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CY 2022 ELECTRIC UTILITY SERVICE QUALITY REPORT UNDER 16 TAC § 25.81	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

ENTERGY TEXAS, INC. REPORT IN RESPONSE TO THE COMMISSION'S DECEMBER 19, 2022 ORDER

On December 19, 2022, the Commission issued an Order Directing Entergy Texas, Inc. ("ETI") to Take Certain Actions Related to Electric Service Quality ("Order") in this project. The Order directed ETI to provide additional reporting related to its distribution feeder electric service quality performance, consistent with the recommendations in the Commission Staff memorandum filed on December 8, 2022 in Project No. 52937.[1] Specifically, the report must analyze the distribution service interruptions caused by the failure of utility-owned equipment since calendar year 2017, provide details on the types of equipment and any common reasons for their failures, and provide information related to ETI's equipment repair and replacement programs. Pursuant to that Order, ETI provides the following report, which is timely filed no later than July 1, 2023.

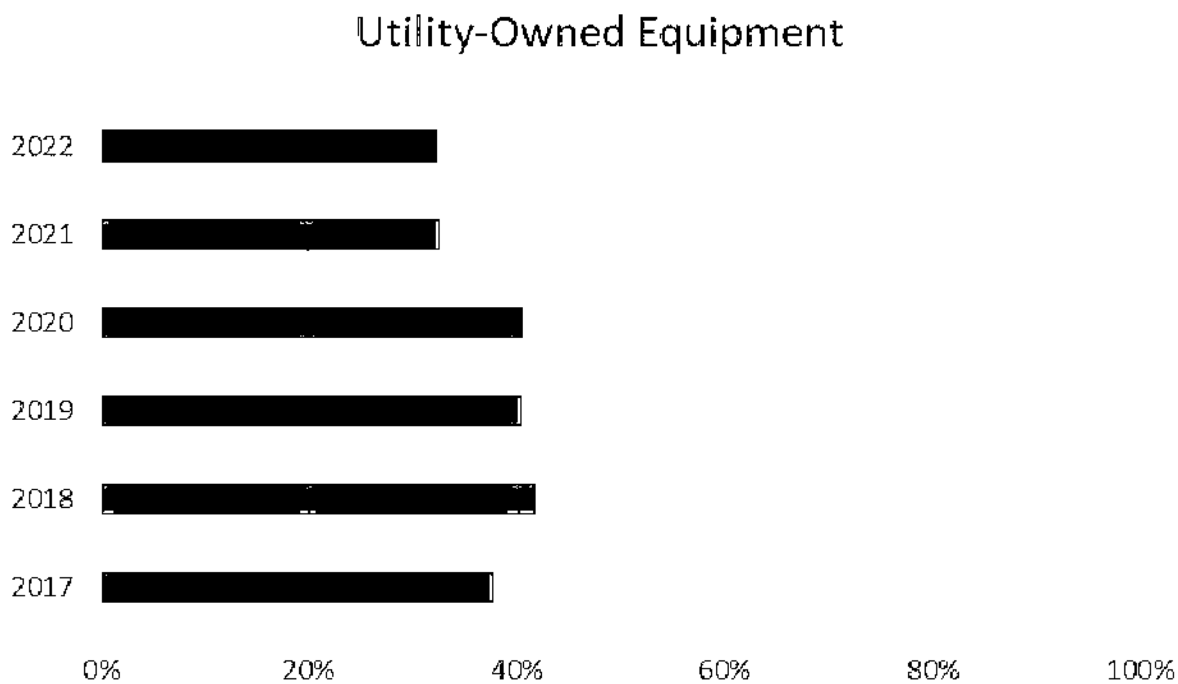
[1] *CY 2022 Electric Utility Service Quality Report Under 16 TAC § 25.81*, Project No. 54467, Order Directing Entergy Texas, Inc. to Take Certain Actions Related to Electric Service Quality at 1-2 (Dec. 15, 2022).

