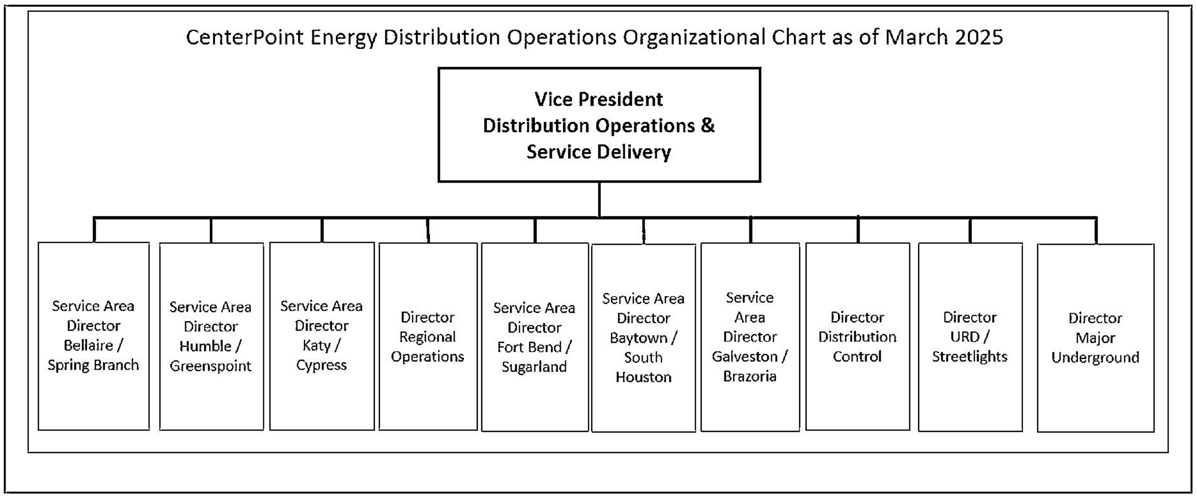
Underground Residential Distribution ("URD")/Streetlights. Figure RP-1 below shows the organizational chart for Distribution Operations and Service Delivery as of March 2025.

Figure RP-1
CenterPoint Houston Distribution Operations Organizational Chart as of March 2025



B. Summary of Distribution System

Q. BRIEFLY DESCRIBE THE COMPANY'S DISTRIBUTION SYSTEM.

A. The Company's distribution system begins at the distribution substation where high voltage, bulk power delivered by the Company's transmission system, is lowered to distribution voltage levels. The electric distribution delivery system consists of poles, conductors (i.e., wires), transformers, meters, and other equipment that efficiently transports power from the transmission delivery system to an end-use customer and measures the usage.

Distribution feeder lines transport power from the distribution substations at 12 kilovolts ("kV") and 35 kV. As of December 31, 2024, CenterPoint Houston has approximately 1,862 distribution feeders for both overhead and underground service to customers. These feeders included approximately 5,765 miles of 12 kV and 5,773 miles of 35 kV overhead main lines.

Customers not served directly from main distribution feeder lines receive their electric service from fused overhead or URD lines originating from these main feeders. These fused lines are referred to as laterals. As of December 31, 2024, CenterPoint Houston's distribution system included over 11,932 miles of overhead primary laterals (with 8,838 miles at 12 kV and 3,094 miles at 35 kV) and over 11,900 miles of underground URD laterals (3,328 miles at 12 kV and 8,572 miles at 35 kV).

The distribution system also includes underground distribution facilities. The Company utilizes two main types of underground facilities to serve designated areas. Dedicated underground feeder lines that serve the downtown Houston, Texas Medical Center, Houston Intercontinental Airport, the University of Texas Medical Branch at Galveston, the Galleria and Greenway Plaza areas, freeway crossings, and substation connections called "getaways" are the responsibility of MUG. The underground system also includes URD single-phase circuits primarily used for serving residential subdivisions.

Finally, customer usage is measured by advanced smart meters owned, maintained, and operated by CenterPoint Houston.

Q. WHERE IS THE COMPANY'S DISTRIBUTION AREA?

A. The Company's distribution area covers approximately 5,000 square miles from the Gulf Coast throughout the greater Houston area and twelve surrounding counties.

Company witness Darin Carroll includes a map of the Company's service area in his direct testimony.

C. Distribution Programs

Q. PLEASE DESCRIBE THE COMPANY'S PROGRAMS THAT ARE FOCUSED ON IMPROVING AND MAINTAINING THE COMPANY'S DISTRIBUTION SYSTEM.

A. CenterPoint Houston uses a variety of proactive distribution programs to improve the reliability and quality of service to electric customers including:

1. Pole Life Extension Program: ensures that a portion of the Company's distribution system poles are assessed annually by contract ground-line crews. The assessment includes visual assessment of the pole and ancillary equipment, such as guy wires, guy strains, and anchors. Poles are manually excavated and assessed for decay below the ground line, as well as sounded and bored to locate internal voids. Poles are also treated with fumigant or preservative to extend their lifespan. As part of the Company's grid hardening initiative, pole assessment and treatment have been accelerated.

2. Underground Residential Distribution Cable Life Extension Program: focuses on identifying potential failures in aged underground cable and other URD components that do not meet specifications before failure can occur.

3. Feeder Inspection Program: focuses on inspecting distribution feeders and laterals on a periodic basis to identify and correct issues found with the condition of a feeder that could impact the reliable operation of the feeder. These inspections occur when circuit reliability is on the 10% or 300% Worst Performing Circuit list.

4. Power Factor Program: designed to maintain good power factor ("PF") on the electric grid. PF is the ratio of real power (kW or kilowatts) to total power (KVA or kilovolt-amperes) or PF = KW / KVA. A good PF reduces the amount of current flowing on a distribution circuit and will, as a result, reduce line losses, reduce voltage drop, and enable the circuit to carry more power.

5. Infra-red Program: utilizing infra-red technology, the Company can see the heat generated by deteriorating components on the overhead distribution system. These "Hot Spots" eventually result in equipment failure and a loss of service. Infra-red technology is a unique tool to find potential equipment

outages before they occur, so that proactive repairs can be made prior to an outage.

6. Root Cause Analysis Program: a detailed evaluation of a circuit's outages for the current year is conducted from which a recommendation and action plan is generated to address circuit issues. CenterPoint Houston uses outage causes, outage location, outage frequency, customer outage minutes, and the results of a field inspection to develop an action plan that can include a number of possible recommendations to address the root cause of the outages.

7. Hot Fuse Program: identifies line and transformer fuses that have experienced recurring outages. On a daily basis, fuses are identified and within approximately four weeks, corrective action is identified. For those circuits with greater than four outages in 12 months, these fuses are also reviewed during the Root Cause Analysis process to verify a successful solution to the outages. CenterPoint Houston field personnel inspect all the hot fuses that meet one of these criteria and research outage records to determine the cause of the outages causing the hot fuse. The Company then issues work orders to correct the problem.

8. Distribution Grid Resiliency Program: improves the strength of the grid by designing and building to a higher standard. The Grid Resiliency criteria use a higher windspeed, from 60 mph to over 130 mph, and ice loading criteria to reduce the impact of extreme forces such as hurricanes, tornados, or ice storms on the Company's grid and is intended to allow for quicker restoration after a weather event. The program includes installing composite poles, such as fiberglass and ductile iron, and increasing the size of wood poles. It also requires the replacement of aging equipment, such as conductors, transformers, capacitor banks, and regulators.

9. Intelligent Grid Switching Device ("IGSD") Program: reduces the number and frequency of sustained outages experienced by customers by isolating faults to the smallest section possible. These devices can be operated as a recloser, switch or sectionalizer. When set as a recloser or sectionalizer, the device will operate automatically and restore service in less than one minute to many customers. When set as a switch, the status and operation of the IGSDs is fed back to Dispatchers who are able to control these devices remotely, eliminating the need for a crew to be on-site to initiate restoration.

10. TripSaver Program: reduces the number of sustained outages by replacing traditional fuses with a TripSaver® that utilizes automatic reclosing. This allows for the system to clear a momentary fault and restore service to customers in seconds. This program also reduces the number of truck rolls (which simply means crews having to get in a truck and visit a site in-person).

Q. PLEASE DESCRIBE THE COMPANY'S DISTRIBUTION VEGETATION MANAGEMENT ("VM") PROGRAMS AND PRACTICES.

A. The goal of the Company's distribution VM programs is to mitigate the risk of trees and other vegetation from inside or outside the right-of-way ("ROW") from contacting distribution facilities and causing customer power outages. This is particularly important as it relates to extreme weather events involving wind and/or water, and after periods of prolonged drought or extreme temperatures (both heat and freezing) because of their impact on the health of trees and vegetation. The Company's distribution VM programs can be divided into three main areas: Proactive, Reactive, and Hazard Tree.

Q. PLEASE DESCRIBE THE PROACTIVE VM PROGRAM.

A. The Proactive VM Program prioritizes vegetation trimming for circuits based on each circuit's trim cycle and the reliability of each circuit. Circuits that initially meet the trim cycle criteria are then ranked and prioritized using an analytics model based on reliability criteria. The recommended trim cycle for all circuits is dependent upon multiple factors, including the last trim date, vegetation encroachment risk, vegetation-caused outages, potential impact on critical loads, and overall customer count impacted. Circuits identified as eligible for the proactive work plan are then scheduled to be performed on a quarterly basis. Additionally, vegetation near laterals along with the feeder-main is trimmed on circuits identified for trimming. In addition, hazard trees may be removed as part of the Proactive VM Program if a tree is identified in the course of normal work.

The Company also uses herbicide treatments in specific locations where it can prevent or deter growth of vegetation.

In 2023, the Company conducted proactive tree trimming on approximately 4,600 miles of distribution circuits. In 2024, the Company conducted proactive tree trimming on approximately 5,800 miles of distribution circuits, which included VM of over 2,000 miles of high-risk distribution circuits. From 2020 to 2024, approximately 85% of the Company's Distribution VM spending was completed as part of the Proactive VM Program. For more details on the VM costs, see workpaper WP RMP-1.

Q. PLEASE DESCRIBE THE REACTIVE VM PROGRAM.

A. The Reactive VM Program is for unscheduled or reactive VM and is performed by CenterPoint Houston to address tree or vine issues that require immediate attention. By definition, this VM work is not planned as part of the Company's proactive work. This work is done in response to specific requests from customers or CenterPoint Houston personnel located at the regional Service Centers. From 2020 to 2024, approximately 12% of the Company's VM spending was completed as part of the Reactive Program. For more details on the VM costs, see workpaper WP RMP-1.

Q. PLEASE DESCRIBE THE HAZARD TREE PROGRAM.

A. The Hazard Tree Program is for hazardous trees that are identified and removed as part of scheduled and unscheduled circuit maintenance. Hazard trees are typically dead or dying trees that are outside the of the Company's ROW that may pose a risk to distribution facilities. CenterPoint Houston utilizes a proactive hazard tree removal program that involves Level 1 tree risk assessments as defined in Part 9 of American National Standards Institute (ANSI) Standard A300. If vegetation poses a threat and will damage equipment and cause outages, hazard trees outside of the Company's easement are proactively located and removed with the consent of the landowner. From 2020 to 2024, approximately 3% of the Company's VM spending was completed as part of the Hazard Tree Program. For more details on the VM costs, see workpaper WP RMP-2.

Q. REGARDING TREES AND OTHER VEGETATION, IS THE COMPANY PERMITTED TO TRIM ANY AND ALL VEGETATION IT DEEMS A THREAT OR HAZARD TO THE COMPANY'S DISTRIBUTION SYSTEM?

A. No. The Company cannot unilaterally trim or remove vegetation outside of the Company's easements. Typically, an easement is approximately ten feet wide and within that space, the Company can remove vegetation that could interfere with the delivery of electricity. Outside of the easement, the Company must obtain consent from the property owner to trim trees or vegetation.

Q. ARE THESE VM PROGRAMS AND PRACTICES INTENDED TO ELIMINATE ALL OUTAGES ON THE COMPANY'S SYSTEM?

A. No, eliminating all outages completely is not feasible. Instead, these VM programs are designed to remove the vegetation most likely to cause outages, with the goals of mitigating the frequency and duration of customer outages when operations are typical and in the aftermath of a severe weather event. There are limits, however, to how much ongoing programs can protect the Company's distribution system when it is faced with a hurricane or other severe weather event, as I will discuss below.

IV. <u>COMMON PRACTICES FOR SYSTEM RESTORATION</u>

Q. WHAT GUIDES THE COMPANY'S RESTORATION EFFORTS WHEN THEY ARE NEEDED?

A. As explained in more detail in Mr. Carroll's testimony, CenterPoint Houston's Emergency Operations Plan ("EOP") provides the foundation for the Company's restoration efforts. The EOP is a comprehensive plan focused on orderly and prompt restoration of service in the Company's service area following major damage or disruption of service.

Q. WHAT PROCESSES DOES CENTERPOINT HOUSTON USE TO PREPARE FOR AND RESTORE SERVICE AFTER A SIGNIFICANT EVENT THAT CAUSES OUTAGES?

A. For weather that is forecasted to affect the Company's service area, CenterPoint Houston tracks storms as they approach the Houston area using weather updates from StormGeo and the Situational Awareness updates from the Company's Emergency Preparedness and Response organization. Based on this information, the Company may extend crew hours past their normal stop time to support restoration efforts outside of traditional business hours. Depending on the intensity and expected impact, other options include adding additional contract resources for line skill or VM. These resources may be brought in via mutual assistance ("MA") or contacting companies directly.

Once the major storm passes, CenterPoint Houston continues to follow its EOP by opening the Distribution Operations Center ("DOC"), and staffing it with Distribution personnel, such as the Quality Assurance ("QA") Team, Priority Desk, Damage Assessment Team and Resource Acquisition Team. The roles and responsibilities of each team are described below.

The QA team assigns trouble orders to native contractors on the system, based on EOP prioritization, which are used to restore service to customers.

The Priority Desk receives and prioritizes outages based on criteria such as customer impact and safety of the public and workers. Leadership for the Crew Spokesperson Team is also located at the DOC, supporting employees (Crew Spokespersons) who are out in the field to address customer and community concerns and provide information related to specific outages in the area. Crew Spokespersons also gather information from the field that the Company utilizes to update customers.

The Damage Assessment Team collaborates with the Emergency Operations Center ("EOC") to determine the optimal number of assessors and acquires any external resources that are needed. Damage Assessors inspect Company facilities, both from the ground and aerially, to determine the amount and type of damage. This information is converted into work packets, which are given to line and vegetation crews to make repairs and restore service to customers.

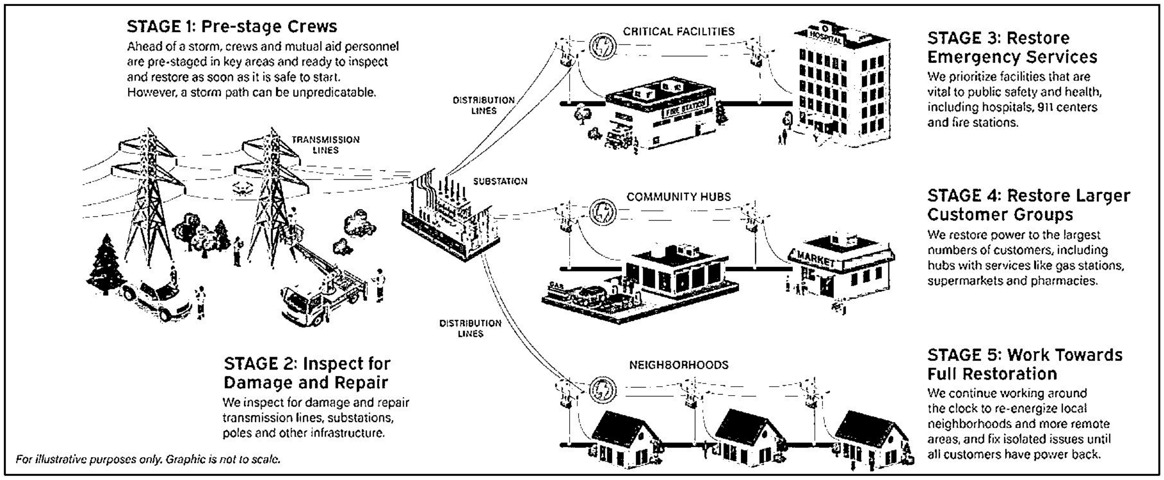
In addition, the Resource Acquisition Team may contact non-native line skill and vegetation-related companies to acquire the necessary personnel to support restoration. This team is responsible for acquiring and releasing resources throughout the restoration.

For a timeline of activities to prepare for a major event, see Exhibit RMP-1.

Q. PLEASE PROVIDE AN OVERVIEW OF DISTRIBUTION RESTORATION EFFORTS FOLLOWING A SEVERE WEATHER EVENT.

A. Because CNP provides an essential public service that supports the health, safety, comfort, and general well-being of the people living in the areas served by the Company, the goal of the EOP is to restore service to customers as safely, quickly, and efficiently as possible, ultimately restoring power to the most customers in the least amount of time. The processes outlined in the EOP aim to reduce service response time, thereby improving overall reliability. Improving service response time is defined by a reduction in the time it takes to energize customers. An overview of the Company's Restoration Process is illustrated below:

Figure RP-2
Illustrative Restoration Process



Q. HOW DOES CENTERPOINT HOUSTON ACQUIRE NECESSARY LINE AND VEGETATION RESOURCES?

A. There are three ways to acquire contract resources for both VM and line skills. The first way is to directly contact individual contract companies that are not associated with Investor-Owned Utilities ("IOUs"). The second way is to engage aggregators that have existing agreements with multiple contract companies. The third way is to notify MA groups, which include IOU members, municipal utilities and electric cooperatives.

Q. DID CENTERPOINT HOUSTON FOLLOW THESE PROCESSES TO PREPARE FOR AND RESPOND TO HURRICANE BERYL, HURRICANE FRANCINE AND WINTER STORM ENZO?

A. Yes. The Company followed these same processes for each weather event and adjusted the magnitude of the response to match the intensity of the damage and outages, which I address in more detail below. Thus, for a large-scale hurricane such as Hurricane Beryl that disrupted service to more than 80% of customers, the

Company used all the options available. For smaller storms, such as Hurricane Francine and Winter Storm Enzo, which did not have the same impacts to the Company's service area as Hurricane Beryl, it was reasonable to scale down the size of the response.

V. IMPACT OF THE WEATHER EVENTS ON CENTERPOINT HOUSTON'S DISTRIBUTION SYSTEM

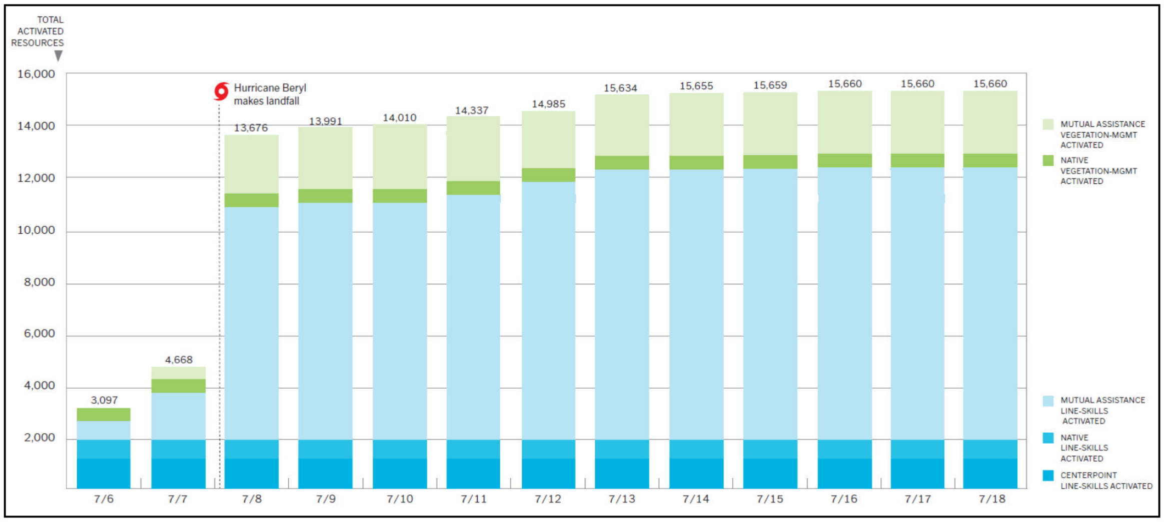
A. Hurricane Beryl

Q. WHAT ACTIVITIES DID DISTRIBUTION OPERATIONS DO TO PREPARE IN ADVANCE OF HURRICANE BERYL?

A. The Company began tracking the storm known as Invest 95L, on June 27, 2024, ten days before landfall. By June 29, 2024, the storm officially became Hurricane Beryl. While initial models showed the storm would make landfall in Mexico, on July 5, 2024, Hurricane Beryl turned northwest moving closer to the Greater Houston area. On July 7, 2024, forecasted landfall around Matagorda Bay crystalized, as did a wind field with greater damage expected over the Houston area. To prepare for landfall, CenterPoint Houston personnel contacted at least seven aggregators of line-skills and VM contract resources and two MA organizations to prepare for Hurricane Beryl. Some of the aggregators were Center Phase Energy, LLC, Collective Strategic Resources, Bird Electric Inc., and Mid-Con Energy Services Inc. The Company also reached out to Texas Mutual Assistance Group ("TxMAG") and Southeastern Electric Exchange ("SEE"). In total, CenterPoint Houston requested approximately 9,400 line skill resources, 2,800 VM resources and 1,000 damage assessment resources from external contractors.

