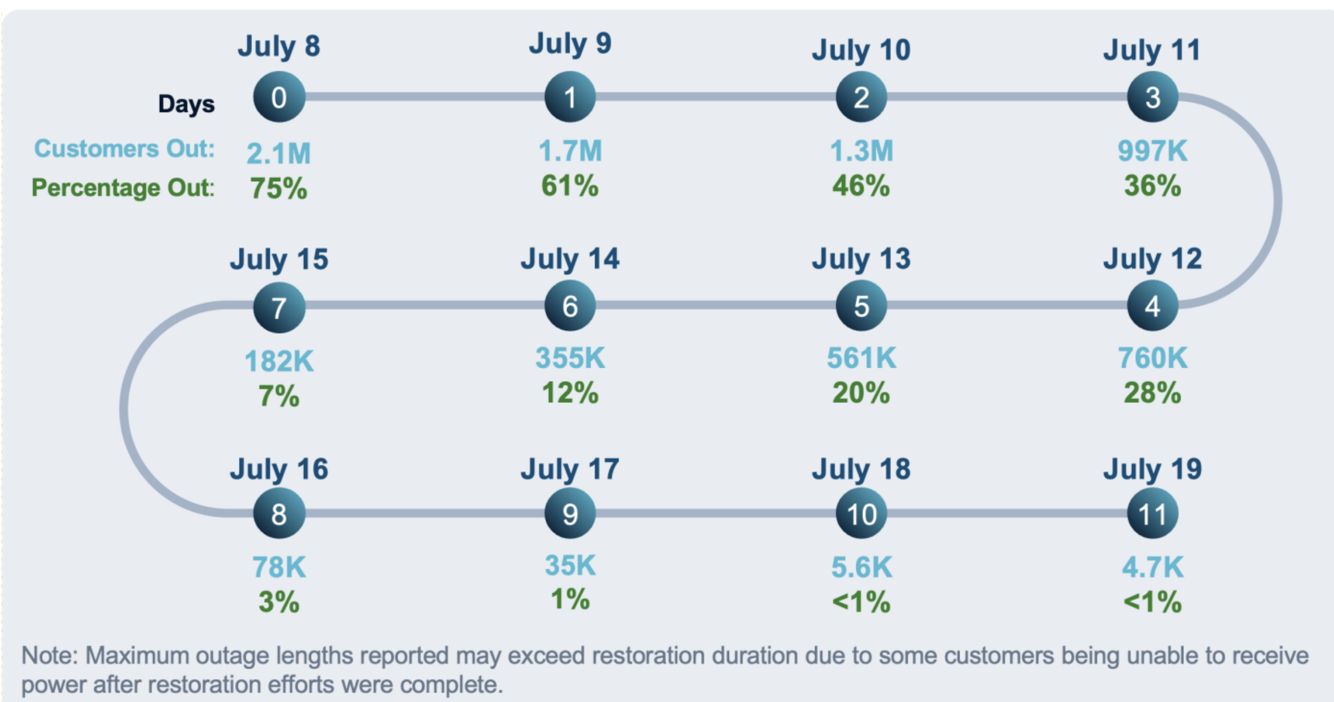
[4] National Oceanic and Atmospheric Administration Climate.gov website. https://www.climate.gov/. Accessed August 2024.
[5] National Oceanic and Atmospheric Administration Climate.gov website. https://www.climate.gov/. Accessed August 2024.
[6] National Oceanic and Atmospheric Administration website. https://www.nhc.noaa.gov/. Accessed August 2024.

- South Texas: Another predicted path had Beryl targeting the southern Texas coast, potentially making landfall between Corpus Christi and Brownsville. This would have steered the storm away from major urban centers like Houston but still affected smaller coastal communities.
- Central Texas Coast: A more central path included potential landfall near Matagorda Bay, which would have put both Corpus Christi and Houston at risk, depending on the storm's trajectory after landfall.
- Eastern Texas and Louisiana: Some models suggested Beryl could curve more northeastward, which would have brought it closer to the Texas-Louisiana border or even into Louisiana, threatening areas like Beaumont, Port Arthur, and Lake Charles.

As the storm progressed, its path became more defined, leading to its eventual landfall and subsequent impact on the Greater Houston area. On July 8, Beryl made landfall as a Category 1 Hurricane. The forecast, as of 3:00AM CT,[7] indicated that the storm would have high impact to Houston with hurricane force winds and rain. The storm made landfall at 4:00AM and the eyewall tracked through Houston throughout the morning until around 2:00PM. The storm weakened slowly after hitting the coast and caused high levels of damage as it moved through Houston. Beryl's eye passed over the west side of the metro area, with the most damaging area of the storm northeast of the eye (or the "dirty-side"), passing directly through Houston as a direct hit.

The combination of high winds, over a foot of rainfall, and surge flooding led to downed trees, poles, and power lines, resulting in more than 2.1 million CEHE customers in the Greater Houston area losing power. Beryl caused significant flash flooding, power outages, and damage to vegetation creating a difficult environment for utility and emergency response crews to operate in. Multiple deaths were reported due to trees falling on homes and heavy rain caused several roadways in the area to become flooded with officials needing to perform almost 50 high water rescues by 3:30PM.[8] Figure 2 - 2 presents a daily breakdown of customer outages, detailing the extent of power loss experienced over the first nine days of the storm restoration period.

Figure 2 - 2: Customer Peak Outages Per Day Post-Beryl



[7] All times listed are Central Time unless otherwise stated.
[8] University of Houston Public Media article. "Beryl blows into Houston: Hurricane makes landfall as category one; three deaths reported." Accessed September 2024.

Following the initial power outage, nearly two hundred thousand customers remained without electricity for over a week as CenterPoint continued its restoration efforts.

Figure 2 - 3: Map of Customer Restoration Dates

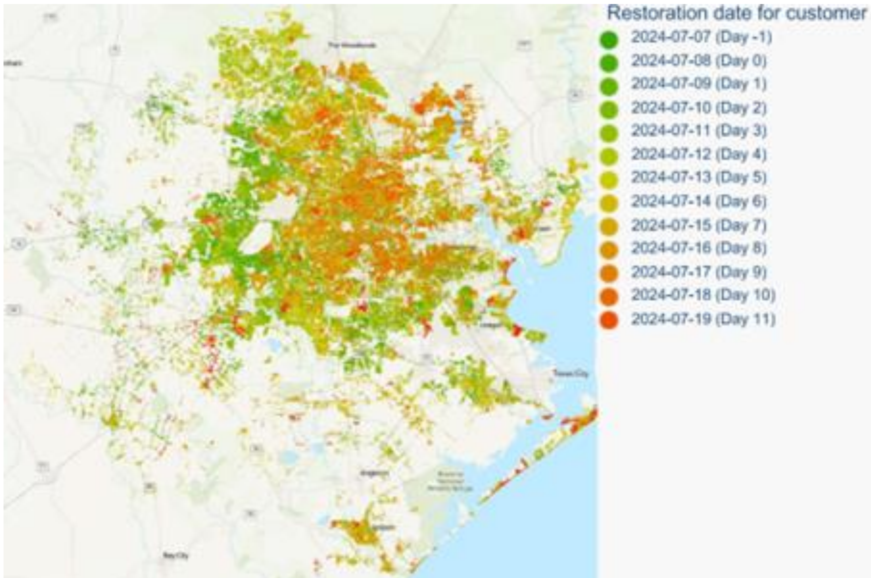


Image provided by CenterPoint Energy.

After the storm passed, government officials and nonprofits began opening cooling centers for the public to seek refuge from the heat, charge electronic devices, and access food and clean water. However, due to power loss some cooling centers were unable to operate.

During the storm, St. Luke's Health-Brazosport Hospital faced power outages and sustained damage, forcing it to rely on its standby generator. As a result, patients had to be transferred to nearby facilities. While most hospitals, including Houston Methodist and Memorial Hermann Health System, remained open, many outpatient facilities and clinics closed. Memorial Hermann's convenient care centers were limited to emergency services only and patients were moved to other hospitals due to the storm's impact.

Federal and state officials responded to the event with Federal Emergency Management Agency (FEMA) providing disaster relief to 67 counties in Texas and disaster declarations were issued in 121 counties. CenterPoint mobilized roughly 15,000 personnel for distribution line repair and vegetation management, deployed across 21 staging sites set up between July 8 and July 12 and in place throughout the duration of storm response. This included over 13,000 mutual assistance resources, 1,217 native contractors, and 583 CenterPoint resources. Over the course of the response the utility replaced over 3,000 downed or damaged poles and almost 2,500 transformers and used over 146,000 feet of wire in its effort to restore power to all affected customers.

On September 12, 2024, the Harris County Institute of Forensic Sciences submitted a request under the Texas Public Information Act to determine the number of deaths related to Hurricane Beryl in Harris County.[9] The response to the request confirmed 22 deaths attributed to the storm. Additionally, neighboring counties—including Fort Bend, Galveston, Montgomery, and Matagorda—reported further fatalities, bringing the overall death toll to 42. Trees falling on homes and people in vehicles also caused at least 3 deaths and flooding causing people to be trapped in cars. Overall, the storm caused between \$2.5 and \$3.5 billion in property damage to the area with the total approximate economic loss nationwide being between \$28 and \$32 billion.[10] After passing through Houston, Beryl weakened to a

[9] Harris County Institute of Forensic Sciences Texas Public Information Act Data Request. https://ifs.harriscountytx.gov/. Accessed September 2024.
[10] Axios Houston article. "Hurricane Beryl's estimated damage is in the billions." July 2024.

tropical storm once it was approximately 20 miles northwest from Houston or approximately 80 miles from landfall.[11]

2.2 Summary Event Chronology

The following visual timeline provides a concise summary of CenterPoint's key actions before, during, and after Hurricane Beryl. It highlights CenterPoint's preparedness efforts, response measures, and restoration activities as the storm unfolded, capturing critical decisions and milestones in the storm management process. This overview offers a clear snapshot of CenterPoint's performance and challenges throughout the event, reflecting both the successes and areas where improvements were identified for future response strategies.

Figure 2 - 4: Summary Timeline of CenterPoint Actions throughout Hurricane Beryl

Summary of Events & Response Actions

July 4 - July 6 Pre-Storm Preparations	July 7 Day Before Beryl Landfall	July 8 Beryl Hits Houston	July 9 First Full Restoration Day	July 10 - July 16 Restoration Continues	July 17 - July 18 Post-Beryl Thunderstorm	July 19 Restoration Complete
• CNP was actively monitoring Beryl since June 25 • Staging sites were notified for potential activation • Operational, planning, and weather meetings began on July 6 • Internal crew and native contractors were activated to report on July 8 • Initial request for mutual assistance was made • PAS® alert was sent to enrolled customers	• Emergency Level 2 Activation initiated • ICS was physically assembled • CNP contacted SEE and TXMAG to secure more resources • Requested mutual assistance for line skills, vegetation management & damage assessment • 4 staging sites were planned for July 8 mobilization • 4,468 crew resources were activated	• Beryl arrives at 4:00 AM • Emergency Level 1 Activation initiated • Daily leadership briefings began • Requested additional veg. management, mutual assistance • Began damage assessment • 4 staging sites were dispatch ready with 4,938 FTEs on site • Evaluated TEEEF location deployment • Over 339k customers restored by EOD	• Restoration activity continued: damage assessment and cut-and-clear • Established 14 additional staging sites (18 total) • Evaluated TEEEF location deployment • 10,589 crew members were on site (out of the 13,991 activated) • 74% of circuit lockouts cleared and over 1.1 million customers restored by end of day	• Over 1.3 million customers were restored by the evening of July 11 • Crews continued restoration activities (with over 15,000 total resources) • 21 staging sites were operational • 31 generation units were deployed and energized at 28 critical sites • 80% of customers were restored by July 14	• A thunderstorm (with 60+ mph winds) triggered additional outages • Restoration activities continued • Evaluated TEEEF location deployment • One TEEEF unit remained energized • Over 15,000 crew resources were on site	• All hurricane-related outages were restored • All non-union resources were demobilized • All TEEEF units were demobilized • Deactivated EOC • Transitioned out of Emergency Level 1 • Distribution Operations conducted post-storm recovery activities

CenterPoint Outage Tracker and ETRs

July 4 - July 6	July 7	July 8 - July 19
Absence of Outage Tracker discussed	• Outage tracker was not available • Global ETR was not provided • EOC and DOC suppressed system-generated ETRs	• July 9: A map of outages, circuit states, and circuit-based ETRs was rendered manually at least daily using an ArcGIS Story Map. A count of current customers impacted and those restored in the preceding 24-hour period was posted on CenterPoint's website. • July 10: Information regarding restoration expectations and high-level updates (such as customer counts) began to be provided on July 10 and continued to be released daily through press updates.

2.3 Hurricane Beryl Comparison

Beryl was one of the three most significant wind events in Houston, alongside Hurricanes Alicia (1983) and Ike (2008). While the 2024 storm wasn't as strong as the previous two, Beryl's direct path through the city accounted for the high level of damage to Houston's infrastructure and vegetation. With

[11] National Weather Service website. "Hurricane Beryl 2024." https://www.weather.gov/lch/2024Beryl. Accessed September 2024.

sustained winds up to 58 mph and gusts up to 84 mph, the storm damaged roughly 50% of Houston's urbanized area tree coverage and about 7.8 million acres of forestland.[12,13]

Table 2 - 1 outlines the characteristics of select storms in Houston where CenterPoint provided response and restoration efforts. Notably, it highlights that the reported wind speeds of Hurricane Beryl were the highest among these comparable storms. Additionally, CenterPoint's response to Hurricane Beryl marked the largest storm response in recent history, mobilizing roughly 15,000 internal and external resources—more than any previous response to comparable storms. Despite these comparisons, Beryl proved particularly devastating for Houston due to a combination of factors that intensified its effects compared to other storms.

Table 2 - 1: Houston Area Storms Comparable to Beryl

Select Houston Area Storms					
Storm Characteristics	**Beryl**	**Derecho**	**Nicholas**	**Harvey**	**Ike**
Storm Landfall Date	July 8, 2024	May 16, 2024	Sept 14, 2021	Aug 25, 2017	Sept 12, 2008
Sustained Wind Speed Reported at HOU*	58 mph	43 mph	43 mph	30 mph	75 mph
Peak Gusts Reported at HOU*	84 mph	62 mph	55 mph	40 mph	92 mph
Sustained Wind Speed Reported at IAH**	62 mph	40 mph	33 mph	25 mph	56 mph
Peak Gusts Reported at IAH**	83 mph	62 mph	51 mph	36 mph	82 mph
Weather Event Type	Wind	Wind	Water	Water	Wind
Storm Category at Landfall	1	-	1	4	2
Restoration Duration	11 days	7 days	4 days	10 days	18 days
Resources Mobilized (approx.)	15,000	6,700	5,000	10,000	12,000
Peak Outage Count	2.1M	858,271	502,000	1.27M	2.1M
Deaths in Houston Area	42	8	0	89	112
Houston Area Damage Cost (estimated)	$6.0B	$1.3B	$1.2B	$160.0B	$43.2B

Note: *National Weather Service historical data recorded at William P. Hobby Airport
**National Weather Service historical data recorded at Houston Intercontinental Airport
Source: Publicly available data from the PUCT and confidential CenterPoint Documents.

As the earliest recorded Category 5 storm in the Atlantic, Beryl made landfall in Houston in July, shortly after a severe derecho impacted the city in May. This sequence of events created a particularly challenging period for the region, as it faced the compounded effects of consecutive extreme weather events in a short period of time. The May derecho brought heavy rainfall, leading to significant soil expansion, which, combined with root stress from Winter Storm Uri and a drought in 2022-2023, resulted in an increased tree fall rate. This elevated fall rate adversely affected the distribution infrastructure, with 50% of circuit outages attributed to vegetation damage, particularly in rear lot distribution areas. As a result, Beryl's peak customer outage count exceeded 2.1 million, making it one of the highest in CenterPoint history.

[12] Austin, Texas KXAN Weather News. https://www.kxan.com/weather/2024-tropical-timeline-tracker/. Accessed September 2024.
[13] Texas A&M Forest Service website. https://tfsweb.tamu.edu/content/article.aspx?id=33655. Accessed September 2024.

Hurricanes Beryl and Ike share similarities in terms of damage amounts, the number of customers impacted, and the crew resources required for recovery. However, a notable difference between the two storms is the extent of damage to transmission infrastructure. As shown in Table 2 - 2 almost four times as many transmission structures were replaced in Ike as were in Beryl indicating the benefit of investments made in the transmission system.

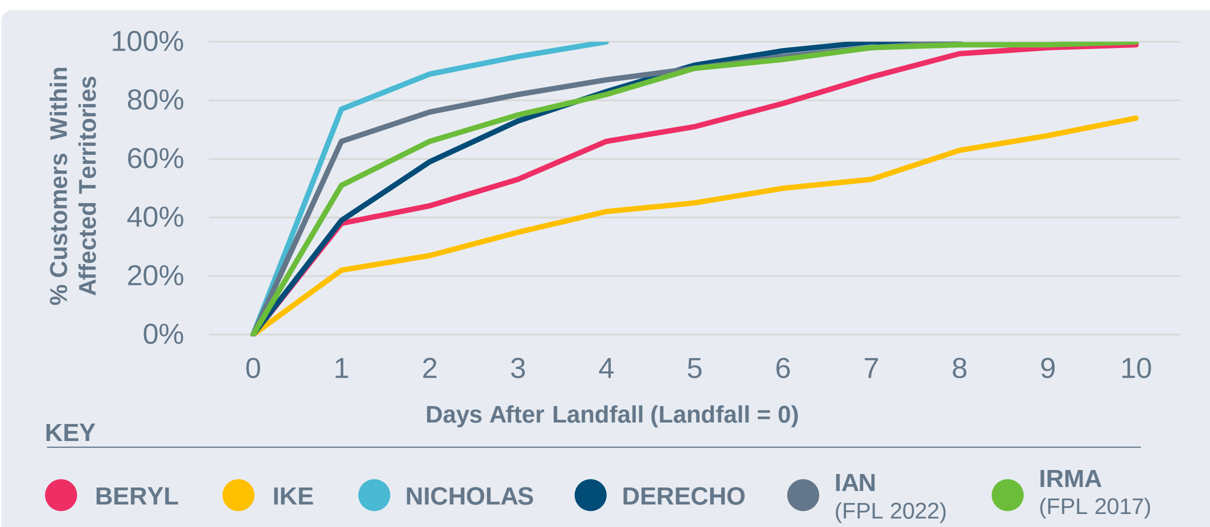
Table 2 - 2: Beryl vs. Ike Damage Summary

Comparable Houston Area Storms		
Impact	**Beryl**	**Ike**
Storm Landfall Date	**July 8, 2024**	**Sept 12, 2008**
Transmission Line Outages	**8% (31/389)**	**31% (99/320)**
Substation Outages	**2% (6/313)**	**18% (49/267)**
Customer Sub Outages	**8% (15/194)**	**41% (56/137)**
Customers Out at Peak	**75.0% (2.1/2.8M)**	**90.5% (1.9/2.1M)**
Transmission Structures Replaced[14]	**16 (.06%)**	**60**
Transmission Structures Needing Repair[15]	**4 (.01%)**	**82**
% Feeder Circuits Out	**75%**	**88%**
Distributions Poles Replaced	**3,025**	**8,500**

Source: Publicly available data from the PUCT and confidential CenterPoint Documents.

Despite the vast number of crews deployed, the widespread damage to the distribution infrastructure resulted in a long duration effort. The restoration curve for Beryl was flatter during the earlier days of the response, with a similar shape to Ike's, when compared to other similar storms in Houston. This flat start to the curve indicates a challenge in quickly restoring power to a large portion of affected customers due to the significantly larger quantity of damage locations caused by Beryl and Ike compared to the other storms. As shown in Figure 2 - 5, PA leveraged restoration data from Florida Power & Light (FPL), which is a leader in infrastructure resiliency and hurricane response, for an industry comparison.

Figure 2 - 5: Restoration Curves for Comparable Storms



[14] Historical data on CenterPoint's total transmission structures is not available.
[15] Historical data on CenterPoint's total transmission structures is not available.

2.4 Hurricane Beryl Response Comparison

As Beryl impacted each service territory, the responses from CenterPoint, Texas-New Mexico Power (TNMP), and Entergy Texas, Inc. (ETI or Entergy) were similar in how the utilities tracked the storm, requested mutual aid, deployed crews and resources, communicated with customers, and restored power.

Service Territory Damage

The damage that Beryl caused in each utility territory varied as shown in Table 2 - 3. While all utilities experienced relatively similar levels of distribution pole damage, none reported significant transmission infrastructure failures. TNMP experienced the highest level of distribution pole damage, with approximately 0.5% of their total poles down. Beryl's path directly hit CenterPoint service territory resulting in the larger amount of customer outages experienced compared to the other two utilities.

Table 2 - 3: Key Beryl Restoration Metrics from Peer Utilities

Peer Utilities Performance of Hurricane Beryl			
Utility	**CEHE**	**Entergy**	**TNMP**
Peak Customer Outage Count	**2.1M**	**299,512**	**142,000**
Restoration Duration (days)[16]	**11**	**8**	**9**
Average Restoration Time (hours)	**43**	**72**	**55**
Maximum Outage Length (hours)[17]	**248**	**227**	**242**
% of Affected Customers	**75%**	**45%**	**53%**
Total Distribution Poles Down	**3,025**	**910**	**481**
Non-wood Failures	337	-	-
Wood Failures	2,688	910	481
Total Poles	1,165,862	517,683	103,032
Total Distribution Pole Failure %	**0.26%**	**0.18%**	**0.47%**
Total Transmission Structure Failures	**20**	**6**	**-**
Non-wood Failures	-	-	-
Wood Failures	20	6	-
Total Transmission Structures	25,849	25,087	2,737
Total Transmission Structure Failure %	**0.1%**	**-**	**-**

Source: Publicly available data from the PUCT (RFI Responses) and confidential CenterPoint Documents.

[16] The end date of restoration is considered to be the day that all customers who can safely receive service are restored.

[17] Maximum outage lengths reported may exceed restoration duration due to some customers being unable to receive power after restoration efforts were complete.

