PENNSYLVANIA ELECTRIC RELIABILITY REPORT

2023

PAPUC
PENNSYLVANIA PUBLIC UTILITY COMMISSION

TECHNICAL UTILITY SERVICES
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Table of Contents

Executive Summary

The Electricity Generation Customer Choice and Competition Act mandated the Pennsylvania Public Utility Commission (PUC or Commission) to ensure levels of reliability that existed prior to the restructuring of the electric utility industry continue in the new competitive markets.[1] In response to this mandate, the Commission adopted reporting requirements designed to ensure the continued safety, adequacy and reliability of the generation, transmission and distribution of electricity in the Commonwealth.[2] The PUC also established reliability benchmarks and standards to measure the performance of each electric distribution company (EDC).[3]

The benchmarks and standards established by the Commission are based on four reliability performance metrics adopted by the Institute of Electrical and Electronics Engineers (IEEE). Those metrics are:

- SAIFI: System average interruption frequency index or frequency of outages.

- CAIDI: Customer average interruption duration index or duration of outages.

- SAIDI: System average interruption duration index or frequency of sustained outages.

- MAIFI: Momentary average interruption frequency index or occurrences of momentary customer interruptions.

Note that the Commission has only established benchmarks and standards for CAIDI, SAIDI and SAIFI. Given the uncertainty of weather and other events that affect reliability performance, the Commission has stated EDCs shall set goals to achieve benchmark performance to prepare for times when unforeseen circumstances may briefly and occasionally exceed benchmark performance.[4] In recognition of these unforeseen circumstances, the PUC set the performance standard as the threshold for those times when an EDC can briefly and occasionally exceed benchmark performance. An EDC that consistently fails to achieve benchmark performance is considered out of compliance with the performance regulations and may require a robust corrective action plan, re-organization of management objectives, and/or regulatory penalties.[5]

As mandated, EDCs report reliability performance metrics[6] using both a rolling 12-month average and a rolling 3-year average. Appendix B provides a brief visual comparison summary of the EDCs' rolling 12-month reliability performance in each quarter for 2021 through 2023. More detailed analysis can be found in Section 4, *EDC Reliability Performance Data*. Appendix A provides the 2023 rolling 12-month and rolling 3-year reliability metrics for all EDCs.

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[1] Act of Dec. 3, 1996, P.L. 802, No. 138, 66 Pa. C.S. §§ 2801 *et.seq.*
[2] Docket No. L-00970120; 52 Pa. Code §§ 57.191-57.197.
[3] *See, Amended Reliability Benchmarks and Standards for the Electric Distribution Companies*, Order entered May 11, 2004, at Docket No. M-00991220.
[4] *Id.* at 24.
[5] *Id*. at 25.
[6] For an explanation of performance standards, see Section 2, page 2.

Of note, only two of 11 EDCs achieved the standard performance metric in all three performance categories for the rolling 3-year average. For the rolling 12-months ending Dec. 31, 2023, only three of 11 EDCs achieved the standard performance metric, and only one of 11 EDCs achieved the benchmark metric, in all three reliability performance categories.

In addition to monitoring EDCs' reliability performance, the Commission established inspection and maintenance standards for electric transmission and distribution systems.[7] Biennial plans for the periodic inspection, maintenance, repair, and replacement of facilities, designed to meet performance benchmarks and standards, were approved by the PUC's Bureau of Technical Utility Services (TUS).

Evaluation

In general, overall reliability performance of most EDCs in meeting benchmark performance metrics declined in some important areas. The EDCs struggled in achieving benchmark and standard performance for the average number of outages experienced by customers, or SAIFI.[8] As seen in Appendix B, only four of the 11 EDCs achieved benchmark for SAIFI in all four rolling 12-month quarters of 2023, and only three of the 11 EDCs achieved benchmark for SAIFI in all four rolling 12-month quarters of 2022. Five EDCs achieved benchmarks for SAIFI in all four rolling 12-month quarters in 2021. Out of all 11 EDCs, only three (Duquesne, PECO and PPL) have been consistently achieving benchmark for SAIFI in all rolling 12-month quarters for the past six calendar years (2018 through 2023).

Of note, the three large EDCs that have expended the most capital through their Long-Term Infrastructure Investment Plans (LTIIPs) have been the most consistent in achieving benchmark SAIFI performance the past three years.[9] Duquesne, PECO and PPL have achieved the SAIFI benchmark for all four rolling 12-month quarters each of the past three years.

It is hoped that 2024 will see the beginning of improving performance as TUS views SAIFI as the more important metric to focus on improving as it relates directly to the number of service outages experienced by a customer. The impacts and disruptions to life-sustaining and productive activities caused by electric service outages will obviously be reduced if there are less outages. However, this is not meant to minimize CAIDI as that represents the average duration of an outage for a customer, which is also very important.

As EDCs introduce more distribution automation into their systems, CAIDI will most likely increase. This occurs because of the elimination of non-faulted line sections and their automatic restoration to service by distribution automation systems, *i.e.,* less customers are impacted by any one service outage event. While sectionalizing may reduce the number of customers impacted by an outage, it could possibly lead to increased CAIDI as the outages may be of longer duration as those outages could not be restored by automated means. The Commission finds that in this regard,

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[7] *See, Revision of 52 Pa. Code Chapter 57 Pertaining to Adding Inspection, Maintenance, Repair, and Replacement Standards for Electric Distribution Companies*, Order entered May 22, 2008, at Docket No. L-00040167.
[8] *See,* Section 2, below, for an explanation of SAIFI and all other reliability metrics.
[9] The large EDCs are Duquesne Light, Met-Ed, Penelec, Penn Power, PECO, PPL and West Penn. The Small EDCs are UGI, Citizens', Pike County and Wellsboro.

the CAIDI metric is becoming more realistic of the customer's experienced interruption duration, rather than a general average as determined by aggregate data. The two factors that affect CAIDI are response times and repair times. EDCs will be expected to improve worsening CAIDI, but reducing service outages from occurring in the first place is crucial to improving reliability performance.

Possibly a more significant issue is that most of the EDCs, large and small, have shown very little improvement in reliability as evidenced by the increasing number of service interruption events. From 2015 through 2023, all but four of the EDCs (Citizens', Penn Power, Pike, and Wellsboro) have shown a trend of increasing service interruption events. In terms of the number of customers impacted by those interruption events, only Duquesne, Penn Power, and West Penn had a lower total number of customers interrupted in 2023 than were interrupted during 2015, while PECO had approximately the same number of customers interrupted in 2023 as in 2015.[10] Met-Ed, Penelec, and West Penn have not met benchmark SAIDI in any rolling 12-month quarter in 2021, 2022, or 2023. PPL is currently meeting the SAIFI benchmark metric, but is still experiencing an upward trend in both customer minutes interrupted (CMI) and number of service interruption events.

Electric reliability and resilience[11] in Pennsylvania appear to be most challenged during storm activity that brings down off-right-of-way (OROW) trees, and overhanging limbs from canopy trees above the clearing zones within the right-of-way (ROW) onto the distribution lines. Many of those trees and limbs are still standing dead vegetation from the ravages of the Emerald Ash Borer and other pests which have attacked the state woodlands. EDCs are continuing to struggle to achieve sustained benchmark performance. This is the direct result of vegetation management policies, programs and storm activity. Storm activity acts upon the vulnerability of weakened trees in the overhanging canopy, and OROW trees. Since 2015 and continuing throughout 2023, vegetation is the number one cause of outages and lost customer-minutes in Pennsylvania. This issue has increased sharply and can be seen in the individual EDC performance details in Section 4, below, and for all Pennsylvania EDCs in Section 5, below.

Reliability Collaborative

Based on the findings of the PUC's reliability report released on Sept. 16, 2020, and the reliability performance in the first two quarters of 2020, TUS issued an informal data request to the EDCs and the Energy Association of Pennsylvania (EAP) that generally focused on what EDCs believed the challenges were to consistently meet the reliability benchmarks. TUS then held an informal discussion on Oct. 16, 2020, with the EDCs and EAP about the responses to the data request.

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[10] Note that Duquesne reports by million kilovolt-amps interrupted, rather than by customers disrupted. See the individual EDC figures for customers interrupted, customer minutes interrupted, and number of interruption events in the Utility Specific Performance Data portion of Section 4, below.

[11] Resilience has many definitions, but commonly is understood to align generally with the definition in Presidential Policy Directive 21: "…the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents." https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil.