REPORT

Utility-Owned Equipment Failures and Leading Causes

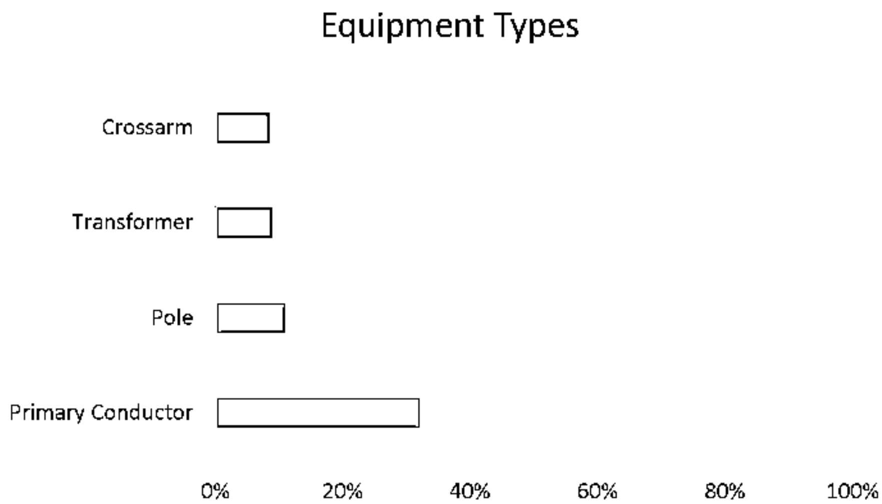
Through its annual Service Quality Reports ("SQR") for the years 2017-2022, ETI reported the following percentages of total forced interruptions attributable to the failure of utility-owned equipment:

Table 1



Forced interruptions caused by utility-owned equipment failure trended downward in percent of total interruptions from 2020-2022 (40.66% v. 32.32%) and reflected a 14% reduction when comparing 2017 to 2022 (37.74% v. 32.32%). The specific types of equipment contributing to the longest duration of forced interruptions are shown in Table 2 below.

Table 2



Primary Conductor – ETI's distribution facilities are approximately 83% overhead and 17% underground. Primary conductor failure, the largest contributor to ETI's customer minutes ("CM") interrupted on average from 2017-2022, is driven by aged cable – in particular, non-jacketed cross-linked polyethylene ("XLPE") for underground conductors. Many of ETI's XLPE underground conductors installed in the early 1980s were non-strand filled (moisture block) and non-jacketed. While consistent with industry practices at the time, this type of conductor can lead to water ingress due to the strands not being filled and jacketed resulting in water treeing[2] and premature failure. XLPE is no longer used in power distribution applications for ETI. Other common causes of primary conductor failure include contamination in high corrosive areas leading to premature failure, mechanically damaged conductor, insulation degradation for underground cable, and non-jacketed cable with exposed neutrals leading to excessive corrosion. The most significant causes of neutral corrosion include soil and differential aeration corrosion. This occurs when a portion of the neutral is wet while the rest of the neutral remains dry, resulting in corrosion in the intermediate zone between the two. Underground conductor failures tend to result in longer restoration times affecting CM due to the time needed to troubleshoot and find the fault location, unlike an overhead conductor failure which can be patrolled more quickly.

Pole failure – Pole failures are the second largest contributor to CM for the utility-owned equipment failure category. Common reasons for pole failure include rot, accumulated damage from third parties (such as vehicle accidents involving poles) leading to subsequent premature failure, excessive weight through changing tension, and damage from animals (woodpeckers, bees, etc.). Pole failures tend to result in longer restoration times affecting CM due to the time needed to replace the pole and restring the wire, as opposed to failure of pole framing (cross arms, insulators, etc.).

[2] "Water treeing" is defined as the presence of moisture in cable polymer insulation resulting in electrical degradation and premature failure.

Transformer failure – The third largest contributor to CM for the utility-owned equipment failure category are transformer failures. Common reasons for transformer failure include winding insulation degradation, leaking due to hull degradation, overload conditions, damage from wildlife (ants in particular), and lightning damage.

Crossarm failure – The fourth largest contributor to CM for the utility-owned equipment failure category are crossarm failures. Common reasons for crossarm failures include rot and excessive weight due to changing conductor tension. The changes in conductor tension are driven by damage to facilities (*e.g.*, cross arm braces failing, guy wires breaking, etc.) leading to excessive sags or tension in portions of the overhead circuit.