Storm Tracking & Preparedness

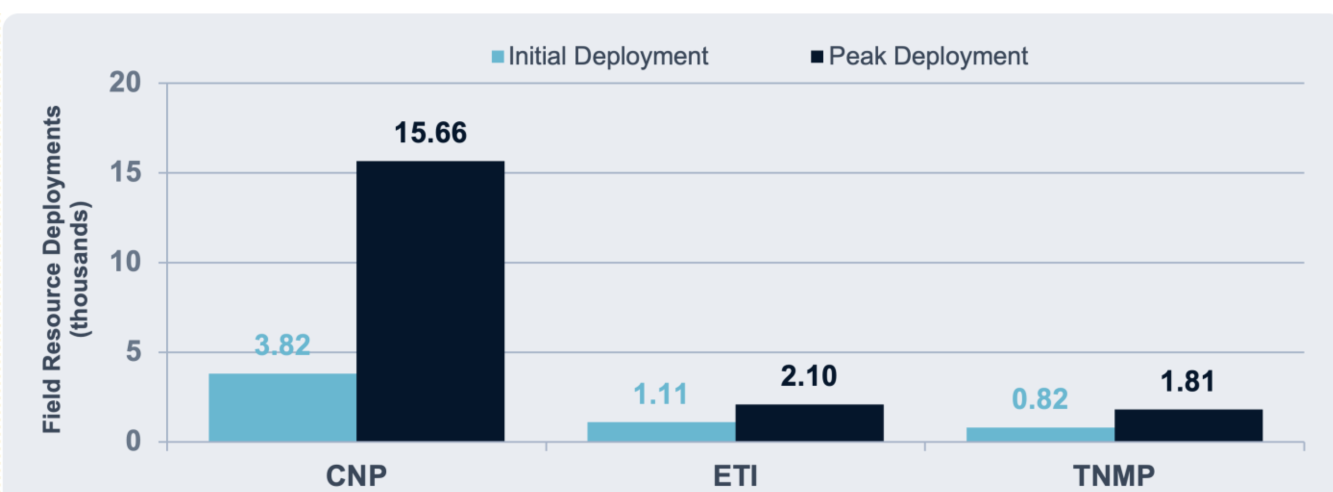
CenterPoint began tracking tropical disturbance 7 (which would become Hurricane Beryl) on June 25. On July 2, CenterPoint received a notification from StormGeo indicating that Hurricane Beryl could possibly make landfall near Houston. StormGeo is a professional meteorologist and weather forecasting vendor that provides daily weather forecasts and 24/7 meteorological support. The same day, CenterPoint initiated storm preparations and began coordinating with a line skills resource aggregator. Similarly, ETI had begun monitoring the disturbance on June 25 and commenced storm preparedness activities subsequent to that date. TNMP's storm monitoring began on June 30, a few days after the neighboring utilities, and initiated storm preparedness on July 6.

A key element in storm preparedness is to ensure all systems are working properly. CenterPoint's Outage Tracker was not available during Hurricane Beryl; however, the Company deployed an alternative Outage Map that provided customers with a map of outages, restoration process, circuit states, and circuit-based ETRs. TNMP reported that their outage tracker was not specifically tested as the tracker's "functionality and performance are continuously monitored as part of normal operations."[18] ETI reported having a dedicated team that regularly tests the functionality and performance of their outage tracker, including planning and storm preparation activities, throughout the year. The utility stated, "monitoring is increased during major storms to quickly detect and address any issues affecting the ability to accurately track outages."[19]

Mutual Assistance Comparison

ETI initiated mutual assistance coordination on July 5, submitting its first request for 640 field restoration resources on July 7. TNMP requested initial resources on July 6 and identified roughly 90 nearby full-time contractors who were prepared to assist in the area. Both utilities leveraged local contractors, and once Beryl made landfall on July 8, each utility requested mutual assistance crews and began deploying resources to respond to the storm. Similar to CenterPoint, neighboring utilities activated their respective incident commands by July 7. Due to the extensive damage brought to CEHE's territory, CenterPoint coordinated and managed a considerably greater number of mutual assistance and field resources compared to neighboring utilities.

Figure 2 - 6: Peer Utility Crew Deployments during Beryl

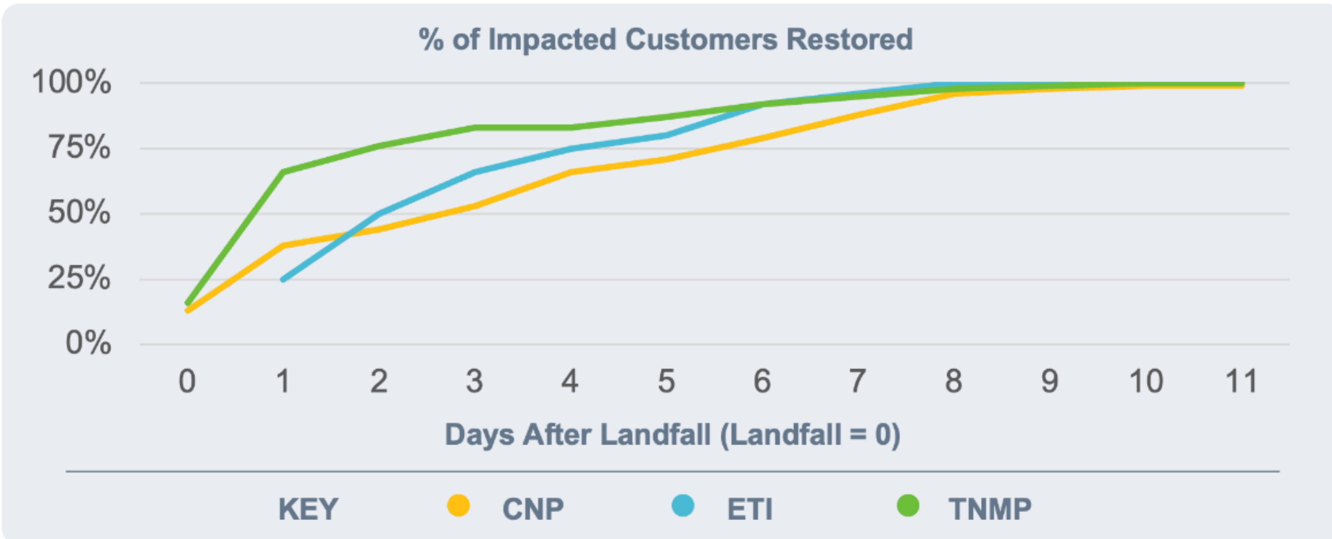


[18] Public Utility Commission of Texas Filing. Texas-New Mexico Power Company's Response to Commission Staff's First Request for Information. PUC Docket No. 56822. Accessed September 2024.
[19] Public Utility Commission of Texas Filing. ETI's Responses to Staff's 1st RFI Questions 1 Through 55. PUC Docket No. 56822. Accessed September 2024.

Outage Restoration

As crews operated in each territory, customer restoration timelines varied across the three utilities, as illustrated in Figure 2 - 7. ETI achieved the fastest restoration timeline, fully restoring service to all customers by July 16, followed by TNMP on July 17 and CenterPoint on July 19. TNMP's restoration curve indicates it experienced the largest initial step of outage restorations, with over 80% of customers restored by July 11, just three days after Beryl made landfall.

Figure 2 - 7: Beryl Restoration Curves of Peer Utilities[20]



[20] ETI did not report the percentage of restoration achieved on the 8th, as crews were engaged in overnight operations, and it appears that damage assessment was not fully completed by the time of their last press release that day.

3. Findings & Recommendations

03

This section presents targeted recommendations designed to address specific challenges that emerged during Hurricane Beryl. PA identified areas of concern and potential improvement, along with strategies to enhance storm response and strengthen CenterPoint's resilience by completing a thorough review of the restoration performance data and preparedness processes. The recommendations in this section are intended to optimize response strategies and enhance CenterPoint's infrastructure, ensuring greater response effectiveness in future storms.

3.1 Resiliency Planning & Portfolio Management

Throughout this report, PA presents a series of tailored actions aimed at enhancing CenterPoint's storm response and driving overall improvement. However, the key to success lies not solely in the specifics of each recommendation but in rationalizing these actions, evaluating their potential impact, and prioritizing them effectively. Once prioritized, the portfolio of actions can be harmonized with existing capital and operations and maintenance (O&M) programs, significantly advancing resilience, and delivering a noticeably improved customer experience. By employing the methodology outlined below, CenterPoint can craft an ideal restoration curve that aligns with the customer experience they aim to deliver. This approach will enable the creation of a portfolio of initiatives, which can be leveraged to develop a comprehensive roadmap for achieving their stated objectives within realistic resource constraints.

01 **Dissect Beryl's Restoration Curve:** Dissect the restoration curve from Beryl, along with similar historical curves (such as Ike), on an order-by-order basis—evaluating factors like damage severity, ease of restoration, and resource deployment. Developing a disaggregated restoration curve with order-by-order granularity will serve as the foundation for further analysis and establish a baseline for forecasting improvements.

02 **Develop the Target Restoration Curve:** Develop a targeted restoration curve that outlines the expected timeline and sequence for restoring services after a major event. The curve considers the specific needs of different customer types and their associated challenges. By aligning restoration efforts with customer expectations and operational capabilities, CenterPoint can enhance their response strategies, improve overall customer satisfaction, and help ensure a more resilient grid.

03 **Conduct an Impact Analysis:** Conduct an impact analysis by evaluating historical storm data alongside forecasts of potential future events to determine the benefit that implementing each initiative would provide to grid infrastructure and the customer experience.

04 **Prioritize Initiatives:** Once the impact is assessed, prioritize initiatives based on their potential benefits, focusing on those that offer the greatest improvement to grid resilience and customer experience. This helps ensure that resources are directed to the most impactful actions, optimizing both short- and long-term outcomes.

05 **Develop Portfolio of Initiatives:** Once the initiatives are prioritized, develop a portfolio to effectively manage all the initiatives slated for implementation. This portfolio should align with strategic objectives while carefully considering capital and O&M cost constraints. By consolidating initiatives into a cohesive framework, CenterPoint can help ensure that resources are allocated efficiently, track progress, and adjust as needed to maximize both financial sustainability and overall success.

3.2 Incident Command

An IC and EOC are vital components for electric utilities during the storm restoration process. The IC should provide a clear, organized framework for managing emergencies, helping to ensure effective coordination among various teams and resources. By establishing defined roles and responsibilities, the IC enhances communication and decision-making, allowing for rapid responses to evolving situations. The EOC serves as the central hub for strategic oversight, where key personnel can monitor the storm's impact, assess damages, and prioritize restoration efforts. Together, these systems facilitate a streamlined response, benefiting the safety of both utility workers and the public while expediting the restoration of power and critical service. Once activated, the IC assumes unified command (top-down control and management) of all personnel, processes, and technologies involved in the restoration process. The primary responsibilities of the IC include:

- Establishing restoration strategies (e.g., ticket, circuit, area)
- Acquiring and allocating resources on a continual basis
- Setting global ETR and transitioning to circuit-based and ticket-based approaches
- Monitoring progress and supporting the Department Operations Center and branch directors
- Providing updates to the Crisis Management Committee

In short - the “buck stops” at the IC.

3.2.1 Findings

During CenterPoint’s Beryl response, the EOC was activated. PA found that the activation of the IC was consistent with industry practices and many of the IC’s functions aligned with industry norms and standards. For example, the CMC served as the policy leader and the DOC played a crucial role in requesting and coordinating resources as well as shaping restoration strategies. However, several of the IC’s functions including the planning section did not operate consistent with industry norms and standards.

As the storm track shifted between July 5 and July 7, just before impact, the anticipated damage and the demand for restoration crews and resources increased significantly. On Saturday, July 6, the DOC made the decision to mobilize resources in preparation for a Monday morning start to restoration efforts.

Preparedness

CenterPoint’s IC was activated according to the processes outlined in its EOP. IC section level chiefs (or their equivalents) monitored the shifting forecasted storm tracks prior to storm impact and acted accordingly. Staffing plans for Monday morning were influenced by union callout rules and a lack of dedicated storm riders. Daily Incident Action Plans (IAPs) were assembled and documented. IAPs are discussed further in ‘Restoration Management’ section of this report.

Four staging sites were activated on Sunday July 7, and 21 staging sites were activated by end of day Wednesday July 10. Mutual assistance crews were sought out as CenterPoint reached out to Regional Mutual Assistance Groups (RMAGs) to secure additional resources (e.g., line crews and vegetation crews). DOC effectively took the lead in terms of shaping and executing the restoration plan.

PA observed instances where the flow of information and field experiences did not align with established EOP restoration procedures. Evidence indicates that in certain cases restoration crews addressed damage without utilizing insights from the damage assessment teams. Following the preestablished restoration procedures outlined in any utility's emergency plans allows for greater restoration efficiency.

Performance

PA observed that the activation of the IC adhered to the EOP, which complied with the requirements set forth in Texas Admin. Code 25.53. While the EOP met the letter of the requirements, PA observed that in certain instances IC roles and responsibilities lacked clarity, potentially limiting the IC's effectiveness and coordination. For example, within the EOC and DOC, planning and strategic decisions—typically handled by the Planning Section, such as overall restoration strategy, work prioritization, and resource allocation (including crews and temporary generators)—were instead carried out by the Operations Section.

The CMC was activated throughout the event and, as restoration progressed, assumed an increasingly larger role in its management. The IC received strategic direction from the CMC in a host of areas throughout the event including communications, resourcing, and overall approval of restoration plans.

3.2.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
IC-1 **Streamline EOC Layout:** EOC physical layout should be updated to facilitate communications and information flow. Planning, Operations, Crisis Management Committee (CMC), Logistics, and Finance/Administration each should have dedicated work room in adjacent spaces. Provide workspaces for other Incident Command (IC) leader team members as required (Legal, Liaison, Safety, Customer, etc.). Physically align the EOC and the Distribution Operations Section Chief, when the EOC is open for an electric event. Co-locate the EOC and CMC until each entity is fully established and independently operational. **IC-2** **Revise IC Roles and Responsibilities:** All roles and responsibilities within the EOC structure need to be reviewed and updated as appropriate. The actual personnel staffing these positions should be at the executive level and be the most experienced CenterPoint personnel in major storm restoration. IC organization needs to be at least two-deep across IC section chief and higher roles. Use Deputies as a professional growth and development opportunity. **IC-2-a.** Add ETR Manager and team role within the Planning Section. **IC-2-b.** Clarify and document the placement of the IT/OT Manager within the IC. **IC-2-c.** Technology operations should be given more visibility as it can be a significant factor in restoration, particularly when systems fail to function as expected.	**IC-4** **Continue to Streamline EOC Layout:** Split the District Operations Branch during an EOC electric event to maximize impact of restoration efforts: Distribution Operations Branch Leadership located at the EOC. Region 1 work assignment located at Addicks Operations Center. Region 2 work assignment located at the Energy Control/Data Center (ECDC). **IC-5** **Establish EOC-Sections Daily Meeting:** Establish a new daily meeting cadence for the EOC and Sections (e.g., Planning, Operations, Logistics, and Finance/Administration).

Short-Term Actionable	Mid-Term Actionable
IC-3 **Expand IC/EOC Training:** To the extent possible, arrange for the current Planning Section Chief and Deputy to observe the Planning Section in action during the next major event in the Eastern United States. Tabletop exercise the revised Planning Section responsibilities. In the event of a major weather event in the Atlantic region during the 2024 storm season, designated CenterPoint personnel should shadow with the affected utility's IC to gain valuable insights and experience. Train additional personnel to function in IC roles (e.g., primary as well as backup roles), use shadowing opportunities to create 2-in-box type operations throughout EOC operations.	

3.3 Emergency Preparedness & Response

The Emergency Preparedness & Response (EP&R) group is typically responsible for developing and implementing comprehensive preparedness plans that prepare the utility to respond effectively to severe weather and other events. By conducting risk assessments, coordinating training exercises, and establishing communication protocols, the EP&R group enhances a utility's resilience and operational readiness. During a storm, they facilitate rapid mobilization of resources, streamline response efforts, and promote the safety of both personnel and the community. Their proactive measures not only minimize downtime and service disruptions but also foster a culture of safety and accountability, ultimately leading to a more efficient restoration process.

3.3.1 Findings

CenterPoint's EP&R group was refreshed in 2022 to centralize how the organization prepares for emergency events for both electric and gas operations, using an all-hazards approach. The EP&R team is led by an experienced FEMA-trained professional.

There is a Planning Organization within the EOP. However, this Organization is mainly tasked with gathering various pieces of information about restoration progress, rather than using that information to develop logistics and restoration priorities, targets and setting daily objectives. In the ICS, the Planning Organization should be the one that sets the strategy for the overall restoration effort. It synthesizes available information (e.g., damage assessment, resourcing and material levels, priorities) to set daily priorities and objectives to deliver faster, more effective restorations. It should be the group that formulates the overall restoration plan and enables Operations to execute on a daily/shift basis.

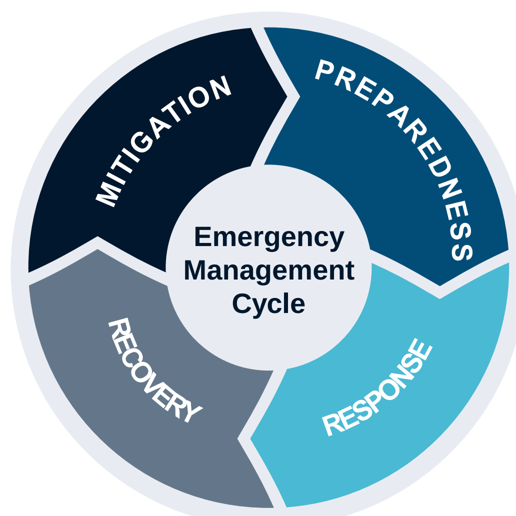


Figure 3 - 1: Emergency Management Cycle

An industry-leading standard is to follow the emergency management cycle (see Figure 3 - 1), which highlights continuous improvement of emergency management through four iterative steps: preparedness, response, recovery, and mitigation.

PA also observed that Foreign Crew Coordinators (FCC) work burdens are particularly heavy in comparison to what typical crew guides are tasked with. FCCs were tasked with guiding up to 10 mutual assistance/foreign crews which typically represents up to 40 to 50 full-time employees (FTEs). This exceeds the typical span of control/coordination benchmark of between 1:7 to 1:10. During circuit sweep restoration activities where all 10 crews are working on the same or adjacent circuits this is not a concern. However, as the restoration progresses and the work assigned to the 10 crews becomes geographically dispersed, the FCC may face difficulty in keeping track of work progress, ETR updates, and close out outage tickets.

Preparedness

The Texas EOP regulation, 16 Tex. Admin. Code § 25.53 - Electric Service Emergency Operations Plans, sets out rules for how electric companies and other related organizations must prepare for emergencies that could disrupt power services. It covers a wide range of entities including electric utilities, power generators, and ERCOT. This section applies to an electric utility, transmission and distribution utility, power generation company (PGC), municipally owned utility, electric cooperative, and retail electric provider (REP), and to the Electric Reliability Council of Texas (ERCOT).

Each entity must create and maintain an EOP. This plan outlines how they will handle different types of emergencies, such as severe weather or cyberattacks. The plan needs to be updated regularly, with a new version filed every year by March 15. If there are significant changes to how emergencies will be handled, the updated plan must be filed with the PUCT and, if applicable, ERCOT. Key components of the plan include:

- Approval and Updates: The EOP should include who is in charge, how changes are tracked, and the latest approval date. It must clearly state that it replaces any previous plans.
- Communication: The plan must outline how the entity will communicate during emergencies with the public, media, government officials, and other stakeholders.
- Emergency Supplies and Staffing: The plan should include details on how the entity will maintain necessary supplies and manage staffing during emergencies.
- Weather and Other Hazards: There should be procedures for dealing with various types of weather-related emergencies, like hurricanes, tornadoes, derechos (micro/macro-bursts) or extreme temperatures, etc.
- Specific Annexes: Different entities need specific annexes in their plans:
  - **Utilities**: Must include plans for weather emergencies, power load shedding, pandemics, wildfires, hurricanes, cyberattacks, and physical security incidents.
  - **Generation Resources**: Need similar plans, with additional sections for water shortages and service restoration.
  - **Retail Electric Providers**: Must include plans for pandemics, hurricanes, cyberattacks, and physical security.
  - **ERCOT**: Requires annexes for pandemics, weather emergencies, hurricanes, cyber security, and physical security.

Entities must conduct at least one full-scale exercise each year to test their emergency plans. If the entity is in an area prone to hurricanes, one drill must test hurricane preparedness. Entities should notify relevant authorities about these drills in advance. PA noted that CenterPoint is in compliance with this regulation.

If an emergency activates the State Operations Center (SOC) and upon request by the Texas Commission Staff, affected entities must provide updates on their operations and recovery efforts. After the emergency, they may need to submit a report on how well their emergency response worked and what lessons were learned.

This code ensures that electric companies and related organizations have robust and regularly updated plans to handle emergencies, conduct regular drills, and keep relevant authorities informed during and after an emergency.

Performance

CenterPoint was actively monitoring Beryl since June 25, when EP&R was first notified of the storm by StormGeo. Members of the IC team started to monitor for potential impact of Beryl starting July 4. CenterPoint started holding weather calls starting on July 5 and made the decision to call in mutual assistance crews (to be on standby). The EOC was activated on July 7, and employees were notified of Level 2 activation. This activation process occurred in accordance with the EOP. Once activated, the planning group prepared daily IAPs (see additional discussion in the Restoration Management section of this report), meetings and calls were held, and press releases were released, all indicating that the plans outlined in the EOP have been successfully implemented.

During Beryl, the EP&R team had transitioned to a standardized form-based system for collecting restoration progress information from various service centers and staging sites. This new approach collected information via these forms which was utilized to prepare Situational Reports that keep the IC informed. Strategic decisions regarding restoration efforts were managed by the Operations group at the DOC in coordination with the EOC and CMC.

3.3.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
EP&R-1 **Enact 24-Hour EOC/DOC Operations:** Switch to 24-hour EOC/DOC operations, operating on two, 13-hour shifts for key functions including Planning.	**EP&R-3** **Focus Planning Section on Strategic Functions:** Revamp Planning Section to focus on more strategic functions. Upgrade the Planning Section Chief to a Vice President-level resource. Update the Planning Section role and responsibilities, including incorporation of Global ETR establishment and management. Establish the strategic response plan for the incident, including resources and allocations needed, restoration tactics, and a global ETR and ETR strategy. Encourage a constructive tension between Planning and Operations Sections.
EP&R-2 **Reevaluate FCC Support:** Re-evaluate number of Field Service Representatives (FSR) needed to support the number of FCC during EOC activations to alleviate some of FCC administrative burden.	

3.4 Safety

During the hurricane restoration process, the safety group plays an essential role in safeguarding both utility workers and the public. As storms bring overhead power lines down and damage infrastructure, this specialized team implements safety protocols, conducts risk assessments, and monitors working conditions to minimize hazards. They help all restoration efforts adhere to safety regulations, offer training and resources for field crews, and communicate vital safety information to impacted communities. By prioritizing safety throughout the restoration process, the safety group facilitates a swift and secure restoration of power, ultimately enhancing the community's resilience during challenging times.

3.4.1 Findings

In spite of heightened challenges and demands given violence and threats, CenterPoint's safety group effectively executed their established processes, procedures, and designated storm roles. Notably, there were no serious injuries or fatalities (SIFs), and the team adeptly managed minor occurrences. Given the magnitude of the storm, achieving no major injuries or fatalities is a notable accomplishment.

Throughout the discovery process, PA identified opportunities for enhancement to further bolster overall safety during storm events and beyond. These enhancements included revising leadership responsibilities and expanding the safety group's integration with other storm functions, such as operations.

Preparedness

The safety organization is resourced in a lean manner, which can affect their ability to respond effectively during storm events. There was a noticeable shortage of field safety specialists, highlighting the need for an evaluation of staffing levels to help ensure adequate support during such critical situations. It was observed that the safety organization would benefit from providing further clarity on safety responsibilities between non-contractor and contractor personnel. It is essential to clarify these roles to enhance overall safety protocols and help ensure a unified approach to safety management during operations.