For the Commission to more fully inform any subsequent electric reliability policies or actions pursuant to those issues, the Commission, via a Secretarial Letter served on June 3, 2021, initiated an Electric Reliability Collaborative (ERC), and invited the EDCs, EAP, and statutory advocates to participate.[12]

The ERC focused on reviewing the electric distribution reliability regulations, with particular attention to the calculation of the reliability performance metrics and also discussed exploring whether options such as performance-based rates tied to reliability metrics may lead to improved reliability performance at a reasonable cost, developing an understanding of the customer experience with electric reliability in Pennsylvania, and exploring how the Commission, EDCs, and other stakeholders can work together to lessen the impact of OROW trees on electric reliability.

The first meeting of the ERC was held on July 21, 2021, subsequent meetings occurred on Sept. 10, 2021, Feb. 11, 2022, April 8, 2022, April 20, 2023, and the latest being April 28, 2023. Meeting points of discussion included electric reliability in general, OROW trees, consideration of the IEEE 2.5 beta method for calculation of the reliability statistics, approaches on the IEEE 2.5 beta in other states, and regulatory and procedural considerations of any proposed change to reliability statistical methodologies in Pennsylvania.[13] Pennsylvania EDCs have forwarded their positions about utilizing IEEE 2.5 beta methodology as it applies to improving the reliability of Pennsylvania's electric distribution system. TUS is preparing its recommendations to the Commission for consideration on next steps to be taken as the reliability review process moves forward.

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[12] The Secretarial Letter was served on June 3, 2021, at Docket No. M-2021-3024513.
[13] The IEEE methodologies utilized by the EDCs are found at IEEE 1366-2012, *IEEE Guide for Electric Power Distribution Reliability Indices*.

Section 1 – Introduction

Purpose

This report discusses the reliability performance of EDCs operating under the Commission's jurisdiction, specifically focusing on the reliability of the electric distribution system.[14]

The data presented in this report comes from the quarterly and annual reliability reports submitted by EDCs pursuant to the Commission's regulations. This data focuses on customer power restoration duration (CAIDI), average customer outage duration (SAIDI) and frequency of outages (SAIFI).[15] From these measures, this report provides an overview of the Commonwealth's electric distribution reliability as well as individual analyses of the EDCs operating within Pennsylvania.

Background

The Electricity Generation Customer Choice and Competition Act mandates the Commission ensure the level of reliability that existed prior to the restructuring of the electric utility industry is maintained in the newly restructured markets.[16] In response to this mandate, the Commission adopted reporting requirements designed to monitor continuing safety, adequacy, and reliability of generation, transmission, and distribution of electricity in the Commonwealth. [17]

The Commission also established reliability benchmark and standard values to measure the performance of each EDC.[18] Given the uncertainty of weather and other events that can affect reliability performance, the Commission has stated that EDCs should set goals to achieve consistent benchmark performance in order to prepare for times when unforeseen circumstances occasionally and briefly cause performance to exceed the benchmark threshold.[19] As mandated, enforcement of the 3-year rolling average standard began with the utilities' filing of their 2006 annual reports. The 3-year performance standard only allows a deviation of 10% from the reliability index benchmark, as compared with the 20% or 35% deviations allowed by the 12-month performance standard.

The Commission set the performance standard as the occasional and brief maximum level an EDC can exceed the benchmark reliability performance value. Reliability performance values that are not considered in compliance require EDCs to provide an evaluation to the Commission that includes a Corrective Action Plan or a credible basis that would justify no corrective action is required. Reliability performance values that are not achieved during an assessment period will be followed up by the Commission. The inability of an EDC to achieve consistent compliance may result in an Order directing specific corrective actions.[20] Continuous noncompliance may

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[14] The high-voltage transmission system, nominally > 100 kV, is regulated by the Federal Energy Regulatory Commission (FERC). The electric distribution system is under the purview of the PUC.

[15] For more information on CAIDI, SAIDI and SAIFI, see Section 2.

[16] 66 Pa.C.S. § 2802(3).

[17] 52 Pa. Code § 57.195.

[18] 52 Pa. Code §§ 57.191-57.198.

[19] *See, Amended Reliability Benchmarks and Standards for the Electric Distribution Companies*, Order entered May 11, 2004, at Docket No. M-00991220, at 24.

[20] 52 Pa. Code § 57.197(a).

trigger additional scrutiny and potential compliance enforcement actions by the Commission's prosecutorial staff in the Bureau of Investigation and Enforcement, including penalties and fines.[21]

Note that by the Order entered on Dec. 7, 2023, the Commission granted certain approvals and certificates of public convenience for the unification of the four FirstEnergy Company EDCs that operated in Pennsylvania (Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company) into one EDC, FirstEnergy Pennsylvania Electric Company (FE PA).[22] The former EDCs are now rate districts of FE PA. FE PA assumed all responsibilities and requirements of the former EDCs, including, *inter alia*, for electric reliability (for reliability performance and the requirements of the former EDCs' Inspection and Maintenance Plans filed pursuant to 52 Pa. Code § 57.198).[23] FE PA reports as one EDC but reports data for each rate district. In order to avoid confusion and to allow comparison to previous electric reliability reports, the FE PA rate districts are referred to as EDCs throughout this report.

Section 2 – Reliability Performance Measures

Reliability Performance Metrics

The Commission's benchmarks and standards are based on four reliability performance metrics that have been adopted by the IEEE. The EDCs report metrics on a system-wide basis, rather than on a regional operating area basis. EDCs report the four-reliability metrics on both a rolling 12-month average and a 3-year calendar year average. Note that the Commission has only established benchmarks and standards for CAIDI, SAIDI and SAIFI. The metrics are defined as:

1. **CAIDI** (Customer Average Interruption Duration Index): Measures average power restoration time (by minutes) for every customer who lost power during reporting period.

2. **SAIDI** (System Average Interruption Duration Index): Measures average outage duration time (by minutes) for every customer served during reporting period.

3. **SAIFI** (System Average Interruption Frequency Index): Measures average frequency of power interruptions for every customer served during reporting period.

4. **MAIFI** (Momentary Average Interruption Frequency Index): Measures average frequency of momentary (five minutes or less) interruptions for every customer served during reporting period.[24]

Additional information and data reported by EDCs:

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[21] 52 Pa. Code § 57.194(h)(1).

[22] *See, Joint Application of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, West Penn Power Company, Keystone Appalachian Transmission Company, Mid-Atlantic Interstate Transmission, LLC, and FirstEnergy Pennsylvania Electric Company*, at Docket Nos. A-2023-3038771, et al.

[23] *Id. See also* at the same Docket Nos., *Joint Petition for Approval of Settlement of All Issues*, filed Aug. 30, 2023, and *Recommended Decision of Administrative Law Judge Conrad A. Johnson and Administrative Law Judge Emily I. DeVoe*, dated Oct. 19, 2023.

[24] EDCs are required to report MAIFI data, provided the equipment capability is available to obtain relevant data. Only Met-Ed, PECO, Penelec, Penn Power and PPL report MAIFI.

- Average number of customers served.

- Number of sustained customer interruption minutes.

- Number of customers affected by service interruptions.

- Analysis of outage causes such as equipment failure, animal contact and contact with trees.[25]

- Reliability performance on the 5% of worst performing circuits and a corrective action plan to increase the reliability of these circuits.

Major Events

To analyze and set measurable goals for electric service reliability performance, outage data is separated into either normal or abnormal periods. Only outages during normal event periods are used in calculating the reliability metrics. The term "Major Event" is used to identify an abnormal event, such as a major storm, and is defined as either of the following:[26]

- An interruption of electric service resulting from conditions beyond the control of the EDC which affects at least 10 % of the customers in the EDC's service territory during the course of the event for a duration of five minutes or greater; or

- An unscheduled interruption of electric service resulting from an action taken by an EDC to maintain the adequacy and security of the electrical system.

Outage data relating to Major Events are to be excluded from the calculation of reliability metrics. Prior to excluding major event data, an EDC is required to formally request to exclude those service interruptions for reporting purposes. The request must be accompanied by data that demonstrates why the service interruption qualifies as a major event exclusion.

Definitions: benchmark, standard, 12-month average, & 3-year average

The **benchmark** performance value represents the statistical average of the EDC's annual, system-wide, reliability performance index values for the five years from 1994 through 1998. The benchmark value serves as an upper limit that EDCs should be consistently achieving to ensure reliability performance is considered satisfactory and acceptable.