Additionally, ETI notes that forced outages categorized as "Emergency Switching" account for 13% of the total CM that make up the Forced System Average Interruption Duration Index ("SAIDI") metric for ETI's 2022 SQR.[3] ETI prioritizes safety above all else, and safe work is a cultural value of the Company. In order to mitigate potentially dangerous situations involving repairs on energized lines, the Company has recently modified its internal work practices to conduct more de-energized work. These changes have resulted in many outages being categorized as "Emergency Switching." An example of "Emergency Switching" includes de-energizing lines to address damaged facilities where there is no loss of load but the damage represents an imminent failure or a safety hazard, and working the job energized would be extremely dangerous. Another modification to ETI's internal work practices that contributes to increased CM is a recent requirement to conduct all work involving small wire copper conductor on a de-energized basis. This requirement was implemented in response to past safety events across Entergy Corporation's ("Entergy") footprint and is driven by the high probability of aged copper to break due to its hard and brittle nature. Safety standards continue to be refined, and ETI expects Emergency Switching outages for 2023 to decline as more repairs are able to be done via energized work in a safe manner.

In addition to challenges associated with these equipment types, ETI's outage durations are impacted by its primarily rural service territory, which contains a low load density and long circuits. Many circuits within ETI have a combination of facilities that are accessible by truck and some that are not, which leads to longer restoration times due to the workforce having to climb poles to make repairs. In addition, ETI's service territory is also prone to adverse weather events. For example, the southeast Texas region and Gulf Coast area that ETI serves has 130+ lightning strokes per square kilometer per year (see Figure 1 below), as well as high amounts of precipitation. The high levels of precipitation and humidity in ETI's service territory are favorable for fungal decay, a leading cause of premature utility pole failure. ETI's service territory is located in deterioration Zone 5 (severe) as defined by the United States Department of Agriculture ("USDA") Rural Utilities Service ("RUS") which is the most severe zone for pole decay. (See Figure 2 below).

[3] *CY 2022 Electric Utility Service Quality Report Under 16 TAC § 25.81*, Project No. 54467, ETI's 2022 Service Quality Report (Feb. 14, 2023).

Figure 1 – VAISALA Lightning Density Map[4]