The safety team does not have a comprehensive understanding of the restoration processes utilized by operations (as these responsibilities were outside their designated roles) which might have impacted coordination efforts during the storm restoration. Cross-training facilitation is recommended to enhance familiarity with operational procedures among safety personnel. The responsibilities of field safety personnel did not extend to inspecting contractors or mutual assistance crews, as this duty falls under the purview of Operations. Field safety personnel would engage primarily when specifically requested by Operations to respond to safety concerns. This delineation of responsibilities should be clearly communicated to enhance operational efficiency and help ensure accountability during future events.

It is essential to prioritize qualified personnel over a less selective approach to ensure operational safety and effectiveness during restoration efforts. When requesting crews, certain skilled resources may not be as readily available as others, as seen in Beryl's case, where the number of available easement vegetation crews was scarce. A thorough evaluation of crew qualifications should be conducted to maintain high safety standards.

The online onboarding and orientation training has been deemed successful from CenterPoint's perspective, a view also echoed by feedback from one of the contractors. Field safety representatives were engaged at the staging site to facilitate on-site orientation and onboarding sessions. Furthermore, the safety group participates annually in the meetings of Southeastern Electric Exchange (SEE) and Texas Mutual Assistance Group (TXMAG) each April to review and enhance CenterPoint's safety protocols.

When inquired about the use of wire guards, the concept was not initially considered by personnel at CenterPoint. However, subsequent discussions revealed a consensus that implementing such measures would be beneficial in the future. When asked how a damage assessor would manage a downed wire, CenterPoint acknowledged this as a pertinent question but, while assessors may have the experience required, CenterPoint was unable to provide a clear explanation of the documented procedure.

Regarding the protocol for closing in on locked-out circuits absent a field patrol immediately following the storm, CenterPoint indicated that they were not aware of any formal protocol, although they noted that this practice has been in place for at least the past decade.

During the response to Beryl, 22 staging sites were established (one subsequently shutdown due to security concerns), and field safety personnel were utilized as floaters due to a shortage of dedicated safety staff. CenterPoint also indicated that a safety representative is assigned to DOC DVAL.

Mutual assistance contractors are permitted to utilize their own protocols rather than adhering to CenterPoint's established procedures. This practice should be carefully managed to ensure alignment with overall safety standards during restoration efforts.

Tracking and communicating safety incidents have been identified as an area for improvement within CenterPoint's Safety team. CenterPoint did keep an incident log during Beryl for events involving both external contractors and internal CEHE employees. Ensuring that all members of the Safety team are briefed with critical information on safety incidents during storm events will help the team coordinate and communicate effectively. Furthermore, the safety department should be responsible for reviewing and approving all safety-related communications from a safety perspective.

Performance

It is noteworthy that there were no major operational incidents reported.

A safety incident concerning security issues and threats to employees, contractors, and mutual assistance crews occurred. The Beryl specific incidents did not warrant a safety standdown, however, CenterPoint has the capability to implement a safety standdown should the need arise.

During the response to Beryl, several safety incidents were reported, including:

- An electrical contact/electrocution incident in Baytown, suspected to be related to copper theft.
- A broken pole that resulted in an injury to a mutual assistance lineperson, who was subsequently assisted down from the pole.
- A rubber gloving event.
- A vehicle related lightning strike incident.
- Multiple cases of heat stress
- One heat stress incident affecting personnel.
- Minor vehicular accidents.
- An incident involving a threat to CenterPoint personnel, which necessitated relocating a staging site to an alternate location. It should be noted that the relocation of the staging site was communicated to the public.
- One public safety incident involving a citizen fatality.

3.4.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
SAF-1 **Expand Safety Standdowns:** Safety is an entire-property, all personnel program and significant events should have safety standdown–all resources, operating or support, should know about the incident. Should be top-down decision and responsibility to communicate standdown to all response personnel.	**SAF-3** **Bolster Safety Leadership Responsibility:** To enhance overall safety management and facilitate effective operational oversight, it is recommended that the responsibilities of the safety group leadership be expanded. Empower safety group leaders with greater authority to enforce safety protocols and make real-time decisions during storm restoration efforts. This will support timely responses to safety concerns and incidents. Provide continuous training on best practices and regulatory updates to help ensure leaders are well-prepared. Establish clear protocols for regular briefings between the safety group and operational teams to address safety concerns promptly.
SAF-2 **Revise Substation Breaker Reclose Policy:** Change the breaker recloser policy in the event of a storm to require visual confirmation on the circuit before reclosing to ensure it is safe to do so. This would require additional communications and integration of processes between Field Operations (e.g., crews and FCCs as appropriate).	

3.5 Damage Prediction

3.5.1 Findings

The then-current CenterPoint damage prediction model was largely ineffective in preparing CenterPoint and its customers for Hurricane Beryl. The model and the source weather data itself are both areas for improvement. The model inputs were limited to Hurricane Ike data from 2008, so there was only a small sample to inform the model. Furthermore, the model is primarily based on windspeed, and its primary output is limited to number of resources and poles predicted to be damaged. In short, the model is one based on the number and types of poles estimated impacted (number of truck accessible, number of not truck accessible), the fraction of poles that would be damaged as a function of wind speeds scaled by Ike's damage rate, and the amount of labor hours needed to repair the various types of poles. At multiple times beginning on July 6, the Saturday before Beryl, the damage prediction model yielded estimates of 538 total FTEs for a 14-day restoration to 2,559 total FTEs for a 5-day restoration. The actual result was 14,000 FTEs who delivered an 11-day restoration (excludes damage assessors).

Admittedly the damage prediction model was handicapped by the direction of the weather (from the south instead of the west), and higher than expected windspeed and the saturated ground all contributed to an inaccurate damage prediction. But the model did not account for clearing vegetation off lines, mainline vs. lateral vs. rear-lot property poles, or for various productivity stats (assumption seems to be work can always be scaled linearly).

Preparedness

Beryl represented the first storm that the damage model was used to help calculate anticipated number of restoration forces required for the forecasted damage. Prior to Beryl's landfall, CenterPoint's Planning Section, with Operations Section input, developed multiple estimated resource requirements based on the latest available storm track and windspeed forecasts. The Planning Section ran its damage prediction model multiple times, and the last model run was developed using the July 7 forecast data.

Performance

Damage prediction models restoration duration and restoration resources using a projected workload forecast. CenterPoint's storm damage prediction model effectively uses the projected number and types of poles damaged (and thus needing replacement) to calculate the required manpower for a given desired restoration period. The lack of historical data presented a challenge to develop a sophisticated damage prediction model. CenterPoint's existing damage prediction model did not accurately capture the amount of effort needed to restore (i.e., Beryl caused much more severe damage than what was anticipated by the damage prediction model), and thus was not able to accurately determine the number of resources needed to meet the desired restoration duration.

As a result, during the first few critical days, the model provided minimal value to help various decision makers in terms of total resources required to meet the restoration targets.

3.5.2 Recommendations

Short-Term Actionable
DM-PR-1
Gather Beryl Damage Data for Model Refinement: Gather granular weather data (e.g., wind gusts, directions) and restoration data from Hurricane Beryl in a well-documented manner to allow for refinement of existing damage prediction model inputs. Gathering this data will help future efforts to improve model accuracy and can be used for future analytics/modeling efforts as well.

Short-Term Actionable	Mid-Term Actionable
DM-PR-2 **Refine Restoration Productivity Assumptions:** Analyze Beryl's restoration data (e.g., type of pole damage, pole reset durations) that are currently used in the damage prediction models to refine and enhance accuracy of the damage prediction model.	**DM-PR-3** **Build, Develop, or Acquire more Comprehensive Damage Prediction Models:** Many of the above limitations can be addressed through a more robust commercially available machine learning based software package. Key elements are the ability to archive small events and scale, use CenterPoint's historical outage data and leverage various sources of data to develop accurate models of damage predictions that can account for various modes of damage (e.g., in addition to the type of downed poles, laterals vs. primary circuit damage locations, transmission and substation damage).

3.6 Estimated Times of Restoration

3.6.1 Findings

During CenterPoint's response to Hurricane Beryl, a global ETR was not provided. This is not an industry-leading practice as ETRs help shape customer expectations and help determine what action, if any, they would need to take. It also helps external stakeholders such as municipalities, water districts and other agencies to coordinate actions.

CenterPoint's EOC and DOC are primarily operations-driven organizations focused on outage restoration and the logistics involved, rather than on disseminating information to customers and stakeholders. For instance, the approach to ETR is indicative of this practice. The CenterPoint EOC and DOC made a prudent decision to temporarily suppress system generated ETRs, allowing field crews the necessary time to assess damage and develop more accurate restoration timelines. This strategy of initial ETR suppression is consistent with industry practices, and ultimately enhances the reliability of the information shared with customers.

As the storm advanced, restoration crews on the ground evaluated the conditions along with the previously documented damage assessment, which detailed the inventory of damaged equipment and materials. This information was essential for developing estimates on the restoration timelines for specific outages. Field estimates of the levels of effort necessary to restore outage jobs were conducted by the FCCs. The field updated ETRs were entered into a spreadsheet which was the source of ETR to be used for customer communications ETRs. Due to limitations covered in section 3.23, ETR information was not populated on CenterPoint's normal Outage Tracker.

CenterPoint is keenly aware that using spreadsheets to track ETRs is difficult to manage and scale and is developing an internal application with the ability for FCCs to update ETRs electronically from the field into a database.

To provide the public with timely restoration updates, CenterPoint created a color-coded circuit-based restoration status indicator, which was launched on July 10. This indicator displayed progress through broad categorizations of status: Energized, Assigned for Work, and Assessment in Progress. It also allowed customers to check high-level statuses based on specific addresses. While this visual representation conveyed the current conditions of various affected CenterPoint circuits, it fell short of informing customers and stakeholders about the anticipated timelines for necessary repairs.

Limited information regarding restoration expectations began to be released in daily press releases on July 10, focusing on high-level customer counts. However, these updates did not provide expected restoration timelines for specific customers or geographic areas. This lack of detailed information left many customers without clear expectations about when their power would be restored.

Preparedness

CenterPoint's Outage Tracker was unavailable during the response to Hurricane Beryl, and there was no defined backup process in the existing business continuity plan. CenterPoint communicated the potential impacts of the approaching storm through preparation messages and press releases prior to July 8. During this time, they also informed customers and stakeholders about the unavailability of the Outage Tracker. Additionally, CenterPoint did not share global-level ETRs, with the first public ETRs not being released until July 10.

Performance

"Default" ETR values (ETR benchmarks) are available in CenterPoint's Advanced Distribution Management System (ADMS) and are subject to update once FCCs have assessed the amount of work needed to restore power on the affected circuit. The information is available but due to the volume of damage, was not easily tracked and communicated outwards. Global ETRs were not actively communicated to customers and stakeholders throughout the storm. One of the few venues for getting that information was through Power Alert Service® (PAS), which less than half (42%) of CenterPoint's customers opted in for. CenterPoint's Outage Map, an alternative to its unavailable Outage Tracker, was made available to provide high-level ETRs, but it indicated when the circuit feeding the customer's service was expected to be restored, rather than specific service points.

ETRs were tracked at the service center levels but were dependent on FCCs and their support personnel to enter the information manually. CenterPoint's Outage Tracker was unavailable and could not be utilized to disseminate ETR information. CenterPoint's alternative solution provided current energized/restoration underway/assessment of damage type status and was not an indication of how long potential work will take and did not serve as a viable means to shape customer expectations and actions during Beryl.

3.6.2 Recommendations

It is industry best practice to first suppress ETRs immediately, then provide a global ETR within the first two days of impact, and finally provide more granular ETRs once accurate damage assessment information is available. This method helps manage customer expectations effectively and helps ensure transparent communication during restoration efforts. ETRs can shape customer and stakeholder expectations and allow them to make informed decisions based on estimates of when power would be restored (e.g., relocation in case of residential customers, and opening relief centers for municipalities and other agencies).

Time-tiered restoration estimations (e.g., Global, Regional/Operating Area, Substation/Circuit level) may offer increasing levels of visibility and granularity to help enable customers and stakeholders to make more informed decisions.

Short-Term Actionable	Mid-Term Actionable
ETR-1 **Calculate and Disseminate Global ETRs:** Develop processes to calculate Global ETRs when most customers (e.g., 90% of impacted customers) would be restored. Global ETRs should be calculated and released publicly within 48 hours of storm impact, ideally within 24 hours of the storm leaving the area. Develop internal and external facing material to educate what the Global/Regional/Substation-level ETRs mean, as well as when they would be communicated publicly.	**ETR-2** **Develop ETR Strategy and Processes:** Develop strategy to calculate Global/Regional/Substation-level ETRs (e.g., approaches to when to disseminate, inputs needed, and roles and responsibilities). Develop processes to consolidate ETR updates from the field and aggregate them to enable the calculation of Regional/Operating/Substation-level ETRs.

Mid-Term Actionable
ETR-3 **Integrate ETR Manager Role into IC:** Fully integrate ETR manager role into IC. Fully develop and map out flow of information needed to generate Global / Regional / Substation-level ETRs, as well as all ways to disseminate ETRs to customers and stakeholders, including soliciting additional customer contact information.
ETR-4 **Define and Track ETR Accuracy:** Develop metrics to track the accuracy of ETRs that are generated and communicated. Common industry standards define an ETR as accurate if power is restored within a specific time band relative to the ETR, and if customers receive fewer than three updated ETRs for the same outage. Typical time bands include: 1) two hours before the stated ETR to zero hours after, and 2) one hour before to one hour after the stated ETR. Excessive updates can create a perception that ETRs are unreliable, ultimately hindering the ability to shape customer expectations and aid in informed decision-making.

3.7 Communications

3.7.1 Findings

Fast, accurate, and informative communications are essential to provide to customers before, during, and after a major event. Following Beryl, the overall customer sentiment was that CenterPoint's preparedness and restoration performance did not meet its full potential. PA reviewed an extensive amount of communication data to identify specific tactics and/or processes that contributed to this perception as this is crucial for determining the most effective path toward improvement.

During storms or major events, CenterPoint has a responsibility to help keep the following customer groups informed of any anticipated impact and restoration plans: the general customer base, critical customers, elected officials, city and county governments, and key accounts. CenterPoint has an established hurricane communications plan that was utilized during Beryl. The plan details potential situations that may occur during a storm, along with corresponding communication tactics, timing, duration, and the designated owner for each action. The plan specifies that the first communication should take place 72-96 hours before a storm event. However, during Beryl, CenterPoint issued their initial public communication on July 6, only 48 hours before the storm.

Preparedness

Throughout each year, CenterPoint hosts a series of annual meetings to share information regarding emergency preparedness in advance of the hurricane season. In 2024, CenterPoint held 12 meetings focused on hurricane preparedness, addressing each of its Service Centers—some of which were combined—and discussing the Company's EOP. Key communication messages encompass advanced storm preparation updates, initial impact-based resource allocation and coordination information, post-storm electrical safety guidance, and reminders on using critical informational and utility contact tools during major events.

Prior to landfall, CenterPoint contacted representatives from city and county governments in addition to several critical customers. Contact methods included conference calls, direct phone conversations, emails, and text messages. As shown in Table 3 - 1, CenterPoint reached out to 8 county governments

5 before Beryl's landfall and 3 on the day of landfall. [21] CenterPoint also contacted 70 city governments, with 10 reached prior to landfall, 30 on the day of landfall, and the remaining 30 afterward.

Table 3 - 1: Coordination Data between CenterPoint and City and County Governments

Initial Contact Dates for City and County Governments							
	Date of Contact						
	Prior to July 8	July 8	July 9	July 10	July 12	July 15	July 23
City and County Governments	15	33	9	16	2	1	2

CenterPoint began providing around-the-clock government liaison support on July 7. The first outage notification report was sent to the PUCT on the morning of July 8, followed by 19 additional updates throughout the storm restoration process. Calls to elected officials commenced on July 9, followed by daily briefings for elected officials and Staff starting July 10 to provide updates on restoration progress. Initially, these briefings were one-way communications led by CenterPoint's Executive Vice President of Regulatory Services and Government Affairs. However, beginning on July 16, the format was changed to allow for two-way interaction, enabling participants to ask live questions during the briefings.

CenterPoint issued its first media release on July 6, providing customers with essential information on storm preparedness, Outage Tracker status, Storm Center updates, PAS enrollment, and steps for critical customers preparedness in the event of a power outage. This type of communication is usually provided to customers more than two days before a storm's landfall. Beginning outreach sooner to the storm's arrival is considered an industry best practice, as utilities generally issue their initial public communications at least five days before landfall.

In response to Hurricane Beryl, Governor Abbott instructed the Texas Division of Emergency Management to issue an advisory to the 39 agencies on the Texas Emergency Management Council. This advisory directed them to prepare for hurricane response and recovery efforts and to establish staffing plans for the State Emergency Operations Center to ensure 24/7 availability. This directive came as the forecast track for Hurricane Beryl suggested possible impacts to the Texas Gulf Coast on July 3. This was the critical moment when CenterPoint should have initiated communication with its customers. Following the Governor's press release, customers became aware of the potential storm threat. Despite the uncertainty of the storm's final landfall location, they were seeking information from their utility providers to make necessary preparations and accommodations for themselves and their families.

Performance

CenterPoint implemented several ad hoc adjustments to their communication strategy during the storm and restoration process in response to customer feedback. For instance, initially, city and county governments could not ask live questions during the daily briefings. However, eight days into the restoration process, CenterPoint revised this approach to include a live Q&A segment, allowing stakeholders to ask questions in real-time.

While CenterPoint provided initial messaging to critical customers, follow-up communication was sporadic and inconsistent, indicating a lack of protocols or strategy for ongoing engagement with these customer groups. This reactive approach was evident across the broader communications strategy, with CenterPoint often responding to events rather than proactively managing the narrative. Hosting a press conference—an industry standard before and during major events—could have mitigated this

[21] County governments include the following Counties/OEMs: Brazoria, Chambers, Fort Bend, Galveston, Harris, Montgomery, and Waller. Other areas are included under 'city governments.'

issue. However, CenterPoint did not hold a press conference and only conducted an executive-level engagement on July 11, three days after landfall.

For media engagement, CenterPoint selected a trusted media partner and invited them into the EOC to conduct an interview with the Company's Chief Executive Officer in a controlled setting. Traditionally, CenterPoint does not provide EOC access to the media to focus the organization on restoration activities. Additional media strategies for major events include hosting interviews at staging sites, conducting field interviews during restoration efforts, and organizing 'ride-alongs,' where a utility employee guides the media through various locations. Although CenterPoint did not host interviews at staging sites, they did facilitate field interviews and arranged a 'ride-along' for an NBC affiliate, granting them full-day access to CenterPoint operations. The affiliate visited a staging site, observed a vegetation management crew, and witnessed pole repair and replacement work firsthand. Throughout restoration efforts, CenterPoint maintained ongoing communication with the media, consistently providing updates and coordinating the availability of CenterPoint spokespeople for on-site interviews. By the end of the storm's restoration, CenterPoint conducted 55 media interviews and answered 390 media inquiries.

3.7.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
COMMS-1 **Update the Current Communications Plan**: Enhancing the plan with additional governance and structure will empower CenterPoint to make communication decisions more quickly, effectively, and consistently during major events. Proactive and informative communication is crucial during power outages, helping enable customers to plan and make necessary accommodations. For utilities, getting this right is a critical component of customer satisfaction.	**COMMS-3** **Expand Relationships with External Stakeholders and Government Officials:** To enhance collaboration and help ensure effective communication, it is vital to deepen relationships with external stakeholders and government officials. Establishing regular engagement and creating a schedule for regular meetings and updates with key stakeholders, including local government officials, emergency management agencies, and community organizations will foster a sense of partnership and facilitate better information sharing. Conduct joint planning exercises and exercises with government agencies and stakeholders to help ensure alignment and coordination during emergencies. This collaborative approach will enhance preparedness and response capabilities.
COMMS-2 **Revise the Current Communications Strategy:** Revise communication strategies to focus on delivering essential information to customers, including storm preparedness and expectations, while addressing key concerns like estimated restoration times. Utilize the most effective channels to help ensure clear and timely communication.	**COMMS-4** **Develop a Liaison Protocol:** Clearly define the liaison protocols during emergencies. This should include identifying preferred communication methods for different scenarios, ensuring rapid dissemination of information during crises. CenterPoint should designate specific individuals within the organization to serve as liaisons for various stakeholders, helping ensure that inquiries and concerns are addressed promptly expanding on what currently exists. Provide training for liaison personnel on effective communication and relationship management, focusing on how to handle inquiries from stakeholders during normal operations and in crisis situations.

Mid-Term Actionable

COMMS-5

Establish Customer Experience Feedback Mechanisms: Implement a system to gather feedback from stakeholders (e.g., elected officials, media, key accounts, customers, etc.) regarding the effectiveness of communication strategies and areas for improvement. This will help refine protocols and strengthen relationships over time.

3.8 Outage Tracker

A public-facing outage tracker is essential during storm restoration, serving as a vital communication tool that keeps customers informed about service interruptions and restoration timelines. By providing real-time updates on outages and the status of restoration efforts, this tracker provides customers with important information, reducing uncertainty and frustration during challenging times. It fosters transparency and trust between the utility and its stakeholders, helping enable effective communication about estimated restoration times and mitigation measures. Ultimately, a well-designed public-facing outage tracker enhances customer experience and supports community resilience during storm recovery efforts.

3.8.1 Findings

CenterPoint's public facing Outage Tracker was taken out of service in May 2024 due to its operational failure during the derecho event. The failure occurred because the tracker was unable to manage the high volume of inquiries generated during a major event. After the derecho, it remained out of service until a scalable replacement solution could be developed. The replacement solution was scheduled to be operational by August 1, but it was not yet in place when Beryl struck on July 8.

Preparedness

The root cause for taking the original outage map out of service was cited as "amount of traffic flooding the site degraded performance to the point that it was not accessible." A business continuity plan should provide an alternative solution. This was not the case, and alternative solutions were quickly improvised during the Beryl event. The decision to remove the Outage Tracker was aggressive and least likely to yield positive feedback. There was the opportunity and the capability to replace the Outage Tap in advance of Beryl, evidenced by the rapid deployment of a partial outage map solution immediately after Beryl.

The absence of a public facing Outage Tracker was reportedly discussed leading into Beryl on July 7, but no alternative service was available to be deployed. Instead, a rapid response to the absence of the Outage Tracker was initiated and two partial solutions were deployed on July 10, approximately two days after Beryl had exited the service territory. The solutions are described as partial because they do not meet the functionality of the original Outage Tracker.