In addition, the figure below, which is also contained in Exhibit RMP-2, shows the activation of resources by type on a daily basis.

Figure RP-3
Daily Resources Activated



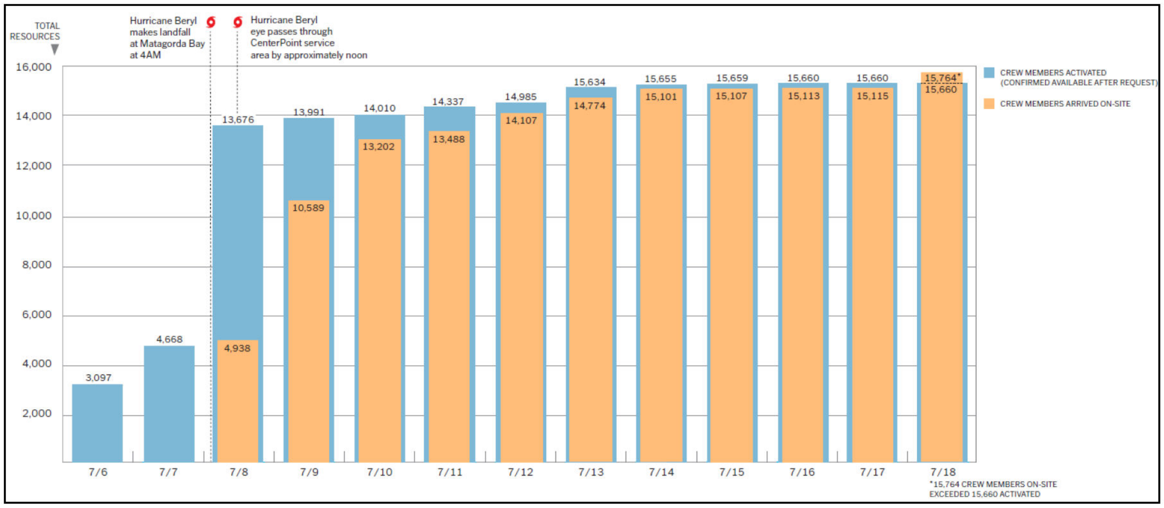
Leading up to Hurricane Beryl, the Company also did the following:

- CenterPoint Houston secured and readied 3,000 crew members and pre-positioned them safely outside of the projected path of the storm.
- CenterPoint Houston coordinated with utilities across the state to ensure resources were available across the Texas Gulf Coast region.
- As the forecast trajectory changed, the Company quickly called on additional MA resources to substantially increase crews.
- CenterPoint Houston had 15,000 poles on hand and used a little over 2,100 poles during restoration.

Q. HOW DID THE ARRIVAL AND ACTIVATION OF RESOURCES ALIGN WITH RESTORATION ACTIVITIES FOR HURRICANE BERYL?

A. As it was safe to do so, crews arrived to assist with restoration activities. The figure below, which is also contained in Exhibit RMP-2 shows the number of resources on a daily basis.

Figure RP-4
Daily Resources Arrivals



Q. DO YOU HAVE A TIMELINE THAT SHOWS THE ACQUISITION OF RESOURCES AS THE STORM APPROACHED AND PASSED THROUGH THE COMPANY'S SERVICE TERRITORY?

A. Yes. Attached to my testimony in Exhibit RMP-2 is a graphic that depicts daily requested resources during Hurricane Beryl. It was provided to the Commission in Project No. 56793.[3]

Q. PLEASE DESCRIBE HOW HURRICANE BERYL AFFECTED THE COMPANY'S SYSTEM, INCLUDING THE DISTRIBUTION GRID.

A. Hurricane Beryl made landfall as a Category 1 hurricane at 4:00 AM on July 8, 2024. By 3:00 AM that day, forecasts indicated the storm would bring significant impacts to Houston, including hurricane-force winds and heavy rain. The eyewall moved through the city throughout the morning, finally clearing around 2:00 PM.

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[3] *Issues Related to the Disaster Resulting from Hurricane Beryl*, Docket No. 56793, CenterPoint Houston's Supporting Materials for Presentation at the July 25, 2024 Open Meeting at 24 (Jul. 24, 2024).

Hurricane Beryl had a catastrophic impact on the Distribution grid, causing widespread damage. Below are photos taken in the aftermath of Hurricane Beryl that provide a microcosm of the damage and impact of vegetation to the distribution system.

Figure RP-5
Tree outside of easement causing outage

Shows the damage caused by a tree outside the easement falling onto power lines during Hurricane Beryl. The tree contacting the power lines would create an outage and restoration would require repairing multiple poles, wires, and connections to the insulators. Note the distance of the fallen tree from the electrical equipment; this tree was well outside the easement and would not have been trimmed by CenterPoint Houston because of the distance from the electrical infrastructure, yet it managed to cause outages and damage equipment.

Figure RP-6
Treetop falling into power lines

Treetop entwined with electrical cables, which would cause outages. It appears the top of the tree snapped during Hurricane Beryl and flew into the power lines. It is common during high winds for debris to be blown into power lines causing outages.

Figure RP-7
Broken poles from tree falling

Two broken poles that were damaged from falling tree sections that are now being supported by the garage roof. This damage is typical during wind events such as hurricanes.

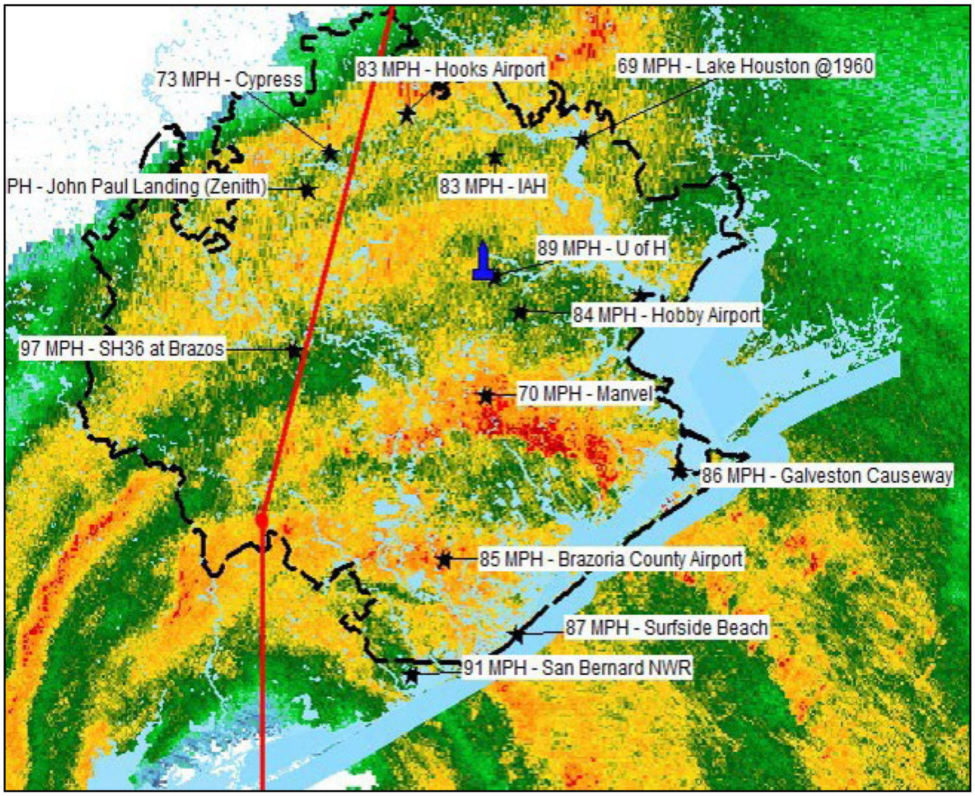
Figure RP-8
Fallen conductor in water

A crew in a boat working to collect the fallen conductor in a flooded area. The crew will then reconnect it to the existing overhead equipment to restore service. Getting access to poles and wires is a challenge during events that have flooding and significant damage.

Q. HOW DID HURRICANE BERYL COMPARE TO PRIOR HURRICANES IN TERMS OF ITS MAKE-UP AND AFFECT ON THE COMPANY?

A. The Greater Houston area has not been hit more directly by the “dirty side” of a hurricane since Hurricane Alicia in 1983. As Hurricane Beryl entered to the west side of the Service Area, this exposed the distribution grid to greater windspeeds, and additional moisture from the Gulf of America.

Figure RP-9
Hurricane Beryl Windspeeds



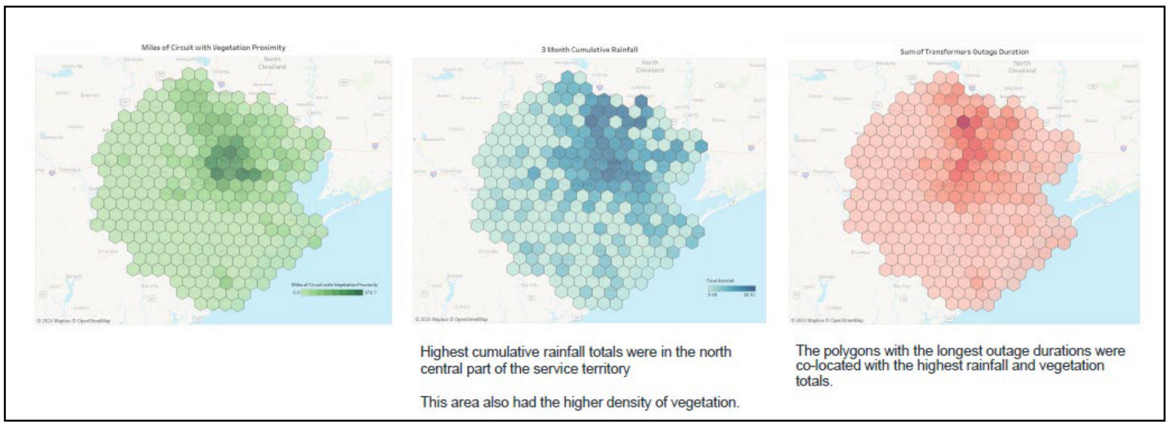
Q. WHAT PORTION OF THE COMPANY'S SERVICE AREA DID HURRICANE BERYL IMPACT?

Hurricane Beryl impacted the entire Distribution footprint, causing significant outages and widespread damage. The areas of the Company's system with the highest System Average Interruption Duration Index ("SAIDI") were Greenspoint, Bellaire, and Humble. These portions of the Company's service areas typically have more outages than other parts of the service area due to vegetation.

Q. TO WHAT EXTENT DID VEGETATION AND SOIL CONDITIONS AFFECT OUTAGES ON THE DISTRIBUTION SYSTEM?

A. The Company provided the following graphic to the Commission in a filing in Project No. 56793,[4] which illustrates the interplay between the proximity of vegetation (shown in green), the three-month cumulative rainfall (shown in blue) and the duration of transformer outages (shown in pink).

Figure RP-10
Vegetation as a Driver of Long Outages



Q. REGARDING THE COMPANY'S ANNUAL VM PROGRAMS, WAS THE COMPANY ABLE TO ASSESS THE DEGREE TO WHICH VARIOUS TYPES OF VEGETATION CONTRIBUTED TO CUSTOMER OUTAGES DUE TO HURRICANE BERYL?

A. Yes. After the hurricane, the Company compiled data identifying annual VM spending by program and feedback from personnel in the field about the nature of vegetation issues that caused damage to the system. The data in Exhibit RMP-3 shows that significant damage was due to trees and large branches falling from

[4] Docket No. 56793, Hurricane Beryl Presentation to the Public Utility Commission of Texas for the Open Meeting Scheduled for July 25, 2024 at 18 (Jul. 24, 2024).

outside the ROW and that many entire trees had to be removed in the aftermath of Hurricane Beryl to restore service. This information was provided to the Commission in Project No. 56793.[5]

Q. WHAT PORTIONS OF THE COMPANY'S SYSTEM ARE GENERALLY AT RISK IN THE EVENT OF HURRICANE CONDITIONS THAT INCLUDE HIGH WINDS?

A. Under unusually high wind conditions, transmission and distribution overhead facilities are at risk due to vegetation being blown onto power lines, flying debris colliding with overhead facilities and the risk of other structures toppling or breaking and causing damage to Company facilities.

Q. WHAT DAMAGE DID HURRICANE BERYL INFLICT ON THE COMPANY'S DISTRIBUTION SYSTEM?

A. Hurricane Beryl impacted 2.3 million customers out of the Company's approximately 2.8 million customers, which is 82% of the distribution customer base, and damaged approximately 90% of the distribution circuits causing lockouts. Further details of the outages include:

- 1,202 Distinct Circuit Lockouts;[6]
- 421 Partial Circuits;
- 2,993 Overhead Line Fuses Blown;
- 2,434 Transformer Fuses Blown;
- 940 URD Terminal Poles Blown;
- 2,150 Events* of Primary Wire Down; and
- 2,256 Events* of Secondary Wire Down.

* (a "Wire Down" Event may be multiple spans per event)

[5] Docket No. 56793, CenterPoint Houston's Supporting Materials for Presentation at the July 25, 2024 Open Meeting at 36.

[6] Circuits can lock out more than one time. There were 1,770 non-distinct circuit lockouts due to Hurricane Beryl.

For information on the damage to the transmission system, please refer to the direct testimony of Company witness David Mercado.

Q. DO YOU HAVE ANY PERSONAL EXPERIENCE WITH RESTORATION EFFORTS FOLLOWING A DESTRUCTIVE STORM SIMILAR HURRICANE BERYL?

A. Yes. I have been involved in the Company's restoration efforts following weather events such as Hurricane Ike in 2008, Hurricane Harvey in 2017, Hurricane Nicholas in 2021, Winter Storm URI in 2021, the Pasadena Tornado in 2023, and the Houston Derecho and thunderstorms in May 2024.

Q. BASED ON YOUR PERSONAL EXPERIENCE, HOW WOULD YOU COMPARE THE DAMAGE CAUSED BY HURRICANE BERYL TO OTHER STORMS?

A. Every storm is different and can have unique impacts on the distribution system. However, the damage from Hurricane Beryl was most similar to Hurricane Ike in 2008. The similarities between the two are that they were both system-wide large-scale wind and rain events that cause more than 80% of our customers to experience outages. Hurricane Ike restoration took 18 days before all customers were restored.

Q. DID HURRICANE BERYL HAVE ANY IMPACT ON THE COMPANY'S DISTRIBUTION FIELD OPERATIONS?

A. Yes. Distribution Field Operations were significantly impacted by Hurricane Beryl. Normal work activities ceased, such as new customer installations, customer service orders, facility relocations, URD installation, streetlight installations and repairs. Distribution field operations crews were transitioned to first responders or foreign crew coordinators ("FCC") to oversee MA crews working on restoration activities. Remaining distribution employees assumed their respective EOP roles. Following damage from the storms, employees were required to work sixteen-hour days, rather than a standard eight- or ten-hour day, every day until the restoration was completed and EOP was deactivated.

Q. WHAT IMPACT DID HURRICANE BERYL HAVE ON OTHER CNP PERSONNEL?

A. In addition to CenterPoint Houston employees whose efforts were necessary to respond to the aftermath of Hurricane Beryl, personnel from CenterPoint Energy Resources Corp., Vectren Corp., and CenterPoint Energy Service Company, LLC personnel were required to perform their EOP roles in support of the restoration of the system, as discussed by Company witnesses Mr. Carroll and Carla Kneipp. This included non-CenterPoint Houston employees coming from other work locations, such as Indiana, Louisiana, Mississippi, and Minnesota.

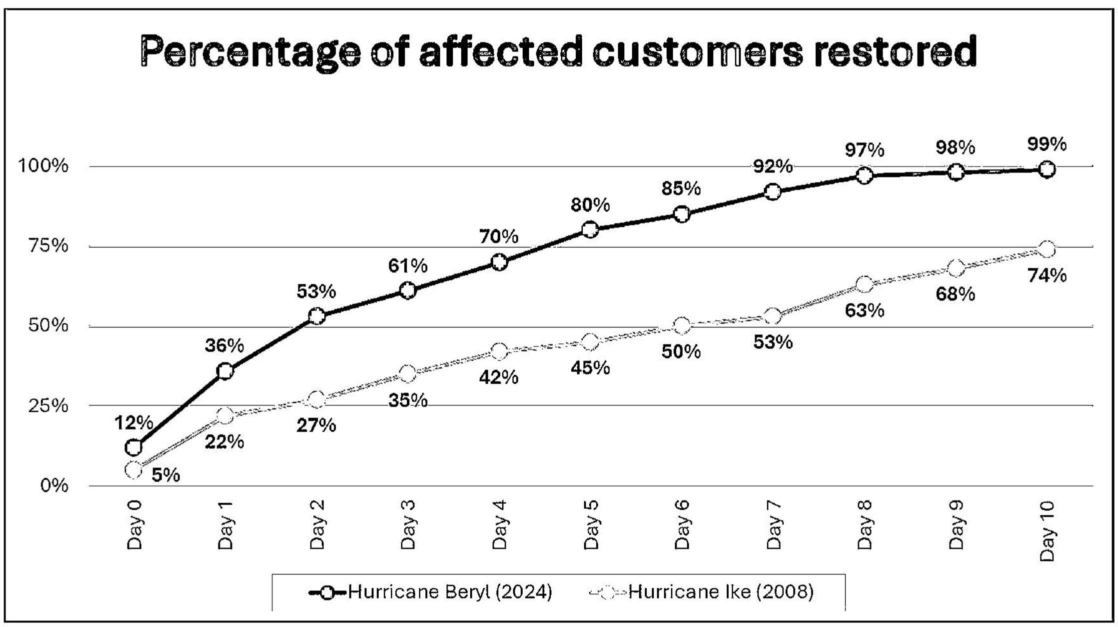
Q. WHAT WAS THE DURATION OF THE RESTORATION EFFORT?

A. Hurricane Beryl hit the service territory on July 8, 2024, and while 80% of customers were restored within six days (by July 14th), restoration was not deemed complete until July 19, 2024. The storm period began at 12:05 a.m. on July 8th and ended on July 19th at 04:25 p.m. A storm period is defined as one hour before leaving normal operations (referred to as Trouble Level 1) to one hour after returning to normal operations.

Trouble Levels vary from 1-8 and provide a summary of the distribution system condensed into a single number based on the number and types of outages and customers impacted. Hurricane Beryl reached Trouble Level 8, the highest possible level. Within 24 hours after it was safe to release crews into the field, CenterPoint Houston had restored power to more than 640,000 customers. Within 48 hours of Hurricane Beryl leaving the Company's service area, more than 914,000 customers had been restored, which represents 40% of impacted customers. By July 17, 2024, CenterPoint Houston had restored power to 98% of all customers who were able to receive service. Customers who remained without power due to Hurricane Beryl needed to fix, repair, or replace damaged weather heads or customer-owned equipment, which was approximately 55,000 customers.

For restoration percentages by each day, see the chart below, which compares the pace of restoration to the pace for Hurricane Ike.

Figure RMP-11
Hurricane Beryl and Hurricane Ike Restoration Timelines



Q. ONCE SERVICE WAS RESTORED, DID CENTERPOINT HOUSTON UNDERTAKE EFFORTS TO MAKE FOLLOW-UP REPAIRS TO ADDRESS ANY TEMPORARY CONSTRUCTION THAT WAS USED TO RESTORE SERVICE AS QUICKLY AS POSSIBLE?

A. Yes. After the system was fully restored, the Company retained line skill and vegetation professionals in addition to internal employees and native contractors, to repair follow up items and take corrective action on temporary repairs made during and immediately after the storm. Resources worked out of the Sam Houston Racetrack and Reed Road staging sites. Damage assessors created work packets, which included facility maps showing the location and type of damage where repairs are needed. Examples of the type of work that crews performed include vegetation clearance, pole replacements, straightening poles, replacing framing, and replacing wires, transformers and other devices.

Q. WERE THE COSTS FOR THE FOLLOW-UP REPAIRS CHARGED TO THE COMPANY'S DISTRIBUTION RESTORATION COSTS FOR HURRICANE BERYL?

A. Yes, costs for follow-up repairs to facilities that were damaged from Hurricane Beryl were charged to distribution restoration costs.