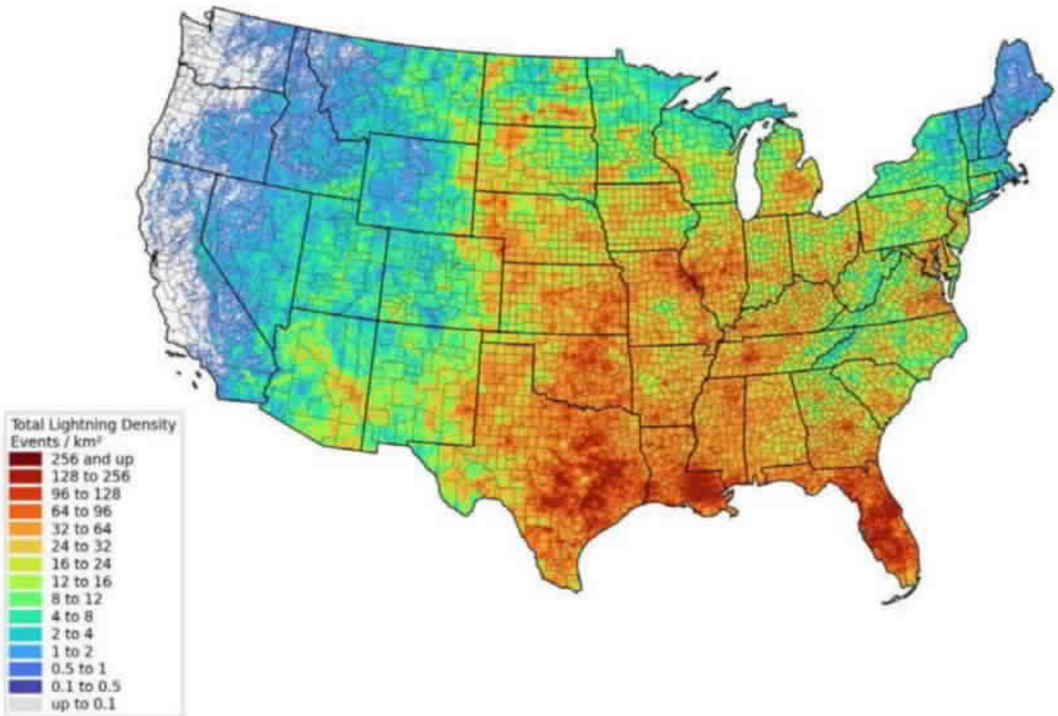
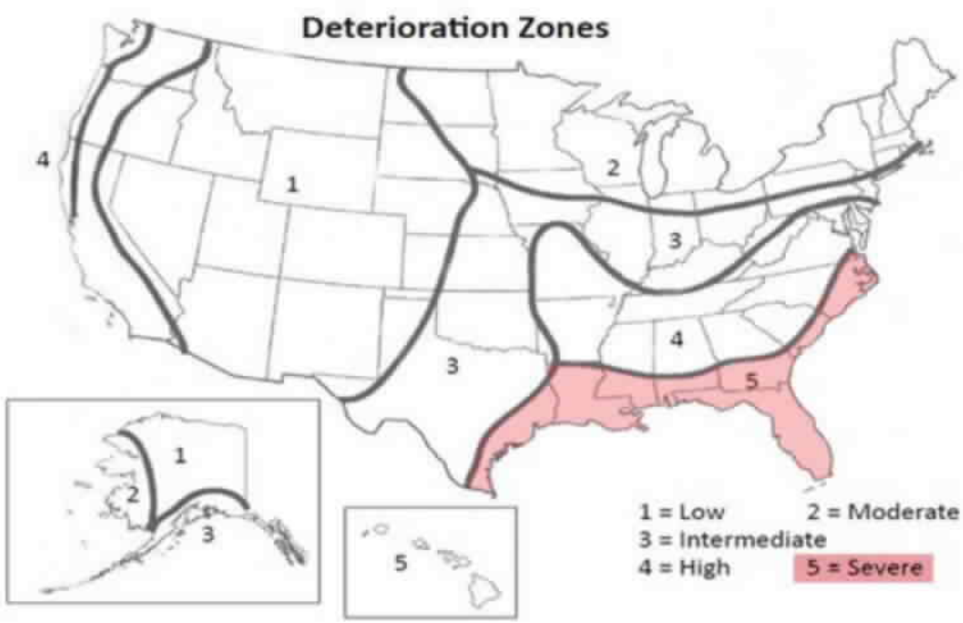


Figure 2 – USDA RUS Deterioration Zones[5]



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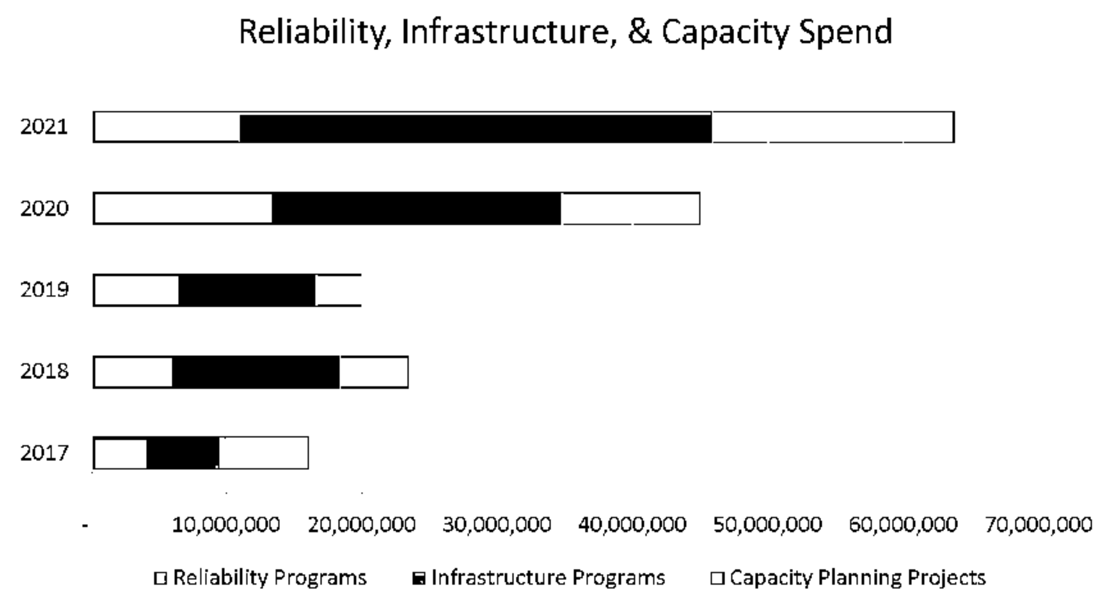
[4] 2021 VAISALA Annual Lightning Report, https://www.vaisala.com/sites/default/files/documents/WEA-MET-2021-Annual-Lightning-Report-B212465EN-A.pdf.