The **standard** performance value represents an EDC's performance upper control limit established to allow EDCs to exceed the benchmark performance value occasionally and briefly. Both long-term (rolling 3-year) and short-term (rolling 12-month) performance standards have been established for each EDC based on individual EDC historical performance benchmarks. The performance standard limit allows an EDC to exceed a benchmark limit occasionally and briefly. However, consistently exceeding benchmark performance, or exceeding the standard limit is an indication that the EDC's performance is not satisfactory and requires additional scrutiny by the Commission.

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[25] This information is collected and trended by EDCs to reduce customer outages and improve system reliability.
[26] *See,* 52 Pa. Code § 57.192.

The performance rolling **12-month average** is 120% of the benchmark for the large EDCs and 135% for the small EDCs.[27] A greater degree of short-term latitude for small EDCs recognizes that small EDCs have fewer customers and fewer circuits than large EDCs, potentially allowing a single event to have a more significant impact on the reliability performance of the small EDCs' distribution systems.

The performance rolling **3-year average** is 110% of the benchmark for all EDCs. This performance standard was set at 10% above the historical benchmark to ensure that the standard is no higher than the worst annual performance experienced during the years prior to the restructuring of the electric industry. The 3-year average performance is measured against the standard at the end of each calendar year. The rolling 3-year standard analysis contained in this report uses 2021, 2022 and 2023 calendar year data.

It is noted that a lower number for any index indicates better reliability performance, i.e., a lower frequency of outages or shorter outage duration. A higher number indicates worse performance.

Example: A large EDC's rolling 12-month **CAIDI benchmark** performance metric is 100 and associated **CAIDI standard** performance metric is 120 (which is 120% of benchmark). Evaluate an EDC's quarterly CAIDI score of 110, 90, and 140:

CAIDI of 110 evaluations: Performance is above **benchmark**, but below **standard**, and may require additional review and action if the EDC is chronically above **benchmark** score and trending toward exceeding **standard**. Upon Commission review, the EDC may be required to develop a Corrective Action Plan (CAP) and **additional PUC oversight will be taken to monitor effectiveness until performance is below benchmark**. In addition, this may result in a referral to the Bureau of Investigation & Enforcement (BIE) for further action.

CAIDI of 90 evaluations: Performance is considered excellent since CAIDI is below both **benchmark and standard**.

CAIDI of 140 evaluations: Performance is considered unacceptable since CAIDI is greater than both **benchmark and standard**. The EDC will be required to develop a Corrective Action Plan (CAP) and additional PUC oversight will be taken to monitor effectiveness until benchmark performance is achieved. In addition, may result in a referral to BIE for further action.

If any EDC's reliability performance does not meet Commission regulations, the Commission may require a report discussing the reasons for not meeting the regulation and the corrective measures the company is taking to improve performance.[28] In addition, Commission staff may initiate an investigation to determine whether an EDC is providing reliable service.[29]

Benchmarks and standards for EDC reliability performance and actual reliability metrics for 2023 are located in Appendix A.

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[27] The large EDCs are Duquesne Light, Met-Ed, Penelec, Penn Power, PECO, PPL and West Penn. The Small EDCs are UGI, Citizens', Pike County and Wellsboro.
[28] *See,* 52 Pa. Code § 57.195(g).
[29] *See,* 52 Pa. Code § 57.197(a).

Inspection and Maintenance

EDCs are required to have a plan for periodic inspection and maintenance of poles, overhead conductors and cables, wires, transformers, switching devices, protective devices, regulators, capacitors, substations, and other facilities critical to maintaining an acceptable level of reliability.[30] The time intervals for such inspections are detailed in Table 1 below. The regulation also sets forth minimum inspection and maintenance intervals for vegetation management, poles, overhead lines and substations.

Listed below are the most recently filed biennial inspection and maintenance (I&M) plans for the periodic inspection, maintenance, repair and replacement of facilities:

- Filed in October 2023 (effective January 2025 through December 2026) for FE PA (Met-Ed, Penelec, Penn Power and West Penn) and UGI.
- Filed in October 2022 (effective January 2024 through December 2025) for Duquesne, PECO, PPL, Citizens', Pike, and Wellsboro.

The plans are subject to acceptance or rejection by the Commission. Most EDCs proposed deviations to the standards for some programs or parts of programs. Appendix C describes the deviations that were requested by the EDCs and provides a summary of the explained justification for said deviations.[31]

Table 1 – Inspection and Maintenance Intervals

Program	Interval
Vegetation Management	4-6 years
Pole Inspections	10-12 years
Overhead Distribution Line Inspections	1-2 years
Overhead Transformer Inspections	1-2 years
Above-Ground Pad-Mounted Transformer Inspections	5 years
Below-Ground Transformer Inspections	8 years
Recloser Inspections	8 years
Substation Inspections	5 weeks

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[30] *See,* 52 Pa. Code § 57.198.
[31] *See,* 52 Pa. Code § 57.198(c).

Section 3 – 2023 Outage Response Review

Overview

Tables 2A and 2B, below, present a breakdown of reportable outage events (ROEs)[32] summarized for 2023 (49 events) as compared to 2022 (42 events).

Table 2C below, details the number of ROEs from 1994 through 2023. Note the number of ROEs that occurred during the benchmark period from 1994 through 1998, as compared to the number that occurred in each of the past 4 years and in the period 2003 through 2012. Some of the increase in ROEs could be due to aging infrastructure that is impacted by weather, but ROEs appear to be increasing in frequency for all EDCs, including those that have strong infrastructure improvement plans, as shown in Table 2E below. This information is highlighted to show that EDCs are expected to provide service at a level equal to or better than that provided during the benchmark period, regardless of whether ROEs are increasing on an annual basis.

Table 2D below details the number of customers affected by ROEs from 1994 through 2023. In 2023, a total of 1,670,056 customers were negatively affected by ROEs as compared to 1,396,669 customers in 2022, 1,964,501 in 2021, and 2,431,842 in 2020.

Note: The high level of customers affected in 2011, 2012, 2014, and 2018 are primarily due to a few high-impact events, such as Irene in 2011, Sandy in 2012, Nika in 2014, and Riley/Quinn in 2018.

Table 2E below, details the cumulative number of ROEs by EDC for the past 10 years (2014 through 2023).

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[32] Service outages reports are required under 52 Pa. Code § 67.1. The reporting threshold for a 67.1 reportable outage event is five percent of total customers or 2,500 customers, whichever is less, for six or more consecutive hours. The reporting requirements are an initial phone call to the Commission when it is believed the threshold will be reached, followed by a written report 10 working days after the last customer is restored.

Table 2A – 67.1 Reportable Outage Events Summary 2023

EDC	Date	Customers Affected	Cause
PPL	2/21/23	13,770	Winter storm with heavy, wet snow
Penelec	3/3/23	50,057	Winter storm with rain, snow and ice
PPL	3/3/23	18,659	Wintry mix of rain & snow
West Penn	3/3/23	52,772	Winter storm with snow & ice
Penelec	3/6/23	9,402	Winter storm with heavy, wet snow
PPL	3/6/23	20,438	Winter storm with heavy, wet snow
DLC	3/25/23	62,276	Severe thunderstorms with high winds
Penelec	3/25/23	52,365	Severe thunderstorms with high winds
Penn Power	3/25/23	58,948	Severe thunderstorms with high winds
West Penn	3/25/23	61,090	Severe thunderstorms with high winds
DLC	4/1/23	67,383	Severe thunderstorms with high winds
Met-Ed	4/1/23	18,728	Severe thunderstorms with high winds
PECO	4/1/23	37,848	Severe thunderstorms with high winds
Penelec	4/1/23	115,095	Severe thunderstorms with high winds
Penn Power	4/1/23	49,977	Severe thunderstorms with high winds
PPL	4/1/23	24,323	Severe thunderstorms with high winds
Wellsboro	4/1/23	4,429	Severe thunderstorms with high winds
West Penn	4/1/23	111,285	Severe thunderstorms with high winds
Met-Ed	4/22/23	12,136	Severe thunderstorms with high winds
PPL	4/22/23	41,738	Severe thunderstorms with high winds
Penelec	5/7/23	5,220	Transmission line outage
PPL	6/3/23	17,851	Severe thunderstorms with high winds
PECO	6/25/23	81,325	Severe thunderstorms with high winds
West Penn	7/13/23	29,076	Severe thunderstorms with high winds
West Penn	7/20//23	21,173	Severe thunderstorms with high winds
Penelec	7/20/23	61,346	Severe thunderstorms with high winds
Met-Ed	7/21/23	8,386	Severe thunderstorms with high winds
Met-Ed	7/28/23	19,241	Severe thunderstorms with high winds
Met-Ed	8/7/23	69,434	Severe thunderstorms with high winds
PECO	8/7/23	49,879	Severe thunderstorms with high winds
PPL	8/7/23	58,870	Severe thunderstorms with high winds
PPL	8/12/23	11,284	Severe thunderstorms with high winds
West Penn	8/12/23	11,812	Severe thunderstorms with high winds
Penelec	8/12/23	19,888	Severe thunderstorms with high winds
Met-Ed	8/13/23	20,399	Severe thunderstorms with high winds
PPL	8/18/23	11,002	Severe thunderstorms with high winds
DLC	8/25/23	20,778	Severe thunderstorms with high winds
Penn Power	8/25/23	9,072	Severe thunderstorms with high winds
West Penn	8/25/23	52,401	Severe thunderstorms with high winds
Met-Ed	9/7/23	54,243	Severe thunderstorms with high winds
Penelec	9/7/23	16,214	Severe thunderstorms with high winds
PPL	9/7/23	60,127	Severe thunderstorms with high winds
UGI	9/7/23	6,867	Severe thunderstorms with high winds
PPL	9/9/23	14,657	Severe thunderstorms with high winds
PPL	9/23/23	17,644	Tropical Storm Ophelia remnants
Pike	10/9/23	1,905	Fallen tree on subtransmission serving substation
PPL	12/10/23	15,550	High rain & wind event
PPL	12/27/23	9,301	High rain & wind event
Met-Ed	12/28/23	12,392	High rain & wind event
Totals		**1,670,056**	