Q. ONCE SERVICE WAS RESTORED, DID CENTERPOINT HOUSTON ENCOUNTER A BACKLOG OF CUSTOMER-RELATED CONSTRUCTION WORK AND CUSTOMER SERVICE ORDERS?

A. Yes. In the immediate aftermath of Hurricane Beryl, the Company was focused on service restoration, which created a back log of other customer-related work, which includes new services, temporary disconnects for repairs/upgrades, disconnects for non-payment, and reconnects, among other items.

Q. WERE THE COSTS FOR THE OVERTIME WORK TO CATCH UP ON THE BACKLOG OF CUSTOMER-RELATED WORK CHARGED TO THE COMPANY'S DISTRIBUTION RESTORATION COSTS?

A. Yes, additional staff and hours were required to execute the increase in temporary disconnects and reconnect orders driven by customer damage caused by Hurricane Beryl. This allowed CenterPoint Houston to restore customers who had repaired damage to their facilities caused by Hurricane Beryl.

However, normal work activities, such as new customer installations, customer service orders, facility relocations, URD installation, streetlight installations and repair, were not charged to the Hurricane Beryl cost objects.

B. Hurricane Francine

Q. PLEASE DESCRIBE HURRICANE FRANCINE.

A. Hurricane Francine made landfall in Louisiana on September 11, 2024, as a Category 2 hurricane with maximum sustained winds of 100 mph (161 km/h). To be prepared for Hurricane Francine, the Company activated its EOC at Level 2 (discussed in Mr. Carroll's testimony) to proactively prepare for response efforts. As the storm approached and made landfall, there were no reported tropical storm windspeeds, storm surges or flooding in the Company's service territory. Although, based on the Company's experiences with prior storms, including Hurricane Beryl, the risk of damage to the Company's system due to a hurricane is serious.

Q. WHAT DID DISTRIBUTION OPERATIONS DO TO PREPARE FOR HURRICANE FRANCINE?

A. Consistent with direction from Governor Abbott's directive to the Company to ensure it had a sufficient number of pre-staged resources, which Mr. Carroll addresses, Distribution Operations monitored the storm as it approached starting on September 6, 2024, and planned for potential impacts, including the scale of impact in terms of pole failure, potential impact to critical customers, crew needs to complete restoration and prioritization of staging sites that would need to be activated.

The Company brought in non-native VM contractors and provided work orders for 2-3 days of trimming feeder laterals in addition to native contractors. In addition, line skill workers were acquired in preparation for potential outages. As the storm continued to track away from the Houston area, the Company released the line skill resources in phases before performing any work so the crews could be eligible to assist those who were impacted by Hurricane Francine. MUG monitored the situation but did not add additional personnel.

Q. DID THE STORM CAUSE DAMAGE OR OUTAGES IN THE COMPANY'S SERVICE AREA?

A. The impact to the Distribution grid was minimal. During the storm, the Distribution system remained at or below Trouble Level 2; and the customer outage percentage never got above 0.2%. This level of outages is typical for normal operations.

C. Winter Storm Enzo

Q. PLEASE DESCRIBE WINTER STORM ENZO.

A. Winter Storm Enzo was a unique winter event, with snow and ice causing major disruptions throughout the greater Houston area, including posing a threat to the Company's system.

Q. WHAT RISKS DO WINTER WEATHER CONDITIONS POSE FOR THE COMPANY'S DISTRIBUTION SYSTEM?

A. The risks to the distribution system from winter weather include the accumulation of ice and/or snow on the Company's distribution facilities, especially distribution conductors themselves, which can cause them to sag. When conductors sag, they may not maintain clearance from vegetation and come into contact, causing an outage. Also, when ice is on a conductor and unfavorable wind conditions occur, conductors may start galloping and touching other conductors, causing outages. Distribution equipment, including mechanical components, is also at risk of freezing, which can cause malfunctions. The Company performs periodic and routine inspections on certain distribution equipment to confirm the equipment will operate as intended during winter weather conditions. Finally, ice can accumulate on vegetation, including tree limbs, causing vegetation to come into contact with the Company's facilities and create outages.

Q. WHAT DID DISTRIBUTION OPERATIONS DO TO PREPARE FOR WINTER STORM ENZO?

A. Distribution Operations started participating in monitoring the storm as it approached starting on January 15, 2025, and developed a plan to respond to outages, if they occurred. The Company considered potential damages in terms of pole failures from ice accumulation and wind based on the weather forecasts as well as potential areas of impact, scale of impact in terms of pole failure and crews' needs to complete restoration.

The Company acquired additional distribution line skill workers to supplement the existing Company employees to bring the total to approximately 2,000 line skills. In addition, vegetation workers were brought in to support native VM personnel, for a total of nearly 1,000 vegetation workers. MUG monitored the approaching storm but did not bring in additional staffing. The costs associated with Winter Storm Enzo were for the preparation for potential impact; once it was determined that the Houston area would not be impacted, crews were released.

Q. DID THE STORM IMPACT THE COMPANY'S SERVICE AREA?

A. Winter Storm Enzo had a minor impact on the distribution grid. More than 99.5% of CenterPoint Houston's customers maintained normal electric service throughout the event, with crews promptly addressing scattered outages. Mr. Mercado addresses transmission issues (i.e., galloping transmission line conductors) in Brazoria and Galveston, Texas, which caused distribution loading issues requiring field switching. Three sites, NRG, Brazoria and Moody Gardens were activated, with the potential closing of the Galveston Causeway due to ice and snow. Opening a site at Moody Gardens ensured crews would be available on Galveston Island.

VI. CENTERPOINT HOUSTON'S RESTORATION PLAN AND IMPLEMENTATION FOR HURRICANE BERYL, HURRICANE FRANCINE, AND WINTER STORM ENZO

Q. WHAT WAS THE COMPANY'S DISTRIBUTION RESTORATION PLAN FOR HURRICANE BERYL, HURRICANE FRANCINE AND WINTER STORM ENZO?

A. The Company's EOP to restore service involved several steps. I will discuss the plans as they relate to distribution restoration; the structure of the Incident Command System ("ICS") organization that is utilized in the restoration; preparations made in advance of the storms; field assessments, which include initial damage assessments, aerial patrols, and field inspectors; restoration and implementation, which includes restoration strategy, resources, work management, information tracking, VM; and follow-up repairs.

Q. PLEASE DESCRIBE THE COMPANY STORM PLAN ORGANIZATION FOR DISTRIBUTION RESTORATION.

A. CenterPoint Houston follows the ICS when EOP is activated. The ICS structure used by CenterPoint Houston is a standardized approach to command, control, and coordination for system restoration. The overall structure has the Incident Commander at the top, with several officers as direct reports, such as Public Information, Liaison, Safety, Legal, and Regulatory and Governmental Affairs. The Incident Commander also reports to the Crisis Management Committee to provide updates on the restoration. I was the Incident Commander during the planning and restorations of Hurricane Beryl, Hurricane Francine and Winter Storm Enzo.

Also reporting to the Incident Commander are the Section Chiefs. For CenterPoint Houston ICS, the Section Chiefs are Operations, Planning, Logistics, and Finance. Reporting directly to the Section Chiefs are Deputy Section Chiefs and Branch Directors. Each of the Deputy Section Chiefs and Branch Directors have staff consisting of CNP employees to perform the necessary duties to support the restoration.

Q. WHAT IS THE COMPANY'S STRATEGY TO RESTORE DISTRIBUTION SERVICE FOLLOWING AN EXTREME WEATHER EVENT?

A. Restoration focuses on providing power to public safety and health facilities, as well as restoring the greatest number of customers as safely and quickly as possible. The Company identifies crews necessary to respond to outages created by the severe weather, pre-stages crews to the extent possible and then works to execute the Company's restoration strategy. The strategy focuses on the feeder-mains initially and then addresses the laterals that are out of service, or that go out when the feeder-main is re-energized. Once all feeder-main and laterals are restored, the focus is on secondary restoration, which includes transformers, secondary conductor and drops.

Q. WHAT IS THE BENEFIT OF INITIALLY FOCUSING ON THE FEEDER MAIN IN THE DISTRIBUTION SERVICE RESTORATION PROCESS?

A. The benefit of focusing on the feeder main is to restore the largest number of customers in the least amount of time. A feeder main typically serves approximately 2,500 overhead customers and must be energized before other services along that circuit can be restored.

Q. HOW WAS THE RESTORATION PLAN IMPLEMENTED AFTER HURRICANE BERYL, HURRICANE FRANCINE AND WINTER STORM ENZO?

A. The restoration plan was implemented consistent with the general plan I describe above. For Hurricane Beryl, the Company's preparation and restoration activities were scaled in proportion to the expected impact and aftermath of the storm. Hurricane Francine and Winter Storm Enzo were much smaller storms with respect to the impact on the Company's distribution system compared to Hurricane Beryl. The Company matched the level of resources to meet the expected outages. As Hurricane Francine turned eastward, the Company was ultimately not required to restore any customer outages. For Winter Storm Enzo, the Company was well-positioned to respond efficiently to the outages that occurred.

Q. HOW MANY RESOURCES DID CENTERPOINT HOUSTON UTILIZE IN THE RESTORATION OF THE DISTRIBUTION SYSTEM FOR HURRICANE BERYL?

A. In addition to the Company's internal resources, for restoration of the distribution system, the Company relied on approximately 1,500 native contractors and 13,400 MA contractors.

Q. HOW MANY RESOURCES DID CENTERPOINT HOUSTON ACQUIRE FOR THE RESTORATION OF THE DISTRIBUTION SYSTEM FOR HURRICANE FRANCINE?

A. In addition to the Company's native contractors, for restoration of the distribution system, the Company acquired approximately 700 VM resources.

In addition to the native contractors and internal resources, the Company also brought in approximately 1,500 line skill resources to support restoration related to Hurricane Francine. They arrived between September 8 and September 11, 2024, and were deactivated between September 10 and September 12, 2024.

Q. HOW MANY RESOURCES DID CENTERPOINT HOUSTON ACQUIRE FOR THE RESTORATION OF THE DISTRIBUTION SYSTEM FOR WINTER STORM ENZO?

A. For restoration of the distribution system, the Company acquired approximately 780 Distribution line skill workers and 420 VM resources in addition to native contractors and internal resources. The line skill resources began activating on January 17, 2025, and were deactivated beginning January 21, 2025. Most of the resources were released on January 21, 2025, with approximately 32 held until the morning of January 22, 2025.

Q. WHAT CHALLENGES DID THE COMPANY ENCOUNTER REGARDING THE ACQUISITION OF SUFFICIENT DISTRIBUTION LINEMEN AND VM CREWS TO AID IN THE RESTORATION EFFORTS FOR HURRICANE BERYL?

A. The Company did not encounter any challenges acquiring sufficient distribution line and VM resources other than the travel time associated with the crews' arrival following Hurricane Beryl.

Q DID THE COMPANY TRACK THE RESTORATION OF DISTRIBUTION CUSTOMERS ON A DAILY BASIS FOR HURRICANE BERYL?

A. Yes. The Company worked diligently to track the daily progress for restoration to ensure that there are adequate resources to respond safely and efficiently for our customers.

Q. HOW DID THE COMPANY TRACK THE RESTORATION OF DISTRIBUTION CUSTOMERS ON A DAILY BASIS?

A. The Incident Commander and Operations Section Chief for Distribution Operations tracked customer outages in real time, using multiple software applications, such as mobile data application, outage management, and analytics systems (IRIS). This updated insight allowed for optimized decisions on resources, customer and load impacts, and other factors.

Q. WHAT WAS THE FOCUS OF SERVICE CENTER LINE CREWS IN RESTORATION ACTIVITIES FOR HURRICANE BERYL?

A. The Service Center Line Crews were reassigned to the role of FCCs. This role is responsible for:

- Ensuring safety rules are followed by non-native crews and report any accidents;
- Overseeing time and equipment from the non-native crews;
- Distributing work orders to non-native crews and monitoring performance and quality assurance;
- Providing restoration times;
- Communicating logistics to non-native crews; and
- Overseeing switching and tagging procedures and communicating with Distribution Control Operations.

Others were assigned to logistics support at staging sites. Finally, some crews were assigned to restoration activities.

Q. WAS THE COMPANY ABLE TO UTILIZE LOCAL CONTRACT LINEMEN IN THE RESTORATION EFFORT?

A. Yes, the Company used existing agreements to have local contractors start restoration immediately. The Company often uses contractors to expedite service restoration in the event of an outage.

Q WERE THE DISTRIBUTION FACILITIES IN THE COMPANY'S MUG SYSTEM IMPACTED BY HURRICANE BERYL?

A. Yes, the MUG system was affected by Hurricane Beryl. Damage included replacing cable, splices, terminators, lightening arrestors, transformers, and other equipment. MUG equipment does have overhead exposure and can incur damage from inclement weather.

Q. DID THE MUG DEPARTMENT MAKE ANY ARRANGEMENTS PRIOR TO HURRICANE BERYL?

A. Yes, MUG added an additional night crew to ride out the time when Hurricane Beryl was making landfall to expedite restorations for the next morning once the hurricane passed through the service area and it was safe to begin restoration work.

Q. HOW WAS SERVICE RESTORED FOLLOWING HURRICANE BERYL TO LARGE THREE PHASE PAD-MOUNT CUSTOMERS SERVED FROM THE OVERHEAD DISTRIBUTION SYSTEM?

A. Crews were dispatched to three-phase customer locations that experienced outages. Crews would then assess the damage, call for materials and/or equipment and then begin restoration of service.

Q. DID THE MUG DEPARTMENT UTILIZE ANY OUTSIDE CONTRACTORS IN THEIR RESTORATION WORK FOLLOWING HURRICANE BERYL?

A. Yes. MUG utilized 24 native contract resources for assistance with restoration and commissioning mobile generation units in addition to 32 MA resources for mobile generation utilization.

Q. PLEASE DESCRIBE THE RESTORATION EFFORTS REQUIRED AFTER WINTER STORM ENZO.

A. There were limited outages typical of normal operations. Company line skill resources and native contractors were able to respond quickly to all outages. External line skill crews and VM crews were not used to complete orders.

VII. SYSTEM RESTORATION COSTS

Q. WHAT WERE THE PRIMARY COST DRIVERS OF THE SRCS INCURRED BY CENTERPOINT HOUSTON FOLLOWING HURRICANE BERYL?

A. There were four primary drivers that affected the restoration costs for Hurricane Beryl: (1) the intensity and impact of the storm; (2) certain obstacles to restoration; (3) the necessity to pay logistics and storm rates for external labor; and (4) logistical needs.

(1) The intensity of Hurricane Beryl created significant damage, mandating major resources and labor for restoration. Approximately 80% of CenterPoint Houston's service territory was impacted by the more intense, "dirty side" of Hurricane Beryl, resulting in widespread customer outages. More than 80% of customers were without power in the immediate aftermath of the storm. While the storm was reported as a Category 1, the power of Hurricane Beryl increased as it was making landfall, and windspeeds were recorded throughout the wooded Greater Houston west-side areas in ranges between 70 to 97 mph in many areas. The need to clear large amounts of vegetation and debris before restoration could begin added to the overall cost of restoration.

(2) There were several obstacles to restoration for Hurricane Beryl. During the restoration of service following Hurricane Beryl, CenterPoint Houston's employees, contractors, and MA crews encountered a wide range of challenges, including damage from trees and debris, access issues, and safety and security challenges. Many trees, including massive pine, oak, and other trees located outside of the ROW, toppled and damaged distribution lines, delaying restoration. When such lines were located in rear easements which comprise approximately 47% of distribution lines, this presented particular challenges in restoring customer services based on difficulties in accessing the easements and moving equipment and resources due to nearby structures and vegetation. Restoration personnel also encountered difficulties in accessing lines and equipment due to unattended properties with locked fences, dogs, or other barriers to entry. They also encountered some customers who refused to allow access to their properties or refused to give permission to cut down trees that had caused localized outages.

Company personnel working to restore services to customers dealt with extreme heat, and it was difficult for some MA crews from more temperate climates to adapt to the heat and maintain pace with native crews.

There were also numerous threats made against employees and crews during the restoration effort following Hurricane Beryl, including threats of gun violence. The Company informed local officials and law enforcement to make them aware of the threats and to solicit their assistance, which they provided, and which proved instrumental in keeping employees and crews safe. Additionally, the Company contracted with professional security personnel to provide additional security to field crews. However, responding to these threats took time and delayed restoration efforts. Indeed, the Company had to shut down and relocate one of its staging sites due to such threats of violence.

(3) When EOP is activated, the financial commitment to bring in non-native crews is a major driver of restoration costs. CNP is contractually committed to pay crews certain rates and hours, which are influenced by the acute need for skilled professionals to restore power quickly. Costs for these crews begin accumulating once the request for crews is initiated and crews are identified and notified for assignment. These costs also include mobilization and de-mobilization costs, as well as necessary expenses incurred by the various contractors.

(4) The costs related to the logistics activities include mobilizing and demobilizing staging sites, and sourcing items such as fuel, vehicle and equipment rentals and other supplies. In addition, Logistics provides services related to environmental, telecommunications, and facilities. Ms. Kneipp provides further information on logistics.

Q. WERE THE COSTS CENTERPOINT HOUSTON INCURRED TO RESTORE SERVICE HIGHER THAN THEY WOULD HAVE BEEN RELATIVE TO CONDITIONS WHEN THERE IS NOT A MAJOR STORM?

A. Yes. When the system is not as heavily impacted, there is not a need to have additional staff working longer hours while paying higher, contracted rates, along with the corresponding logistics costs.

Q. WHAT CAUSED THE COSTS TO BE HIGHER RELATIVE TO CONDITIONS WHEN THERE IS NOT A MAJOR STORM?

A. In order to retain the skillsets and resources to expedite restoration, the Company relies on contracts to determine the rates of pay, scope of work and work hours. These contracts include additional staffing, compensation for 16-hour days, lodging, meals, specialized equipment, and staging site mobilization and demobilization.

Q. ARE THE CONTRACTS FOR EXTERNAL RESOURCES NEGOTIATED IN ADVANCE OF A MAJOR WEATHER EVENT?

A. Yes. Ms. Kneipp addresses this issue in her direct testimony.

Q. DID THE COMPANY ACT PRUDENTLY IN ACQUIRING RESOURCES TO RESTORE SERVICE TO CUSTOMERS?

A. Yes. Prior to and as Hurricane Beryl entered and impacted the service territory, the Company began determining and securing the number of resources needed based on customer outage counts, impacted circuits and outage cases. As the weather and customer impact forecasts for Hurricane Francine and Winter Storm Enzo developed, the Company also began evaluating the resources needed to prepare for customer outages and impacted circuits. The Company leveraged existing contracts with native contractors, aggregators and MA groups to provide the necessary incremental line skill and vegetation resources.

Q. WHAT ARE THE DISTRIBUTION-RELATED SRCS THAT CENTERPOINT HOUSTON INCURRED FOR HURRICANE BERYL, HURRICANE FRANCINE AND WINTER STORM ENZO?

A. CenterPoint Houston has incurred approximately $909 million in distribution costs due to Hurricane Beryl, Hurricane Francine, and Winter Storm Enzo, which are the costs discussed in my testimony. Company witness Russell Wright addresses these and other restoration costs in more detail in his direct testimony and explains how these costs were validated and functionalized. In addition, Mr. Mercado discusses transmission-related costs, and Ms. Kneipp discusses logistics and other support costs. The table below provides the distribution-related SRCs.

Distribution-Related Incurred System Restoration Costs (millions)						
	Beryl		Francine		Enzo	
Payroll	$	57.7	$	0.1	$	4.1
Contract Services		802.4		19.0		25.9
Total Incurred SRCs	**$**	**860.1**	**$**	**19.1**	**$**	**30.0**

A. Payroll Costs

Q. WHAT IS INCLUDED IN THE PAYROLL AMOUNT?

A. The Payroll category includes the cost for CenterPoint Houston internal employees and includes contracted premium pay for employees based on their extended work hour assignments. This cost includes labor, associated overhead, payroll taxes and benefits.

Q. TO WHAT EXTENT DID THE COMPANY RELY ON THE NON-LINE RESOURCES OF CENTERPOINT HOUSTON TO ADDRESS THE IMPACTS OF EACH WEATHER EVENT?

A. There are many roles that the Company relied on in addition to the line skill resources. CenterPoint Houston employees performed their EOP roles and supported the restoration activities of the line skill and vegetation resources. General examples include but are not limited to, Damage Assessors, Crew Spokespersons, Staging Site Staff, Data Analysts, Safety Professionals, Financial Analysis and Reporting. For Hurricane Francine and Winter Storm Enzo, the Company did not have a need to utilize many non-line resources. For more information on the roles during an EOP event, refer to Company witness Mr. Carroll's direct testimony, which includes a copy of the Company's EOP.

Q. WHAT ARE THE BENEFITS OF USING CENTERPOINT HOUSTON EMPLOYEES AND NATIVE CONTRACTORS FOR SYSTEM RESTORATION?

A. Company employees and native contractors have undergone training in system processes, procedures, tools and equipment, and have direct contact with Distribution Controllers. By using Company employees and native contractors, and then supplementing them with MA crews, the restoration time is reduced.