[5] USDA RUS Bulletin 1730B-121 https://www.rd.usda.gov/files/UEP_Bulletin_1730B-121.pdf.

Capital Investment
Consistent with its commitment to provide customers with affordable, reliable, and sustainable power, ETI takes a data driven, analytical, multi-faceted approach to reliability programs. This approach includes balancing system improvements with customer cost impacts to ensure that reliability dollars are spent in a way that makes the most meaningful incremental improvements. From a capital spend perspective, ETI has increased spend by approximately 300% in 2021 as compared to 2017. The breakdown of spend by year is shown in Table 3:

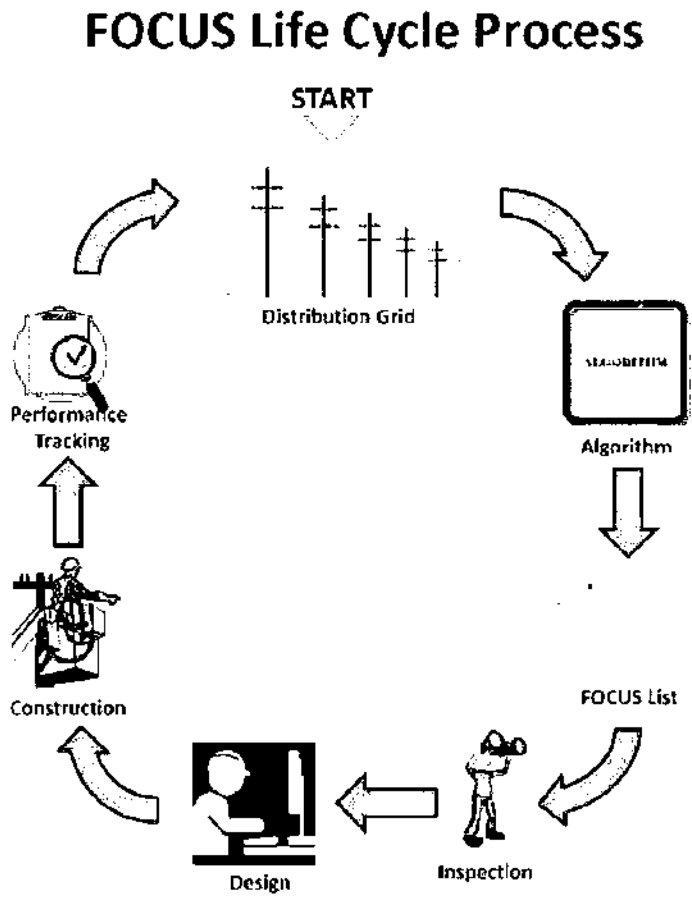
Table 3



ETI Equipment Repair and Replacement Programs
ETI has programs and inspections to help mitigate utility-owned equipment failures, resulting in a reduction in CM, which are described in more detail below. ETI continually looks for ways to enhance or improve upon these programs, as reflected by the use of new technologies discussed throughout that are embedded into various programs (e.g., reclosers, trip savers).