Performance

Two partial solutions for external communication of outage maps were implemented during the storm response, around July 10, 2024 (shown in Figure 3 - 2 and Figure 3 - 3):

- A count of current customers impacted and those restored in the preceding 24-hour period, hosted on CenterPoint's main website (centerpointenergy.com)
- A map of outages, restoration process, circuit states, and circuit based ETRs, rendered manually at least daily using an ArcGIS Story Map hosted on ArcGIS's website (arcgis.com)

Figure 3 - 2: Outage Map Available During Beryl (ArcGIS Story Map)

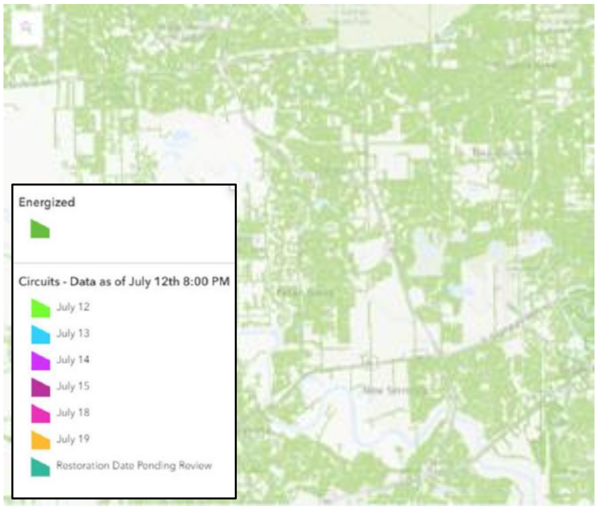
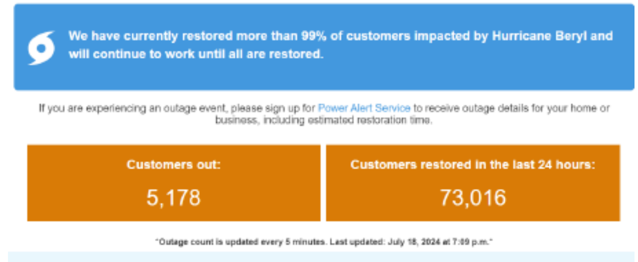


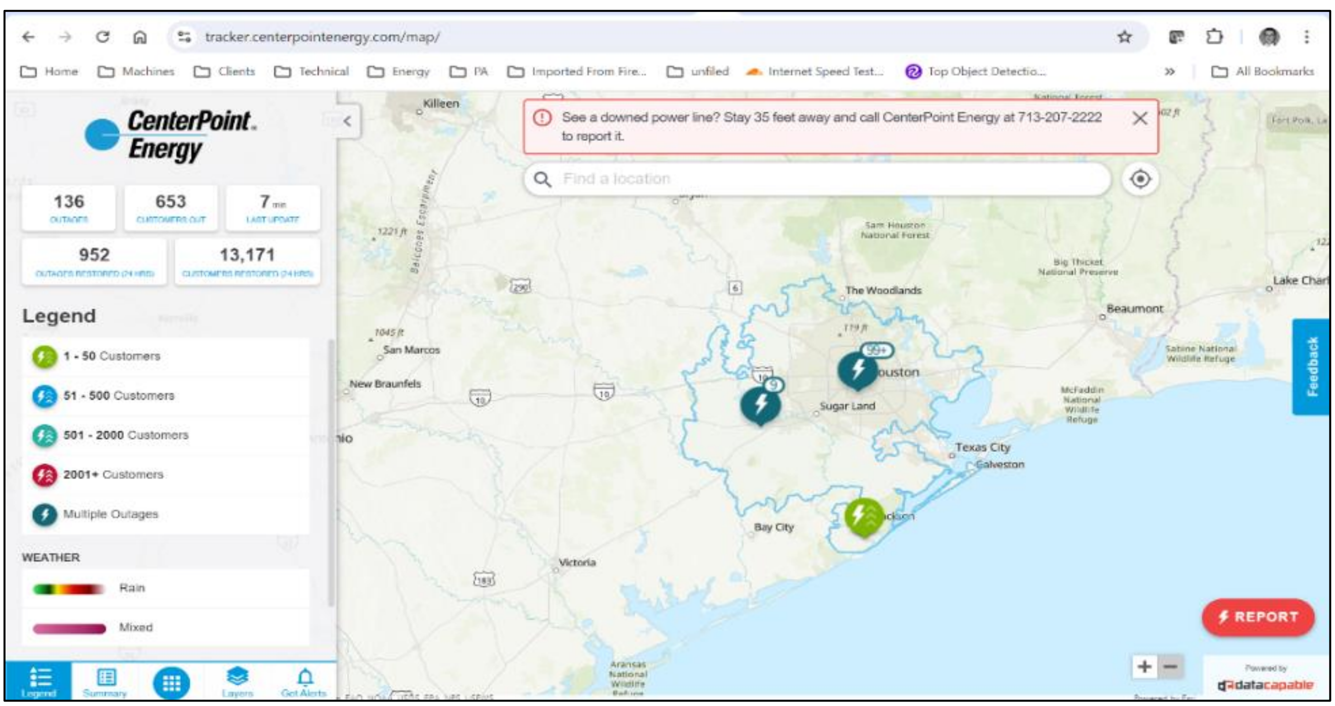
Figure 3 - 3: Outage Map Content Available During Beryl (CenterPoint Website)



Internally to CenterPoint, the absence of the Outage Tracker did not affect operations as this tool is not utilized for internal outage communications or coordination. Externally to the public, the lack of the Outage Tracker contributed significantly to shaping how CenterPoint's customers experienced the event. Customers ultimately resorted to various other resources such as the mobile app for Whataburger restaurants to deduce which areas of CenterPoint's service territory were energized.

As originally planned, a public facing outage map was rolled out on August 1 (shown in Figure 3 - 4). The new service is typical of electric utility outage maps.

Figure 3 - 4: CenterPoint Outage Tracker (deployed August 1)



The EOP requires the following:

- **Referring to internal mapping systems** (page 24): "Access to system outage maps and situational awareness displays via a large-screen monitor (dashboard)." This was prepared for and delivered on throughout the storm. No failures of internal information systems relating to outages were reported, other than bandwidth limitations.
- **Referring to external communications** with the public and other entities (page 27): "Enhanced outage map with estimated time of restoration by large sub-areas of system and sub-system-level outage information/restoration estimates in alignment with outage map." This was not achieved.

3.8.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
OT-1 **Replace Outage Tracker:** Replace the public-facing Outage Map with an Outage Tracker featuring comparable capabilities to the previous version.	**OT-4** **Use Positive Language in Outage Tracker:** Modify the messaging on the outage tracker to address customer journeys with positive rather than negative language. Outage statistics can be reported accurately using availability in addition to customers impacted. Currently there are two methods for reporting outages, safety, and hazards, using a local phone number or using the outage map. Multi-channel reporting and alerting are now commonly available from electric utilities. Guidance can be provided on a variety of relevant customer requirements or journeys including resetting customer breakers, preparing for a storm, post storm, gas leaks, fire, cooling and charging center locations, and others.
OT-2 **Revise Technology Selection and Testing Processes:** The decision-making process for technology solutions should be reviewed so that critical systems receive heightened scrutiny. This includes clearly defining what constitutes a critical system (to include more than just operational continuity) and preventing any critical system from being taken offline without having a suitable replacement in place. **OT-2-a.** In future load testing and sizing for critical systems, include storm volumes and address reported bandwidth issues. It's not enough to test whether the application can handle storm volumes; the information must also be accessible to the end-users who need it. **OT-2-b.** Evaluate multiple solutions for the outage map, including KUBRA, a leading solution used by many utilities. **OT-2-c.** Assess the feasibility of having a unified customer communication solution that can both push alerts and receive reports from customers across the channels to the customer (text, voice, email, social media, and web).	**OT-5** **Host Software Platforms Reliably:** Ensure that all public facing communication solutions are hosted on reliable and scalable infrastructure. The easiest way to achieve this is with major cloud providers including the Environmental Systems Research Institute (ESRI). The current outage map is deployed on ESRI's arcgisonline.com. Ensure there is a storm mode designed within the system that protects and isolates the critical internal systems such as ADMS from storm-level traffic and reporting.

Short-Term Actionable

OT-3

Expand Customer Reporting: Enable customers to report a broader range of issues, including trouble, safety, and hazard incidents (such as wires down or fire), along with guidance for reporting life-threatening situations to the proper emergency agencies. Currently, the Outage Tracker only allows reports for 'Lights Out,' 'Partial Service,' and 'Dim Lights.'.

3.9 Customer Experience

3.9.1 Findings

A customer's experience with a utility during a storm can greatly influence their perception of the company, as clear communication and timely support are important for managing safety and making informed decisions. During storms, the customer experience is primarily impacted by the duration of an outage and the communication they receive regarding the outage. CenterPoint's initial public communication was released on July 6, just two days before landfall. Following that, CenterPoint leveraged a variety of customer communication channels, including Facebook, X, Instagram, LinkedIn, Nextdoor, email, PAS, and their website. Throughout the restoration process, CenterPoint issued a total of 20 daily news release updates, sent 4 customer email blasts, and made 170 posts on Facebook, 376 on X, 118 on LinkedIn, and 185 on Instagram. Additionally, CenterPoint gained over 60,000 followers across its various social media platforms.

CenterPoint customers provided feedback at two distinct time periods—during and immediately after Beryl's restoration—using two different methods: PAS and Voice of the Customer (VOC) surveys. The "During Beryl" period spanned from July 8 (storm landfall) to July 19 (restoration complete), while the "After Beryl" period covered July 20 through August 15. In the PAS survey, customers could submit both a sentiment score and a customer satisfaction (CSAT) score, whereas the VOC survey only captured the CSAT score. This feedback offered valuable insights into their overall sentiment toward the utility. As shown in Table 3 - 2, both the sentiment and CSAT scores from the PAS survey improved between the "During Beryl" and "After Beryl" periods; however, the CSAT score from the VOC surveys declined during the same timeframe.

Table 3 - 2: Customer Satisfaction and Sentiment Score During and After Beryl Restoration

	Customer Feedback Periods					
	July 8-19 ("During Beryl")		Jul 20-Aug 15 ("After Beryl")		Time Period Change	
	Sentiment	CSAT	Sentiment	CSAT	Sentiment	CSAT
PAS	-1.16	3.13	-0.80	3.53	44%	12%
VOC	N/A	3.51	N/A	2.54	N/A	-38%

Note: Sentiment score range is -2 (worst) to 2 (best). Customer Satisfaction score range is 1 (worst) to 5 (best).

Preparedness

Before a storm, customers anticipate receiving preparedness messages from their utility providers. In CenterPoint's first outgoing communication on July 6, the Company informed customers that the Outage Tracker was still out of service, encouraged them to register for Power Alerts through PAS, and directed those in need to sign up for critical care services through the state. PAS is a free, online service that quickly alerts users to power outages and issues near their address, providing estimated restoration times and updates as repairs are assessed. It notifies customers when their outage is resolved, including the cause of the outage, and proactively informs them of significant events, such as weather conditions, that may affect their electric service. Users also have the option to opt-out at any time. Prior to Beryl, 42% of CenterPoint's customers were enrolled in PAS. CenterPoint utilized other methods of communication to reach customers with preparedness messages.

Performance

During the storm, CenterPoint encountered several challenges that negatively impacted the customer experience. Initially, the Houston area faced capacity limitations both internally and externally, which delayed the delivery of Power Alerts to customers. Coupled with the lack of an outage tracker and estimated restoration times, this significantly affected the customer experience during the storm's onset. In line with this, it seemed that CenterPoint was not addressing the issue directly or responding to customer inquiries regarding the absent information, thus adding to the poor customer experience.

CenterPoint leveraged all customer communication platforms to provide updates on overall restoration progress, the restoration process, and other relevant information. Customers were regularly provided with updates directly from crews and other field resources helped the public stay informed. A series of infographics was developed to help explain the complexities of a restoration effort of this scale.

When important information isn't directly provided to customers, they often create their own narratives, which can quickly gain momentum among the broader customer base. During the restoration, CenterPoint customers discovered and shared that the Whataburger app was showing which restaurant locations had power and which did not. This unofficial resource became a go-to for many, who used the app to infer whether their nearby neighborhoods were likely to have power based on the operational status of nearby restaurants. This highlights the importance of timely and transparent communication, as customers will seek alternative sources of information when official updates are lacking.

During the restoration period, feedback emerged regarding the tone of CenterPoint's messaging, with concerns that it lacked empathy and did not fully address the emotional toll the outages had on customers. Many felt the communication could have been more compassionate and understanding, especially given the prolonged nature of the outages and their impact on daily life. Incorporating a more empathetic tone in future communications could help strengthen customer trust and improve the overall experience during such events. CenterPoint opted not to hold a press conference during the event, instead conducting a media interview with the Company's CEO. However, the decision sparked additional uproar when one of the photographs from the interview showed a thermostat set at a relatively low temperature—contrasting sharply with the reality of customers who had been without power for over five days. This oversight further amplified criticism, as many felt it demonstrated a lack of awareness and empathy toward those enduring the extended outages.

3.9.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
CX-1 **Implement Real-Time Customer Feedback during Major Events:** To improve communication and customer satisfaction during major events, the implementation of immediate customer feedback mechanisms is important. This goal focuses on establishing real-time channels for customers to voice their concerns, report outages, and provide feedback on restoration efforts.	**CX-2** **Increase Customer Enrollment and Customer Contact Database:** Increase the completeness of customer contact information from 42% to enhance ETR communications during storm events. Identify enrollment strategies, while ensuring the customer data quality process maintains contact information securely and accurately. Support legislative efforts to aid increased enrollment.

Short-Term Actionable	Mid-Term Actionable
CX-1: Implement Real-Time Customer Feedback during Major Events **CX-1-a.** Implement easy-to-access feedback options via mobile apps, websites, and social media platforms, allowing customers to report issues and provide input as events unfold. Enable two-way SMS systems where customers can quickly share their experiences, report outages, or ask for updates and receive, at a minimum, automated responses to their outreach. **CX-1-b.** Send brief, automated surveys to customers at key stages of the event, such as immediately after an outage is reported, during restoration, and after power is restored. These surveys should gather insights into customer satisfaction, communication effectiveness, and overall service quality. **CX-1-c.** Expand social media monitoring tools to track customer sentiment and identify key concerns in real time. Respond promptly to customer queries or complaints and offer real-time updates to manage expectations. **CX-1-d.** Enhance call center operations by integrating customer feedback tracking into incoming calls. Agents can gather and log customer experiences, which can be shared with operational teams to guide real-time adjustments. **CX-1-e.** Regularly review customer feedback during major events to adjust communication strategies, restoration priorities, and operational tactics. Incorporate this feedback into post-event analysis to inform future response efforts. By creating immediate customer feedback mechanisms, CenterPoint can enhance transparency, improve response times, and better align its actions with customer expectations during major events.	**CX-3** **Enhance Customer Communication Channels:** Assess the feasibility of having customer communication solutions that can both push alerts and receive reports from customers across channels (text, voice, email, social media and web). **CX-4** **Inform Customers of the Potential Need for Electrical Service Work:** Once a global ETR is issued, CenterPoint should promptly inform customers to inspect their property. If there is damage to the weatherhead, mast, or panel, advise them to hire an electrician to complete the necessary repairs. This allows them to act before their neighborhood is re-energized, helping to expedite their individual restoration.

3.10 Mutual Assistance

Mutual Assistance plays a crucial role in utility storm restoration efforts. When severe weather strikes and disrupts power services, utilities often face challenges that exceed their immediate resources and capabilities. Mutual assistance programs allow utilities to collaborate and share resources, expertise, and personnel. This collaborative approach enables quicker restoration of services.

3.10.1 Findings

PA observes that internal CenterPoint mutual assistance and logistics functions were adequately prepared and performed up to CenterPoint's existing standard protocols and procedures.

Preparedness

CenterPoint participates in the SEE and TXMAG regional utility mutual assistance groups that coordinate and provide assistance during emergency events. CenterPoint reached out to SEE and TXMAG on Sunday July 7th to provide initial mutual assistance crew resourcing requests. In addition to the RMAGs, CenterPoint also have established contracts with mutual assistance aggregators and contractors in preparation of storm season. Based on prior storm experiences, CenterPoint did not rely primarily on hotels for mutual assistance crew lodging due to hotel power outages. Lessons learned from other prior storms, including the May 16 derecho, were applied to the mutual assistance and logistics process and performance.

To help prepare to receive, house, and work with mutual assistance crews, CenterPoint annually trains their FCCs, Logistics (e.g., Staging Sites, Lodging, Bussing, Security, Procurement) amongst others to familiarize employees who will be activated into those organization with the processes, procedures, forms, triggers for various actions, and other relevant topics.

Performance

By Sunday night, July 7, CenterPoint had accumulated approximately 2,500 secured mutual assistance resources (mix of line and vegetation crews). Over the course of the entire event, there were 11,603 distribution line resources (10,354 mutual assistance, 666 native contractors, 583 CenterPoint) and 3,335 vegetation management resources (2,784 mutual assistance, 551 native contractors, 0 CenterPoint).

Prior to arriving on site, mutual assistance crews are provided with access to CenterPoint's virtual safety briefing. As crews arrived on site, they were onboarded. Currently for an onboarding tool, CenterPoint uses a Microsoft Excel Spreadsheet. CenterPoint's staff is required to reconcile spreadsheets multiple times per day as numbers change based on mutual assistance crews and storm restoration progression.

Mutual assistance crews were used for circuit-based restoration, while internal crews were used for cut-and-clear. The FCCs would clear each ticket when a circuit was fully restored. Using Service Suite, FCCs were asked to close out the circuit in real-time and would add resources for those who are not on distribution lines to close out tickets on behalf of the FCC. Generally, one FCC would manage 40 FTE and two vegetation crews during restoration.

PA also observed that FCCs work burdens are particularly heavy in comparison with what typical crew guides are tasked. FCCs were tasked with guiding up to 10 mutual assistance / foreign crews which typically represents up to 40 FTEs. This exceeds the typical span of control / coordination benchmark of between 1:7 to 1:10. During circuit sweep restoration activities where all 10 crews are working on the same or adjacent circuits this is not a concern. However, as the restoration progresses and the work assigned to the 10 crews becomes geographically dispersed, the FCC may face difficulty in keeping track of work progress, ETR updates, and close out outage tickets.

CenterPoint used the mutual assistance process to make material and equipment requests to acquire fuse links and splices from other utilities.

3.10.2 Recommendations

Managing mutual assistance resources and providing the associated logistics is a foundational aspect of storm restoration that can affect all aspects of restoration process. PA finds several short- and medium-term actionable recommendations to improve CenterPoint's process regarding mutual assistance and logistics.

Short-Term Actionable	Mid-Term Actionable
MA-1 **Reevaluate FCC Support:** Re-evaluate number of FSRs needed to support the number of FCCs during EOC activations to alleviate some of FCC's administrative burdens. Provide FCC support such as administrative, runners, etc. FCC Team should be comprised of a Lockout/Tagout (LOTO) qualified CenterPoint employee, a service planner or other technical type CenterPoint employee, and an external damage assessment resource (after damage assessment is done). Improve work package distribution. As a stop gap until more robust systems are developed and implemented, provide additional FCC field support to streamline field ETR updates.	**MA-4** **Supply Mobile Technology to Mutual Assistance Crews:** Provide technology for crews (foreign and non-foreign). Equip all CenterPoint and native contract field workers with mobile access to work, outage, circuit, damage assessment and other types of data. Distribute mobile devices (or supply digital apps to personal phones) to all field personnel with an application/tool for time/vehicle/work reporting as well as for onboarding – safety, system information, etc.
MA-2 **Develop Mutual Assistance Tool:** Develop mutual assistance resource tracker and onboarding tool. Assess available tools by function and user experience. Eversource Energy onboarding process is publicly available and can be used as a starting point to model a more efficient onboarding process. Foreign Crew (non-native contractors and mutual assistance) management is critical, and the CenterPoint Energy team identified securing a system to manage this which should help them manage logistical support and cost tracking of these resources.	**MA-5** **Create Equipment Equivalents List:** Develop a comprehensive list of equipment equivalents across manufacturers and utilities to facilitate mutual assistance. This will expedite onboarding and task orders, streamline equipment requests, and enhance monitoring through barcode scanning and GPS tracking. Implementing this list will improve future restoration efforts, ETR accuracy, and staging site efficiency.
MA-3 **Reevaluate Storm Rider Policy:** Storm Rider Policy and decision needs to be reevaluated. During Beryl, most employees or contractors were asked to come in after the storm passed which could have delayed immediate restoration efforts.	**MA-6** **Streamline Mutual Assistance Crew Operations for Enhanced Efficiency Across All Functions:** Generally, utilize mutual assistance crews in the same efficiency as internal crews. This applies to tagging and grounding and lockout tagout switch out, switching dispatch, communications, how they get to a job every day, what they do, what they need to have.

3.11 Logistics

Effective logistics management enhances the storm restoration process by coordinating the deployment of crews, equipment, and supplies, so that they reach the affected areas promptly.

3.11.1 Findings

The logistics group demonstrated effective performance during the response to Beryl, playing a crucial role in resource management and coordination. However, there were opportunities identified for further enhancing coordination with other departments to improve overall operational efficiency and expedite the restoration timeline.

Preparedness

To help ensure redundancies in logistics staffing, CenterPoint uses a primary, secondary, and tertiary structure throughout the entire logistics branch. This also helps so that when people retire or leave the company, knowledge is retained and backup staff, seasoned within the company, is already identified.

There are varying levels of procedures, guides, and checklists for each of the roles within logistics. For example, prior to Hurricane Beryl, security did not have substantial operating procedures because the level of community interaction was not as high in prior events. Since Beryl, the private security resources who helped CenterPoint have documented the security processes which are now incorporated into the standard protocol.

Performance

CenterPoint uses HelmsBriscoe in addition to internal resources to book hotels for crews as well as setting up their own campers ("man camps") which house eight people to a unit. Some man camps were co-located with the staging sites, and for those not co-located the crews would be bussed from hotels to staging sites. Staging sites have all materials, trucks, fueling and food, acting as a hub for crews. Where feasible, CenterPoint used decentralized staging sites as opposed to existing service centers to manage the work assigned to restoration crews, as is emerging as industry best practice.

3.11.2 Recommendations

Short-Term Actionable
LOG-1 **Enhance Operational Efficiency through Alternative Staging Site and Logistics Solutions:** To reduce crew travel time and expedite work, staging sites should be strategically located. In instances where a hotel is identified as a staging site and the hotel is without power, CenterPoint can coordinate and deploy temporary generators to restore electricity, where feasible (e.g., sites can accept power), benefiting both the hotel and restoration efforts. Strategically selecting locations near service centers will help minimize travel time for crews. If applicable, it is essential to confirm that staging sites have adequate staffing to manage operations, clean, and prepare rooms for crews. Additionally, having leadership present at these locations will help maintain an efficient schedule for restoration activities.
LOG-2 **Use Select Service Centers for Staging**: Where feasible, use existing service centers as staging sites. Staging site versus service center operations should be reevaluated (i.e., move the operations team from staging site to service centers as it is too decentralized currently). Minimize moving workforce to decentralized staging sites. Streamline communications and collaboration between system operations employees and field employees. Depending on where storm damage is located, CenterPoint could use those locations which make most geographic sense.

3.12 Damage Assessment

Damage assessment is a critical component of an electric utility's response to a major storm outage, serving as the foundation for effective restoration efforts. Accurate and timely assessments enable utilities to identify the extent of damage to infrastructure, which is essential for prioritizing restoration activities. This process not only informs the allocation of resources and personnel but also facilitates the development of reliable ETRs. Damage Assessment is not an “end” process, but it is meant to inform the overall level of damage (to inform and enable the calculation of ETRs), as well as to prioritize work and effect efficient restorations.