Q. WERE THE DISTRIBUTION COSTS FOR INTERNAL LABOR REASONABLE AND NECESSARY?

A. Yes, the costs for internal labor were reasonable and necessary. Without internal labor, the Company would not have been able to complete the restorations in the timeframes it did or support the MA crews. Internal employees were compensated according to pre-negotiated union contracts and established Company policy.

B. Contract Services Costs

Q. WHAT IS INCLUDED IN THE CONTRACT SERVICES COST CATEGORY OF DISTRIBUTION EXPENSES?

A. This category includes the cost of MA and other contractors, both native and non-native, including construction services and VM contractors that restored service to the distribution system following Hurricane Beryl. For Hurricane Francine, the Company incurred MA costs to prepare for the impact of the storm. For Winter Storm Enzo, the Company incurred costs for MA and other contractors in preparation for the weather event.

Q. WHAT TYPES OF WORK DID CONTRACTORS PERFORM RELATED TO DISTRIBUTION RESTORATION ACTIVITIES?

A. For Hurricane Beryl, line skill contractor work included equipment replacements, such as poles, wires, transformers, crossarms/framing, fuses, and other miscellaneous material. Vegetation contractor work includes removing vegetation, such as tree limbs, vines, or fallen trees on electrical equipment that allows the line skills to complete their work. The contract costs include the labor, specialized equipment and tools, and miscellaneous materials necessary to perform the work required to restore service to customers.

For Hurricane Francine, the line crews were activated and were prepared to perform work similar to Hurricane Beryl. Once it was determined that the outages could be resolved with internal crews and native contractors, the non-native line skill contractors were released. Non-native VM crews were activated and completed work for 2-3 days before they were released.

For Winter Storm Enzo, non-native line skill crews were activated and on stand-by. However, the Company responded to all outages with internal employees and native contractors. Once it was determined they were not needed, the non-native line skill crews were then released. Non-native VM crews were also activated and prepared to work, but the volume of work allowed native contractors to respond to all orders. The non-native vegetation crews were then released.

Q. IS CENTERPOINT HOUSTON A MEMBER OF A REGIONAL MA GROUP?

A. Yes. CenterPoint Houston is a member of three regional MA groups, including TxMAG, SEE and Midwest Mutual Assistance Group (MMAG). For the Hurricane Beryl restoration, CenterPoint Houston requested MA crews from both TxMAG and SEE, as well as contacting native and aggregator line skill and vegetation companies. The Company also coordinated with other impacted utilities on the release of their acquired response resources for vegetation and distribution-line assistance to ensure that all Texas service restoration needs were met before releasing crews. In total, approximately 18,000 internal employees, contractors and MA skilled resources assisted with distribution restoration after Hurricane Beryl.

For the preparation of Hurricane Francine and Winter Storm Enzo, CenterPoint Houston did not use the formal MA process to request crews. Aggregator companies were contacted instead.

Q. HOW MANY CONTRACTORS, BOTH NATIVE AND NON-NATIVE, DID CENTERPOINT HOUSTON USE TO OBTAIN LINE RESOURCES?

A. CenterPoint Houston utilized resources from multiple native, aggregators and MA groups. Approximately 42 different contract companies representing the aforementioned groups from 28 states responded to assist in restoration activities following Hurricane Beryl. For Hurricane Francine, approximately 27 different native and non-native contract companies were activated, and for Winter Storm Enzo, approximately 20 different native and non-native contract companies responded.

Q. DID LINE CONTRACTORS AND MA LINE RESOURCES PROVIDE BUCKET TRUCKS AND OTHER VEHICLES TO SUPPORT THEIR LINE WORK?

A. Yes. Line skill contract resources were responsible for bringing their own equipment, such as bucket trucks, diggers, and other vehicles, as well as specialized equipment, such as easement machines, track equipment, and tools necessary to perform their work.

Q. DID NON-NATIVE VEGETATION CONTRACTORS AND MA RESOURCES PROVIDE BUCKET TRUCKS AND OTHER VEHICLES TO SUPPORT THEIR WORK?

A. Yes. Vegetation contract resources were responsible for bringing their own equipment, such as bucket trucks and other vehicles, as well as specialized equipment, such as easement machines, chippers, and tools necessary to perform their work.

Q. ARE THE CONTRACT SERVICES COSTS REASONABLE AND NECESSARY?

A. Yes. Securing the appropriate number of line skills, vegetation, damage assessors, professional, and support resources, along with the necessary tools and equipment is critical to provide safe and timely restoration of service to customers. Contracts are negotiated and secured prior to storm season so that resources can be obtained quickly and efficiently. Internal resources receive annual training on their EOP assignments so that they are trained and ready to respond, if necessary. The number of resources requested for each of these storm events was determined by factoring the number of customer outages, circuits impacted and outage cases that were generated. Approximately 14,500 people working under contracts contributed to the Company's restoration efforts following damage from Hurricane Beryl.

VIII. MAY 2024 EOP STORMS DISTRIBUTION-RELATED SRCS

Q. WHY DOES THIS FILING INCLUDE DISTRIBUTION-RELATED SRCS FROM THE MAY 2024 EOP STORMS?

A. In the settlement agreement the Commission approved in Docket No. 57271, to address the parties' positions regarding pole replacement and feeder damage costs, the Company agreed to defer $17,500,000 of requested distribution-related SRCs for the May 2024 EOP Storms to a future regulatory proceeding.[7] For this reason, the Company has included these distribution-related SRCs from the May 2024 EOP Storms in this case. Company witnesses Derek HasBrouck and Mr. Wright also address these costs in their direct testimonies.

[7] Docket No. 57271, Stipulation and Agreement; Docket No. 57271, Final Order (Apr. 24, 2025).

Q. BRIEFLY DESCRIBE THE ISSUES RELATED TO THE $17.5 MILLION AMOUNT.

A. In Docket No. 57271, Houston Coalition of Cities ("HCC") witness Michael Ivey claimed that the Company's Pole Life Extension Program and the Feeder Inspection Program left the distribution system weakened and susceptible to storm damage.[8] Mr. Ivey recommended a 20% reduction in pole replacement and damage costs and, together with his position on the Company's Feeder Inspection Program, proposed that $84.8 million in costs be disallowed.[9] On pole inspection issues, Mr. Ivey took the position that the Company's distribution wood poles were not being inspected frequently enough consistent with his position on applicable industry recommendations. Regarding the Feeder Inspection Program, he asserted the Company does not follow industry best practices, which he asserts leaves the distribution system vulnerable to storm damage and criticized the Company's feeder inspection practices.

Q. DO YOU AGREE WITH MR. IVEY'S POSITIONS ON THESE ISSUES?

A. No. The Company relies on standard maintenance practices that have been in place for a long time and that the Company's regulators, both at the Commission and the municipal level, have previously found to be prudent. Mr. Ivey did not identify specific problems with the Company's restoration efforts. Instead, he speculated that the damage to the distribution system might have been less severe if the Company followed his more aggressive schedules related to pole treatment and

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[8] Docket No. 57271, Direct Testimony of Michael E. Ivey at 6:1-16 (Jan. 3, 2025).

[9] *Id.* at 27:18-21.

feeder inspection. He presented no evidence to support his conclusion that treated poles or feeders were major drivers of the distribution-related SRCs in Docket No. 57271. The Company's Pole Inspection Program is consistent with industry standards and other utilities. Mr. Ivey failed to identify several key points about the Company's Pole Life Extension Program, as identified by an outside consultant that provided an independent assessment of the pole program, which I have attached to my testimony as Exhibit RMP-4.

A. Pole Life Extension

Q. PLEASE DESCRIBE THE COMPANY'S POLE LIFE EXTENSION PROGRAM AND RELATED ACTIVITIES.

A. As I described previously in my testimony, the Company's Pole Life Extension Program is a proactive inspection of distribution feeders and laterals ensuring a portion of the Company's distribution system poles and equipment are assessed annually to identify and correct issues that could impact its reliable operation. Program inspections include a visual and/or manual pole assessment. Visual pole assessments are comprised of field observations for evidence of exterior decay or damage above the ground line. Poles are manually excavated and assessed for decay below the ground line, as well as sounded and bored to locate internal voids. Poles of sufficient strength to remain in service until the next scheduled assessment are treated and tagged. Poles that are identified for reinforcement during these assessments are either treated (with a fumigant or preservative, as necessary) and braced, or replaced.

The Pole Life Extension Program also includes visual assessment of pole mounted facilities, guy wires, including checking for guy wires that are damaged, broken, frayed or slacking, and assessment of guy strains and anchors. Damaged or broken facilities are identified, reported, and work orders are created to repair any issues accordingly.

Q. WOULD A SHORTER INSPECTION CYCLE HAVE PREVENTED OUTAGES DUE TO THE MAY 2024 EOP STORMS?

A. No. The Company's data and experience during the May 2024 EOP Storms restoration does not support Mr. Ivey's claim that if the Company was on an eight-year pole inspection program, many of the outages following the May 2024 EOP Storms could have been prevented. The information the Company collected during damage assessments and restoration activities simply does not support an argument that there was widespread damage to the system or outages due to the Company's inspection activities. After reviewing all 154 events that required pole replacements due to the May 2024 EOP Storms, there were only three events where the crews reported a rotten pole. In contrast, of these 154 events, there were 32 events where the crews entered tree removal or tree clearing into the comments section of Mobile Data, and the vast majority of the remaining events were due to strong winds and tornadoes.

Q. WHAT IS THE TIMING OF THE COMPANY'S POLE LIFE EXTENSION PROGRAM?

A. At the time the May 2024 EOP Storms struck the Company's service territory, CenterPoint Houston inspected distribution wood poles on a 10-year cycle. In addition, thousands of poles are inspected annually in addition to the Pole Life Extension Program. This work is done in the course of day-to-day activities when routine work is performed. Both internal and contract crews are instructed to test the pole(s) while performing work and service consultants also verify pole strength when designing planned work for new and existing customers. In 2025, the Company has moved to an 8-year inspection cycle in an effort to implement measures to become the most resilient coastal utility in the country.

Q. WAS THE USE OF A 10-YEAR INSPECTION CYCLE REASONABLE AT THE TIME OF THE MAY 2024 EOP STORMS?

A. Yes. The Company used a 10-year cycle in the Pole Life Extension Program based on Company experience and related data. The 10-year frequency has a reject rate that is less than the industry average of similar 8-year or 10-year programs, which I will illustrate below. The pace of the inspection cycle is also balanced with the cost of the program and available resources to conduct the work. Osmose previously reviewed the Company's program and did not recommended changes to the 10-year cycle. The frequency in place at the time of the May 2024 EOP Storms provided a reasonable balance of inspections, reliability, and cost, and was in line with other similar utilities.

Q. DOES A 10-YEAR INSPECTION CYCLE FOLLOW INDUSTRY STANDARDS?

A. Yes. The Company engaged Nelson Research to perform an analysis related to the Company's wood pole asset management. This independent assessment was performed by Nelson Bingel, a utility expert with over 36 years of electric utility experience. Nelson Research issued a report on July 22, 2024, in which it concluded that the Company's wood pole assessment and inspection practices are

"Best in Class." In the executive summary, Mr. Bingel concluded, "The groundline assessment, maintenance, and restoration programs are all about retaining as much of the original structural strength and resiliency as possible, preventing future degradation, and restoring strength to decayed poles. These CenterPoint Houston programs accomplish that to a very good degree."[10] A copy of the Nelson Research report is provided as Exhibit RMP-4 to my direct testimony.

In his testimony in Docket No. 52721, Mr. Ivey argues that a 10-year inspection is not industry standard. I question the credibility of the industry standards Mr. Ivey relied on in his testimony. The RUS Bulletin 1730B-121, "Pole Inspection and Maintenance" report is from 2013. The "Wood Pole Survivor Rates by Decay Hazard Zone Initial Inspection vs. Recycle Inspection" from Thomas Pope Utilities Division – Osmose, Inc. addresses analysis from 1999 based on data from 1988 – 1999. The reports that Mr. Ivey relies on are outdated.

Q. IF A 10-YEAR INSPECTION CYCLE FOLLOWS INDUSTRY STANDARDS, WHY DID THE COMPANY MOVE TO AN 8-YEAR INSPECTION CYCLE STARTING IN 2025?

A. Because the Company believes that to become the most resilient coastal utility in the country, it must adopt some standards that are higher than the industry's standards similar to utilities in Florida.

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[10] *See* Exhibit RMP-4 at 6-7.

Q. PLEASE EXPLAIN THE ANALYSIS NELSON RESEARCH CONDUCTED TO ANALYZE THE COMPANY'S ASSESSMENT AND INSPECTION PROCESSES.

A. In Section VIII of the report, Mr. Bingel breaks down the components of the Pole Life Extension Program and scores them. Mr. Bingel states, "The [CenterPoint Energy] assessment/inspection program is the best in class as all the following steps are incorporated right up to full excavation."[11] Specifically, Mr. Bingel analyzed the Company's visual assessment, sounding assessment, and boring assessment practices. For the Company's Wood Pole Assessment/Inspection activities, the report concludes that the Company's "specification for wood pole assessment calls for all of the steps above to be completed during the assessment. This is **Best in Class**, especially when full excavation is included. There is no instrument or tool that can be added to the assessment process that will improve the efficacy of the assessment."[12]

The report also addresses the materials the Company uses to extend the lives of poles and concludes that the External Preservative Paste Application and Internal Void Preservative Treatment are "Best in Class," while recommending that a newer fumigant be used to support the 10-year inspection cycle. The report also rates the Company's preservative application as Best in Class as well, and states "CenterPoint's practice of full excavation whenever possible and applying MP-500 external past is Best in Class."[13]

[11] *Id.* at 16.

[12] *Id.* at 20 (emphasis in original).

[13] *Id.* at 21.

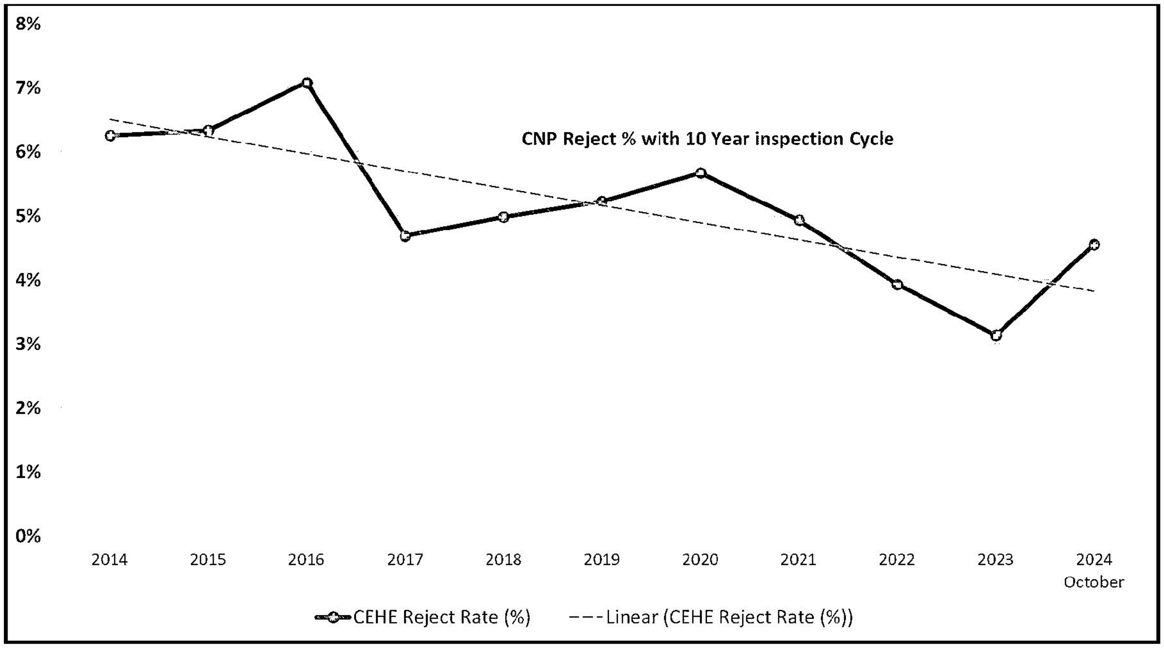
Q. ARE THERE OTHER ASPECTS OF THE NELSON REPORT THAT SUPPORT THE COMPANY'S APPROACH TO POLE ASSET MANAGEMENT?

A. Yes. The report notes the Company adopted National Electrical Safety Code Rule 250C related to Extreme Wind (and Rule 250D related to Extreme Ice with Concurrent Wind Loading, which is not applicable to the May 2024 EOP Storms). The Company has been following that standard since 2022. Significantly increasing the wind and ice loading ability of the Company's poles is considered "Best in Class." The Nelson Report also considers the following practices to be "Best in Class": requiring Class 2 as the minimum wood pole class on feeders; increasing the embedment depth for heavy load class wood poles and installing pole toppers and groundline preservative wrap on new pole installations.

Q. SHOULD THE COMPANY BE TARGETING A LOWER REJECT RATE FOR DISTRIBUTION POLES, AS MR. IVEY CONCLUDED?

A. No. Relying on the Osmose report from 1999, Mr. Ivey concludes that the Company has a history of high pole reject rates. The Company's pole reject rates have followed a distinct downward trend of the rate of reject poles since 2014, as shown below. This trend illustrates the efficacy of the Company's Pole Inspection Program at the current process and pace.

Figure RMP-12
CenterPoint Houston Reject Rate for Poles Inspected



In addition, the Company was able to get high-level data from Osmose showing reject rates for other utility companies showing the different cycles counts, reject rates, and inspection cycle frequencies.[14] The variance of reject rate for four of the companies despite being on the same 10-year cycle is shown below.

Company	Cycle #	Reject Rate	Cycle Period (years)
A	Third	3.5% for Primary Poles	10
A	Third	9% for Secondary Poles	10
B	First	14%	10
C	Sixth	0.30%	10
D	Third	2.90%	8
E	First	9%	10

Based on the data above, the average reject rate is approximately 7%, which is higher than the Company's reject rate. In addition, Company D follows an 8-year

[14] A "primary pole" is a larger pole used for feeder main and supports voltages of 12 kV and 35 kV, and a "secondary pole" is a smaller pole that is used to carry secondary voltages of 120 V or 240 V to the customer's point of service. Because secondary poles are smaller than primary poles, decay affects a secondary pole faster than a primary pole, which is reflected in the higher reject rate for secondary poles.

inspection period, yet its rejection rate is 2.9%, which is higher than the 1-2% rejection rate Mr. Ivey recommends the Company target.

Q. IS THERE A LINK BETWEEN POLE REJECT RATES AND SPECIFIC DAMAGE TO THE COMPANY'S SYSTEM FROM THE MAY 2024 EOP STORMS?

A. No. As I noted previously, the damage assessment reports from the field identify vegetation damage to the Company's poles and do not identify major groundline failures or decaying poles as causes of pole damage. Mr. Ivey provided general testimony about pole inspection cycle periods and pole reject rates and then speculated that the Company's poles are not being adequately maintained and there was an increase in poles with excessive decay and decreased pole strength. But, he made no correlation between his general statements and the actual damage to the Company's poles due to the May 2024 EOP Storms.

B. Feeder Inspections

Q. WHAT ARE THE COMPANY'S FEEDER INSPECTION PRACTICES?

A. The Company inspects the worst performing circuits based on reliability metrics and data-driven decisions. Crews also inspect feeders as they perform daily work, and service consultants also inspect when out in the field.

Q. ARE THE COMPANY'S FEEDERS INSPECTED REGULARLY?

A. Yes. The Company inspects distribution feeders more often as part of the Pole Life Extension Program, on a 10-year cycle. In addition, the Company inspects feeders "as-you-go" for outages, and based on outages, customer concerns, and new projects.

Q. DOES THE COMPANY ONLY INSPECT THE "WORST 10% OF ITS FEEDERS"?

A. No. Mr. Ivey took the position in Docket No. 57271 that the Company only inspects feeders that fall into the group of the worst 10% of feeders. The table below shows the number of overhead circuits on the Company's "Worst Performing Circuit" list in the last three years and data related to circuits that locked out during the May 2024 EOP Storms.[15]

635	Unique Circuits on Worst Performing Circuit List 2022-2024
628	Unique Circuits that Locked Out During Either Derecho or May 28th Storms
286	Circuits on Both Lists

CenterPoint Houston has approximately 1,675 overhead feeders. Inspecting 635 feeders within the previous three years represents inspecting 38% of the distribution feeders on the system. Mr. Ivey's claim that over 90% of the system is not included in the feeder inspection program is, therefore, obviously incorrect.