Table 2B – 67.1 Reportable Outage Events Summary 2022

EDC	Date	Customers Affected	Cause
DLC	2/3/22	18,911	Winter Storm Landon w/rain, snow, ice
DLC	3/7/22	13,147	High winds
DLC	5/3/22	9,562	Severe tstorms, heavy rain, high winds
DLC	6/22/22	25,374	Severe tstorms, high winds, heavy rains
DLC	7/23/22	53,935	Severe tstorms, high winds, heavy rains
DLC	8/29/22	10,993	Severe tstorms with high winds
DLC	12/23/22	36,790	Winter Storm Elliott
Met-Ed	1/16/22	15,030	Winter storm with high winds and wet snow
Met-Ed	2/17/22	48,143	Winter storm with rain, snow, and high winds
Met-Ed	3/7/22	13,538	High winds, rain
Met-Ed	3/12/22	35,704	Winter storm with rain, snow, and high winds
Met-Ed	12/23/22	65,662	Winter Storm Elliott
PECO	2/18/22	57,871	High winds, rain, and lightning
PECO	5/6/22	28,053	Severe tstorms, heavy rain, high winds
PECO	12/23/22	65,562	Winter Storm Elliott
Penelec	2/17/22	17,266	Winter storm with rain, snow, and high winds
Penelec	3/7/22	40,903	High winds, sleet, rain
Penelec	4/19/22	48,934	Winter storm with rain, wet snow and high winds
Penelec	5/21/22	10,900	Severe tstorms, heavy rain, high winds
Penelec	7/22/22	51,707	Severe tstorms, high winds, heavy rains
Penelec	8/4/22	25,556	Severe tstorms with high winds
Penelec	12/22/22	50,105	Winter Storm Elliott
Penn Power	5/21/22	24,536	Severe tstorms, heavy rain, high winds
PPL	1/16/22	15,354	Winter storm with high winds
PPL	2/17/22	44,699	Winter storm with rain, snow, and high winds
PPL	3/7/22	33,332	High wind and rain event
PPL	4/18/22	20,441	Winter storm with rain,wet snow and high winds
PPL	7/12/22	9,732	Scattered severe tstorms
PPL	7/24/22	13,728	Severe tstorms, high winds, heavy rains
PPL	11/30/22	24,686	High wind and heavy rain event
PPL	12/15/22	34,985	Winter storm with ice and high winds
PPL	12/22/22	75,372	Winter Storm Elliott
West Penn	2/3/22	36,402	Winter Storm Landon w/rain, snow, ice
West Penn	2/17/22	34,040	Winter storm with rain, snow, and high winds
West Penn	3/7/22	41,793	Cold front with tstorms, rain, and high winds
West Penn	5/3/22	56,066	Severe tstorms, heavy rain, high winds
West Penn	6/16/22	29,695	Severe tstorms with high winds
West Penn	6/22/22	39,810	Severe tstorms, high winds, heavy rains
West Penn	7/23/22	49,879	Severe tstorms, high winds, heavy rains
West Penn	11/27/22	9,795	Severe tstorms, high winds, heavy rains
West Penn	12/15/22	11,486	Winter storm with ice and high winds
West Penn	12/23/22	47,192	Winter Storm Elliott
TOTALS		**1,396,669**	

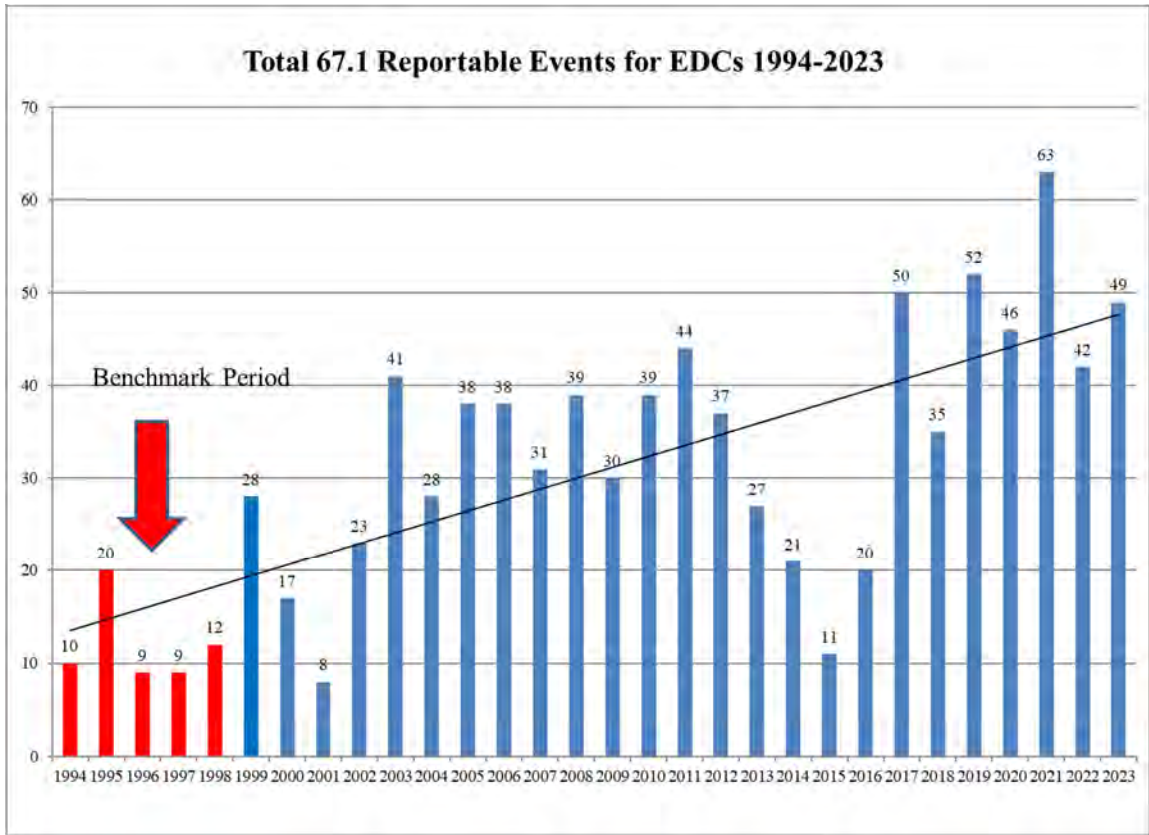*Table 2C – Total 67.1 Reportable Events for EDCs 1994 through 2023*