CenterPoint uses damage assessors to document areas of damage and identify restoration material needs (e.g., poles and associated hardware, conductor spans, and any pole top equipment). The information is then consolidated into a work package, which the restoration line crews would use to establish the scope of repair work needed. During Beryl, damage assessment works alongside the “cut-and-clear” crews and start damage patrols staring from the point of isolation and identify the necessary work to repair the damaged / unenergized portions of the circuit.

3.12.1 Findings

The damage assessment was useful for high level resource planning and material/equipment acquisition, but the work packages and damage assessment findings were underutilized by the field crews during the restoration process. Once a damage assessment was completed using the damage assessment app, which was developed internally, the information was sent to the Geographic Information System (GIS) team where it was rolled up to a circuit level and passed on to the service centers for QA. Ultimately the damage assessment information for the circuits was used to create physical work packets which eventually ended up at their respective staging sites.

The damage assessment app, dashboard, and Trouble Information Monitoring System (TIMS) present an effective set of tools to manage damage assessment information. While some modifications are evident, the larger issue is how to distribute the work packages, and how to make the work packages more useful to improve restoration efficacy.

Preparedness

The damage assessors were not on site at the same time the “cut and clear” teams were mobilized, and no work packages were available for the FCCs to use in their initial response to Beryl. This caused the FCCs to conduct their own damage assessment as an “add on” workstream. Throughout the rest of the restoration process, damage assessors produced work packages that were underutilized by the FCCs necessitating duplicated assessment efforts on many occasions. And indeed, one whose output would be scarcely utilized by the FCCs.

The initial damage assessments should begin as soon as possible after a storm has passed and should be used to develop initial restoration time estimates.

When practical, utilities should preposition its restoration workforce, including damage assessors, line restoration and vegetation management resources. Pre-positioning these resources reduces mobilization times so the restoration work can begin immediately after it is safe to do so after the storm passes.

Performance

Damage assessment, vegetation management, and cut-and-clear operations should operate in a coordinated manner. The lack of synchronization among the teams highlights the need for these groups to function as a cohesive unit. Proper onboarding and orientation are essential to streamline the cut-and-clear process and help ensure efficient response efforts. Additionally, many damage assessment packages were found to be incomplete, leading to delays in the preparation of work packages. As a result, crews often began work without having received a comprehensive damage assessment or resorted to conducting their own assessments to determine the necessary materials. While high-level assessments can facilitate initial progress, sufficient detail is crucial for generating accurate ETRs.

3.12.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
DM-AS-1 **Integrate Damage Assessment and Vegetation Management Crews:** Integrate the vegetation management crews and damage assessors with the “cut and clear” resources as a first responder team to be dispatched together.	**DM-AS-4** **Upgrade Damage Assessment Technology:** Explore and leverage Light Detection and Ranging (LiDAR) sensors and machine learning to quickly assess and integrate data with ESRI tools. The damage model should be able to take storm tracks, CenterPoint asset information, and develop an estimate for the level of repair efforts that are needed to help the Incident Commander and other IC Staff to confidently determine level of crewing required for restoration duration. The Planning Section Chief should be ultimately responsible for making sure the model is populated, tested, and exercised for accurate results and restoration preparedness.
DM-AS-2 **Pre-Stage Materials/Equipment:** While thorough damage assessments may not completely eliminate the need for an FCC to inspect a circuit segment for LOTO and safety purposes, efforts should be made to enhance the identification of required materials, equipment, and vegetation clearing before the arrival of line restoration resources. This proactive approach can help streamline the restoration process and improve overall efficiency.	
DM-AS-3 **Streamline Damage Assessment for Work Packages:** Rework damage assessment processes to improve the usefulness of work packages. During the initial wave of damage assessments, validate and verify damage prediction models regarding required resources and materials. Following this initial assessment, the focus should shift to estimating restoration times to provide accurate timelines for stakeholders. Subsequently, attention should be directed toward proactively supporting line restoration and pole-setting crews to facilitate an efficient recovery process. This structured approach will enhance operational effectiveness and help ensure a timely restoration of services.	**DM-AS-5** **Revise Resource Utilization:** Currently the DOC decides how to utilize the damage assessors. Consider using the damage assessors after initial assessments to be patrol inspectors during the circuit sweep operations. Harmonize veg and line crews and damage assessors, in a way that’s more real-time and less sequential – eliminate wait times. “Advance deployment team” (slot team) preparing next line section(s) for work while other crew is working (assess damage, deliver materials, set up isolation and grounding points). So that when line crew moves on to the next section, they can immediately begin work.

3.13 Restoration Management

During a storm response, effective resource management is critical for restoring power and minimizing downtime. Utilities should prioritize the establishment of a centralized command structure to coordinate restoration efforts, ensuring clear communication among teams. It is essential to assess damage rapidly and deploy resources strategically, leveraging both internal crews and mutual assistance partnerships. Regular situational updates should be shared across all levels to maintain awareness of progress and emerging needs. Cross-cutting recommendations include implementing standardized reporting protocols to enhance data accuracy, investing in training for all personnel on restoration procedures, and utilizing technology to track resource allocation and status in real-time. Additionally, post-storm reviews should be conducted to identify lessons learned and refine future response strategies.

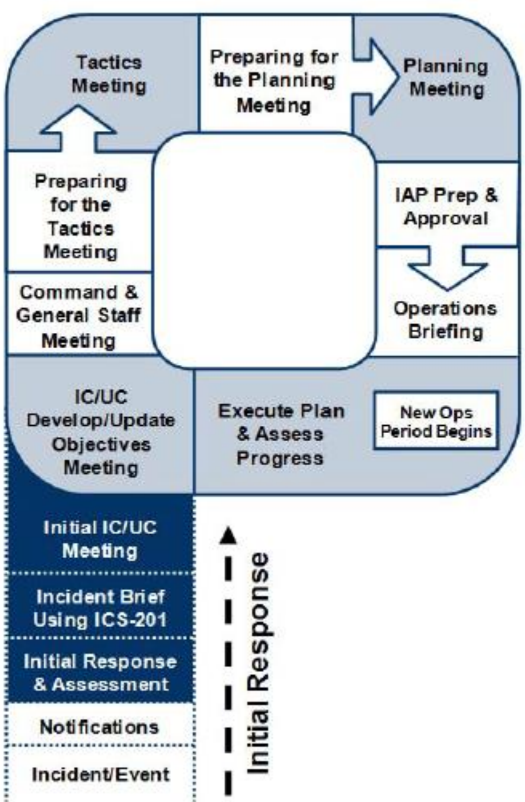
Restoration management refers to the systematic process of planning, coordinating, and executing the restoration tasks following a storm outage. It helps ensure an organized approach to restoring power efficiently and safely. Effective restoration management facilitates work packages that are usable, measurable, and recordable, allowing for clear tracking of progress and resource allocation. This structured methodology not only enhances operational effectiveness but also improves communication with stakeholders, ultimately leading to a timelier recovery and increased customer satisfaction. By prioritizing restoration management, utilities can optimize their response efforts and better serve their communities during challenging events.

3.13.1 Findings

The restoration management philosophy should establish a production or assembly line approach. This strategy involves clearly identifying areas of focus for restoration resources and ensuring that work packages and necessary materials are prepared in advance of line crews arriving at job sites. Additionally, utilizing runners to deliver incremental materials—especially those at higher risk of theft—can further streamline operations. The primary objective is to minimize downtime for restoration line crews by having all required items readily available, thereby enhancing overall efficiency and expediting the restoration process.

Preparedness

Figure 3 - 5: “Planning P” Structure



The approach adopted by CenterPoint effectively utilizes decentralization during large-scale weather restoration efforts, treating these operations more like reconstruction projects than typical trouble response efforts. This necessitates the distribution of personnel resources and physical assets, along with the integration of mutual assistance crews. The execution of decentralization by CenterPoint was commendable. Ideally, this entails centralizing Strategy and Planning functions to optimize both physical and human resources while decentralizing the execution of tasks. Utilization of line skilled resources as FCCs is an industry-leading practice, as these individuals know the system, locations, and work needed to be done, rather than the alternative of crew guides who tend to function as navigators and distributers of work packages.

During the response to Beryl, management activities were centered at the staging center. It is recommended to shift this management to the service center, which has greater access to critical systems, printing capabilities, and additional resources. While decentralization of work is beneficial, managing operations from a more centralized service center can mitigate logistical IT issues.

The storm response was conducted under an overall IC strategy, with specific plans outlined in IAPs. It is important to improve upon the current planning process, as the DOC is charged with planning in real time and executing on the plans, which may lead to less-than-optimal strategic decisions being made and complicates restoration management. IAPs should originate from the Planning section and flow downward to the DOC, rather than the reverse. The planning process has been established based on the National Incident Management System (NIMS), modified to suit CenterPoint's unique circumstances. While the "Planning P" structure is generally followed (shown in Figure 3 - 5), enhancing the use of this process is essential. The Planning P cycle involves initial setup, daily meetings for IAP development, and subsequent revisions after each operational period.

The implementation of a no-customer-left-behind strategy[22] should be approached with caution. This strategy should not be enacted at the outset of restoration efforts; rather, it is more appropriate to consider it once the majority of laterals are restored. The decision to transition to this strategy lies with the IC leader, who should ensure that the focus remains on restoring the entire line before implementing this approach.

Performance

CenterPoint's Planning group prepared daily IAPs; however, these were approved in the middle of the Operational Period. For example, the IAP for July 10 (day 3 of storm), which was meant to cover the operational period between July 10, 2024, 6:00AM through July 10, 2024, 10:00PM was approved at 9:50AM. IAP for July 11 covering the operational period between July 11, 6:00AM through 10:00PM, was approved on July 11, 12:55PM. In the following days, IAPs were approved as late as 7:22PM of the operating day. IAPs should be approved ahead of the operating day to set out daily restoration objectives.

CenterPoint's IAPs outlined daily primary objectives (as many as 11 on July 10, and then decreased to 5 after July 12). The IAP also captured a number of supporting objectives (ranging as high as 20+ on July 10, and subsequently stabilizing to approximately 15). Objectives could be more curated and prioritized to focus on the strategically important items to make sure the more critical items are addressed accordingly.

Dissemination / update of ETRs policy was listed as objective starting from the July 9 IAP. Finalization of high impact area ETRs (Restoration Tracker) was listed as an IAP objective on July 10 and July 11. IAPs on both these days indicated the Outage Tracker was online. Subsequently, ETR accuracy monitoring has been captured as an objective starting July 13. There was no mention of development or shaping of the ETR strategy in the IAP, which could have been useful to shape subsequent planning activities.

The IAP captured the planned work and activities for the High Voltage (transmission) and Substation areas (Transmission Assignment List and Substation Assignment List). While there was discussion of the planned work and activities for the Distribution side of operations, the amount of work and assignments listed is the sparsest of the three areas listed, and frequently just identified that personnel were working along the mutual assistance crews to support restoration. There were minimal discussions on which areas to prioritize, where the crews were allocated, and where restoration is slower / faster vs. plan. In general, the IAP did not provide meaningful views on remaining activities needed (either in level of effort or ticket volumes) to complete restoration. Finally, there should be discussions and documentation of available (as well as committed but not yet arrived) resources to conduct restoration work. This will be critical to determine allocation of the remainder of the work needed to completion of restoration, provides a view if there are resource gaps (either between operating areas or overall restoration effort), and can be informative of the remaining restoration duration.

[22] This is a strategy where all open tickets associated with the circuit / restoration area are completed before crews move on to the next assignment, regardless of if the next ticket has a higher number of customers impacted. This is in contrast to the normal, blue sky strategy of prioritizing restoration of outages based on highest number of impacted customers regardless of if the outage restoration tickets are on different circuits.

Restoration efforts and strategic decisions were primarily managed by the Operations group at the DOC. However, several bottlenecks were identified that if addressed will enhance scalability and efficiency:

FCCs: The number of FCCs currently limits operational efficiency.

Distribution Control Operations (DCO) / Regional Transmission Organization (RTO) Operators: The volume of requests handled by DCO/RTO operators presents another bottleneck. Consider decentralizing these operations into service centers, as these operators cannot be stationed at staging centers. Empowering field personnel with ownership and control can alleviate the dependency on operators, especially once control moves past the breaker in the substation.

Staging Sites: The number of staging sites should be expanded to include hotel and other locations, which can provide additional support for field operations.

Material Drop-offs: Implementing job site drop-offs for materials can streamline the logistics of resource distribution.

Manage by Substation: Managing operations by substation can facilitate a more effective division of labor. Segmenting restoration efforts at substations creates a framework that effectively manages overlapping resources, material delivery, and safety protocols. Establishing a command center at each substation allows for more localized decision-making and coordination. For example, distributing circuits among multiple FCCs from a single substation can enhance operational effectiveness.

Restoration Strategy: The current ticket-based restoration approach should be evaluated in conjunction with a circuit-based restoration strategy. Assigning FCCs to manage circuits across multiple substations is not recommended; instead, each FCC should be designated to a specific substation to optimize their focus and efficiency.

By addressing these bottlenecks in restoration management, CenterPoint can significantly improve its storm restoration capabilities and overall operational efficiency.

3.13.2 Recommendations

Short-Term Actionable

RM-1

Expedite IAP Completion: The IAP should be finalized and approved before the operating period begins, establishing a clear set of objectives to serve as execution targets for the various operational areas. The IAP should encompass the ETR strategy and resource allocation, along with the prioritization of remaining tasks. Additionally, EOC briefings should concentrate on executing the plans outlined in the IAP rather than developing new plans for the day.

RM-2

Evaluate FCC Pool Size: The effectiveness of decentralization is directly linked to the number of and efficiency of FCCs. To enhance scalability during restoration efforts, it is recommended to assess and potentially expand the FCC pool size. Engaging native contractors with journeyman-level experience as additional FCCs can significantly bolster capacity, allowing for improved management and coordination of field operations. This approach will help ensure that resources align with restoration needs, thereby optimizing overall response efforts.

RM-3

Use Substation Restoration Segmentation: Implement segmentation of restoration efforts by assigning specific crews to operate from designated staging centers associated with their respective substations. This approach will allow crews to focus on the circuits linked to their assigned substation, thereby minimizing the potential for overlap and interference with other crews working across different substations. By clearly delineating responsibilities and operational areas, this strategy should enhance coordination and efficiency during restoration efforts.

RM-4

Leverage Low Voltage Resources for Parallel Restoration: In cases of significant damage to overhead services, deploy low voltage restoration teams to start repairing and replacing services ahead of the primary repairs in an area. This approach optimizes additional resources and helps shorten the tail end of the restoration process by eliminating the potential for small, nested outages in advance.

Mid-Term Actionable

RM-5

Test Processes and Technology: Test all revised processes and technologies during smaller storm events, moving beyond simulations or training exercises. Engaging native contractors to implement these new processes in real-world scenarios will provide valuable insights and practical experience. Additionally, conducting after-action reviews following these smaller events will facilitate the gathering of lessons learned, enabling continuous improvement and refinement of operational procedures. This proactive approach will help ensure that processes are effective and efficient when faced with larger storm restoration efforts.

RM-6

Change RTO/DCO Jurisdictional Boundary: Operational jurisdiction and control of the distribution feeder breaker should be transitioned to the DCO. This will eliminate the bottlenecks inherent in Distribution Controllers calling RTO operators to operate a distribution circuit breaker. This revised boundary will also align much better to the modern distribution system, where automated circuit ties, distributed energy resources, and active voltage management each play key roles in serving customers on both blue sky and grey sky days.

3.14 Vegetation Management

Properly maintained vegetation helps minimize the risk of power outages and damage during storms by reducing the likelihood of trees and branches coming into contact with power lines. Proactive vegetation management and trimming according to established guidelines, which not only protects infrastructure but also enhances safety and reliability for communities. In the aftermath of a storm, well-planned vegetation management accelerates the restoration process by preventing further damage and facilitating quicker access to affected areas.

3.14.1 Findings

PA observes that the vegetation in the Houston area coupled with residential overhead rear lot circuits made for vast power outages during a storm like Hurricane Beryl. Prior to Hurricane Beryl, the Houston area experienced several years of hard freezes and droughts, followed by periods of heavy rainfall, thus leaving the vegetation and soil in a distressed and/or dying condition, apt for tree fall.

Preparedness

CenterPoint conducts regular vegetation management across its system, including tree trimming, removal of hazardous branches, and clearing vegetation near power lines and infrastructure to minimize the risk of outages caused by falling trees or branches during severe weather. As part of this program, CenterPoint identifies hazardous trees growing directly under or near power lines that could pose a risk if they were to fall. These trees are proactively removed and replaced to prevent vegetation-related outages, enhancing grid reliability and safety.

Performance

Hurricane Beryl saw higher tree fall damage than other prior extreme weather events due to the vegetation and soil conditions (root stress, root death, soil shrinkage and sudden expansion). With the highest rainfall occurring in the highest vegetation-dense areas, the longer outages were in areas with the highest vegetation densities. Circuits with no vegetation or adequate trimming were less likely to be affected by the storm. Approximately half of the circuit outages were driven by vegetation damage.

Service territory in established neighborhoods with mature trees (e.g., 50-to-90-foot pine trees) saw much tree fall on infrastructure or facilities from outside the CenterPoint easement. In a typical storm, those mature trees would bend with the wind but not fall. Due to the soil conditions and root distress, those same trees fell during Hurricane Beryl.

During Beryl restoration, at least two vegetation crews were assigned to each FCC. Vegetation crews are not sent out with the first crews responding to an outage or downed line. Coordinators must send out different crews at different times which cause logistical challenges and delays. The vegetation team uses a vegetation dashboard to manage their workload.

Certain areas (e.g., wetlands) require federal permission to access and conduct vegetation management. And even with permission, CenterPoint is not allowed to bring heavy machinery into the area and must rely on hand machines (e.g., chainsaws, saws, etc.) to clear fallen vegetation and restore power.

3.14.2 Recommendations

PA recommends that CenterPoint enhance their vegetation management program to be more targeted and condition based.

Short-Term Actionable	Mid-Term Actionable
VM-1 **Revise Trimming Cycles:** To enhance the effectiveness of vegetation management, CenterPoint should immediately revise its tree trimming cycles to a more frequent interval of three years. This adjustment will allow for more proactive and responsive management of tree growth, significantly reducing the risk of outages caused by overgrown vegetation interfering with power lines.	**VM-3** **Enhance Tree Replacement Program:** Enhance the existing tree replacement program by introducing a range of options for customers with at-risk vegetation. This initiative could include personalized consultations to assess individual properties, recommendations for suitable replacement species, and incentives for participating in the program. By actively engaging customers in the management of at-risk trees, CenterPoint can help reduce the risk of outages while fostering community involvement and promoting environmental sustainability.
VM-2 **Optimize Crew Coordination:** To maximize the effectiveness of vegetation management efforts, CenterPoint should focus on enhancing the coordination and optimization of vegetation resources and crews. This involves implementing strategies that streamline operations, improve communication, and helps ensure that the right crews and resources are deployed to the most critical areas.	**VM-4** **Develop a Digital Intelligence Program to Effectively Perform Condition-Based Trimming:** Transition to a data driven, condition-based trimming approach to enhance the effectiveness of vegetation management. Unlike the current practice of relatively long cycle trims, condition-based trimming based on various imagery processing based analytics and tools (LiDAR) focusing on the specific health and growth patterns of trees and vegetation surrounding power lines. This method involves regular assessments of tree conditions, identifying which trees require trimming based on their growth, structural integrity, and proximity to power lines. By adopting this proactive strategy, CenterPoint can prioritize vegetation management efforts on high-risk areas, helping ensure timely interventions that reduce the likelihood of outages caused by falling branches or trees.

3.15 Call Center/Handling

The call center plays a vital role in an electric utility's response during major storm-related outages, serving as the primary communication link between the utility and its customers. Effective call handling is essential for efficiently managing the influx of inquiries and reports of outages, helping ensure that customers receive timely information and support. A well-trained call center staff can provide critical updates on restoration efforts, ETRs, and safety information, helping to alleviate customer concerns and frustration. Additionally, accurate data collection during these calls enables utilities to assess the extent of outages and prioritize restoration efforts based on customer needs. Ultimately, robust call center operations are crucial for maintaining customer satisfaction and trust during challenging circumstances, reinforcing the utility's commitment to reliable service.

3.15.1 Findings

CenterPoint's call center experienced a significant surge in incoming calls as soon as Hurricane Beryl made landfall on July 8. That day, the total number of incoming calls reached 421,898, with the peak interval call center volume at 1,481 (excluding Interactive Voice Response (IVR) callers).

During restoration, all outage reporting, and non-emergency calls, were routed to self-service channels meaning that if a customer needed to report an outage or had a non-emergency request, the customer was routed to the IVR. Additionally, customers were advised that these self-service options were available online.

Preparedness

CenterPoint's customer call center is comprised of contact center agents (CCAs). 73% of CenterPoint's CCAs are internal employees while the remaining 27% are full-time contractors. Once onboarded to the utility, every CCA is trained to help with each of CenterPoint's regulated utility businesses. The call center delivers proactive, tiered training customized to the CCAs' roles during major events. Existing CCAs complete a condensed 1-day course in preparation for storm scenarios, which is designed to closely align with their-day-to-day regular responsibilities.

One of CenterPoint's customer service corporate goals is to answer 65% of calls within 30 seconds. This is a common metric to track for call centers, '% Service Level (30).' CenterPoint's Houston Electric has an additional goal to address customer issues within 250 seconds from when the call was answered.

A total of 441 CCAs participated in the Beryl response, including 34 members from other Customer Experience teams, such as Electric Market Operations, Billing, and Credit, who also contributed at the Customer Center. The maximum call volume for the call center that was available and in operation during and after Hurricane Beryl was 2,000. The Company had capacity for additional callers utilizing IVR including 4,000 lines for its IVR outage reporting.

Performance

Call Center performance was noticeably impacted during the period of storm restoration as shown in Table 3 - 3. In July 2024, the average number of incoming calls per day, excluding IVR, was 18,250. During the storm restoration period from July 8-July 19, 11 out of 12 days saw a higher volume of total calls offered than the monthly average. Total calls offered (i.e., incoming calls offered to agents) reached their peak on Saturday, July 13, with a total of 53,156. While individual calls exceeded the daily averages, on July 13, the Average Speed of Answer (ASA) was 6 minutes and 17 seconds, and the Average Handle Time (AHT) was 5 minutes and 59 seconds. This indicates that, although some callers experienced longer wait times, the overall efficiency of call handling was maintained within reasonable limits. ASA peaked on Monday, July 8, reaching 24 minutes and 28 seconds. AHT peaked on Friday, July 12 reaching 6 minutes and 8 seconds. This increase in call center performance metrics is typical during a storm event and by the end of July, performance metrics returned to their normal ranges.