Q. WHAT CAUSED CIRCUITS TO LOCK OUT DURING THE MAY 2024 EOP STORMS?

A. Circuits lock out for reasons outside the Company's control such as vegetation, interactions with animals, and foreign debris. The potential for lockouts is even higher when there is a major weather event such as the Houston Derecho or the May 28th Storms. The Company's feeder inspection program can only address factors within the Company's control such as material type, installation practices and standards, and clearing vegetation within the easement. Natural disasters

[15] *See* WP RMP-2

inevitably create circumstances outside the Company's control that can cause circuit outages, which is what happened during the May 2024 EOP Storms.

Q. ARE SAIDI AND SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX ("SAIFI") METRICS APPROPRIATE TO MEASURE THE DAMAGE IN THE MAY 2024 EOP STORMS?

A. No. The damage to the Company's distribution system during the May 2024 EOP Storms was largely due to vegetation and other debris falling on the Company's distribution poles and wires. Mr. Ivey focused on generalized reliability metrics data instead. While SAIDI and SAIFI metrics are informative for measuring reliability in general, Mr. Ivey uses that data to speculate about the causes of storm damage. Each year, the Company inspects 10% for each of the SAIDI and SAIFI metrics, which results in a review of up to 20% of the circuits annually. This shows that the Company inspects more than 10% of its distribution feeders per year, contrary to Mr. Ivey's claims in Docket No. 57271.

Q. IS THE $17.5 MILLION RELATED TO POLE INSPECTION AND FEEDER ISSUES REASONABLE AND NECESSARY DISTRIBUTION-RELATED SRCS?

A. Yes. My testimony, along with the testimony of Mr. HasBrouck, shows that the Company's practices are reasonable and consistent with industry standards. HCC did not present any evidence that directly ties damage to the Company's distribution system during the May 2024 EOP Storms to the Company's pole inspection and feeder practices.

Mr. Ivey provides generalized testimony regarding inspection activities based on outdated standards compared to the recent assessment of the Company's activities that is attached to my testimony. In addition, his testimony does not tie the types of pole deficiencies he addresses to actual damage to the Company's distribution poles as a result of the May 2024 EOP Storms. In addition, he claimed that the equipment on the feeder was weakened because a significant portion of the system does not get inspected.[16] His analysis of feeders inspected was flawed, and he did not consider the root cause of the circuit lock outs during a major storm event such as occurred during the May 2024 EOP Storms.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

[16] Docket No. 57271, Direct Testimony of Michael E. Ivey at 27:11.

CenterPoint Energy Houston Electric, LLC Operations Timeline of Activities

-7 to – 6 days
- Confirm Operations team availability
- Review Staging Site and Service Center Rosters
- Initiate final review of employee emergency contact info
- Ensure underground fuel tanks at each location are full
- Begin pole pickup for jobs in field
- Focus internal crew activity on out of service devices
- Confirm satellite phones are operational
- Review circuit prioritization

-5 days
- Initiate Mutual Assistance calls
- Hold management calls to discuss EOP plans, expectations, and reporting functionality
- Begin securing service centers(debris, equipment, dumpsters)
- Discuss evacuation plans for coastal locations
- Identify FCC's and review training line skills
- Review cut and clear and back-feeding SOP with internal and external resources

-4 days
- Cancel employee vacation
- Conduct operations conference call to determine prep progress
- Make hotel reservations
- Purchase day "0" food/water for storm riders and/or ensure S/C food pallets are delivered
- Communicating with local cities and the S/C level
- Ensure non-perishable items are sufficient
- Communicate with onsite contract resources

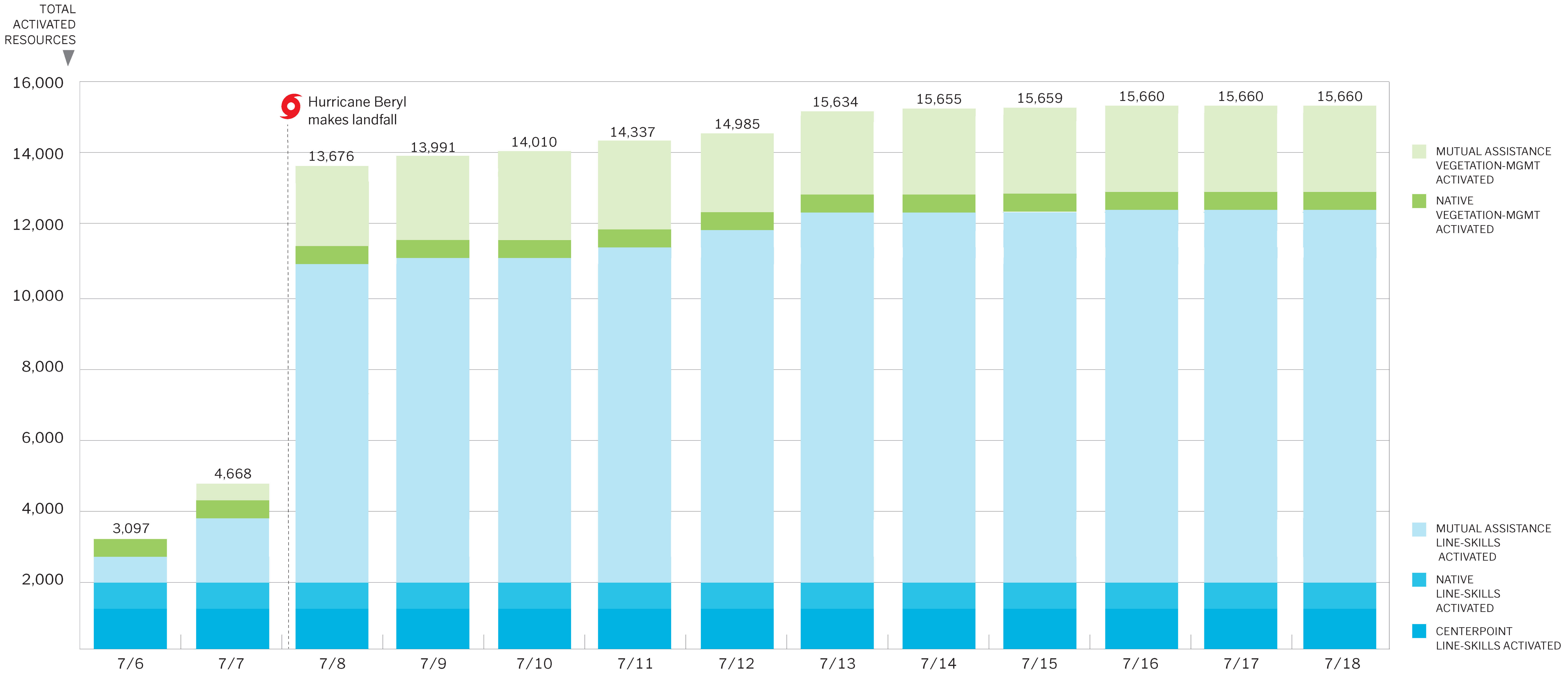
-3 to -2 days
- Determine initial staging sites and update logistics
- Coordinate with facilities to board up coastal centers
- Rotate select crews to prepare families/homes
- Begin moving fleet, equipment, materials to higher ground / inland
- Coastal S/C evacuation decision
- Confirm availability of spare laptops
- Update cyber keys
- Ensure handheld radios are available

-1 days
- Participate in Regional Mutual Assistance Division conference call
- Secure Mutual Assistance resources day -2 or -1 for pre-staging
- Suspend normal operations
- Initiate rotating 16-hour shift schedule and put night crews and critical operations personnel in place
- Update hotel reservation counts

Storm Day
- Prepare for incoming employees and cut and clear process
- Monitor the system impact and begin prioritizing circuit level outages
- Preparing for initial storm conference call and the timing

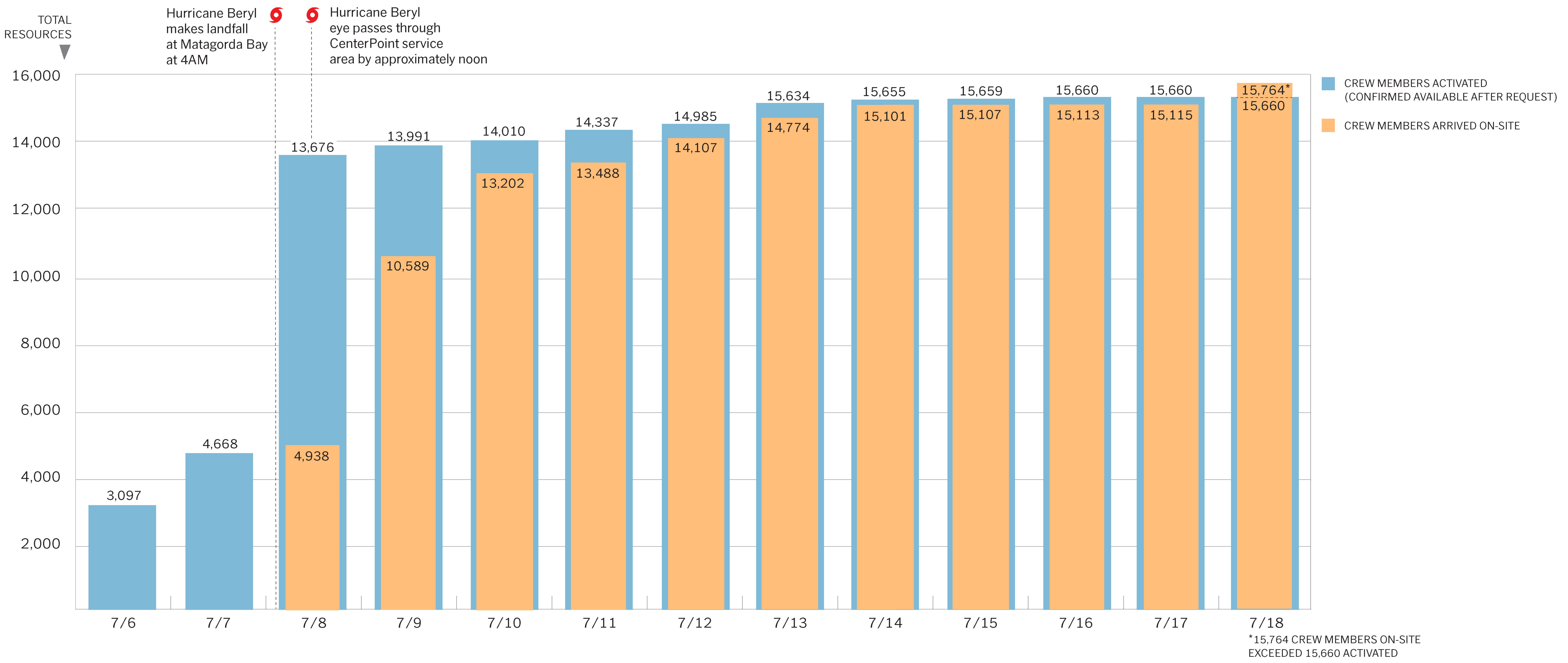
Day 1
- Evaluate the need to expand staging sites
- Initiate damage assessment and cut and clear procedures
- Appropriately staff contract resources across system to initiate cut and clear
- Confirm staging site & S/C needs
- Facilities/fleet damage assessment
- Establish Operations conference call cadence
- Facilitate onboarding of MA crews
- Confirm safety, well-being and availability of all personnel

Daily Resources Activated



FIGURES ARE NOT FINAL AND ARE SUBJECT TO REVIEW

Daily Resources Arrivals



FIGURES ARE NOT FINAL AND ARE SUBJECT TO REVIEW

Mutual Assistance/Work Resources

July 6

CenterPoint activated its **internal resources** (line skills: 1,131; damage assessment: 210) and **native-contractor resources** (line skills: 740; vegetation management: 501) to report at 6:00 am on 7/8.

Hurricane Beryl makes landfall 4AM (July 8)

July 2 | July 3 | July 4 | July 5 | July 6 | July 7 | July 8 | July 9 | July 10 | July 11 | July 12 | July 13 | July 14

July 2 through July 8
CenterPoint personnel contacted at least seven aggregators of line-skills and vegetation-management contract resources (*e.g.*, Center Phase Energy, LLC, Collective Strategic Resources, Bird Electric, Inc., Mid-Con Energy Services Inc.) and two mutual assistance organizations (Texas Mutual Assistance Group and Southeastern Electric Exchange) to prepare for Beryl.

July 6 through July 14
CenterPoint personnel requested 9,388 line-skills resources, 2,837 vegetation-management resources, and 1,000 damage-assessment resources from external contractors.

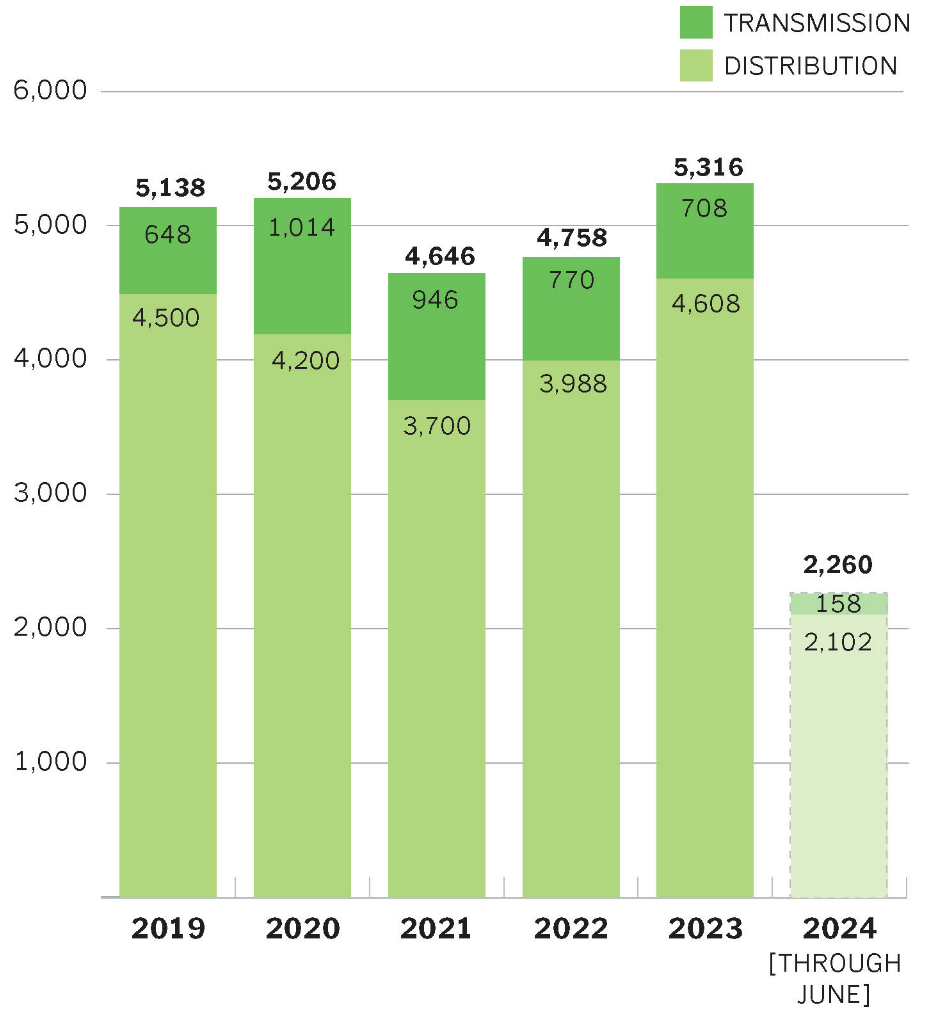
CenterPoint requested over 94% of those resources by 7/8

	July 6	July 7	July 8	**TOTAL** (JULY 6-8)
LINE SKILLS RESOURCES REQUESTED	2,787	2,502	3,626	**8,915**
VEGETATION MANAGEMENT RESOURCES REQUESTED	0	594	1,928	**2,522**
DAMAGE ASSESSMENT RESOURCES REQUESTED	0	400	600	**1,000**

FIGURES ARE NOT FINAL AND ARE SUBJECT TO REVIEW

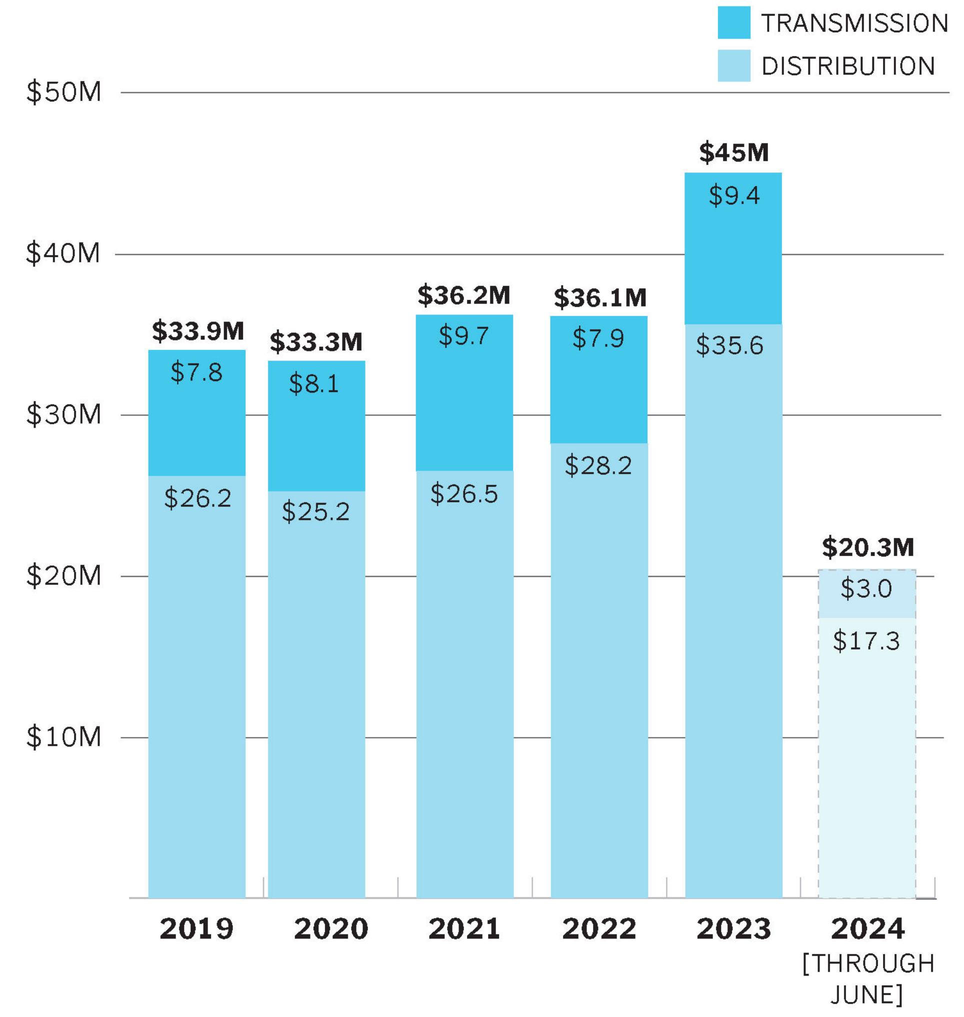
Vegetation Management

Proactive Miles Trimmed



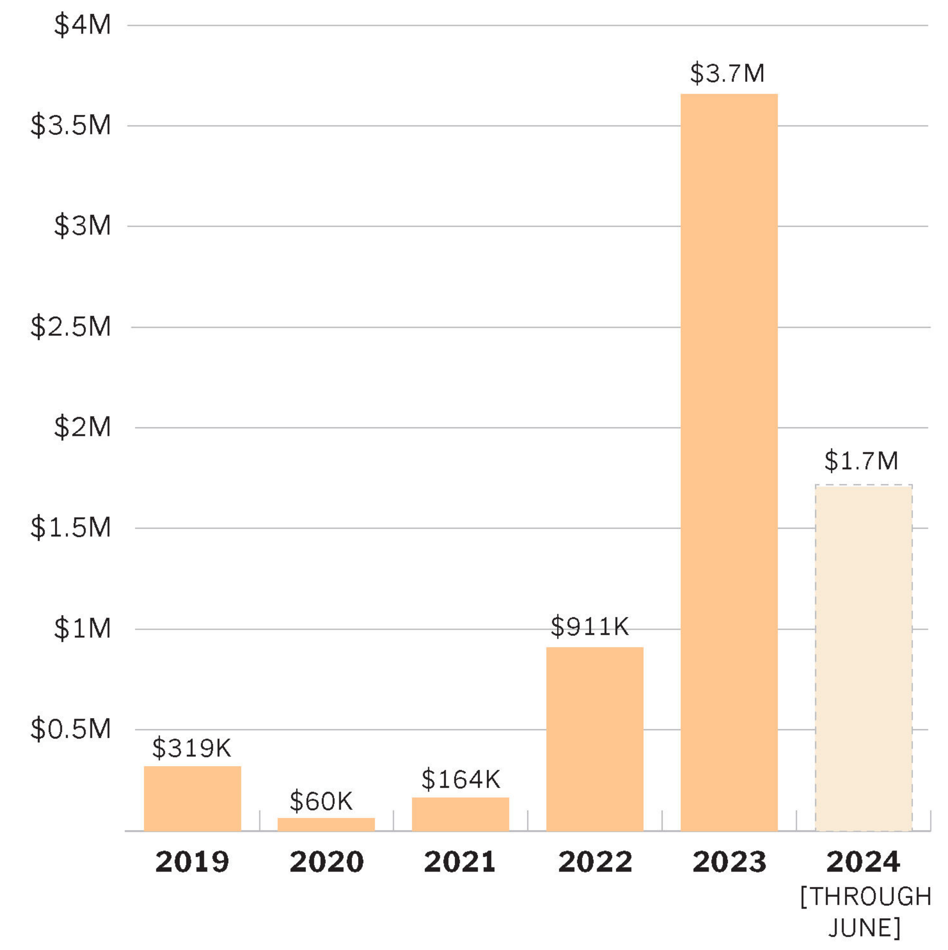
- Each year, CenterPoint proactively plans to trim at least 3,500 miles of overhead distribution lines, in addition to reactive tree trimming, proactive tree hazard removal, and restoration. It scores circuits based on a combination of time and reliability impact. The highest scoring circuits are trimmed first. Additionally, circuits with vegetation putting them at risk of 300% worse than CenterPoint's system SAIDI/SAIFI average or among the 10% worst-performing circuits are also trimmed.
- CenterPoint trims transmission circuits on a five-year cycle.
- Tree trim clearances minimum of 7' laterally for 12 kV and 12 kV narrow voltages and minimum of 10' laterally for 35 kV. Tree trim clearances minimum 15' below primary conductor for all voltages.