Find, Observe, Correct, Understand, Succeed ("FOCUS") program – The FOCUS program is designed to identify underperforming devices (breakers, reclosers, fuses) based on an algorithm of customer interruptions and outage frequency created by the Asset Management team. The Reliability organization coordinates a full protection zone inspection of selected devices to increase the basic insulation level of the structure, relocate arrestors downstream of fuses, install guy strain insulators, and address any imminent failure issues. Since 2020, ETI has completed approximately 90 FOCUS projects, including 56 on line fuses, 20 on reclosers, and 15 on breakers. This program helps reduce CM through mitigation of interruptions, including installation of sectionalizing devices to help restore unaffected zones. The FOCUS life cycle process is provided as Figure 3 below.

Figure 3 – FOCUS Life Cycle Process



<u>Capacity planning projects</u> – Entergy continually evaluates planning and improvement projects, which are designed to mitigate potential overload of conductor and transformers, including addressing power quality issues due to voltage. Examples of such projects include upsizing a conductor to a higher ampacity, increasing transformer size due to load growth, adding capacitors and regulators, and adding transformers in parallel to spread load. This program helps reduce CM through mitigating interruptions by increasing capacity, including reframing existing structures when increasing wire size is needed. Sectionalizing devices are also incorporated into these scopes, which help reduce CM through the ability to energize unaffected zones through the transfer of load.

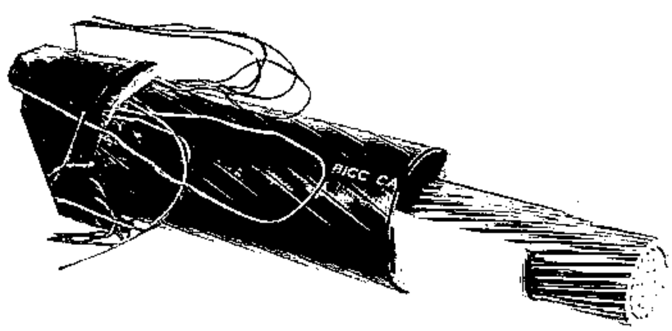
<u>Reliability inspections</u> – Reliability inspections are conducted as needed (typically on a weekly basis) and are a type of rapid response to address devices with a high frequency of outages or other known issues. ETI created a dedicated reliability team to manage these inspections and oversee the other various reliability programs (e.g., FOCUS, underground re-cable). The Reliability team works with personnel in the local networks within ETI's service territory to help identify underperforming devices and address those devices before they become part of the FOCUS

program. The goal of these projects is to address devices with repeat issues more quickly and include various scope types including replacing damaged equipment, addressing hot spots on circuits, eliminating phase slap, and installation of sectionalization devices. This program helps reduce CM through mitigation of interruptions, including placement of sectionalizing devices to help restore unaffected zones.

Equipment inspections – This program facilitates annual inspections on capacitor banks, regulators, and reclosers (> 100 amps) to ensure the devices are operating appropriately. During the inspections, any observed damage to the structure (including the pole and other hardware) is also captured and addressed to help mitigate potential outages. This program reduces CM by mitigating potential causes of interruptions.

Underground re-cable program – The re-cable program is designed to identify end-of-life underground residential development ("URD") conductors for replacement or rejuvenation through cable injection. The program consists of a full loop inspection of URD spans downstream of devices followed by designs for replacement or rejuvenation of the aged facilities. Devices are selected based on performance, and the conductor is replaced or injected based on asset condition and attributes. ETI primarily targets early 1980s non-jacketed XLPE cable for replacement with new Ethylene Propylene Rubber ("EPR") cable. The cable rejuvenation process consists of injecting siloxane dielectric enhancement fluid into the conductor strands to mitigate water egress. The fluid rapidly diffuses from the conductor strands into the solid dielectric material, and once inside the insulation the fluid repairs the damage caused by existing water trees and other defects. Since 2020, ETI has inspected approximately 40 underground loops. Loops are inspected annually, in the spring of the year prior to when the work is to be performed, which allows time for inspections, design, and material procurement. Underground interruptions typically require longer restoration times due to the time needed to troubleshoot and identify the fault location. This program is critical in lowering CM through reducing the number of underground interruptions.