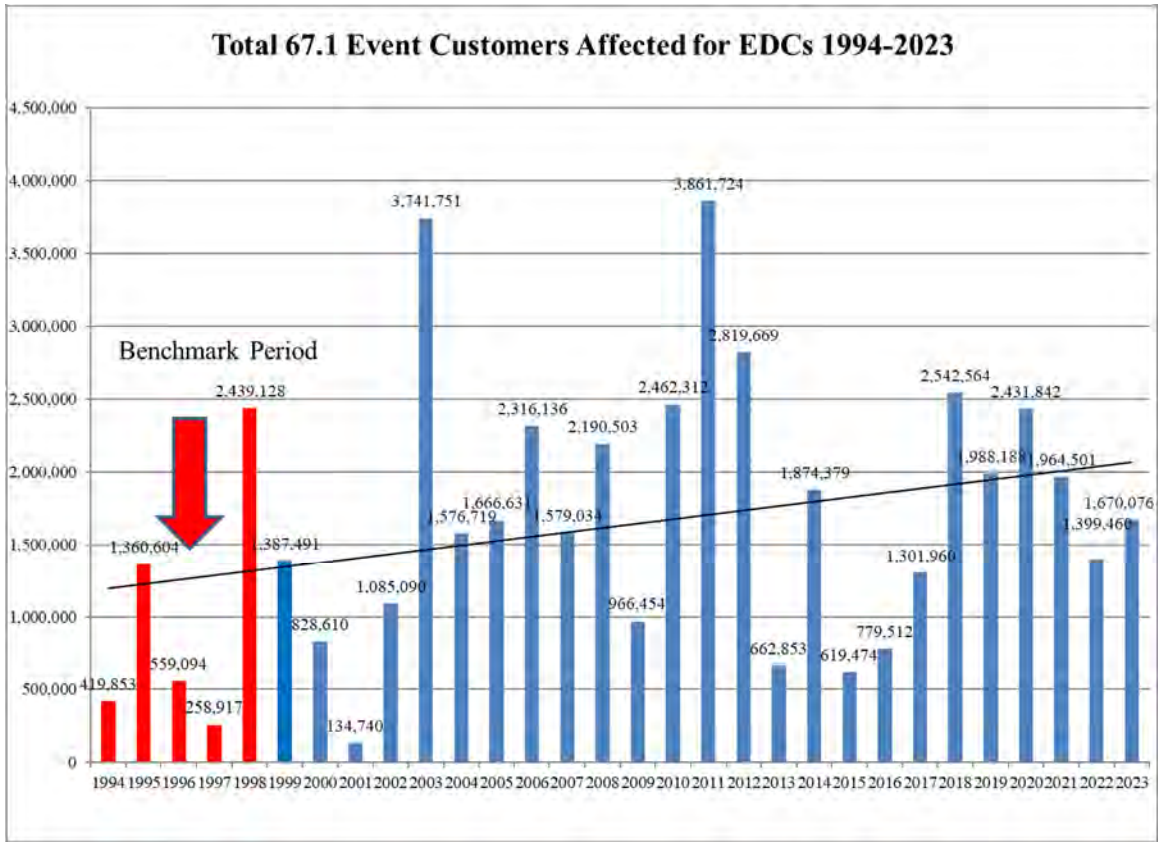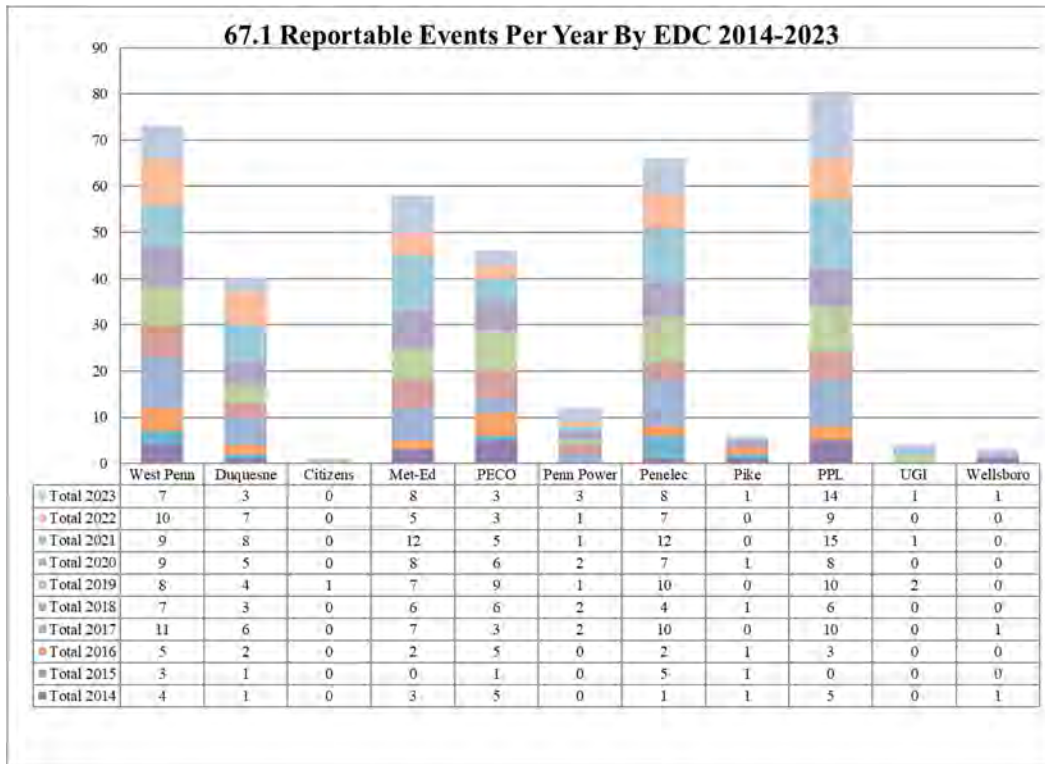*Table 2D – Total Customers Affected by 67.1 Reportable Events 1994 through 2023*

Table 2E – 67.1 Reportable Events by EDC 2014 through 2023

	West Penn	Duquesne	Citizens	Met-Ed	PECO	Penn Power	Penelec	Pike	PPL	UGI	Wellsboro
Total 2023	7	3	0	8	3	3	8	1	14	1	1
Total 2022	10	7	0	5	3	1	7	0	9	0	0
Total 2021	9	8	0	12	5	1	12	0	15	1	0
Total 2020	9	5	0	8	6	2	7	1	8	0	0
Total 2019	8	4	1	7	9	1	10	0	10	2	0
Total 2018	7	3	0	6	6	2	4	1	6	0	0
Total 2017	11	6	0	7	3	2	10	0	10	0	1
Total 2016	5	2	0	2	5	0	2	1	3	0	0
Total 2015	3	1	0	0	1	0	5	1	0	0	0
Total 2014	4	1	0	3	5	0	1	1	5	0	1

Major Events

In 2023, the resilience of Pennsylvania's electrical system was challenged with a substantial amount of severe storm activity as evidenced by the number of ROEs. Pennsylvania customers were adversely affected in 2023 with approximately 601,222 customers impacted by Major Events in 2023, as compared to 114,539 customers impacted in 2022 and 177,115 customers in 2021. In 2023, there were 21 Major Event exclusion requests approved, as compared to 16 in 2022, 22 in 2021, 29 in 2020 and 23 in 2019. Note that Major Events are excludable from an EDC's reliability indices and the additional customer outages and customer-minutes-interrupted are not added to the reliability metrics.

Major Events for 2023 and 2022 are shown below in Tables 3A and 3B, respectively.

Table 3A – Major Events for 2023

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Duquense	3/25/23	62,276	Weather	417,158,713 kVA-Min
Duquense	4/1/23	67,383	Weather	234,650,099 kVA-Min
Citizen's	4/1/23	801	High Winds & Tree	97,272
Met-Ed	8/7/23	69,436	Storms with High Winds	93,209,582
Penelec	4/1/23	126,310	Storms with High Winds	85,092,453
Penn Power	3/25/23	59,706	Storms with High Winds	49,757,745
Penn Power	4/1/23	49,977	Storms with High Winds	47,932,357
Pike	10/9/23	1,905	Tree on Feeder	59,055
PIke	12/4/23	1,614	Animal contact	272,766
UGI	1/11/23	10,605	Animal contact (substation)	871,809
UGI	9/7/23	6,867	Weather	2,767,551
Wellsboro	2/3/23	738	High Winds & Trees	49,406
Wellsboro	2/21/23	3,703	High Winds & Trees	219,247
Wellsboro	4/1/23	4,429	High Winds & Trees	1,493,292
Wellsboro	7/27/23	1,723	High Winds & Trees	276,180
Wellsboro	8/8/23	1,726	High Winds & Trees	55,519
Wellsboro	9/22/23	1,124	Fault on Line	15,417
Wellsboro	10/4/23	713	Conductor Failure	140,556
Wellsboro	11/21/23	1,175	High Winds	239,049
West Penn	3/3/23	17,626	Winter Storm	21,202,760
West Penn	4/1/23	111,285	Storms with High Winds	61,088,108
21	**Totals**	**601,122**	**Totals**	**364,840,124**