Table 3 - 3: Call Center Performance

Day Date 2024	Total Calls Offered	IVR Containment Rate	Call Handling Rate	Call Abandonment Rate	Overall Abandonment Rate	ASA	AHT
Monday, July 1	7,864	39%	96%	4%	2%	01:26	04:34
Tuesday, July 2	6,994	41%	99%	1%	0%	00:08	04:42
Wednesday, July 3	5,572	40%	99%	1%	0%	00:05	04:36
Thursday, July 4	1,829	83%	99%	1%	0%	00:02	03:53
Friday, July 5	4,357	35%	100%	0%	0%	00:03	04:33
Saturday, July 6	17,927	78%	70%	30%	7%	03:29	03:55
Sunday, July 7	13,501	76%	84%	16%	4%	02:04	04:07
Monday, July 8	49,030	**51%**	**42%**	58%	28%	**24:28:00**	**05:31**
Tuesday, July 9	35,485	**9%**	**59%**	41%	37%	**11:37**	**05:57**
Wednesday, July 10	33,068	**7%**	**65%**	35%	33%	**09:13**	**05:56**
Thursday, July 11	36,703	**14%**	**71%**	29%	25%	**07:39**	**05:57**
Friday, July 12	35,835	**11%**	**67%**	33%	30%	**09:13**	**06:08**
Saturday, July 13	53,156	**48%**	**76%**	24%	13%	**06:17**	**05:59**
Sunday, July 14	34,024	**24%**	**86%**	14%	11%	**02:47**	**05:33**
Monday, July 15	31,139	**25%**	**76%**	24%	18%	**06:06**	**05:44**
Tuesday, July 16	32,607	**47%**	**91%**	9%	5%	**02:48**	**05:24**
Wednesday, July 17	26,950	**49%**	**90%**	10%	5%	**02:48**	**05:09**
Thursday, July 18	18,714	**46%**	**94%**	6%	3%	**01:59**	**05:17**
Friday, July 19	11,790	**36%**	**98%**	2%	1%	**00:47**	**04:58**
Saturday, July 20	5,987	48%	97%	3%	2%	00:46	04:23
Sunday, July 21	4,753	57%	100%	0%	0%	00:04	03:52
Monday, July 22	17,526	47%	80%	20%	11%	07:39	04:59
Tuesday, July 23	12,878	43%	85%	15%	8%	05:05	05:24
Wednesday, July 24	10,957	41%	98%	2%	1%	00:39	05:03
Thursday, July 25	8,616	40%	99%	1%	0%	00:09	04:43
Friday, July 26	9,099	44%	99%	1%	0%	00:15	04:46
Saturday, July 27	3,672	54%	99%	1%	0%	00:07	03:44
Sunday, July 28	6,160	66%	87%	13%	4%	01:05	03:33
Monday, July 29	10,606	38%	93%	7%	4%	02:39	05:05
Tuesday, July 30	10,472	37%	92%	8%	5%	02:27	04:57
Wednesday, July 31	8,468	32%	94%	6%	4%	02:24	05:00

% LOW — HIGH

TIME SLOW — FAST

The daily call center performance in July 2024 offered valuable insights worth noting:

- **IVR Containment Rate**: On the first day of the storm, July 8, the IVR containment rate was typical, but it experienced a dramatic decline over the following four days. On Wednesday July 10, the IVR Containment Rate was 7% meaning that only 20,495 customers were able to achieve resolution within the IVR. The industry standard for daily containment rate is above 50%.
- **Other Call Center Performance Metrics**: Call Handling Rate, ASA, and AHT all aligned with the expected trends typically observed after a major event.
- **ASA Recovery Speed**: Between July 8 and 9, the Average Speed of Answer (ASA) was halved, while all other factors remained constant. This reduction serves as a positive indicator of the call center's effective storm response.

3.15.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
CCH-1 **Increase Call Center Resource Pool:** Identify and train additional resources, whether within the CenterPoint workforce or from third-party agencies, to ensure they can effectively assist during storm response. Train existing CenterPoint gas and Indiana call center organizations to provide supplemental support during storm response.	**CCH-3** **Forecast Call Center Resource Needs:** Develop a framework to forecast additional call center support required during storm response, utilizing historical data from past storms.
CCH-2 **Analyze Root Cause of IVR Containment Drop:** Conduct a root cause analysis to determine why the call center experienced a noticeable drop in the IVR containment rate sustained for five days.	**CCH-4** **Establish a Call Center Storm Response Plan:** The plan should outline the tiers of additional assistance needed to maintain full operational capacity and establish criteria for deploying these resources. Once the plan is completed, train all mutual assistance call center representatives, including those from third-party agencies.

3.16 Temporary Generation

3.16.1 Findings

In certain storm scenarios, utilities can deploy temporary generation units to provide temporary power to critical facilities such as hospitals, emergency service centers, water/sewer treatment plants, or cooling sites that are essential to the safety of customers or to aid utility and emergency response crews in restoration efforts. As crews work to restore power, the units can be repositioned according to where they are needed and what sites take priority. This priority matrix is created before a storm hits to streamline deployment and redeployment processes.

Preparedness

CenterPoint leases temporary generation units between 230 kW and 5 MW in size. It maintains this fleet for distribution events caused by natural disasters such as hurricanes. CenterPoint also leases 32 MW generators which are used for transmission events such as load shed or loss of substation events. These larger generators were not compatible with the types of sites that were requesting temporary generation; none of these were deployed during Hurricane Beryl. If there were outages at substations where a 32 MW generator deployment would have been feasible, CenterPoint could have deployed those units.

Depending on their size, these generators are typically used in 3 different use cases: (i) Point of Use, connecting directly to customers, (ii) Circuit Based, connecting to the grid at a midspan location, and (iii) Substations, connecting directly at a substation during a substation outage or while load shedding. Case (iii) would generally be the use of the 32 MW units. For this scenario, CenterPoint has installed bays and open switches at substations in order to speed up the connection process.

When preparing for a storm there are four key considerations taken by the utility to deploy temporary generation:

Anticipated Outage Duration: identifying locations that have the highest potential outage density and are expected to experience the longest duration outages using Damage Prediction Modeling.

Customer Criticality: establishing priority levels for all critical customers in a service territory and using this priority list to deploy generation once requests are made during an event.

Technical Feasibility and Generation Availability: determining customer load, service, voltage, physical space constraints and availability of connection to facilities that could require temporary generation. Also determine the availability of generation units ready for deployment and crew members that can perform the deployment process.

Type of Outage: determining the type of outage that the grid is experiencing such as a circuit, transformer or use fuse outage and evaluate if temporary generation is required as a part of the restoration process.

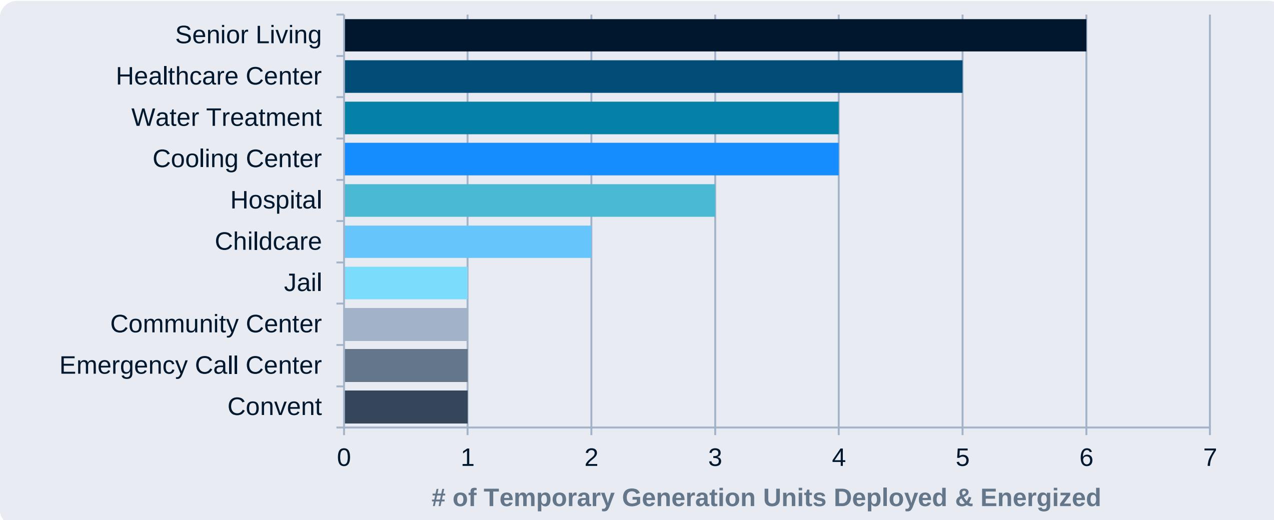
In addition to the above consideration, CenterPoint also prepositioned drivers to transfer generation units more quickly throughout the storm, acquired smaller and single-phase temporary units and increased staffing on the temporary generation team to assess deployment sites and complete generator deployments more quickly.

CenterPoint's deployment of emergency generation during Hurricane Beryl appeared to be in line with the procedures outlined in its EOP. The Emergency Generation Tiger Team identified locations where 230 kW generators were needed and coordinated their mobilization and deployment. They later oversaw the demobilization once the emergency generation was no longer necessary. The deployment of emergency generation did not hinder CenterPoint's overall restoration efforts.

Performance

CenterPoint utilized temporary generators where feasible / possible as a part of Hurricane Beryl restoration efforts. Of these total deployments the utility energized 31 temporary generation units at 28 critical facility locations as shown in Figure 3 - 6. During the storm the deployment strategy to deploy generators following the prioritization outlined in the priority matrix, with the temporary generation team working to identify customers that required generation, evaluating the size required at the site, and assessing the feasibility of deployment.

Figure 3 - 6: Temporary generation Units Deployed & Energized



For each request received for temporary generation, CenterPoint's temporary generation team evaluated the feasibility of deployments. Reasons for not deploying temporary generation included sites already having their power restored, temporary generation not being the correct size in terms of load, space constraints, or other electric system related incompatibility making the site unable to receive power from temporary generation.

Some critical facilities served by CenterPoint experienced outages throughout the duration of Beryl. For example, only 22% of hospitals served by CenterPoint experienced an outage, and only two of those hospitals experienced an outage lasting more than 72 hours. Emergency services also experienced long outages with 90% of police and 100% of airports restored by July 13 and 95% of fire stations restored by July 15, seven days after the storm hit Houston. 70% of cooling / warming centers were without power on the day of the storm with 90% of these centers restored by July 15. CenterPoint deployed temporary generation at some of these facilities to provide temporary power while crews worked to complete restoration efforts.

The average deployment time for generators was about 2 days with the longest deployment lasting 140 hours. Once power was restored to a site, generators would be removed. There were no fuel spill incidents associated with generator deployment.

Table 3 - 4 provides details on the location and size of generator deployed during the storm. The temporary generation team received about 300 requests for temporary generation and deployed:

230 kW unit at 1 site	**400 kW** units at 5 sites	**500 kW** units at 2 sites	**560 kW** units at 4 sites	**625 kW** units at 4 sites	**1 MW** units at 9 sites	**5 MW** units at 3 sites

Table 3 - 4: Temporary Generation Deployment & Energization Location

Address	Location	Size[23]
5505 Belrose Dr	Shannon Walker Library	400 kW
10525 Red Bluff Rd	US PL BTB Pasadena Ozarka	5 MW

[23] Parenthetical indicates use of a generator obtained through mutual assistance and identifies the utility providing that support.

Address	Location	Size[23]
11612 Memorial Drive	Memorial Drive Presbyterian Church - Cooling Center	1 MW (Oncor)
11929 W Airport Blvd	Atrium Medical Ctr Senior	1 MW (Oncor)
1201 Commerce	Harris County Jail	1 MW (Oncor)
1424 Fallbrook Dr	Capstone Healthcare Estates at Veterans Memorial	230 kVA
14949 Mesa Dr	Fall Creek Rehab and Healthcare	560 kW (AEP)
1617 Elmview Dr	Gracewood	625 kW (Oncor)
17720 Hwy 59, Humble	Humble Sewer	1 MW (Oncor)
17750 Cali Dr	Psychiatric Facility	500 kW
1851 Cross Point, Houston	UT Health	1 MW
1907 Holcombe Blvd	Ronald McDonald House	1 MW
2001 Ladbrook Drive	SUN Behavioral Healthcare	625 kW (Oncor)
22999 Hwy 59	HCA Kingwood	1 MW (Oncor)
23775 Kingwood Pl Dr	Regent Care	560 kW (AEP)
2401 Green Oak Dr	Novellus Kingwood	560 kW (AEP)
2401 Holcombe	St Dominic Village, Senior Care Community	5 MW
24025 Kingwood Pl Dr	Landon Ridge	560 kW (AEP)
3033 Pearland Parkway	Trinity Oaks of Pearland	1 MW
3702 Cove View	Gulf Coast Health Center/Cascades at Galvseton	400 kW
4802 Lockwood Dr	Warming/Cooling Center	500 kW
4920 San Jacinto	Czech Heritage Center	400 kW
6501 Almeda	Dominican Sisters of Houston	625 kW (Oncor)
7401 Rankin Rd	City of Humble Water	400 kW
7603 Antoine	White Oak Conference Center	400 kW
9351 E Point Dr. #B	Ozarka - Drinking Water	625 kW (Oncor)
9455 W Montgomery Rd	Emergency Call Center	1 MW
9505 NorthPointe Blvd	Villages of Glenloch Farms Senior Living	5 MW

3.16.2 Recommendations

Recommendations for improving the temporary generation deployment process during storm scenarios involve solidifying plans for deploying units and ensuring that deployment can happen swiftly during a storm.

Short-Term Actionable	Mid-Term Actionable
TG-1 **Catalog Critical Customers:** Compile the list of all critical customers in the service territory, prioritize this list taking into account the risk of an extended outage at the specific customer location, the presence of customer owned backup generation, and other relevant factors, and understand how the priority customers with the highest risk of suffering an extended outage can be served by temporary generation.	**TG-4** **Develop and Promote Interconnection Services for Temporary Generation**: Develop and promote an efficient interconnection process that coordinates with and supports critical sites lacking standby generation, helping ensure a seamless interconnection experience. Advise sites to build infrastructure, including bays and cables at all critical sites such as hospitals, cooling centers, and water treatment plants which enable quick deployment of temporary generation with limited additional work to be done to begin supplying sites with energy.
TG-2 **Test Existing On-site Generation:** Educate and encourage critical sites that have on-site backup generation to routinely test their generators to ensure performance during a storm event.	**TG-5** **Procure Additional Distribution-scale Generation:** Acquire additional smaller generators, between 230 kW and 5 MW in size, to enable greater use of temporary generators during future events.
TG-3 **Establish Deployment Priority Matrix:** Establish a priority matrix to deploy and utilize generators at critical facilities including which units are compatible at which site, what size units are available for each site, and what is the priority of deploying generation to each critical site within CenterPoint's territory. In the case of more deployment requests than available generation units, the priority matrix should be followed.	

3.17 Distributed Energy Resources

In a storm scenario, distributed energy resources (DERs), such as solar panels and battery storage systems, can play a critical role in enhancing grid resilience and maintaining power continuity. During power outages caused by storms, DERs can provide localized backup power to homes, businesses, and essential services, reducing reliance on the centralized grid. Batteries can be charged during times when the grid is operating normally, offering a steady, dependable power supply when the grid is down. Microgrids, which can operate independently of the grid and use DERs and traditional fuel generators like diesel or natural gas for power, enhance resilience during storms by isolating critical areas, like hospitals and emergency centers, ensuring they continue to receive power even when widespread outages occur. However, for regulatory reasons, utilities such as CenterPoint are not permitted to own and operate DERs. This limits their ability to directly deploy these resources for storm mitigation. Instead, DERs are owned by third-party providers or consumers themselves, which presents challenges for utilities during emergency restoration efforts as they are unable to directly leverage these resources during times of need. Utilities should track and collaborate with private owners and operators of DERs to maximize the benefit of the infrastructure to aid in storm preparedness and response.

3.17.1 Findings

As mentioned above, CenterPoint is prohibited from owning DERs by regulations in Texas and therefore was unable to use them as a resource directly during Beryl. CenterPoint does have a commercial battery installation program which limits battery installations to under 10 MW per battery. Currently, CenterPoint has deployed one 9.99 MW commercial battery (energized post-Beryl) with a target of having 500MW of storage deployed by 2026. These commercial installations, however, are not interconnected to the CenterPoint energy circuit and would not be able to provide power as a resiliency measure, instead they allow the owner to participate in the wholesale energy market during events and provide energy arbitrage services for compensation. Exploring potential changes in the regulations governing the ownership and use of DER could lead to the utility being able to own these types of resources and deploy them in response to storms.

CenterPoint also does not have a utility-scale microgrid deployed at this time on its system but has seen an increased number of individual, behind-the-meter DER deployments at residential and commercial (e.g. Home Depot, Target, Walmart) locations. This volume trends heavily on the residential side with about 90% of DERs deployed at homes and 10% at commercial locations. The utility has a program with the Electric Power Research Institute (EPRI) to understand the benefits of micro-grid systems and the changes that CenterPoint can make to help ensure an environment that supports the continued development of these systems. While CenterPoint does have a database of customers which were granted permission to operate microgrids in island mode the utility has not yet collected information on whether these customers could also supply power to customers in the surrounding areas.

3.17.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
DER-1 **Continue to Catalog DERs and Microgrids in CenterPoint Territory:** Understanding deployments within CenterPoint's territory can help the utility identify locations where DER and microgrids could be used for resiliency purposes in the future. Identify locations where a DER or microgrid could help temporarily restore power to surrounding areas or temporary emergency response locations.	**DER-2** **Leverage Capacity Maps:** Leverage capacity maps with relevant parties to encourage behind-the-meter DER installation in certain locations on CenterPoint's circuit where deployments could offer resiliency solutions. **DER-3** **Use DERs during Restoration Efforts:** Consider establishing emergency solutions such as staging sites, cooling centers, or other community shelters in areas that can be powered by DERs or microgrids.

3.18 Grid Performance, Design, and Automation

In an era marked by increasing frequency and intensity of major storms, the resilience and efficiency of electric utility grids are more crucial than ever. Effective grid performance, innovative design, and advanced automation play pivotal roles in facilitating rapid and reliable restoration of power during outages caused by severe weather events. A well-designed grid can withstand environmental stresses, while automation technologies enhance situational awareness and streamline response efforts. By integrating these elements, electric utilities can minimize downtime, reduce economic impacts, and enhance the overall reliability of the power supply.

3.18.1 Findings

The transmission system withstood the test of Beryl with only one substation outage and minimal impact on the transmission lines. For many utilities, this poses a significant challenge during extreme weather events, reflecting the overall resiliency of the transmission and sub-transmission systems and the effectiveness of CenterPoint's investments. However, the number of circuit lockouts (nearly 78% of overhead feeders) represents the greatest area for grid performance improvement. Only about 83,000 of the 2.1 million customers out of service were not part of a circuit lockout. This represents an opportunity to limit the number of customers initially impacted and to free up crews to restore downstream segments of an impacted circuit faster. These lockouts took roughly three days to clear.

Preparedness

Segmentation provides greater resilience against storms, fewer customers without power, and faster storm recovery. Currently the CenterPoint circuit design largely is made up of single Intelligent Grid Switching Devices (IGSD) at the midpoint of the circuit and one at an end point (tie points to other circuits). Beyond the basic fault isolation benefits, sectionalizers give dispatchers more options to shift loads to restore customers quicker through remote switching. Today CenterPoint’s isolation is primarily done through the operation of manual field operated switches. Finally, more automated sectionalizers with communications can direct damage assessors more quickly to the faulted areas. Many utilities have programs to get 500 customers or less per circuit segment (one utility has a goal of getting 250 customers per circuit segment) and it is a proven best practice. While the coordination of reclosers can be tricky there are solutions to accomplish the necessary segmentation.

Indeed, hardening the circuit main lines reduces the number of customers affected during a major storm and speeds up the restoration of those and all other downstream circuit segments. At the same time, it’s estimated that while laterals and secondary outages accounted for a considerable portion of the restoration work, they affected only a small number of customers. The installation of TripSaver® reclosers can have a significant impact on minimizing lateral outages and these customers are the smallest in number, but those that were out the longest during Beryl. Finally, the amount of rear lot construction (primary and secondary) in the CenterPoint service territory is large by industry standards and represents a tremendous challenge in terms of both vegetation management and speed of restoration. Once again, the complexity of restoration in this circuit segment is exceedingly high and large numbers of crews are required to restore a small number of customers.

Improving the customer experience, as portrayed by the restoration curve, requires circuit redesign work in each circuit segment to achieve a multi-faceted reimagined distribution circuit design.

Performance

Beyond a robust targeted vegetation management program and circuit hardening, preventing, or minimizing circuit lockouts is most impacted by a strong main line fault-sectionalizing program. A good circuit-sectionalizing program has three main components: increased sectionalization on main line (backbone), looped circuits with manual, and automatic transfer capability and circuit inter-ties. When implemented at scale, the benefits include blue and grey-sky reliability improvements and substantial resiliency improvements including mitigating circuit lockouts.

3.18.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
GRID-1 **Develop a Program to Segment Less than 500 Customers per Remotely Controllable Circuit**: Initiate a program to prioritize circuits for segmentation with the goal of eventually reaching 500 customers underneath an IGSD. Rebuild a prioritized group of circuits to new "withstand" standards (greater than 65 mph sustained). This will help limit the number of customers who are exposed to outages by providing Distribution Controllers the ability to remotely isolate the damage.	**GRID-3** **Increase Use of Composite Pole and Crossarms:** Consider increasing the use of composite pole and cross-arms use in the CenterPoint service territory. Composite poles and cross-arms have longer service lives and are more resistant to damage than comparable wooden poles and crossarms. This helps to improve system reliability and resiliency performance.
GRID-2 **Develop Laterals Protection and Sectionalizing Strategy:** Install TripSaver® (or similar) reclosers on all currently fused laterals, and then expand deployment to non- fused tap laterals. TripSaver® provides the ability to have a one-shot reclose capability on laterals, which may reduce the number of sustained outages affecting the lateral.	**GRID-4** **Replace Open Wire with Covered Conductors:** Where feasible, systematically replace open-wires in the service territory as open-wires are more prone to damage from felled trees / limbs and are less reliable and resilient to insulated conductors. Where practical, spacer cable (e.g., Hendrix or similar systems) should be used to increase mechanical strength, resist mechanical wear related outages, and better withstand contact related outages.

3.19 Strategic Undergrounding

Electric undergrounding involves installing power lines below ground rather than above it, which can significantly benefit utilities during storm outages. By burying lines, utilities reduce the risk of damage from high winds, falling trees, and other debris that affect overhead lines. This leads to fewer service interruptions and faster restoration times during storms. Undergrounding can enhance the overall reliability of the grid, decrease maintenance costs, and improve safety.

3.19.1 Findings

Preparedness

CenterPoint's electric distribution system is substantially underground in designated areas. There are 159 distribution circuits which supply those areas. CenterPoint currently has plans to extend underground lines into residential areas and for three phase services. The Company's standard practice is to install underground residential distribution (URD) systems to serve subdivisions with 24 or more lots. Normally, the URD installation will include buried primary lines and pad-mounted transformers. For subdivisions with less than 24 lots and for other new business circumstances, developers can pay the overhead underground cost differential to obtain URD service. CenterPoint also identifies areas to be dedicated underground areas such as downtown Houston and the medical center.

Performance

While there was minimal damage to URD systems from Beryl, customers served by most URD systems had their service interrupted due to damage to the overhead circuit supplying the URD system they are fed from.

Hurricane Beryl was not primarily a flooding event, and the underground circuits performed well or were restored swiftly following the storm. Where underground equipment was subject to outage, this was because the specific UG circuits that were fed from overhead circuits.