Figure 4 – Jacketed EPR Cable



Pole inspection program – The pole inspection program (including inspection of the attached overhead facilities) complies with the requirements in the National Electric Safety Code ("NESC") for such a program, and ETI has a target 10-year pole inspection cycle. The two inspection methods that ETI utilizes are the "full excavation method" and the "selective sound and bore method." The "full excavation method" involves excavating wood poles to effectively treat and prevent decay at groundline and below (see Figure 5 below). The "selective sound and bore method" involves sounding and selective boring on wood poles to identify those that do not meet NESC loading criteria and to treat internal decay. Since 2017, ETI has restored 9,293 poles and replaced approximately 400 poles as part of the pole inspection program. These replacements are only those attributable to the pole inspection program, and do not take into account additional replacements that ETI has conducted in response to severe weather events, or in other project types such as revenue, mandated, etc. This program is critical in mitigating pole failures, which directly reduces CM, given the longer restoration times required to set a new pole and install framing.

Figure 5 – Below Ground Pole Decay

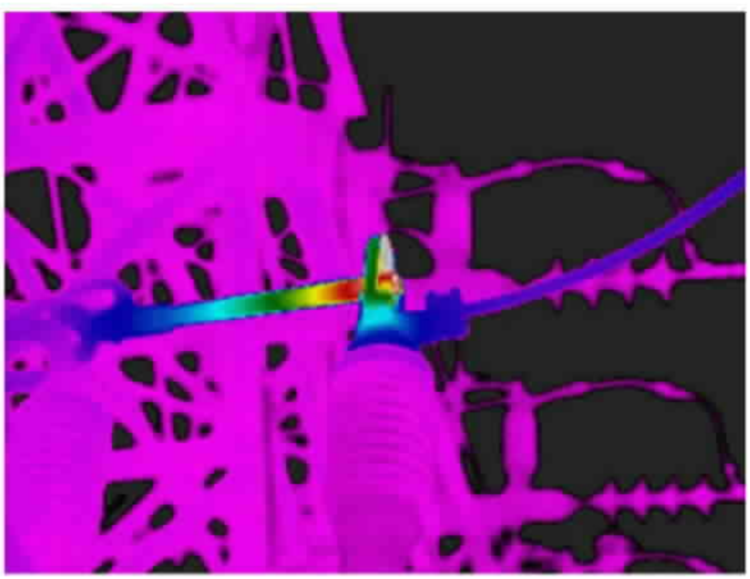
Padmount transformer inspections – This program, recently instituted in 2019, is to inspect and identify padmount transformers connected to underground electrical facilities to be proactively replaced prior to failure. Transformers are inspected as needed based on the performance of upstream devices to ensure they are in good working condition. This program reduces CM by mitigating potential causes of interruptions.

Figure 6 – Padmount Transformer

<u>Underground switch cabinet inspections</u> – This program proactively identifies end-of-life switch cabinets for replacement prior to failure. Equipment is identified based on asset attributes including age, insulating medium, and current state. Following inspections, designs are completed and equipment is replaced with new modern switch cabinets. Entergy has added a new type of switch cabinet called a "Type 5," which helps sectionalize circuits and reduce CM by reducing the number of customers affected during an outage.