Cost of Scheduled Vegetation Maintenance



- CenterPoint inspects and proactively trims rights of way based on the reliability of each circuit and each circuit's trim cycle.

Cost of Hazardous Tree Removal Program



- CenterPoint operates a separate program to inspect, and identify, and proactively remove potentially hazardous trees showing stress outside of the easement with the landowner's consent. CenterPoint patrols high-risk areas to identify trees that are at risk of falling on circuits. Importantly, CenterPoint cannot force a landowner to remove a potentially hazardous tree, and does not identify or remove healthy trees that could impact circuits.
- Between 2021 and 2023, the Houston area experienced drought and extreme cold, resulting in an abnormally large amount of trees outside the easement needing to be removed. CenterPoint spent $3,660,247 on such removals compared to the budgeted $523,000.

Initial Feedback from the Field on Vegetation and Hurricane Beryl

- The damage found by vegetation management crews during the storm indicates that significant circuit damage came from trees and large branches falling from outside the right of way.
- One of the largest vegetation management providers working after Hurricane Beryl (Lewis Tree Services) recorded that more than 50% of the trees "worked" were outside of the easement (defined as greater than 5 feet from the centerline). Of these, daily reports indicate 70% or more were removals. It described the inside-of-easement work as trimming to enable new conductor to be raised and to permit access to the poles.
- Potential contributing factors to tree falls were: the 2022 and 2023 droughts and extreme cold, Derecho, and high soil moisture in advance of Beryl.
- CenterPoint estimates that 3,200 poles were replaced during Hurricane Beryl which is approximately .3 of 1% of the entire population of poles.

Subject Matter Expert Report Related to CenterPoint Energy Wood Pole Asset Management

prepared by

Nelson G. Bingel, III
Utility Lines Expert
National Electrical Safety Code (NESC)
Past Chairman – 2023 – 2028
Chairman – 2016 – 2023
Member – Executive Subcommittee
Member – Strength & Loading Subcommittee
Member – Clearances Subcommittee

July 22, 2024

TABLE OF CONTENTS

I. Introduction

My name is Nelson Bingel. I am the founder and principal of Nelson Research, LLC, and have over 36 years of experience in the electric utility industry. I have been retained by CenterPoint Energy (CPE) to assess and evaluate the Wood Pole Asset Management Programs.

II. Qualifications

I briefly summarize my educational and work background, professional associations, and publications below. My complete Curriculum Vitae is attached at Appendix A.

A. Education

I received a Bachelor of Science in Mechanical Engineering (BSME) from Purdue University in 1973.

B. Work History

Osmose®

I was employed for 30 years with Osmose Utilities Services, Inc., the largest services company for the inspection, maintenance, repair, and restoration of electric utility structures in North America.

- Responsibilities focused on finding and developing better ways to inspect, maintain, and repair/restore wood, steel, concrete, and fiberglass utility structures. Included research, full-scale testing, and ongoing development in each area.
- Worked with utility companies nationwide to help optimize their wood pole inspection and maintenance programs. Developed a tool to project the future condition of their entire pole plant depending on the efficacy of different programs.
- Developed *StrengthCalc®*, an electronic inspection tool used to determine the remaining strength of wood poles based on the measurements of damage that was caused by decay, mechanical impact, or insect infestation. This tool is used to inspect millions of wood utility poles each year.
- Developed two versions of a comprehensive pole loading program, *O-Calc®/O-Calc Pro*™, that is used by utility companies and contractors across the United States to evaluate the environmental loading that is applied to in-service poles and to address make ready requirements.

Work History ***(cont'd)***

- I was awarded three U.S. patents for unique designs of steel trusses to restore strength to wood poles weakened by decay near the groundline. I was also awarded two U.S. patents for automated inspection of wood poles to detect decay.

NELSON RESEARCH In 2017 I founded and became principal of Nelson Research, LLC, through which I provide product development and expert witness services in the electric and telecom utility industries.

C. Technical Associations and Leadership Roles

National Electrical Safety Code (NESC)
Premier national safety standard for overhead and underground lines

- Past Chairman, 2023 -2028
- Chairman, 2016 – 2023
- Member, Executive Subcommittee, 2006 – Present
- Member, Main Committee, 2006 – Present
- Chairman, Strength & Loading Subcommittee, 2006 – 2016
- Member, Strength & Loading Subcommittee, 1991 – 2016

Accredited Standards Committee O5 (ASC-O5)
Publishes manufacturing standards for new wood poles and crossarms

- Vice chairman – 2021-Present
- Chairman – 2006 – 2020
- Member, 1989 - Present

Institute of Electrical and Electronics Engineers (IEEE)

- Member, 1989 – Present
- Working Group Coordinating Changes to the NESC
  - Vice-Chairman, 2017 – 2020
  - Chairman, 1992 – 2017

American Society of Civil Engineers (ASCE)

- Member, 1994 – 2021
- Co-authored publications listed below

D. Recent Publications and Presentations

ASCE Manuals

- *Recommended Practice for Design and Use-Wood Pole Structures for Electrical Transmission Lines*, ASCE Manual No. 141 (2019) (Co-Author & Editor)
- *Reliability-Based Design of Utility Pole Structures*, ASCE Manual No. 111 (2006) (Co-Author & Editor)
- *Fiber-Reinforced Polymer Products for Overhead Utility Line Structures*, ASCE Manual No. 104 (2003) (Co-Author & Editor)

Recent Articles

- "Poles Apart: The Surprising Truth About Power Pole Evaluation Methods and Their Results", *T&D World Magazine (2023)*
- "IEEE Hosting National Electrical Safety Code (NESC) Change Proposal Development Workshop," *IEEE Press Release* (2018)
- "Wood Pole Strength & Loading - Key to Resiliency, Require Programs," *Natural Gas & Electricity* (2017)
- "The Pole Express – Road to System Resiliency Varies, but all Benefit from Taking a Closer Look," *Power Grid International* (2017)
- "Guest Editorial | 2017 Revisions and Review Underway to the National Electrical Safety Code (NESC)," *Electric Energy Online* (2016)

Recent Presentations

- 2023 POWERLINE Overhead Lines Conference, October 11, 2023, Overland Park, Kansas, Effectiveness of Traditional Wood Pole Assessment Methods
- 2023 Osmose University – Joint Use, June 20-21, 2023, Peachtree City, GA, Update on the NESC
- 2023 National Electrical Safety Code (NESC) Workshop - 2023 Edition Overview, June 1-2, 2023, San Antonio, TX, Host and Presenter
- 2021 POWERLINE Overhead Lines Conference, August 11, 2021, Memphis, TN, National Wood Pole Standards
- 2019 National Electrical Safety Code (NESC) Change Proposal Comment Period Workshop, October 2-3, 2019, Kansas City, MO, Host and Presenter
- 2018 National Electrical Safety Code (NESC) Change Proposal Development Workshop, April 10-11, 2018, Savannah, GA, Host and Presenter
- 2018 National Association of Regulatory Utility Commissioners (NARUC), Winter Policy Summit, February 11-14, 2018, Washington, D.C., "Utility Distribution Poles and Lines – How Strong is Strong Enough?

III. Materials Reviewed

In formulating my opinions on this matter, I have reviewed the following materials:

- National Electrical Safety Code (NESC) 2017
- CenterPoint 007-231-06 Rev 15 Ground Line Treatment Specification
- CenterPoint Pole Life Extension Summary 2024-04-08
- Direct Testimony of Eugene Shlatz
- CEHE – Tutunjian Direct Testimony FINAL 4.25.24
- D5648 – Application of CEHE for Approval of its Transmission and Distribution Resiliency Plan
- STD-CRI-DIS RES REL Distribution Grid Resiliency & Reliability 08/15/2022
- *T&D World – February 2023 – "Building New Resilience In the Sooner State"*
- *"The Power of Trusses – Post-Storm Research Proves Trusses are a Long-Term Solution"- White Paper Published by Osmose Utilities Service, Inc*

IV. Executive Summary

CenterPoint Energy has had a focused on effective asset management for decades. This was back when RELIABILITY was the primary concern so that computer systems would not crash. The CenterPoint wood pole assessment/inspection, maintenance and restoration programs have been active through that period and to today.

With a series of damaging hurricanes in Florida during the early 2,000's and culminating with Super Storm Sandy, RESILIENCY has become a focus along with SAFETY and RELIABILITY. System resiliency improvement includes many different aspects that play different roles. Although resiliency is a complex multi-faceted issue for utility companies, the definition and measurement of resiliency is simple:

How well does a system resist a major storm to minimize outages
and
How quickly are services restored

Utility companies have become familiar with the term "Structural Resiliency", especially in reference to wood poles. When fewer wood poles break and fail in a storm, less outages is usually a result but more importantly, services can be restored more quickly and at a much lower cost.

The groundline assessment, maintenance, and restoration programs are all about retaining as much of the original structural strength and resiliency as possible, preventing future degradation, and restoring strength to decayed poles. These CenterPoint programs accomplish that to a very good degree. As will be explained, there are only a few tweaks that can improve the effectiveness of those programs.

Resiliency and high winds now bring the need to evaluate the loading side of wood poles. The National Electrical Safety Code (NESC) is a basic safety standard and governs the installation, operation, and maintenance of overhead lines. It includes District Loads that are based on combined ice and wind conditions (expected winter loads) along with Extreme Wind loads (summer storms). However, the NESC does not require poles extending less than 60 feet above groundline to comply with the Extreme Wind Load case.

One result of this exclusion has been that coastal utilities who complied with the NESC District Loads were found to have extensive damage during major storms. Those results are what brought about an emphasis on resiliency.

In addition to effective wood pole assessment, maintenance, and restoration programs, CenterPoint has enacted structure hardening programs and taken many additional steps to improve system resiliency. Firstly, they took the initiative in 2022 to apply the Extreme Wind load case to all poles. Along with that they have conducted pole loading assessments on specific circuits and installed steel upgrade trusses on wood poles along with replacing poles with engineered non-wood poles that have greater strength and structural resiliency.

To date this work has not been extensive but the standards and mechanics are in place to move forward if that is the strategy. Best in class utility companies that have significantly increased structural resiliency tend to operate with a short term plan and a long term plan. The long term plan may take 20 years to execute across an entire system.

The short term plan is to perform loading assessments and upgrade wood poles that don't meet a higher load requirement with the steel truss upgrade. This option is the lowest cost, can be installed quickly, and has shown to resist the hurricanes with almost no failures. The short term plan quickly improves resiliency and can last for decades as any other long term plan is executed.

In this report, the aspects of wood poles are explained in sections V through VII. The CenterPoint asset management and resiliency initiatives are explained in section VIII and IX and compared to Best in Class.

The balance of this section will provide a high level look at each program with comments on comparison with Best in Class.

High Level Overview of Program Evaluations

Wood Pole Procurement	Best in Class; Third party inspection at pole plant
Wood Pole Assessment	Best in Class
External Preservative Past	Best in Class
Internal Void Preservative	Best in Class
Fumigant Preservative	A better more effective and longer lasting fumigant should be adopted to support a 10 year cycle
Steel Truss Restoration	Unnecessary restrictions limit the restoration candidates; not Best in Class
Steel Upgrade Trusses	Unnecessary restrictions limit the upgrade candidates; not Best in Class
Upgrading with Non-wood Engineered Poles	
Concrete	Only targeted for highway crossings; underground preferred; Best in Class
Modular Fiberglass	Not a commonly used upgrade pole; very expensive; only 19,000 installed
Ductile Iron	Targeted for specific applications; only 1,800 installed
Critical Installations on Engineered Poles	Many of these poles are either restored or upgraded with steel trusses at Best in Class utility companies
Large Transformer Banks	Best in Class; Go underground or install ductile iron;
Adopted NESC Extreme Wind Loading	Best in Class
Freeway Crossings	Best in Class; Underground first; Concrete second
Require minimum class 2 wood poles for feeders	Best in Class
Increasing wood pole embedment depth	Best in Class
Apply Pole Toppers and Groundline Preservative to new pole installations	Very Best in Class

Wood Utility Pole Basics

V. Wood Utility Pole Strength and Original Preservative Treatment

The species of the pole involved in this incident was Southern Yellow Pine. Pine poles are a thick sapwood species that readily accepts preservatives deep into the sapwood. (see Figure 1).

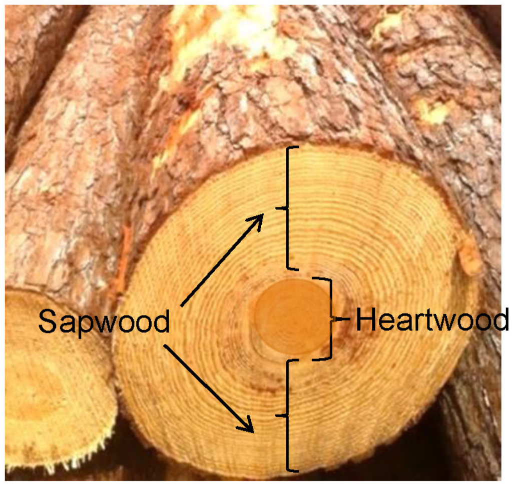


Figure 1. The cross section of a Southern Pine pole

During manufacturing, poles are placed on small rail cars that roll into a pressure vessel that is then filled with preservative, pressurized, and maintained at a specified temperature (see Figure 2). The heartwood of a pole does not accept preservative treatment even when pressurized.

Figure 2. A mini-rail car with treated poles leaving the treatment cylinder.

The poles are full-length treated, but the main concern is to prevent decay from establishing below groundline.

The bending strength of wood poles is identified by their length and class. The groundline circumference determines the class which corresponds with a horizontal load applied 2 ft from the tip. The length of the pole determines the distance from the applied load to the groundline. A general rule of thumb for the setting depths of poles is 10% of the pole length plus 2 ft.

A sample of distribution pole classes and the corresponding average applied horizontal load that the class can support is shown in Figure 3. The applied load is calculated by multiplying the horizontal load (lb) times the distance from the groundline (ft) and is expressed in foot-pounds (ft-lb) because the loading creates a bending or torque load at the groundline.

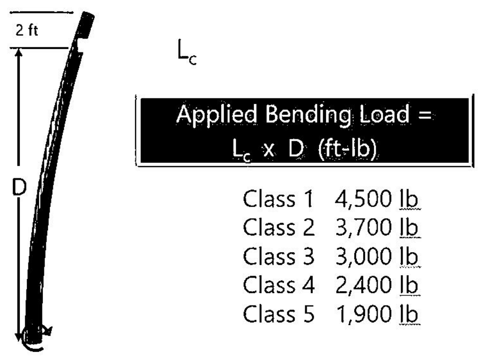


Figure 3. Typical distribution class poles and the tip loads

The bending strength or capacity (as opposed to the applied load) of a pole is determined using the formula below. Directly related to the fiber strength of the wood species multiplied by the cube of the groundline circumference. The fiber strength for southern pine poles is 8,000 psi. Be aware that the fiber strength is a mean value so for a given population of poles, half of the poles have a greater fiber strength and the other half have less strength.

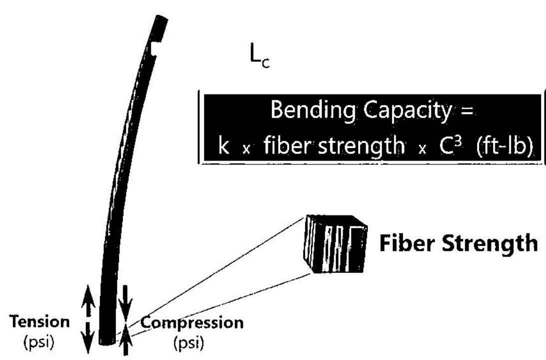
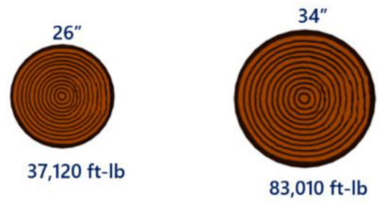


Figure 4. The bending strength of a pole is based on the groundline circumference.

The bending capacity of a specific pole is based on the circumference at the groundline. As the circumference increases in size, the bending capacity increases significantly due to the cube of the circumference factor. These next examples show a 30% increase in circumference results in a 123% increase in bending capacity.

Bending Capacity
= .000264 x Fiber Stress x Circumference ^{3}



Circumference Increase - 30%

Bending Capacity Increase - 123%

Common industry references for distribution poles are that:

Approx. 50% of bending strength is supported by the outer 1” of shell

Approx. 75% of pole bending strength is supported by the outer 2” of shell

VI. Wood Utility Pole Loading

Wood poles are round, tapered structures that are installed as a cantilever. Loading is applied in many directions. However, the pole design is usually governed by the transverse bending loads applied by wind pressure on the wires (including ice when appropriate), equipment, and the pole surface as illustrated in figure 5.

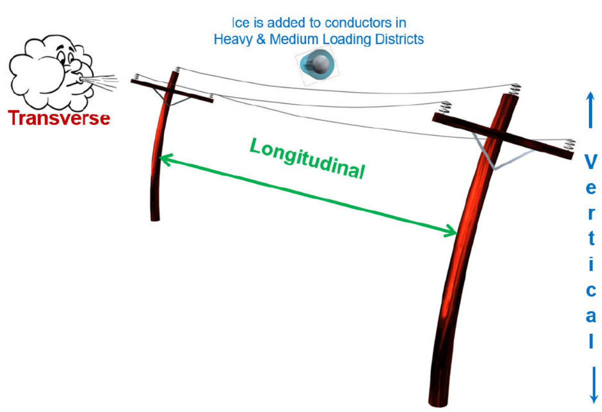


Figure 5. Utility structures most importantly support the transverse ice and wind loading which is perpendicular to the wires.

In this cantilever structural configuration, the maximum stress point along the pole is where the circumference is 1.5 times the circumference of the load point (see Figure 6). The maximum stress point is the theoretical location where a wood pole is expected to break due to maximum bending stress. Wood poles are not a very homogeneous material so defects or variation in pole properties may cause a pole to break a short distance above ground due to bending loads.

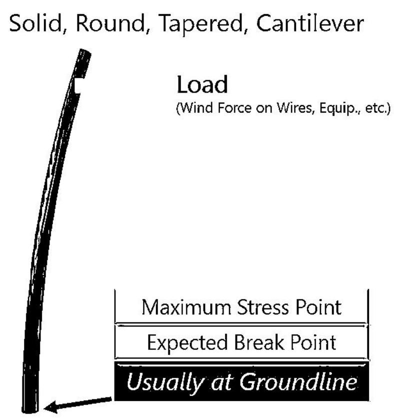


Figure 6. The maximum stress point due to bending loads for poles up to at least 60 feet in length is usually at the groundline.

Not only is the expected break point at groundline, this is where decay is also most likely to occur and weaken the pole (see Figure 9). External decay in the groundline zone causes a significant reduction of the pole's ultimate bending capacity.

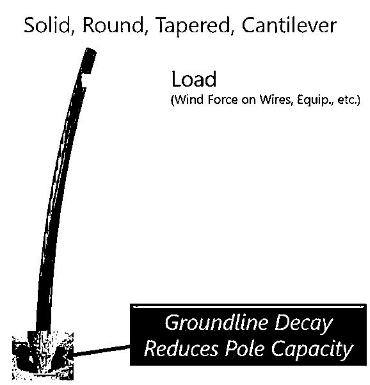


Figure 7. Decay occurs at the expected break point causing a reduction of the bending capacity.