3.19.2 Recommendations

Short-Term Actionable	Mid-Term Actionable
UG-1 **Identify a Pilot to do Underground Replacement of Existing Overhead Rear Lot Construction:** Identify a pilot project to underground existing rear lot overhead construction. Relocate rear lot to public right of way with better access (sidewalk, street, etc.).	**UG-3** **Expand UG Priority Circuits:** Focus on high-density urban areas, critical facilities, and regions prone to frequent outages. Identify funding and capital for undergrounding, incorporate advanced technologies such as real-time monitoring systems, automated underground fault detection, and predictive maintenance tools to enhance the ability to quickly identify and address issues in underground networks. Use high-quality materials and implement best practices for underground cable installation to reduce the likelihood of future faults. Consider designing systems with redundancy to minimize the impact of any single point of failure. Utilize data analytics to assess the performance of underground systems and inform decision-making. Analyze outage patterns, restoration times, and system performance to continuously improve the undergrounding program.
UG-2 **Develop Worst Performing Feeder Underground Program:** Expand and prioritize circuits to be undergrounded, identifying those that make the most feasible and cost-effective sense and that addresses the circuits that continue to lose power and/or are most likely to lose power often. Identify and prioritize key areas where undergrounding can have the most significant impact on reliability and storm resilience. Assess benefits and costs of undergrounding in varying sections of service territory.	

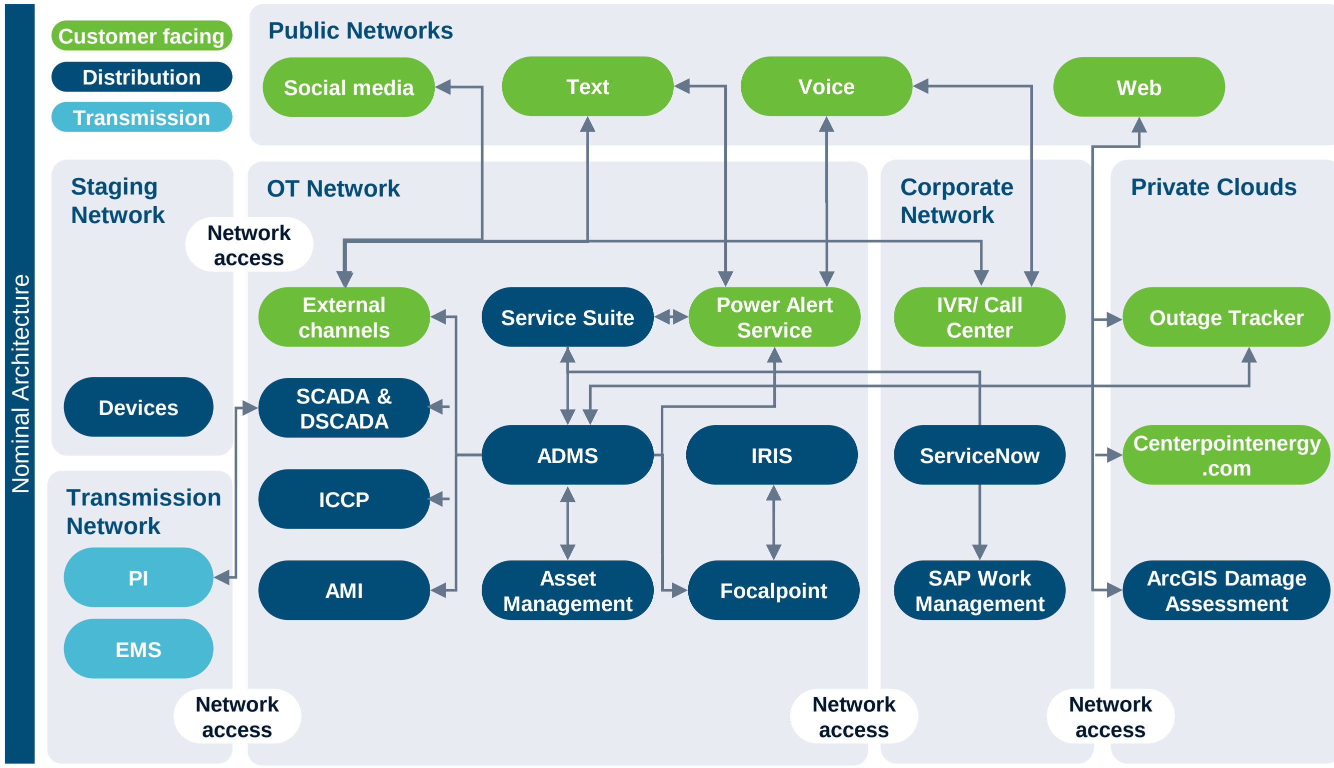
3.20 IT / OT

Other than the issues noted with CenterPoint's Outage Tracker, CenterPoint's information technology and operational technology functioned as designed prior to, during, and after Beryl. Only 13 technology problems were identified during Beryl and the restoration.

3.20.1 Findings

The overall technology landscape reflects normal practices with utility information technology and operational technology. The relevant components of the Information Technology (IT) and Operations Technology (OT) landscape are illustrated in Figure 3 - 7.

Figure 3 - 7: CenterPoint IT and OT Landscape



The systems that performed a notable role during Beryl are:

- Advanced Distribution Management System. CenterPoint uses a widely used ADMS solution hosted on-premise and provides functionality for distribution network monitoring and control, outage management, switching, powerflows, DER management. The ADMS is pivotal to managing outages and functioned as expected during Beryl.
- Asset Management is a collection of tools that maintain a registry, controls, inspection, documentation, prediction and performance models, imagery of assets and their surrounding locations and geographic information on distribution assets. Asset management tools provide asset information to ADMS and other systems so that they function as expected. Asset management also informs activities including Vegetation Management and inspection so that problem trees and access problems are identified and corrected.
- Damage Assessment is a collection of tools used by field inspectors, office-based supervisors and operations teams to assess damage and estimate repairs to distribution assets. CenterPoint uses ESRI tools to capture assessments, which are packaged into logical groupings to inform operations teams of the damage extent, priority and work required. These tools functioned as expected during Beryl.
- SCADA, Distribution Supervisory Control and Data Acquisition (DSCADA) is the solution architecture used for remote control of distribution automation devices such as reclosers, switches and IGSD. SCADA normally refers to transmission level devices and DSCADA refers to distribution level devices. The overlap between the two is within a substation for the reclosing devices used to control distribution circuits exiting the substation. The SCADA and DSCADA functioned as expected during Beryl.
- PAS is a voice, email, and text notification service for customers that is intended to notify customers of outage events and restoration information. Contact data allows CenterPoint to associate a meter number with a customer and the customers' phone, text, and email contact details. PAS is not a mobile app that customers can download, and it doesn't provide for outage or hazard reporting. Given the constraints of Texas energy market rules, CenterPoint only has contact details for 42% of actual electric customers, most of which are gas customers. PAS functioned as expected, within the

constraint of a limited and unknown quality customer contact database. Users of PAS experienced trouble with the service as a consequence of the infrastructure PAS operates on, in addition to external cellular bandwidth limitations.

- IRIS and FocalPoint provide a situational awareness capability with dashboards, driven by information collected from ADMS, Service Suite, and other systems. It is used as an input to command-and-control decisions on the deployment of field resources, as well as monitoring the progress of restoration. IRIS and FocalPoint functioned as expected during Beryl, except for occasional unavailability as a consequence of the infrastructure it operates on.
- Automation of Reports and Consolidated Orders System (ARCOS) is a callout tool typically used for the initial mobilization of field resources. ARCOS functioned as expected during Beryl.
- Service Suite is a work management solution that allows packages of work to be created, assigned, dispatched, updated, and completed. Outages that are detected automatically by SCADA and actioned by ADMS are communicated to Service Suite for further work assignments as well as work assignments created manually through command-and-control actions. Service Suite can be used centrally on large displays and by field workers using small screen devices. Service Suite functioned as expected during Beryl, except for occasional unavailability as a consequence of the infrastructure it operates on.
- Advanced Metering Infrastructure (AMI) is the advanced meters, communication infrastructure and control systems used to read, update and control electric meters. CenterPoint's AMI is 2010 era technology and is undergoing a phased upgrade to modern era technology through 2030. AMI can be used to detect loss of power and reenergize events automatically. It is not CenterPoint's practice to verify restoration with automated pings, but meter pings can be requested manually from the distribution control center. AMI functioned as expected during Beryl.
- OT Network is a secured network where OT systems and devices communicate.
- Corporate Network is a secured network where the main IT systems are available.
- Staging Network is a temporary secured network that enables field workers and supervisors to collaborate.
- IVR and automatic call distribution are call handling tools commonly used in call center operations.

Preparedness

Several perceived application failures were experienced by internal users, and PA expects, but has not verified, impacted external users. The root cause of these failures was not the applications but with the infrastructure they operate due to capacity limitations both internally and externally.

Performance

ServiceNow is used to manage the operation of CenterPoint's technology which is a common practice across well-managed modern companies.

Typical definitions for priorities are:

01 **Priority 1 (P1):** critical impact and/or urgency.

02 **Priority 2 (P2):** high impact and/or urgency

03 **Priority 3 (P3):** moderate impact and/or urgency

Typical levels of problem and incident rates are:

01 Highest performing IT operations achieve an annual rate of <1 per employee.

02 Average performance is in the 2-5 range.

03 Poor performance is 5+.

04 CenterPoint extrapolation from the storm period to one year yields an annual rate of 0.07 with is comfortably in the range for the highest performing operations.

The main observations from this performance are:

- No failures within the core systems or communications in the OT network
- Recommend storm volumes are factored into testing, provisioning and preparation for all critical systems and infrastructure. Commentary on the performance of centerpointenergy.com carries the implication that other systems besides centerpointenergy.com may also have been sized with normal growth rates rather than storm volumes.

3.20.2 Recommendations

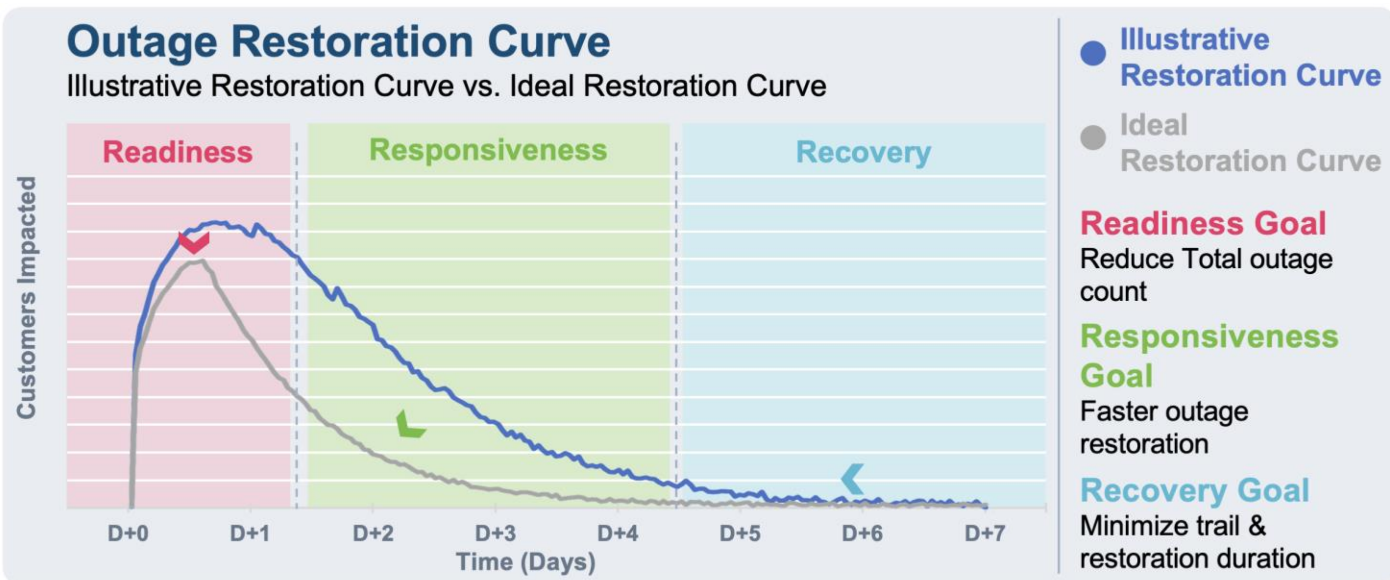
Short-Term Actionable	Mid-Term Actionable
IT/OT-1 **Factor Storm Volumes into All Systems:** Recommend storm volumes are factored into provisioning and preparation for all systems. Commentary on the performance of centerpointenergy.com carries the implication that other systems besides centerpointenergy.com may also have been sized with normal growth rates rather than storm volumes.	**IT/OT-3** **Harden IT/OT:** Harden IT and OT infrastructure and communications to increase availability. Use storm volumes, or larger, for load test exercises, covering for (1) all customer reporting/publishing and (2) all internal triggers arriving from AMI, SCADA, and DSCADA. Ensure there is redundancy for infrastructure and communication paths. Use cloud resources for high transaction or page views, triggered by major events.
IT/OT-2 **Ensure Data Quality and Robustness:** Ensure there is a customer data quality process, so that contact information is maintained both securely and with high quality. Outage and problem reporting has multiple methods; rationalize applications to minimize customer information solutions, currently Outage Tracker, PAS, website, and other temporary solutions. Provide for storm, bad weather and blue sky scenario operation for all customer contact methods. Address mismatch between verbal reports of system failures and their absence in service records.	

4. Recommendations by Resiliency Phase

04

The restoration process is structured into three key phases: readiness, responsiveness, and recovery, with recommendations aligned to each phase. Since every phase has specific objectives, PA has developed targeted recommendations and actions to meet them. By following these steps, CenterPoint will not only accomplish the immediate objectives of each phase but also enhance its long-term resilience as a coastal grid. The timing (short- versus mid-term) of recommended actions refers to when CenterPoint should begin or initiate the action and, especially for those recommendations that are not feasible to complete within a short timeframe, does not refer to the completion timing.

Figure 4 - 1: Illustrative Restoration Curve by Phase



Readiness

Table 4 - 1: Recommendations for Reducing Total Outage Count

ID	Name	Timing	Description
Finding Area: Emergency Preparedness & Response			
EP&R-1	**Enact 24-Hour EOC/DOC Operations**	Short-Term Actionable	Switch to 24-hour EOC/DOC operations, operating on two, 13-hour shifts for key functions including Planning.
EP&R-2	**Reevaluate FCC Support**	Short-Term Actionable	Re-evaluate number of FSR needed to support the number of FCC during EOC activations to alleviate some of FCC administrative burden.

ID	Name	Timing	Description
EP&R-3	**Focus Planning Section on Strategic Functions**	Mid-Term Actionable	Revamp Planning Section to focus on more strategic functions. Upgrade the Planning Section Chief to a Vice President-level resource. Update the Planning Section role and responsibilities, including incorporation of Global ETR establishment and management. Establish the strategic response plan for the incident, including resources and allocations needed, restoration tactics, and a global ETR and ETR strategy. Encourage a constructive tension between Planning and Operations Sections.
Finding Area: Damage Prediction			
DM-PR-3	**Build, Develop, or Acquire more Comprehensive Damage Prediction Models**	Mid-Term Actionable	Many of the above limitations can be addressed through a more robust commercially available machine learning based software package. Key elements are the ability to archive small events and scale, use CenterPoint's historical outage data and leverage various sources of data to develop accurate models of damage predictions that can account for various modes of damage (e.g., in addition to the type of downed poles, laterals vs. primary circuit damage locations, transmission and substation damage).
Finding Area: Estimated Time of Restoration			
ETR-3	**Integrate ETR Manager Role into IC**	Mid-Term Actionable	Fully integrate ETR manager role into IC. Fully develop and map out flow of information needed to generate Global / Regional / Substation-level ETRs, as well as all ways to disseminate ETRs to customers and stakeholders, including soliciting additional customer contact information.
ETR-4	**Define and Track ETR Accuracy**	Mid-Term Actionable	Develop metrics to track the accuracy of ETRs that are generated and communicated. Common industry standards define an ETR as accurate if power is restored within a specific time band relative to the ETR, and if customers receive fewer than three updated ETRs for the same outage. Typical time bands include: 1) two hours before the stated ETR to zero hours after, and 2) one hour before to one hour after the stated ETR. Excessive updates can create a perception that ETRs are unreliable, ultimately hindering the ability to shape customer expectations and aid in informed decision-making.
Finding Area: Communications			
COMMS-2	**Revise the Current Communications Strategy**	Short-Term Actionable	Revise communication strategies to focus on delivering essential information to customers, including storm preparedness and expectations, while addressing key concerns like estimated restoration times. Utilize the most effective channels to help ensure clear and timely communication.
COMMS-3	**Expand Relationships with External Stakeholders and**	Mid-Term Actionable	To enhance collaboration and help ensure effective communication, it is vital to deepen relationships with external stakeholders and government officials. Establishing regular engagement and creating a schedule for regular meetings and updates with key stakeholders, including local government

ID	Name	Timing	Description
	Government Officials		officials, emergency management agencies, and community organizations will foster a sense of partnership and facilitate better information sharing. Conduct joint planning exercises and exercises with government agencies and stakeholders to help ensure alignment and coordination during emergencies. This collaborative approach will enhance preparedness and response capabilities.
Finding Area: Customer Experience			
CX-2	**Increase Customer Enrollment and Customer Contact Database**	Mid-Term Actionable	Increase the completeness of customer contact information from 42% to enhance ETR communications during storm events. Identify enrollment strategies, while ensuring the customer data quality process maintains contact information securely and accurately. Support legislative efforts to aid increased enrollment.
CX-3	**Enhance Customer Communication Channels**	Mid-Term Actionable	Assess the feasibility of having customer communication solutions that can both push alerts and receive reports from customers across channels (text, voice, email, social media and web).
Finding Area: Mutual Assistance			
MA-1	**Reevaluate FCC Support**	Short-Term Actionable	Re-evaluate number of FSRs needed to support the number of FCCs during EOC activations to alleviate some of FCC's administrative burdens. Provide FCC support such as administrative, runners, etc. FCC Team should be comprised of a LOTO qualified CenterPoint employee, a service planner or other technical type CenterPoint employee, and an external damage assessment resource (after damage assessment is done). Improve work package distribution. As a stop gap until more robust systems are developed and implemented, provide additional FCC field support to streamline field ETR updates.
Finding Area: Vegetation Management			
VM-1	**Revise Trimming Cycles**	Short-Term Actionable	To enhance the effectiveness of vegetation management, CenterPoint should immediately revise its tree trimming cycles to a more frequent interval of three years. This adjustment will allow for more proactive and responsive management of tree growth, significantly reducing the risk of outages caused by overgrown vegetation interfering with power lines.
VM-3	**Enhance Tree Replacement Programs**	Mid-Term Actionable	Enhance the existing tree replacement program by introducing a range of options for customers with at-risk vegetation. This initiative could include personalized consultations to assess individual properties, recommendations for suitable replacement species, and incentives for participating in the program. By actively engaging customers in the management of at-risk trees, CenterPoint can help reduce the risk of outages while fostering community involvement and promoting environmental sustainability.

ID	Name	Timing	Description
VM-4	**Develop a Digital Intelligence Program to Effectively Perform Condition-Based Trimming**	Mid-Term Actionable	Transition to a data driven, condition-based trimming approach to enhance the effectiveness of vegetation management. Unlike the current practice of relatively long cycle trims, condition-based trimming based on various imagery processing based analytics and tools (LiDAR) focusing on the specific health and growth patterns of trees and vegetation surrounding power lines. This method involves regular assessments of tree conditions, identifying which trees require trimming based on their growth, structural integrity, and proximity to power lines. By adopting this proactive strategy, CenterPoint can prioritize vegetation management efforts on high-risk areas, helping ensure timely interventions that reduce the likelihood of outages caused by falling branches or trees.
Finding Area: Grid Performance, Design, and Automation			
GRID-3	**Increase Use of Composite Pole and Crossarms**	Mid-Term Actionable	Consider increasing the use of composite pole and cross-arms use in the CenterPoint service territory. Composite poles and cross-arms have longer service lives and are more resistant to damage than comparable wooden poles and crossarms. This helps to improve system reliability and resiliency performance.
GRID-4	**Replace Open Wire with Covered Conductors**	Mid-Term Actionable	Where feasible, systematically replace open-wires in the service territory as open-wires are more prone to damage from felled trees / limbs and are less reliable and resilient to insulated conductors. Where practical, spacer cable (e.g., Hendrix or similar systems) should be used to increase mechanical strength, resist mechanical wear related outages, and better withstand contact related outages.
Finding Area: Strategic Undergrounding			
UG-1	**Identify a Pilot to do Underground Replacement of Existing Overhead Rear Lot Construction**	Short-Term Actionable	Identify a pilot project to underground existing rear lot overhead construction. Relocate rear lot to public right of way with better access (sidewalk, street, etc.).
UG-3	**Expand UG Priority Circuits**	Mid-Term Actionable	Focus on high-density urban areas, critical facilities, and regions prone to frequent outages. Identify funding and capital for undergrounding, incorporate advanced technologies such as real-time monitoring systems, automated underground fault detection, and predictive maintenance tools to enhance the ability to quickly identify and address issues in underground networks. Use high-quality materials and implement best practices for underground cable installation to reduce the likelihood of future faults. Consider designing systems with redundancy to minimize the impact of any single point of failure. Utilize data analytics to assess the performance of underground systems and inform decision-making. Analyze outage patterns, restoration times, and system performance to continuously improve the undergrounding program.

Responsiveness

Table 4 - 2: Recommendations for Restoring Outages Faster

ID	Name	Timing	Description
Finding Area: Incident Command			
IC-1	**Streamline EOC Layout**	Short-Term Actionable	EOC physical layout should be updated to facilitate communications and information flow. Planning, Operations, CMC, Logistics, and Finance/Administration each should have dedicated work room in adjacent spaces. Provide workspaces for other IC leader team members as required (Legal, Liaison, Safety, Customer, etc.). Physically align the EOC and the Distribution Operations Section Chief, when the EOC is open for an electric event. Co-locate the EOC and CMC until each entity is fully established and independently operational.
IC-2	**Revise IC Roles and Responsibilities**	Short-Term Actionable	All roles and responsibilities within the EOC structure need to be reviewed and updated as appropriate. The actual personnel staffing these positions should be at the executive level and be the most experienced CenterPoint personnel in major storm restoration. IC organization needs to be at least two-deep across IC section chief and higher roles. Use Deputies as a professional growth and development opportunity.
IC-3	**Expand IC/EOC Training**	Short-Term Actionable	To the extent where possible, arrange for the current Planning Section Chief and Deputy to observe the Planning Section in action during the next major event in the Eastern United States. Tabletop exercise the revised Planning Section responsibilities. In the event of a major weather event in the Atlantic region during the 2024 storm season, designated CenterPoint personnel should shadow with the affected utility's IC to gain valuable insights and experience. Train additional personnel to function in IC roles (e.g., primary as well as backup roles), use shadowing opportunities to create 2-in-box type operations throughout EOC operations.
IC-4	**Continue to Streamline EOC Layout**	Mid-Term Actionable	Split the District Operations Branch during an EOC electric event to maximize impact of restoration efforts. Distribution Operations Branch Leadership located at the EOC. Region 1 work assignment located at Addicks Operations Center. Region 2 work assignment located at the ECDC.
IC-5	**Establish EOC-Sections Daily Meeting**	Mid-Term Actionable	Establish a new daily meeting cadence for the EOC and Sections (e.g., Planning, Operations, Logistics, and Finance/Administration).
Finding Area: Safety			
SAF-1	**Expand Safety Standdowns**	Short-Term Actionable	Safety is an entire-property, all personnel program and significant events should have safety standdown–all resources, operating or support, should know about the incident. Should be top-down decision and responsibility to communicate standdown to all response personnel.