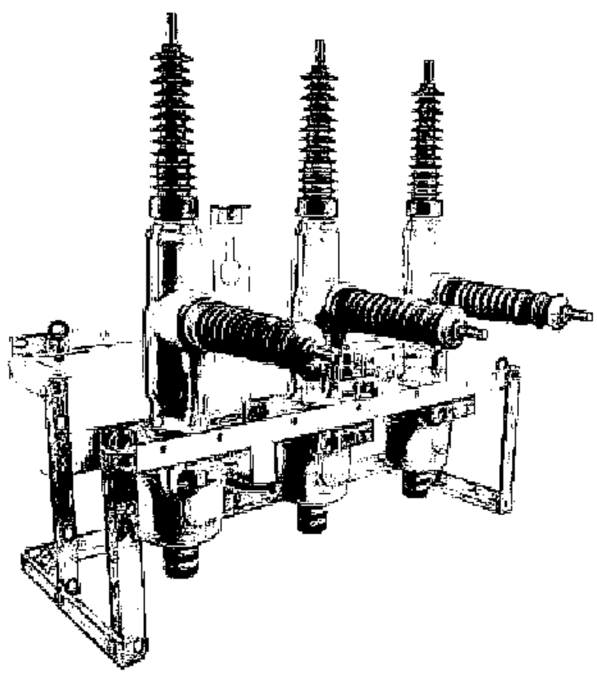
<u>Infrared inspections</u> – Infrared inspections are designed to identify circuit hot spots prior to failure through identification of thermal abnormalities (see Figure 7 below). These inspections help mitigate transformer, connectors, switches, and arrestor failures, and are embedded into the FOCUS program and general reliability inspections. These inspections help reduce CM through mitigating interruptions.

Figure 7 – Disconnect Switch Excessive Heat



Sectionalization (automation) – Recloser devices (see Figure 8 below) that are part of Automatic Load Transfer ("ALT") and Self-Healing Networks ("SHN") move load among the devices to avoid disruption for customers that are not within the faulted zone. These transfer systems have the capability to avoid sustained outages to thousands of customers annually. Installation of these devices can result in automatically transferred load (< 15 seconds) to adjacent unaffected circuits to reduce the number of customers involved in an outage. Smart reclosing devices detect faults through an increase in fault current. ETI has 9 SHN and 51 ALT networks throughout its service territory. There are 19 new SHNs planned and another 25 existing ALTs planned to be converted to the new SHN platform. This program is effective at reducing CM by keeping customers located in unaffected zones energized during an outage.

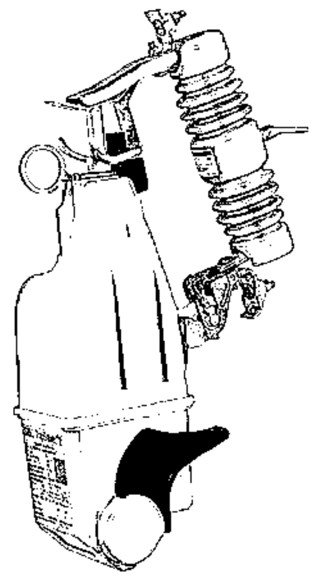
Figure 8 – Vacuum Fault Interrupting Recloser



The programs described above have contributed to the reduction of utility owned equipment failure interruptions that are reflected in Table 1 above.

Leveraging Technology and Enhancing Standards to Improve Reliability
In 2020, ETI began utilizing Trip Savers (cutout mounted reclosers) to further extend reclosing deeper into circuits. These devices work by preventing momentary interruptions from becoming sustained, leading to a reduction in outages and their durations.

Figure 9 – Trip Saver



Entergy modified its pole design standards to incorporate extreme wind guidelines as defined in the NESC to create a more resilient system, which will positively impact outage duration through a reduction in failures. This design change will result in fewer pole failures during adverse weather events, due to designs requiring larger diameter poles (pole Class) that can withstand extreme winds. Entergy has also adopted the process of switching / bringing unaffected zones online prior to making repairs during an outage to reduce CM.

Conclusion
ETI appreciates the significant priority the Commission places on ensuring the reliability of transmission and distribution systems in Texas. ETI is focused on achieving continued improvement in reliability performance to further mitigate and reduce service interruptions. As detailed in this report, ETI has taken and continues to take steps to implement a long-term strategy to achieve sustained reliability through more holistic, data-driven, proactive investments at the whole-feeder level that will replace aging infrastructure and take advantage of technological advancements. As substantial efforts and significant and increasing levels of investment demonstrate, ETI is committed to system reliability and takes seriously its charge to serve its customers' needs reliably. Accordingly, the continued improvement of its processes and deployment of resources to reduce service interruptions remains at the forefront of the ETI's focus and business priorities.