Table 3B – Major Events for 2022

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	4/1/22	801	Weather	97,272
Met Ed	12/23/22	65,662	Winter Storm Elliot	33,801,371
Penn Power	5/21/22	24,536	Weather	20,138,249
Pike	6/18/22	2,157	Human Error (Non-Employee)	204,807
Pike	6/23/22	2,157	Vehicle	195,437
Pike	9/5/22	1,847	Weather & Equipment Failure	251,192
Pike	9/12/22	4,757	Vehicle	3,820,796
Wellsboro	3/7/22	735	Weather - Winds	148,068
Wellsboro	4/19/22	1,239	Weather - Snow	157,284
Wellsboro	7/21/22	1,731	Off ROW Tree	156,360
Wellsboro	7/22/22	815	Annimal Contact	51,535
Wellsboro	8/4/22	743	Weather - Winds	64,283
Wellsboro	8/30/22	755	Off ROW Tree	120,334
Wellsboro	9/24/22	1,716	Off ROW Tree	237,208
Wellsboro	9/26/22	2,338	Weather - Winds	466,925
Wellsboro	12/23/22	2,550	Weather - Winds	467,185
16	**Totals**	**114,539**	**Totals**	**60,378,306**

Review of Long-Duration Outage Events

There were no long duration electric outage events (those with outages lasting six or more days) in 2023.

Section 4 – EDC Reliability Performance Data

Statewide Summary

Rolling 12-month Benchmark Performance Compliance

The 2023 end-of-year reliability data for 12-month CAIDI, SAIDI, and SAIFI Benchmark performance compliance submitted by the 11 EDCs is presented below. **Note that a zero or negative percentage indicates positive performance at or below the benchmark**. The data indicates that:

- Four EDCs achieved the **CAIDI Benchmark**, while seven of the EDCs failed to achieve the CAIDI benchmark (Figure 1 below).

- Only four EDCs achieved the **SAIDI Benchmark**, while seven EDCs failed to achieve the SAIDI benchmark (Figure 2 below).

- Five EDCs achieved the **SAIFI Benchmark**, while six EDCs failed to achieve the SAIFI benchmark (Figure 3 below).

Figure 1 – 2023 CAIDI Comparison (percent above or below benchmark)
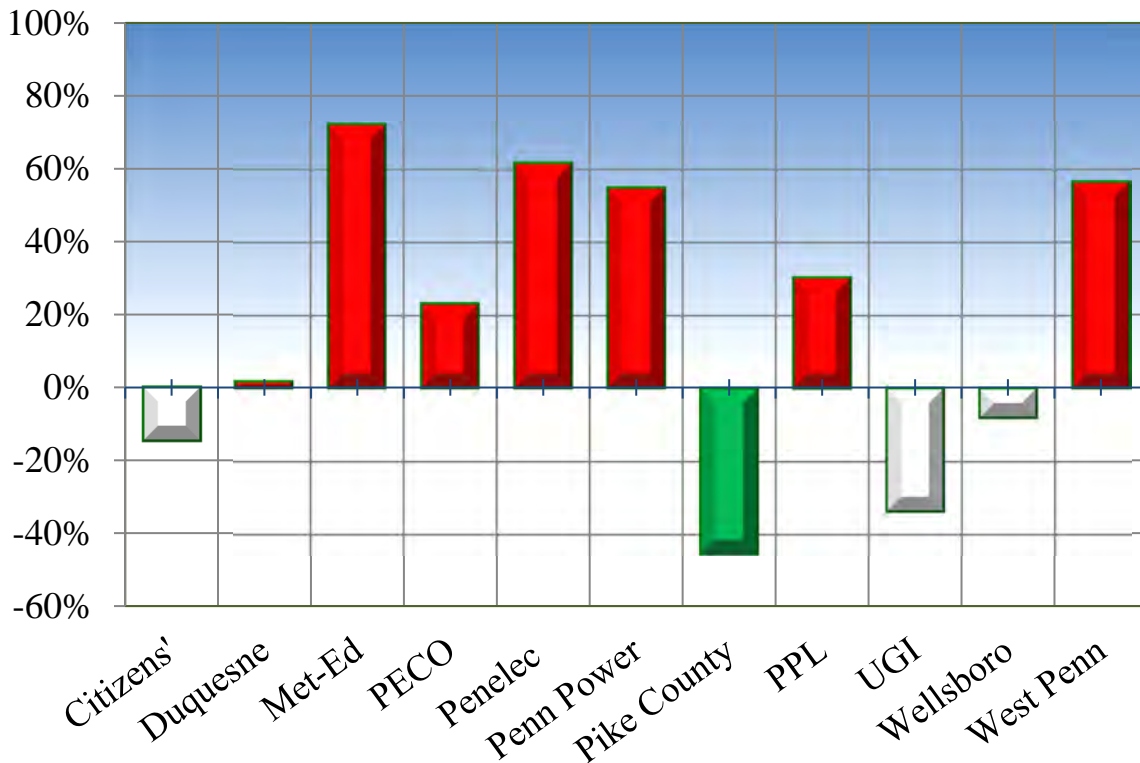
Figure 2 – 2023 SAIDI Comparison (percent above or below benchmark)
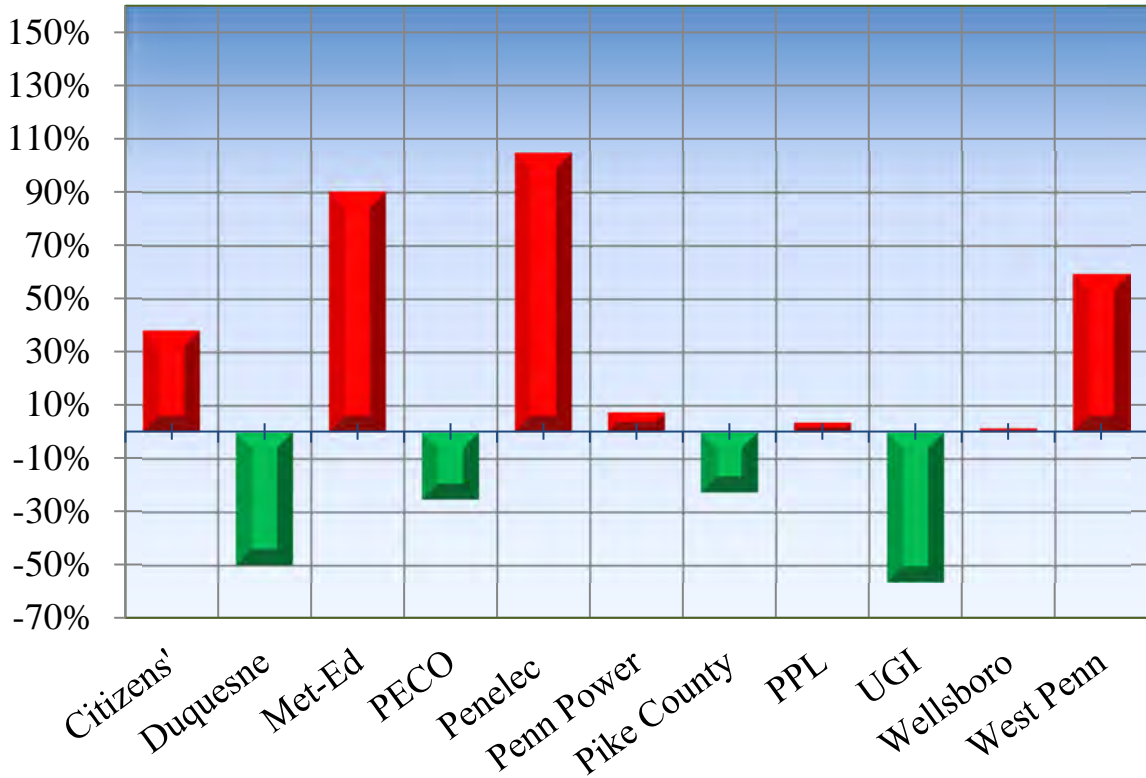
Figure 3 – 2023 SAIFI Comparison (percent above or below benchmark)
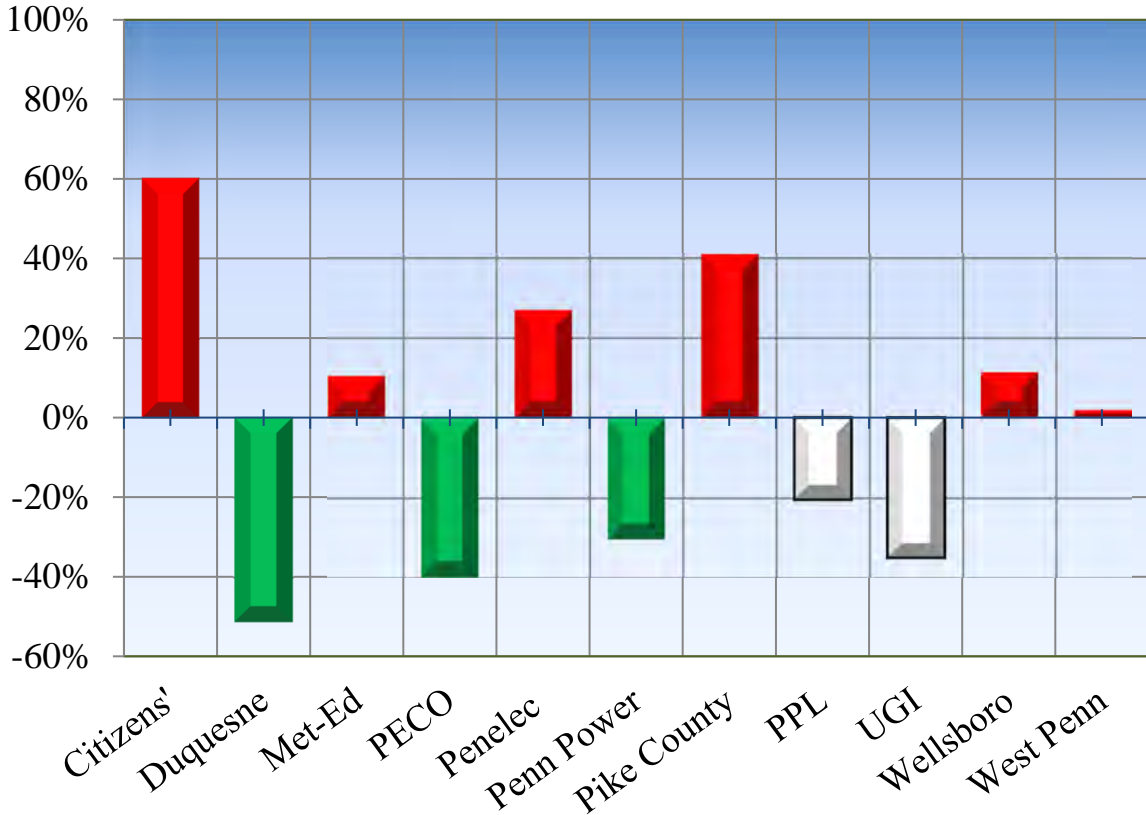
Rolling 3-year Average (2021-2023) Performance Compliance