ID	Name	Timing	Description
SAF-2	**Revise Substation Breaker Reclose Policy**	Short-Term Actionable	Change the breaker recloser policy in the event of a storm to require visual confirmation on the circuit before reclosing to ensure it is safe to do so. This would require additional communications and integration of processes between Field Operations (e.g., crews and FCCs as appropriate).
SAF-3	**Bolster Safety Leadership Responsibility**	Mid-Term Actionable	To enhance overall safety management and facilitate effective operational oversight, it is recommended that the responsibilities of the safety group leadership be expanded. Empower safety group leaders with greater authority to enforce safety protocols and make real-time decisions during storm restoration efforts. This will support timely responses to safety concerns and incidents. Provide continuous training on best practices and regulatory updates to help ensure leaders are well-prepared. Establish clear protocols for regular briefings between the safety group and operational teams to address safety concerns promptly.
Finding Area: Damage Prediction			
DM-PR-1	**Gather Beryl Damage Data for Model Refinement**	Short-Term Actionable	Gather granular weather data (e.g., wind gusts, directions) and restoration data from Hurricane Beryl in a well-documented manner to allow for refinement of existing damage prediction model inputs. Gathering this data will help future efforts to improve model accuracy and can be used for future analytics/modeling efforts as well.
DM-PR-2	**Refine Restoration Productivity Assumptions**	Short-Term Actionable	Analyze Beryl's restoration data (e.g., type of pole damage, pole reset durations) that are currently used in the damage prediction models to refine and enhance accuracy of the damage prediction model.
Finding Area: Estimated Time of Restoration			
ETR-1	**Calculate and Disseminate Global ETRs**	Short-Term Actionable	Develop processes to calculate Global ETRs when most customers (e.g., 90% of impacted customers) would be restored. Global ETRs should be calculated and released publicly within 48 hours of storm impact, ideally within 24 hours of the storm leaving the area. Develop internal and external facing material to educate what the Global/Regional/ Substation-levels of ETRs mean, as well as when they would be communicated publicly.
ETR-2	**Develop ETR Strategy and Processes**	Mid-Term Actionable	Develop strategy to calculate Global/Regional/Substation-level ETRs (e.g., approaches to when to disseminate, inputs needed, and roles and responsibilities). Develop processes to consolidate ETR updates from the field and aggregate them to enable the calculation of Regional/Operating Area, or Substation-level ETRs.
Finding Area: Communications			
COMMS-1	**Update the Current Communications Plan**	Short-Term Actionable	Enhancing the plan with additional governance and structure will empower CenterPoint to make communication decisions more quickly, effectively, and consistently during major events.

ID	Name	Timing	Description
			Proactive and informative communication is crucial during power outages, helping enable customers to plan and make necessary accommodations. For utilities, getting this right is a critical component of customer satisfaction.
COMMS-4	**Develop a Liaison Protocol**	Mid-Term Actionable	Clearly define the liaison protocols for both routine (blue sky) days and during emergencies (black/grey sky days). This should include identifying preferred communication methods for different scenarios, ensuring rapid dissemination of information during crises. CenterPoint should designate specific individuals within the organization to serve as liaisons for various stakeholders, ensuring that inquiries and concerns are addressed promptly expanding on what currently exists. Provide training for liaison personnel on effective communication and relationship management, focusing on how to handle inquiries from stakeholders during normal operations and in crisis situations.
COMMS-5	**Establish Customer Experience Feedback Mechanisms**	Mid-Term Actionable	Implement a system to gather feedback from stakeholders (e.g., elected officials, media, key accounts, customers, etc.) regarding the effectiveness of communication strategies and areas for improvement. This will help refine protocols and strengthen relationships over time.
Finding Area: Outage Tracker			
OT-1	**Replace Outage Map**	Short-Term Actionable	Replace the public-facing Outage Map with an Outage Tracker featuring comparable capabilities to the previous version.
OT-2	**Revise Technology Selection and Testing Processes**	Short-Term Actionable	The decision-making process for technology solutions should be reviewed so that critical systems receive heightened scrutiny. This includes clearly defining what constitutes a critical system (to include more than just operational continuity) and preventing any critical system from being taken offline without having a suitable replacement in place.
OT-3	**Expand Customer Reporting**	Short-Term Actionable	Enable customers to report a broader range of issues, including trouble, safety, and hazard incidents (such as wires down or fire), along with guidance for reporting life-threatening situations to the proper emergency agencies. Currently, the Outage Tracker only allows reports for 'Lights Out,' 'Partial Service,' and 'Dim Lights'.
OT-4	**Use Positive Language in Outage Tracker**	Mid-Term Actionable	Modify the messaging on the outage tracker to address customer journeys with positive rather than negative language. Outage statistics can be reported accurately using availability in addition to customers impacted. Currently there are two methods for reporting outages, safety, and hazards, using a local phone number or using the outage map. Multi-channel reporting and alerting are now commonly available from electric utilities. Guidance can be provided on a variety of relevant customer requirements or journeys including resetting customer breakers, preparing for a storm, post storm, gas leaks, fire, cooling and charging center locations, and others.

ID	Name	Timing	Description
OT-5	**Host Software Platforms Reliably**	Mid-Term Actionable	Ensure that all public facing communication solutions are hosted on reliable and scalable infrastructure. The easiest way to achieve this is with major cloud providers including the ESRI. The current outage map is deployed on ESRI's arcgisonline.com. Ensure there is a storm mode designed within the system that protects and isolates the critical internal systems such as ADMS from storm-level traffic and reporting.
Finding Area: Customer Experience			
CX-1	**Implement Real-Time Customer Feedback during Major Events**	Short-Term Actionable	To improve communication and customer satisfaction during major events, the implementation of immediate customer feedback mechanisms is important. This goal focuses on establishing real-time channels for customers to voice their concerns, report outages, and provide feedback on restoration efforts.
CX-4	**Inform Customers of the Potential Need for Electrical Service Work**	Mid-Term Actionable	Once a global ETR is issued, CenterPoint should promptly inform customers to inspect their property. If there is damage to the weatherhead, mast, or panel, advise them to hire an electrician to complete the necessary repairs. This allows them to act before their neighborhood is re-energized, helping to expedite their individual restoration.
Finding Area: Mutual Assistance			
MA-2	**Develop Mutual Assistance Tool**	Short-Term Actionable	Develop mutual assistance resource tracker and onboarding tool. Assess available tools by function and user experience. Eversource Energy onboarding process is publicly available and can be used as a starting point to model a more efficient onboarding process. Foreign Crew (non-native contractors and mutual assistance) management is critical, and the CenterPoint Energy team identified securing a system to manage this which should help them manage logistical support and cost tracking of these resources.
MA-3	**Reevaluate Storm Rider Policy**	Short-Term Actionable	Storm Rider Policy and decision needs to be reevaluated. During Beryl, most employees or contractors were asked to come in after the storm passed which could have delayed immediate restoration efforts.
MA-4	**Supply Mobile Technology to Mutual Assistance Crews**	Mid-Term Actionable	Provide technology for crews (foreign and non-foreign). Equip all CenterPoint and native contract field workers with mobile access to work, outage, circuit, damage assessment and other types of data. Distribute mobile devices (or supply digital apps to personal phones) to all field personnel with an application/tool for time/vehicle/work reporting as well as for onboarding – safety, system information, etc.
MA-5	**Create Equipment Equivalents List**	Mid-Term Actionable	Develop a comprehensive list of equipment equivalents across manufacturers and utilities to facilitate mutual assistance. This will expedite onboarding and task orders, streamline equipment requests, and enhance monitoring through barcode scanning and GPS tracking. Implementing this list will improve future restoration efforts, ETR accuracy, and staging site efficiency.

ID	Name	Timing	Description
MA-6	**Streamline Mutual Assistance Crew Operations for Enhanced Efficiency Across All Functions**	Mid-Term Actionable	Generally, utilize mutual assistance crews in the same efficiency as internal crews. This applies to tagging and grounding and lockout tagout switch out, switching dispatch, communications, how they get to a job every day, what they do, what they need to have.
Finding Area: Logistics			
LOG-1	**Enhance Operational Efficiency through Alternative Staging Site and Logistics Solutions**	Short-Term Actionable	To reduce crew travel time and expedite work, staging sites should be strategically located. In instances where a hotel is identified as a staging site and the hotel is without power, CenterPoint can coordinate and deploy temporary generators to restore electricity, where feasible (e.g., sites can accept power), benefiting both the hotel and restoration efforts. Strategically selecting locations near service centers will help minimize travel time for crews. If applicable, it is essential to confirm that staging sites have adequate staffing to manage operations, clean, and prepare rooms for crews. Additionally, having leadership present at these locations will help maintain an efficient schedule for restoration activities.
LOG-2	**Use Select Service Centers for Staging**	Short-Term Actionable	Where feasible, use existing service centers as staging sites. Staging site versus service center operations should be reevaluated (i.e., move the operations team from staging site to service centers as it is too decentralized currently). Minimize moving workforce to decentralized staging sites. Streamline communications and collaboration between system operations employees and field employees. Depending on where storm damage is located, CenterPoint could use those locations which make most geographic sense.
Finding Area: Damage Assessment			
DM-AS-1	**Integrate Damage Assessment and Vegetation Management Crews**	Short-Term Actionable	Integrate the vegetation management crews and damage assessors with the "cut and clear" resources as a first responder team to be dispatched together.
DM-AS-2	**Pre-Stage Materials/ Equipment**	Short-Term Actionable	While thorough damage assessments may not completely eliminate the need for an FCC to inspect a circuit segment for LOTO and safety purposes, efforts should be made to enhance the identification of required materials, equipment, and vegetation clearing before the arrival of line restoration resources. This proactive approach can help streamline the restoration process and improve overall efficiency.
DM-AS-3	**Streamline Damage Assessment for Work Packages**	Short-Term Actionable	Rework damage assessment processes to improve the usefulness of work packages. During the initial wave of damage assessments, validate and verify damage prediction models regarding required resources and materials. Following this initial assessment, the focus should shift to estimating restoration times to provide accurate timelines for stakeholders. Subsequently, attention should be directed toward proactively supporting line restoration and pole-setting crews to facilitate

ID	Name	Timing	Description
			an efficient recovery process. This structured approach will enhance operational effectiveness and help ensure a timely restoration of services.
DM-AS-4	**Upgrade Damage Assessment Technology**	Mid-Term Actionable	Explore and leverage LiDAR sensors and machine learning to quickly assess and integrate data with ESRI tools. The damage model should be able to take storm tracks, CenterPoint asset information, and develop an estimate for the level of repair efforts that are needed to help the Incident Commander and other IC Staff to confidently determine level of crewing required for restoration duration. The Planning Section Chief should be ultimately responsible for making sure the model is populated, tested, and exercised for accurate results and restoration preparedness.
DM-AS-5	**Revise Resource Utilization**	Mid-Term Actionable	Currently the DOC decides how to utilize the damage assessors. Consider using the damage assessors after initial assessments to be patrol inspectors during the circuit sweep operations. Harmonize veg and line crews and damage assessors, in a way that's more real-time and less sequential – eliminate wait times. "Advance deployment team" (slot team) preparing next line section(s) for work while other crew is working (assess damage, deliver materials, set up isolation and grounding points). So that when line crew moves on to the next section, they can immediately begin work.
Finding Area: Restoration Management			
RM-1	**Expedite IAP Completion**	Short-Term Actionable	The IAP should be finalized and approved before the operating period begins, establishing a clear set of objectives to serve as execution targets for the various operational areas. The IAP should encompass the ETR strategy and resource allocation, along with the prioritization of remaining tasks. Additionally, EOC briefings should concentrate on executing the plans outlined in the IAP rather than developing new plans for the day.
RM-2	**Evaluate FCC Pool Size**	Short-Term Actionable	The effectiveness of decentralization is directly linked to the number of FCCs available and their operational efficiency. To enhance scalability during restoration efforts, it is recommended to assess and potentially expand the FCC pool size. Engaging native contractors with journeyman-level experience as additional FCCs can significantly bolster capacity, allowing for improved management and coordination of field operations. This approach will help ensure that resources align with restoration needs, thereby optimizing overall response efforts.
RM-3	**Use Substation Restoration Segmentation**	Short-Term Actionable	Implement segmentation of restoration efforts by assigning specific crews to operate from designated staging centers associated with their respective substations. This approach will allow crews to focus on the circuits linked to their assigned substation, thereby minimizing the potential for overlap and interference with other crews working across different substations. By clearly delineating responsibilities and

ID	Name	Timing	Description
			operational areas, this strategy should enhance coordination and efficiency during restoration efforts.
RM-4	**Leverage Low Voltage Resources for Parallel Restoration**	Short-Term Actionable	In cases of significant damage to overhead services, deploy low voltage restoration teams to start repairing and replacing services ahead of the primary repairs in an area. This approach optimizes additional resources and helps shorten the tail end of the restoration process.
RM-5	**Test Processes and Technology**	Mid-Term Actionable	Test all revised processes and technologies during smaller storm events, moving beyond simulations or training exercises. Engaging native contractors to implement these new processes in real-world scenarios will provide valuable insights and practical experience. Additionally, conducting after-action reviews following these smaller events will facilitate the gathering of lessons learned, enabling continuous improvement and refinement of operational procedures. This proactive approach will help ensure that processes are effective and efficient when faced with larger storm restoration efforts.
RM-6	**Change RTO/DCO Jurisdictional Boundary**	Mid-Term Actionable	Operational jurisdiction and control of the distribution feeder breaker should be transitioned to the DCO. This will eliminate the bottlenecks inherent in Distribution Controllers calling RTO operators to operate a distribution circuit breaker. This revised boundary will also align much better to the modern distribution system, where automated circuit ties, distributed energy resources, and active voltage management each play key roles in serving customers on both blue sky and grey sky days.
Finding Area: Vegetation Management			
VM-2	**Optimize Crew Coordination**	Short-Term Actionable	To maximize the effectiveness of vegetation management efforts, CenterPoint should focus on enhancing the coordination and optimization of vegetation resources and crews. This involves implementing strategies that streamline operations, improve communication, and helps ensure that the right crews and resources are deployed to the most critical areas.
Finding Area: Call Center/Handling			
CCH-1	**Increase Call Center Resource Pool**	Short-Term Actionable	Identify and train additional resources, whether within the CenterPoint workforce or from third-party agencies, to ensure they can effectively assist during storm response. Train existing CenterPoint gas and Indiana call center organizations to provide supplemental support during storm response.
CCH-2	**Analyze Root Cause of IVR Containment Drop**	Short-Term Actionable	Conduct a root cause analysis to determine why the call center experienced a noticeable drop in the IVR containment rate sustained for five days.
CCH-3	**Forecast Call Center Resource Needs**	Mid-Term Actionable	Develop a framework to forecast additional call center support required during storm response, utilizing historical data from past storms.

ID	Name	Timing	Description
CCH-4	**Establish a Call Center Storm Response Plan**	Mid-Term Actionable	The plan should outline the tiers of additional assistance needed to maintain full operational capacity and establish criteria for deploying these resources. Once the plan is completed, train all mutual assistance call center representatives, including those from third-party agencies.
Finding Area: Grid Performance, Design, and Automation			
GRID-2	**Develop Laterals Protection and Sectionalizing Strategy**	Short-Term Actionable	Install TripSaver® (or similar) reclosers on all currently fused laterals, and then expand deployment to non- fused tap laterals. TripSaver® provides the ability to have a one-shot reclose capability on laterals, which may reduce the number of sustained outages affecting the lateral.
Finding Area: IT/OT			
IT/OT-1	**Factor Storm Volumes into All Systems**	Short-Term Actionable	Recommend storm volumes are factored into provisioning and preparation for all systems. Commentary on the performance of centerpointenergy.com carries the implication that other systems besides centerpointenergy.com may also have been sized with normal growth rates rather than storm volumes.
IT/OT-2	**Ensure Data Quality and Robustness**	Short-Term Actionable	Ensure there is a customer data quality process, so that contact information is maintained both securely and with high quality. Outage and problem reporting has multiple methods; rationalize applications to minimize customer information solutions, currently Outage Tracker, PAS, website, and other temporary solutions. Provide for storm, bad weather and blue sky scenario operation for all customer contact methods. Address mismatch between verbal reports of system failures and their absence in service records.
IT/OT-3	**Harden IT/OT**	Mid-Term Actionable	Harden IT and OT infrastructure and communications to increase availability. Use storm volumes, or larger, for load test exercises, covering for (1) all customer reporting/publishing and (2) all internal triggers arriving from AMI, SCADA, and DSCADA. Ensure there is redundancy for infrastructure and communication paths. Use cloud resources for high transaction or page views, triggered by major events.

Recovery

Table 4 - 3: Recommendations for Minimizing Restoration Duration

ID	Name	Timing	Description
Finding Area: Distributed Energy Resources			
DER-1	**Continue to Catalog DERs and Microgrids in CenterPoint Territory**	Short-Term Actionable	Understanding deployments within CenterPoint's territory can help the utility identify locations where DER and microgrids could be used for resiliency purposes in the future. Identify locations where a DER or microgrid could help temporarily restore power to surrounding areas or temporary emergency response locations.
DER-2	**Leverage Capacity Maps**	Mid-Term Actionable	Leverage capacity maps with relevant parties to encourage behind-the-meter DER installation in certain locations on CenterPoint's circuit where deployments could offer resiliency solutions.
DER-3	**Use DERs during Restoration Efforts**	Mid-Term Actionable	Consider establishing emergency solutions such as staging sites, cooling centers, or other community shelters in areas that can be powered by DERs or microgrids.
Finding Area: Temporary Generation			
TG-1	**Catalog Critical Customers**	Short-Term Actionable	Compile the list of all critical customers in the service territory, prioritize this list taking into account the risk of an extended outage at the specific customer location, the presence of customer owned backup generation, and other relevant factors, and understand how the priority customers with the highest risk of suffering an extended outage can be served by temporary generation.
TG-2	**Test Existing On-site Generation**	Short-Term Actionable	Educate and encourage critical sites that have on-site backup generation to routinely test their generators to ensure performance during a storm event.
TG-3	**Establish Deployment Priority Matrix**	Short-Term Actionable	Establish a priority matrix to deploy and utilize generators at critical facilities including which units are compatible at which site, what size units are available for each site, and what is the priority of deploying generation to each critical site within CenterPoint's territory. In the case of more deployment requests than available generation units, the priority matrix should be followed.
TG-4	**Develop and Promote Interconnection Services for Temporary Generation**	Mid-Term Actionable	Develop and promote an efficient interconnection process that coordinates with and supports critical sites lacking standby generation, helping ensure a seamless interconnection experience. Advise sites to build infrastructure, including bays and cables at all critical sites such as hospitals, cooling centers, and water treatment plants which enable quick deployment of temporary generation with limited additional work to be done to begin supplying sites with energy.
TG-5	**Procure Additional Distribution-scale Generation**	Mid-Term Actionable	Acquire additional smaller generators, between 230 kW and 5 MW in size, to enable greater use of temporary generators during future events.

ID	Name	Timing	Description
Finding Area: Grid Performance, Design, and Automation			
GRID-1	**Develop a Program to Segment Less than 500 Customers per Remotely Controllable Circuit**	Short-Term Actionable	Initiate a program to prioritize circuits for segmentation with the goal of eventually reaching 500 customers underneath an IGSD. Rebuild a prioritized group of circuits to new “withstand” standards (greater than 65 mph sustained). This will help limit the number of customers who are exposed to outages by providing Distribution Controllers the ability to remotely isolate the damage.
Finding Area: Strategic Undergrounding			
UG-2	**Develop Worst Performing Feeder Undergrounding Program**	Short-Term Actionable	Expand and prioritize circuits to be undergrounded, identifying those circuits that make the most feasible and cost-effective sense and that addresses the circuits that continue to lose power and/or are most likely to lose power often. Identify and prioritize key areas where undergrounding can have the most significant impact on reliability and storm resilience. Assess benefits and costs of undergrounding in varying sections of service territory.

Glossary

ADMS	Advanced Distribution Management System	**IAP**	Incident Action Plan
AHT	Average Handle Time	**IC**	Incident Command
AMI	Advanced Metering Infrastructure	**IGSD**	Intelligent Grid Switching Device
ARCOS	Automation of Reports & Consolidated Orders System	**IT**	Information Technology
ASA	Average Speed of Answer	**IVR**	Interactive Voice Response
CCA	Call Center Agent	**kW**	Kilowatt
CEHE	CenterPoint Energy Houston Electric	**LiDAR**	Light Detection and Ranging
CI	Customers Interrupted	**LOTO**	Lockout/Tagout
CMC	Crisis Management Committee	**MW**	Megawatt
CMI	Customer Minutes Interrupted	**NIMS**	National Incident Management System
CNP	CenterPoint Energy	**NOAA**	National Oceanic & Atmospheric Administration
CSAT	Customer Satisfaction	**OH**	Overhead
CST	Central Standard Time	**OMS**	Outage Management System
DCO	Distribution Control Operations	**OT**	Operations Technology
DER	Distributed Energy Resource	**PA**	PA Consulting
DOC	Distribution Operations Center	**PAS**	Power Alert Service®
DSCADA	Distribution Supervisory Control and Data Acquisition	**PI**	OSI PI Data Historian
DVAL	Distribution Evaluation	**PUCT**	Public Utility Commission of Texas
ECDC	Energy Control/Data Center	**QA**	Quality Assurance
EMS	Energy Management System	**REP**	Retail Energy Provider
EOC	Emergency Operations Center	**RFI**	Request for Information
EOP	Emergency Operations Plan	**RMAG**	Resources Mutual Assistance Group
EP&R	Emergency Preparedness and Response	**RTO**	Regional Transmission Organizations
EPRI	Electric Power Research Institute	**SCADA**	Supervisory Control and Data Acquisition
ERCOT	Electric Reliability Council of Texas	**SEE**	Southeastern Electric Exchange
ESRI	Environmental Systems Research Institute	**SIF**	Serious Injury and Fatality
ETI	Entergy Texas, Inc.	**SOC**	State Operations Center
ETR	Estimated Time of Restoration	**TDEM**	Texas Division of Emergency Management
FCC	Foreign Crew Coordinator	**TIMS**	Trouble Information Monitoring System
FEMA	Federal Emergency Management Agency	**TNMP**	Texas New Mexico Power Co.
FSR	Field Service Representative	**TXMAG**	Texas Mutual Assistance Group
FTE	Full Time Employee	**UG**	Underground
GIS	Geographic Information System	**URD**	Underground Residential Distribution
GPS	Global Positioning System	**VOC**	Voice of Customer

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