In almost all cases, when a pole line is designed, the bending loads created by the ice and wind are the governing design criteria. That means that if the structures are strong enough for the wind loading, they are more than strong enough for the vertical and longitudinal loading.

VII. Wood Utility Pole Decay and Loss of Strength

The structural integrity of wood may be reduced by decay fungi that feed on wood. This can occur in wood poles after years of service if the original treatment is no longer present at adequate levels to resist decay. However, decay fungi require components for the decay process to occur:

1. Moisture
2. Oxygen
3. Food (untreated wood)
4. Favorable Temperatures

Wood with a moisture content below 20% is usually safe from fungi. Wood cell structure forms tall cylinders and so water wicks up the pole by capillary action from the butt until reaching above groundline. At that point, the moisture dissipates into the air and there is usually not enough moisture in the pole above ground to support the decay process.

The food source for the decay process is wood that no longer has adequate original preservative levels below ground to resist decay. The oxygen level in the soil below 18" usually is not adequate to support decay on the outer shell of the pole below ground.

Due to the moisture limit at groundline and the oxygen limit at 18" below ground, the groundline zone (groundline to 18" below) is the most decay prone section of southern pine poles (see Figure 8). The decay most often initiates on the outer shell below ground which causes a rapid loss of pole bending strength.

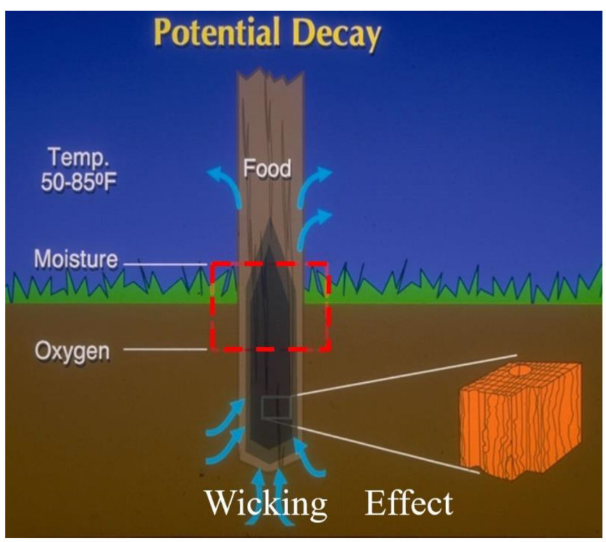


Figure 8. The most decay prone zone of a southern pine pole is limited above ground by lack of moisture and below ground by a lack of oxygen deeper than 18".

Figure 9 shows how abruptly decay in southern pine poles ends at 18 inches below groundline due to a lack of oxygen to support decay.

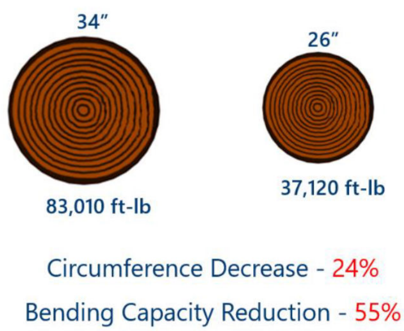
Figure 9. The section of a failed southern pine pole from the groundline and below.

The sooner that shell rot is identified in a pole, the more original bending strength is retained, and the pole can be treated to control future deterioration. The following images show that shell rot identified early can be chipped off the pole and the effective remaining circumference is measured to determine the remaining bending strength.

The next images show an example of more advanced shell rot which had been removed. The remaining sound wood was subsequently treated with preservative paste to prevent future decay. The bending strength was restored with the installation of a steel truss as shown on the right. Pole restoration can be completed much faster and for much less cost than pole replacement.

The decay process was so advanced for this pole that the only option was to replace it.

It was mentioned earlier that the outer 1" of shell supports around 50% of a wood pole's bending strength. In this example, which is drawn to scale, a 24% reduction in circumference due to external decay results in losing 55% of the bending capacity. Controlling shell rot in southern pine poles is critical to retaining the much-needed bending capacity.

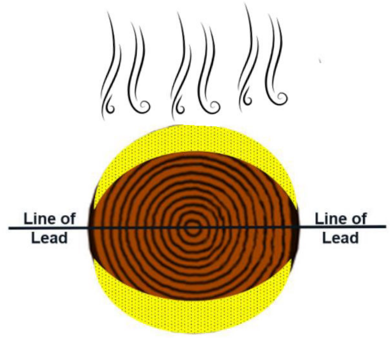


As shown in the examples above, shell rot generally forms rather evenly around the outer shell. Removing the shell rot and measuring the circumference of the remaining sound wood is a good method for determining the remaining bending strength as a percentage of original strength. That pole now has the bending capacity of a sound pole having a circumference equal to the effective circumference.

It has been mentioned that the outer shell of a wood pole provides most of the support for bending loads. However, since bending loads are generally perpendicular to the direction of the wires, the entire circumference does not contribute to the bending support.

For a pole with spans directly opposing each other (span to the east and a span to the west) , the Line of Lead is a line going through the center of a pole in the direction of the overhead wires (see figure below). This line also represents the Center of Gravity for the cross section of the pole, meaning the average location of all the weight or the balance point of the cross section.

With the wind blowing from the north in this figure, only the yellow highlighted outer shell contributes to the pole capacity when bending toward the south. The portion of the pole cross section that is close to the Line of Lead in this image can do little to help support the north/south bending loads.



CenterPoint Wood Pole Asset Management Programs

VIII. CenterPoint Wood Pole Asset Management Programs

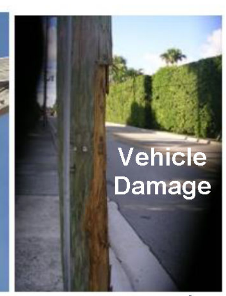
-Retaining and Upgrading Structural Resiliency-

A. Wood Pole Assessment/Inspection – Best in Class

Pole owners are required by national, state, and local codes to inspect utility lines. There are a wide range of methods, tools, and instruments that may be incorporated in a pole owners inspection program. The CPE assessment/inspection program is the best in class as all the following steps are incorporated right up to full excavation.

Visual Assessment

The inspector visually examines the pole from the top down to groundline. Issues to be reported include items such as woodpecker holes, split tops, decayed tops, broken insulators, rotten/broken crossarms, slack/broken guy wires, mechanical or fire damage, and other visible issues. Since most decay conditions occur below ground, this method does little to identify groundline decay.



Sounding Assessment

The inspector sounds the pole with a hammer all around the pole circumference and as high and low as he has access to the pole to locate internal decay. Hammer marks should be visible to indicate where the pole was sounded. A firm, ringing tone suggests sound wood while a hollow or dead sound locates internal decay and the most likely location for boring to assess further.

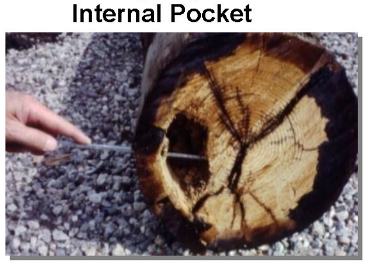
Boring Assessment

Boring can be accomplished before any excavation and is the only option when dealing with poles set in concrete or other obstacles that prohibit digging. It is most effective to bore after excavation, which is described in 7.4, as the most decay prone section of the pole is exposed and boring can start at a deeper location.

Typically, a 3/8" or ½" bit is used for drilling the pole at a 45° angle to the center of the pole. If there is a suspected internal pocket following sounding, a boring should be started there. Multiple borings should be made to determine the extent of advanced internal decay. Care should be taken to ensure multiple borings are not initiated on the same plane.

A shell thickness indicator should be used to measure the depth of a pocket and the remaining sound shell as shown in these images.

Measuring Depth of an Internal Pocket



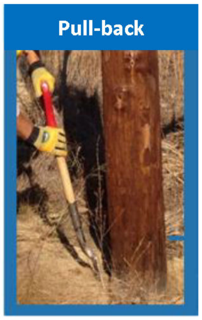
Measuring Sound Shell Thickness

A Variety of Excavation Processes Can be Incorporated

Excavation of wood utility poles takes many forms from a simple pull-back on one side to a full excavation all around the pole to a depth of 18" to 24" depending on local soil conditions and pole species. ***The greater the amount of excavation, the higher the efficacy for accurately finding all decay conditions.***

The range of excavation program types includes the following:

Single and double pull-back



Usually performed with a narrow tool used for chipping and removing shell rot from a pole or with a shovel. The chipper is pushed below ground at the circumference of the pole and then pulled back to expose that portion of the pole below ground. A sharp triangular tool is then used to scrape the pole surface to detect shell rot.

A double pull-back pulls the soil back on opposite sides of the pole to provide greater potential for finding external decay that does not extend around the full circumference.

Single and double partial-excavation

A shovel is used to remove the soil from a shovel width and to a depth of 6"– 8". The surface of the pole is then checked for very early stages of external decay or to measure the depth of more advanced conditions of shell rot.

A double partial-excavate applies the excavation to opposite sides of the pole to provide greater potential for finding external decay that does not extend around the full circumference.

Full excavation

Excavate around the entire circumference of the pole whenever possible to a depth of 18" to 24" depending on local soil conditions and potential for decay. The excavation should extend at least 10" from the pole at the groundline and a minimum of 4" at the bottom to enable proper evaluation of the pole.

Full excavation provides the highest efficacy of finding all decay conditions.

Removal of Decay

Removing decayed wood from the pole will help to control the advance of additional decay and enables measuring the remaining sound wood circumference for estimating the remaining strength of the pole. A trained inspector uses a "chipper" to remove the decay in slices without removing much sound wood. The chipped wood should be removed from the excavation, so it does not spread decay to the remaining sound wood.

Chipping and removing the decayed wood also prepares the pole for application of supplemental preservatives which provides a boost to the original treatment to help prevent future decay deterioration

Remaining Strength and Resulting Pole Classifications

For decades early wood pole inspection incorporated a slide rule or tables that were limited in the ability to account for all the variables that affect wood pole remaining strength. Since the early 2000's, electronic strength calculators have been in use to account for more variables to determine the remaining strength more accurately.

As shown in this photo, measuring the remaining circumference of a pole after removing the shell rot provides a good estimate of the remaining strength. In this case, the remaining strength of a pole with an original circumference of 34" was the equivalent of a 32" circumference pole.

In addition, any internal decay measurements are input to the electronic strength calculator to determine the final remaining strength of the pole.

The National Electrical Safety Code (NESC) specifies the reduced strength at which a pole requires restoration or replacement:

NESC Table 261-1 Footnote 2

"Wood and reinforced concrete structures shall be replaced or rehabilitated when deterioration reduces the structure strength to 2/3 of that required when installed. When new or changed facilities modify loads on existing structures, the required strength shall be based on the revised loadings."

Since wood poles are considered serviceable until the point that the groundline strength is reduced to 2/3 of the required strength, each pole inspected as part of a scheduled inspection program will be classified into one of 4 conditions:

No decay

Decayed but serviceable (DBS)
-remaining strength ***above*** code requirement >67%

Decayed Reject
-remaining strength ***below*** code requirement ≤67%

Decayed Priority Reject
-remaining strength ***below*** pole owner requirement

Wood Pole Assessment/Inspection

IN SUMMARY:
Poles with extremely advanced shell rot decay **(Priority Reject)** are likely easier to detect than poles with very early stages of shell rot **(DBS)**. The ability to accurately identify these conditions depends on how comprehensive the inspection procedure is.

The CenterPoint Energy specification for wood pole assessment calls for all of the steps above to be completed during the assessment. This is **Best in Class**, especially when full excavation is included. There is no instrument or tool that can be added to the assessment process that will improve the efficacy of the assessment.

B. Supplemental Preservative Application – Life Extension

External Preservative Paste Application -Best in Class

Remedial treatments provide a boost to the original treatment of a pole which helps control decay and extend the useful life of a pole. The presence of shell rot indicates the original preservative is no longer at threshold levels that prevent decay. Applying supplemental external preservatives provides a boost to the original treatment and can help prevent decay for the recommended inspection cycle.

If a pole has no sign of shell rot, the outer shell is still treated to help make sure the pole strength is retained and there is no shell rot on the next assessment cycle. If there is shell rot present, it is removed so that the preservative does not soak into the decayed wood and have less opportunity to protect the sound wood.

These photos show the removal of an early stage of shell rot and then the application of a preservative paste to the critical outer shell to control future decay. A plastic backed paper is then wrapped around the pole below groundline to help the preservative migrate into the pole by osmosis.

CenterPoint's practice of full excavation whenever possible and applying MP-500 external past is Best in Class.

Internal Void Preservative Treatment – Best in Class

Some of the poles inspected will have existing internal voids. There is a liquid preservative treatment that only requires a splash contact with the surface of the void to help control decay until the next assessment cycle. The product, which is applied under pressure, is called Hollow Heart and included in CenterPoint's specification. Hollow Heart is only intended for use when internal decay has advanced to create a void.

Fumigant Treatments to help Sterilize Sound Wood

A more effective fumigant should be adopted to support a 10 year cycle

A third treatment type is referred to as fumigants. Sound wood is bored into, and the fumigant treatment is applied into the hole and then plugged. The fumigant treatment may be in liquid form, a solid in a tube, or in granular form. Whatever the original form, a chemical reaction occurs to create a gas that migrates both up and down from the point of application. That treatment is a booster to the original treatment in the pole. This sterilized the internal section of the pole to help prevent decay for another inspection cycle.

The older portions of the CenterPoint system have a greater portion of the poles located in backlots that cannot be fully excavated around the pole circumference. CenterPoint is currently using a liquid form of fumigant called WoodFume which was developed more than 50 years ago. In recent years, a new granular fumigant has been developed that is more effective and much longer lasting. That product is called OsmoFume and would be an enhancement to the current program.

C. Wood Pole Restoration–Life Extension – Program can be expanded

When pole assessments determine a remaining strength that is below NESC requirements, those poles either need to be restored with a steel truss or replaced. The steel truss was tested at many utility companies during the 1970's and 1980's, including Houston Lighting and Power shown in the far right image below.

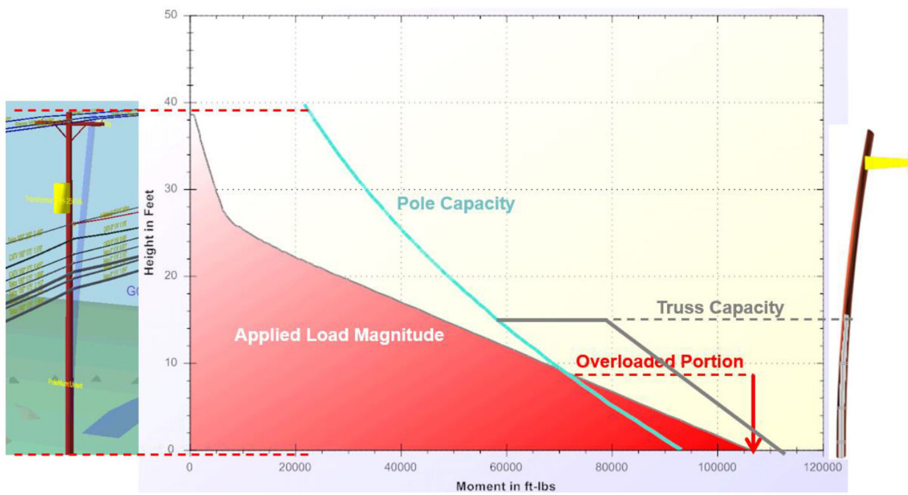
The truss proved to work every time and utility companies switched from thinking of trussing as a temporary fix to a restoration that has shown to last for 30 to 40 years and even more. CenterPoint does restore a percentage of the poles that are below NESC strength requirements.

However, restrictions on restoring certain poles like equipment poles, that were initiated in the 1980's, are still in effect. Many utility companies have shown over decades of implementation that many of CenterPoint's reject poles restricted from restoration can be quickly and efficiently restored to the original level of safety.

D. Steel Upgrade Truss Systems Increase Pole Capacity and Resiliency

CenterPoint has engaged but the rate of implementation should increase

Some in-service poles may be overloaded or may need to be upgraded to support higher wind loading. A pole is not overloaded from top to bottom. As shown below, there is a location between the pole tip and groundline where the applied load becomes greater than the pole capacity.



The upgrade steel truss can increase the bending capacity of wood poles by 1, 2, or 3 classes. This system is a low cost and quick way to make wood poles more resilient.

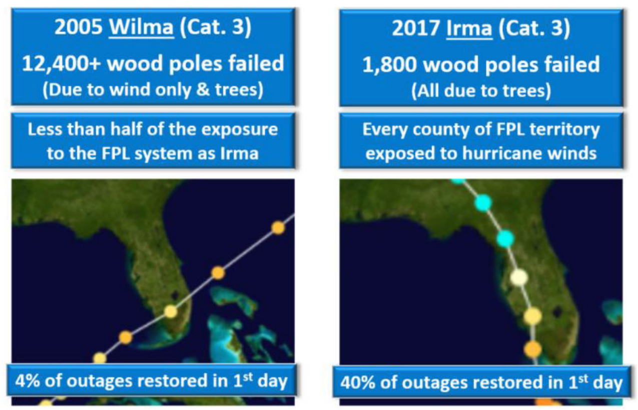
Best in class utility companies like Florida Power & Light and Oklahoma Gas & Electric install upgrade trusses as soon as a pole is found to be overloaded or in need of upgrading to support higher wind speeds. The upgrade is a low cost installation that can be completed quickly. The trusses are considered a long term fix. However, they may also have a 20 year plan for what is thought of as a more permanent fix, but the upgrade trusses provide the same improved resiliency quickly, at a much lower cost with an expected life of 30 years or more.

The following are case studies from these two utilities that have storm proven performance of the steel upgrade trusses.

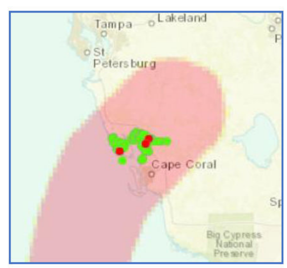
These excerpts and images were taken from the magazine article and white paper listed in the Materials Reviewed section.

Florida Power & Light began an aggressive hardening program in 2006. There are more than 23,000 upgrade trusses installed as shown on this map.

The following images show the comparative performance of the FP&L system resulting from hurricane Wilma in 2005 versus hurricane Irma in 2017. Irma covered more than twice the amount of service territory and only 1,800 poles failed compared to Wilma where 12,400 poles failed. Only 4% of the outages were restored the first day after Wilma whereas 40% of the outages were restored the first day following Irma.



On September 28, 2022, category 4 hurricane Ian made landfall in Florida.



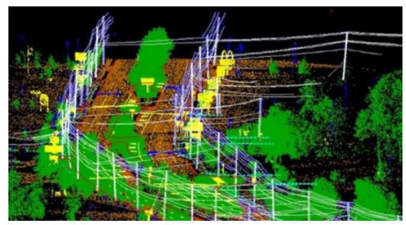
Osmose Utilities Services, Inc. independently researched the actual wind speeds and conducted a field study to determine how the steel upgrade trusses performed. The field study was conducted in or near Port Charlotte where the weather data showed sustained winds of 150 mph. The poles had been upgraded with the steel upgrade truss from 8 to 12 years earlier.

A total of 288 poles with steel upgrade trusses were visited and it was found that 283 (98%) of the poles were resilient and survived Ian with no damage. There were 5 poles that had been replaced so it was not clear how those 5 upgraded poles performed during the storm.

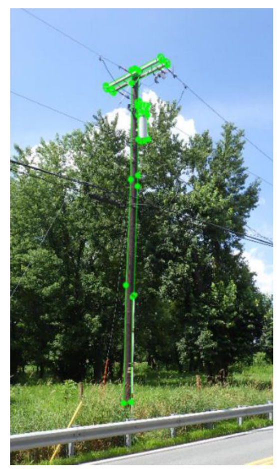
An added benefit of the steel upgrade truss is that it increases the surface area that is bearing on the soil. Poles with the trusses had much less movement at the groundline and did not require straightening.

Oklahoma Gas & Electric experienced a severe ice storm in October 2020 which showed that the structural resiliency of their system needed to be increased. They ended up adopting a four stage process to harden their lines and establishing a system-wide wind speed of 150 mph.

Step 1: Detailed field data collection which consisted of vehicles outfitted with GPS, light detection and ranging (LiDAR), high resolution cameras and a backpack version for walkout data collection. This process collected highly accurate data for modeling circuits.



Step 2: Automated classification of poles, equipment, wires, buildings, etc., using the LiDAR data and imagery from step 1. Technicians measure heights and distances between poles precisely, identifying attachments and creating a georeferenced database for all attached objects. This data is automatically fed into O-Calc Pro pole loading software and a model of each pole is created.



Step 3: O-Calc Pro pole loading software was used to create a complete digital model of OG&E's pole network, including comprehensive structural load analysis. The model enabled prescribing effective solutions for any found conditions throughout the network and offer efficient remediation options.