Appendix A provides the 2023 results for the 12-month average and 3-year average reliability performance metrics for individual EDCs.

Seven EDCs (Duquesne Light, Met-Ed, PECO, Penelec, Penn Power, PPL, and West Penn) failed to meet the rolling 3-year **CAIDI performance standard**.

Five EDCs (Citizens', Met-Ed, Penelec, Pike County, and West Penn) failed to meet the rolling 3-year **SAIFI performance standard**.

Four EDCs (Citizens', Met-Ed, Penelec, and West Penn) failed to meet the rolling 3-year **SAIDI performance standard**.

Utility-Specific Performance Data

The Commission compares reliability metrics on a quarterly basis, using data obtained for the preceding 12 months. This periodic assessment determines the status of electric service reliability on an ongoing basis and is instrumental in identifying negative trends. The 3-year average performance is measured at the end of each calendar year, using the average of the past three end-year metrics, as indicated in Appendix A. The following sections provide a detailed description of the 11 EDCs' individual reliability performance on a rolling 12-month and 3-year average basis.

Citizens' Electric Company

Citizens' Electric Company (Citizens') has an operating service area of about 41 square miles with about 7,139 customers. The electric system consists of one distribution substation and nine distribution feeder lines.

In 2023, Citizen's experienced 2,309 customer interruptions and 207,294 CMI, as compared to: 1,947 customer interruptions and 195,608 CMI in 2022; 1,926 customer interruptions and 181,274 CMI in 2021; 561 customer interruptions and 48,645 CMI in 2020; and 1,982 customer interruptions and 154,257 CMI in 2019.

Citizens' experienced one Major Event in 2023. The Major Event impacted over 801 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

> **Rolling 12-month:** Decreased from 101 minutes in 2022 to 90 minutes in 2023; achieved benchmark by 14.5%.

3-year average:	Increased from 94 minutes in 2022 to 95 minutes in 2023; achieved standard by 17.4%.

SAIDI

Rolling 12-month:	Increased from 28 minutes in 2022 to 29 minutes in 2023; failed to achieve benchmark by 38.1%.
3-year average:	Increased from 20 minutes in 2022 to 27 minutes in 2023; failed to achieve standard by 9.5%.

SAIFI

Rolling 12-month:	Increased from 0.27 outages in 2022 to 0.32 outages in 2023; failed to achieve benchmark by 60.0%.
3-year average:	Increased from 0.21 outages in 2022 to 0.29 outages in 2023; failed to achieve standard by 30.3%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown below in Figures 4 and 5. Beginning in 2004, Citizens' CAIDI performance has been overall positive for most years.[29] Citizens' CAIDI performance is currently good and below the "green" benchmark performance upper-control-limit-line. It appears the Citizens' CAIDI performance trend is now in a positive direction. However, more management attention is needed to continue CAIDI performance below the "green" benchmark performance upper-control-limit-line. The Commission finds this is indicative of consistently good response and restoration times.

Beginning in 2004, Citizens' SAIFI performance has been inconsistent. From the 4th quarter 2011 through the 4th quarter 2023, Citizens' SAIFI performance has frequently been above the "green" benchmark performance upper-control-limit-line. Citizens' SAIFI performance in 2020 was excellent and well below the benchmark. However, from 2021 through 2023, Citizens' has not met the SAIFI benchmark. SAIFI has been trending upward past benchmark and has exceeded the 12-month standard. More management attention is needed to ensure consistent SAIFI performance is sustained below the "green" benchmark performance upper control-limit-line.

Outage Causes

Figure 6 below, shows the top five reported 2023 outage-cause categories, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. OROW trees, Vehicle and Other were the top causes for number of customers affected. The OROW trees and Vehicle causes were the largest contributors to CMI.

Figure 7 below shows the historical trend of the top three main outage causes. OROW trees, Equipment, and Animals are the three most frequent outage-causes that are significantly

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[29] Smaller CAIDI, SAIFI, and SAIDI benchmark values are typical for companies with fewer customers. While Citizens' did not achieve benchmark for SAIDI in 2023, its SAIDI value for 2023 is still much lower than that of all other EDCs. The same can be said about Citizens' SAIFI metrics.

negatively affecting Citizens' distribution system reliability and resilience. Trees are the most frequent cause of EDC customer outages in Pennsylvania.

General Reliability

Citizens' noted that it experienced very slight increases in SAIFI and SAIDI in 2023 while CAIDI remained lower than the previous two years. Citizens' noted that it experienced half as many outages from OROW trees in 2023 as compared to 2022. Citizens' noted that the company's direct communication with customers targeting danger and OROW hazard trees was a contributing factor in the decline. Citizens' also noted that CMI was most impacted by the increase in vehicle-related outages.

Citizens' indicated that it was again recognized in 2023 as a "Tree Line USA" utility. This award from the National Arbor Day Foundation recognized Citizens' for the 21st consecutive year for its use of nationally approved trimming techniques and procedures in its vegetation management program. The Company continues to partner with the Penn State Extension for its annual educational session. Citizens' noted that it continues to participate in and gather information from various industry best practices groups. These groups include members from diverse utility groups such as the Pennsylvania Rural Electric Association, the Energy Association of Pennsylvania, and the National Rural Electric Cooperative Association. The Company will continue to implement best practices defined by these groups as appropriate.

Conclusion

Citizens' CAIDI remained below benchmark for all four rolling 12-month quarters of 2023. Citizens' SAIFI performance has significantly declined over the past two years and continues to show signs of erratic performance. SAIDI performance has also deteriorated over the past two years and is above benchmark at the end of 2023, but still below standard. Citizens' should continue to refine its processes and methods to improve this performance.

The Commission recommends continued and increased efforts in vegetation management and emphasis on response times.