Step 4: Provide a pole-by-pole recommendation, considering the remaining strength estimation performed during the evaluation and life-extension treatment process as well as the pole load analysis results. The outcomes included:

-Poles that already meet the 150 mph wind loading

-Poles that should be strengthened using steel upgrade trusses

-Poles that required stronger replacement poles

The work is ongoing, but it is estimated that this initial effort will analyze and harden more than 1,200 line-miles encompassing 38 circuits and roughly 49,000 poles. It is projected that over a quarter are projected to require strengthening with the steel upgrade truss to meet the new OG&E wind loading. Cost savings are estimated as up to 65% versus replacing every identified pole. Further, the pole replacement rate required to bring true weather resiliency to OG&E's customers is less than 5% of all poles evaluated.

In a recent high-wind storm event, a circuit that was hardened with the above process had no poles fail. Neighboring circuits experienced multiple pole failures.

CenterPoint has incorporated some Lidar pole loading assessments to identify poles that need to be hardened to meet the NESC extreme wind criteria. Some of the steel upgrade trusses have been installed as well. The results of the last two years are shown here:

2022

The company rebuilt **33** circuits (6 circuits are still outstanding)
About **145** miles of line was completed out of 147 miles
1,855 pole replaced
539 upgrade trusses installed

2023

The company completed **21** circuits for a total of **64** miles of line
1,177 poles replaced
306 upgrade trusses installed
Also reviewed and included poles that passed extreme wind loading adding another **100 miles** of line

These quantities seem to represent a rate that is established for a long term plan. It is likely that an accelerated plan of installing upgrade trusses could possibly upgrade all the main feeders in one and half to two years.

Additional CenterPoint Wood Pole Asset Management Programs

IX. Additional CenterPoint Proactive Resiliency Improvements

CenterPoint Standard, Distribution Grid Resiliency & Reliability, issued in March 2022 and August 2022 includes many additional steps toward improving system resiliency.

The following includes excerpts from the CenterPoint Distribution Grid Resiliency & Reliability Standard.

A. Upgrading with Engineered Poles -The Quantities Seem Low

CenterPoint has approved multiple options for upgrades with non-wood engineered structures.

5.3 Non-Wood Engineered Structures

CenterPoint Energy evaluated alternate materials to provide options as EWL is adopted across the system. Use of non-wood, engineered materials in certain design situations will increase overall system resiliency.

a. Concrete poles

In some cases, concrete poles are a desirable structure but there are limitations which have kept the use of concrete pole limited.

> 1. Concrete – Allows for higher strengths but has highest weight. Installation requires truck accessibility. In most cases, concrete poles are not field customizable and must be manufactured with known framing hole standard(s) in advance.

b. Fiberglass poles

CenterPoint has worked with a fiberglass pole manufacturer to design and develop high strength fiberglass poles. When it is necessary, the fiberglass poles are designed to have a similar tip deflection as wood poles.

> 3. Modular Fiberglass – These are modular, light weight, field customizable, and high strength but deflection is higher than other pole materials. Fiberglass pole modules can be carried by hand and allow for installations without a truck. Fiberglass poles are advantageous in difficult to access locations.

The total number of fiberglass poles installed in the CenterPoint territory is **19, 429.**

c. Ductile iron poles

Ductile iron poles offer a stiffness that is helpful in reducing deflection in high wind loading. Like fiberglass poles, ductile iron are installed for specific types of installations that it is well suited for because of its stiffness.

> 2. Ductile Iron (DI) – Also allows high strengths but weighs like wood poles. DI poles are field drillable and fully coated for corrosion protection. DI poles are preferred material for certain applications due to their ability to field drill for various configurations and the customization they offer. Due to the installation practices and weight, DI poles require less installation time and coordination.

The total number of ductile iron poles installed in CenterPoint territory is: **1,822.**

d. Critical Installations on Engineered Structures

-Steel Truss Upgrading should be considered

> **4.2.1 Equipment Poles**
> All major equipment including Intelligent Grid Switching Devices (IGSDs), large three-phase transformer banks (>250kVA), pole top switches, terminal poles, capacitor banks, regulator racks, junction poles, and double stacked circuits will be installed on poles composed of a non-wood, engineered material like fiberglass, ductile iron, and/or concrete.

- Intelligent Grid Switching Devices
- Regulator Racks
- Large Transformer Banks (3-250 kva, 3-333 kva, 3-500 kva banks)
- Double Circuit Poles
- Junction Poles
- Substation Getaways
- Capacitor Banks
- Pole Top Switches
- Three Phase Terminal Poles (Feeder Dips, Substation Terminal Poles)

e. Large Transformer Banks

Large transformer banks have not performed well in extreme storms. Putting those structures underground or on stronger engineered ductile iron structures does improve resiliency.

B. Significantly Increasing Wind and Ice Loading – Best in Class

> **4.1.1 Extreme Wind Loading**
> CenterPoint Energy adopted National Electrical Safety Code (NESC) Rule 250C (Extreme Wind) and 250D (Extreme Ice with Concurrent Wind Loading), regardless of pole height. All new distribution structures and replacements will be designed to applicable hurricane level extreme wind speeds; 110-mph (North of US 59 and Hwy 90) and 132-mph (South of US 59 and Hwy 90).

The NESC has a District Loading map which specifies deterministic Combined Ice and Wind loads for all poles. For poles extending more than 60 feet above groundline, the NESC requires an Extreme Wind additional load case to be evaluated. The Extreme Wind maps show higher wind speeds that are based on the probability of occurrence. In many cases, the Extreme Wind conditions create a greater load on poles that extend less than 60 feet above ground, but they are excepted from that rule from that rule based on safety considerations.

By adopting the Extreme Wind conditions for all poles, CenterPoint has gone above and beyond what is required to account for hurricane events. This new requirement will help to improve structural resiliency for years to come.

C. Freeway Crossings -Best in Class

> **4.2.3 Freeway Crossings**
> For all freeway crossings underground construction will be the primary design option. If that is not feasible, then overhead construction with concrete pole will be considered.

D. Requiring Class 2 as the minimum wood pole class on feeders -Best in Class

Pole failures on feeders can lead to more widespread outages than laterals. Increasing the minimum wood pole class increases feeder structural resiliency.

E. Increasing Embedment Depth for Heavy Load Class Wood Poles -Best in Class

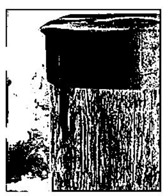
The industry rule of thumb for embedment depth of wood poles is 10% of length plus 2 feet. As pole class increases, the corresponding percentage of foundation capacity decreases. CenterPoint has increased the setting depth for high class poles as an improved measure to increase foundation capacity and reduce the chance of foundation failure and leaning poles in extreme weather events.

5.5 Wood Pole Usage & Embedment Criteria

Pole setting depths are dependent on the class of wood poles. For example, for pole classes 2 through 9, poles shall have a minimum embedment of 10% plus 2 feet. For pole Class 1, H1, and H2, shall have a minimum embedment of 10% plus 3 feet. On larger equipment poles (transformer banks > 250kVA) that require an H2, poles are set deeper as shown below.

F. Installing pole toppers and groundline preservative wrap on new pole installations – Best in Class

Installing the groundline preservative wrap provides a booster shot to the original preservative treatment right at day one. This is sure to retain adequate levels of preservative for additional years.



Groundline decay has the highest potential for wood pole deterioration. The second highest potential for degradation is the pole top. Over time the top tends to split and in many cases decay originates there. A split or decay can extend down to the connection point for crossarms and other equipment. The pole topper provides long lasting protection against UV and environmental conditions.

X. Opportunities for Improvement

A. Change wood pole fumigant from liquid WoodFume to granular OsmoFume for greater effectiveness and longer lasting. This will support the 10 year inspection cycle.

B. Reduce the limitations for restoring reject poles. Many of the poles not allowed to be restored are in fact restored by utility companies across the nation.

C. Increase pole loading assessments, perhaps on the main feeders, to enable steel truss upgrading and quickly increasing resiliency.

I reserve the right to modify or amend my opinions upon receiving additional or new information.

Respectfully submitted,

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Appendix A

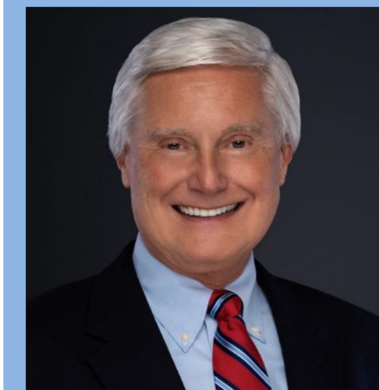
Nelson G. Bingel, III
Curriculum Vitae

CURRICULUM VITAE

Nelson G. Bingel III

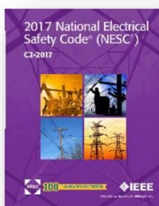
Subject Matter Expert
Expert Witness
NESC Code Expert
Electric & Telecom Overhead Lines
Utility structures
Wood, Steel, Concrete, Fiberglass
Original Structure Strength
Wood Decay and Steel Deterioration
Inspection Techniques
Remaining Strength Analysis
Structure Loading Analysis
Clearance Analysis
Third Party Attachments
Industry Best Practices

April 2024



Marital Status: **Happily Married**
Date of Birth: **9/13/1951**
Place of Birth: **Buffalo, NY**
Business: **Near Atlanta, GA**

Nelson Research, LLC
207 Marcie Ct.
Senoia, GA 30276
(678) 850-1461
nbingel@nelsonresearch.net



National Electrical Safety Code

Past Chairman *(2023 – 2028)*
Chairman *(2016 – 2023)*

The premier safety standard for overhead and underground electric and telecom lines

Accredited Standards Committee O5

Vice Chairman *(2021 – Present)*
Chairman *(2006 – 2021)*

Publishing standards for the manufacture of wood poles and crossarms

Other Technical Society Participation

IEEE – *Institute of Electrical and Electronics Engineers*
ASCE – *American Society of Civil Engineers*
AWPA – *American Wood Protection Association*

Education

Purdue University (1969-1973)
BS Mechanical Engineering

CURRICULUM VITAE

Work History

Lincoln Electric Company, Cleveland, OH (1973 – 1985)
Lincoln Electric is the world leader in arc welding equipment and consumable products. After completing a 9-month sales engineering training program and becoming a certified welder through the Lincoln Welding School, Nelson spent 10 years in the sales organization working to find better solutions for the design and manufacturing process of customer's products.

Some of the applications were at seven US Steel plants, a Bethlehem Shipyard, Port of Oakland Loading/Unloading structures, skyscraper erection in San Francisco with companies like Kiewit, Fluor, Bechtel and others, and large oil and fuel storage tank fabrication with Chicago Bridge and Iron.

Osmose Utilities Services, Inc., Atlanta, GA (1987 – 2017)
Osmose is the largest provider of utility structure inspection, maintenance, and restore/repair services in North America, including the acquisition of Provincial Pole in Canada. Nelson had a 30-year career researching, developing, and testing instruments, products and methods for inspection, analysis, maintenance and repair or restoration of wood, steel, concrete and fiberglass utility structures. He received six US Patents; 3 for wood pole inspection and 3 for unique designs of wood pole restoration systems.

Nelson Research, LLC, Senoia, GA (2017- Present)
President
Consultant/Expert Witness – Overhead Electric & Telecommunication Lines

Patents obtained while with Osmose

June 27, 2000
US Patent 6,079,165: Apparatus and method for bracing vertical structures

April 29, 2008
US Patent 7,363,752 B2: Pole Reinforcement Truss

August 26, 2008
US Patent 7,415,808 B2: Pole Reinforcement Truss

Patents obtained while with Osmose (cont'd)

January 16, 2018
US Patent 9,869,622: Automated profiling of the hardness of wood

March 3, 2020
US Patent 10,578,532: Automated profiling of the hardness of wood

November 1, 2022
US Patent 11,486,806: Automated profiling of the hardness of wood

Products developed while with Osmose

1987
Design of **Osmo-C-Truss** wood pole restoration system. Steel truss design was optimized for efficiency in correlating with the loading and strength requirements of the National Electrical Safety Code.

1999/2010
O-Calc®/O-Calc Pro™ - Comprehensive Pole Loading Software

Software used by Osmose and companies across the country to model in-service utility poles and evaluate loading per the National Electrical Safety Code or GO 95 in California.

2000
C2-Truss™ - Wood Pole Restoration System – 3 Patents Awarded

This unique, computer-aided design enabled using very high strength steel to produce steel trusses for restoring wood poles that are lighter, stronger and lower in cost.

2005
StrengthCalc® - First Electronic Wood Pole Strength Calculator

This software tool provides greatly enhanced precision for determining the remaining strength of in-service wood poles that have some level of deterioration in the zones just below and above the groundline. StrengthCalc is utilized during inspection of millions of wood poles annually and helps insure proper classification of their condition for optimum asset management.

2006
LoadCalc® - Electronic Pole Loading Estimating Tool

This software tool enables users to estimate the loading of in-service poles as a low-cost screening tool that can be incorporated with regular pole inspection programs. This can save a majority of poles from requiring a comprehensive pole loading analysis which incurs a is significantly higher cost.

Industry Association Activities

National Electrical Safety Code (NESC) – the standard that establishes safety requirements for the construction, operation and maintenance of overhead and underground electrical and communication lines.

NESC Main Committee
Past Chairman: Mar 2023 – Mar 2028
Chairman: Aug 2016 – Mar 2023

NESC Strength & Loading Subcommittee
Chairman: 2009 – 2016
Member: 1990 – 2016

NESC Main Committee
Member: 2009 – present

NESC Executive Subcommittee
Member: 2013 – present

American Standards Committee O5 (ASC O5) – this committee publishes standards for the manufacturing of wood poles and crossarms.
Vice Chairman: 2021 - present
Chairman: 2006 – 2021
Member: 1990 - present

ASC O5 Fiber Strength Subcommittee
Chairman: 1998 – 2015
Member: 1990 - present

American Society of Civil Engineers (ASCE)
Member: 1996 – 2022

Co-Author **ASCE Manual No. 141, Recommended Practice for the Design and Use of Wood Pole Structures for Electrical Transmission Lines** (Published 2019)

Co-author of **ASCE Manual No. 111, Reliability-based Design of Utility Pole Structures** published by Structural Engineering Institute of ASCE (Published 2006)

Co-author of **ASCE Manual No. 104, Fiber-Reinforced Polymer Products for Overhead Utility Line Structures**; the Structural Engineering Institute of ASCE (Published 2003)

Institute of Electrical and Electronics Engineers (IEEE)
Overhead Lines Working Group on the NESC
Vice-Chair: 2017 – present; Chairman: 1996 – 2017; Member: 1988 – present
Overhead Lines Joint Use Working Group
Vice-Chair: 2020 – present
Co-Author – **IEEE Joint Use Guide for Wireless Facilities** – published in 2023

American Wood Protection Association (AWPA) – publishes standards for preservative treatment of all wood groups, including wood poles.
Member: 1988 – 2001

The Committee for International Council on Large Electrical Systems (CIGRE)
United States Representative on Working Group B2.67 – Wood Poles
2018 – 2021 Co-Authored Manual for Wood Pole Best Practices
Mostly international virtual meetings
Face to Face Meetings
2018 – Working Group meeting in Paris, France
2019 – Working Group meeting in New Delhi, India

Articles, Manuals, Publications

1994 Electric Perspectives Magazine – Nov/Dec – Edison Electric Institute
"Restore, Don't Replace"

1998 Wood Design Focus
- A Journal of Contemporary Wood Engineering; Forest Products Society
"Computer-Aided Design of Fiber Composite Wraps for Wood Pole Restoration"

2003 – *Manual of Recommended Practice for Fiber-Reinforced Polymer Products for Overhead Line Structures*; Edited by Jim Davidson; ASCE MOP-104

2006 – *Manual of Practice for Reliability-Based Design of Utility Pole Structures*; Edited by Habib Dagher; ASCE MOP-111

2007 – *Transmission and Distribution World Magazine*
"Extreme Winds Test Wood Pole Strength"

2016 – *Electric Energy Online*
"Guest Editorial | 2017 Revisions and Review Underway to the National Electrical Safety Code (NESC)"

2016- *Energy Central*
"Highlights, Changes and New User Elements of the 2017 National Electrical Safety Code

2017 – *Power Grid International*
"The Pole Express
– Road to System Resiliency Varies, but all Benefit from Taking a Closer Look"

2017 – *Natural Gas & Electricity*
"Wood Pole Strength & Loading - Key to Resiliency, Require Programs"

2019 – *Consulting & Specifying Engineer*
"National Electrical Safety Code is Open for Comments"

2019 – IEEE NESC Preprint Announcement

2019 - "2022 National Electrical Safety Code (NESC)" – Key proposals, what to know and how to contribute

2020 – May/June - *IAEI magazine* – International Association of Electrical Inspectors
NESC's Value Grows as it Addresses Disruptive Technologies
– Nuts-and-bolts Issues arise as 5G, utility-scale solar and energy storage are deployed.

2022 – May/June – *IAEI magazine* – International Association of Electrical Inspectors
"Highlights of the Next Edition of the National Electrical Safety Code"

2023 – May/June – *IAEI magazine* - International Association of Electrical Inspectors
"HEADS UP: Hitting utility lines when hauling heavy equipment can become an expensive ordeal"

2023 – October 25 – *T&D World Magazine* – "Poles Apart - The Surprising Truth About Power Pole Evaluation Methods"

2023 – *Osmose White Paper* – "Poles Apart – The Surprising Truth About Power Pole Evaluation Methods"

2023 – *Osmose White Paper* – "Post-Storm Research Proves Trusses are a Long-Term Solution"

2024 – *Osmose White Paper* – "Rethinking Wood Pole Evaluation – Updated Research on Method Effectiveness"

2024 – *Osmose White Paper* – "Strength in Numbers - The New Structural Asset Health Index for the Electric Grid"

2024 – May/June – *Western Energy Magazine* – "Osmose Celebrates 90 Years of Pioneering Contributions to Utilities Asset Management"

Conference Presentations

1999 Utility Pole Structures Conference – Reno, NV –
Northwest Public Power Association (NWPPA), Western Electric Power Institute (WEPI) Utility Structure Conference
"Proposed Code Changes: American Standards Committee O5/National Electrical Safety Code"

2000 Northeast Utility Pole Conference – October 17-18, Binghamton, NY
"Product Design in the new Electric Utility Environment"

2000 American Society of Civil Engineers (ASCE) Structures Congress – Philadelphia, PA
"Code Issues and Applications for Fiber Reinforced Composite Utility Poles"

2000 International Conference on Utility Line Structures – March 20-22, Ft. Collins, CO
"Product Design in the New Electric Utility Environment"

2000 Southern Pressure Treaters Association (SPTA) Winter Conference – January, 23-25, Key Largo, FL
"Update on ANSI O5.1 New Wood Pole Standard"

2000 Geospatial Information and Technology Association (GITA) Conference
"Utility Pole GIS Data Systems"

2001 Power Transmission & Distribution Asset Management Conference – Oct 27-28, Atlanta, GA
"Building a Data Strategy to Improve Reliability Planning"

2001 Institute of Electrical and Electronics Engineers (IEEE) Transmission and Distribution Conference – October 28-November 1, Atlanta, GA
"2002 National Electrical Safety Code (NESC) Update"

2001 National Joint Use Educational Conference – October 22-23, Phoenix, AZ
"2002 National Electrical Safety Code (NESC) Update"

2001 Southeast Electrical Exchange (SEE) Joint Use Committee Meeting – March 4-6, Orlando, FL
"Utility Pole Strength and Loading for Joint Use Applications"

2001 Edison Electric Institute (EEI) Transmission Committee Meeting – October 7-10
"2002 National Electrical Safety Code (NESC) Update"

2001 Western Energy Institute (WEI) Overhead Electric Distribution Workshop –Sep 10-12
"2002 National Electrical Safety Code (NESC) Update"

2002 Southeast Electrical Exchange (SEE) Joint Use Committee Meeting – May 19-21, Atlanta, GA
"Options for Overloaded Poles"

2002 Northeast Utility Structure Conference – October 22-23, Binghamton, NY
"Update on ANSI O5.1 – New Wood Pole Specification"

2002 SBC/Ameritech Technical Training Symposium - Chicago, IL
"Utility Pole Loading and Clearances"

2003 Southeastern Electric Exchange (SEE) Annual Conference – June 11-13
"Transmission Structure Asset Management"

2003 Northwest Public Power Association (NWPPA) Utility Structure Conference - Reno
"ANSI O5.1-2002 – The Inside Story", "2002 NESC Update"

2005 Western Electric Institute (WEI) Utility Pole Conference, October 26-27, Reno, NV
"Code Update: ANSI O5.1-2005, Upcoming NESC 2007"

2005 Institute of Electrical and Electronics Engineers (IEEE) Winter Power Meeting – Jan 23-25, Albuquerque, NM
"NESC and ANSI O5 Overview"