The Commission recognizes overall Citizen's appears to be making improvements in CAIDI as witnessed by the data shown below.

As can be seen in Figures 8 through 9 below, Citizens' seems to maintaining its CMI level and has improved the number of interruptions since 2015 but experienced a slight uptick in the number of customers interrupted in 2023.

Figure 4 – Citizens' CAIDI (minutes)
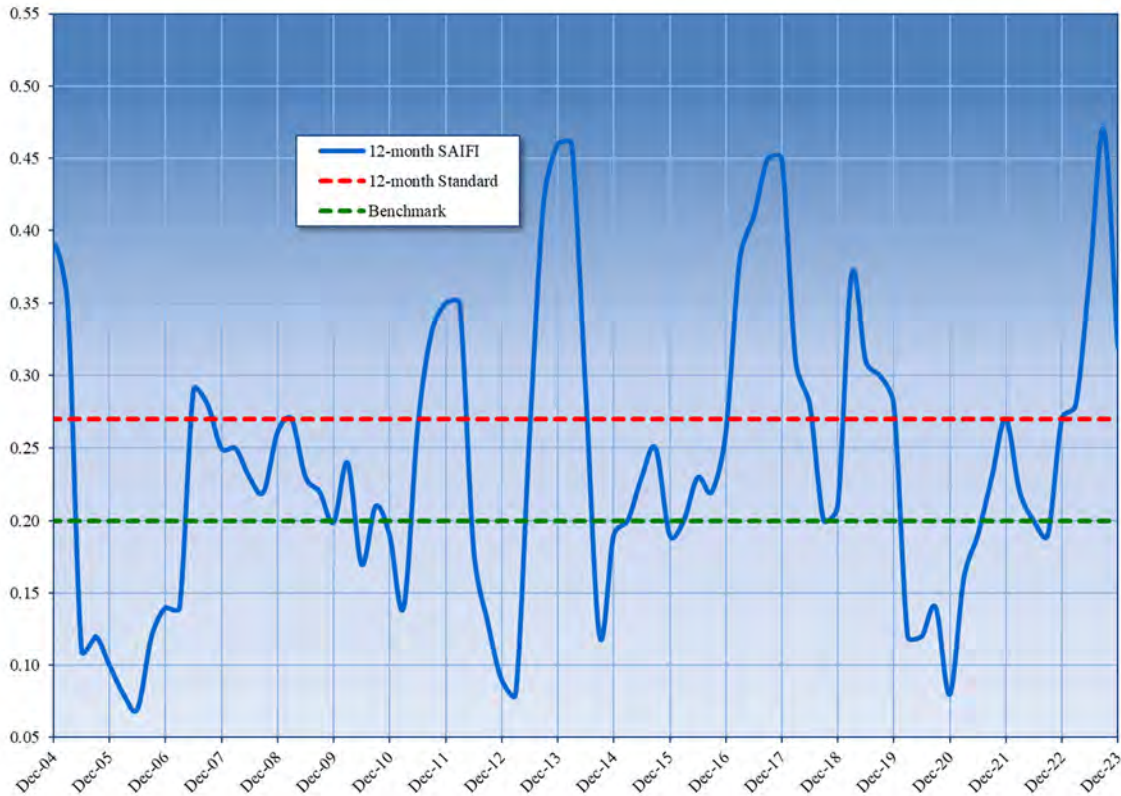

Figure 5 – Citizens' SAIFI (interruptions per customer)
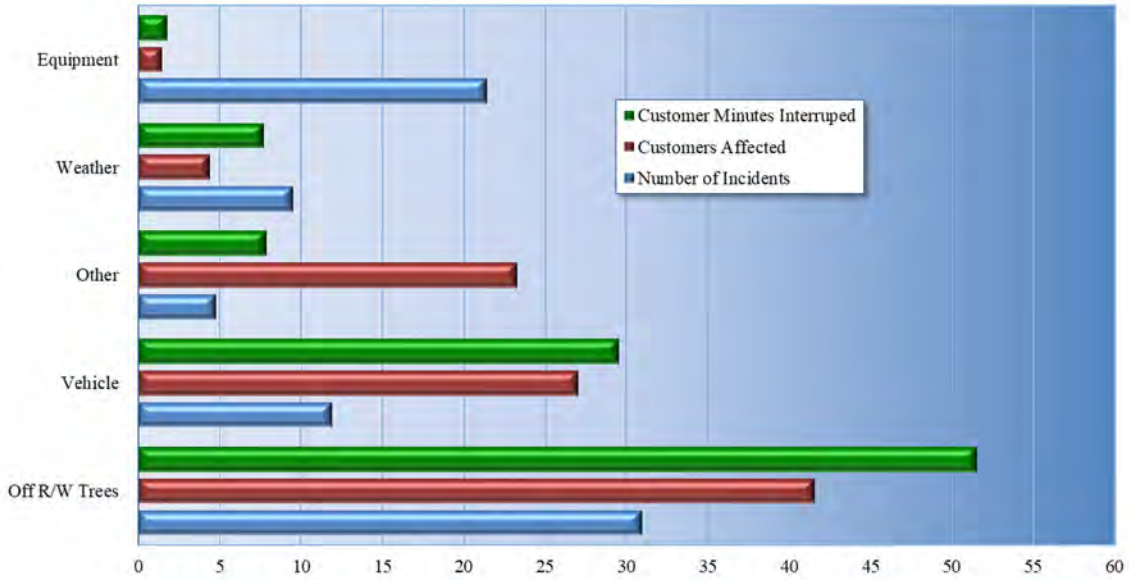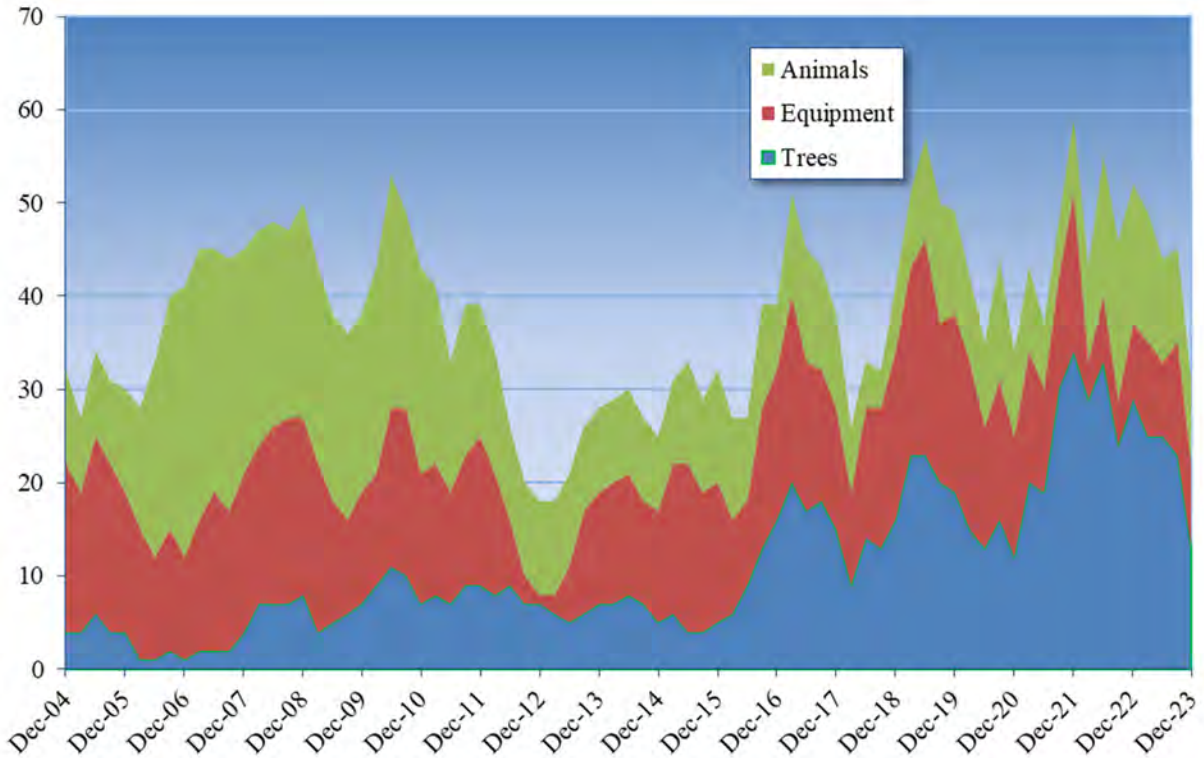
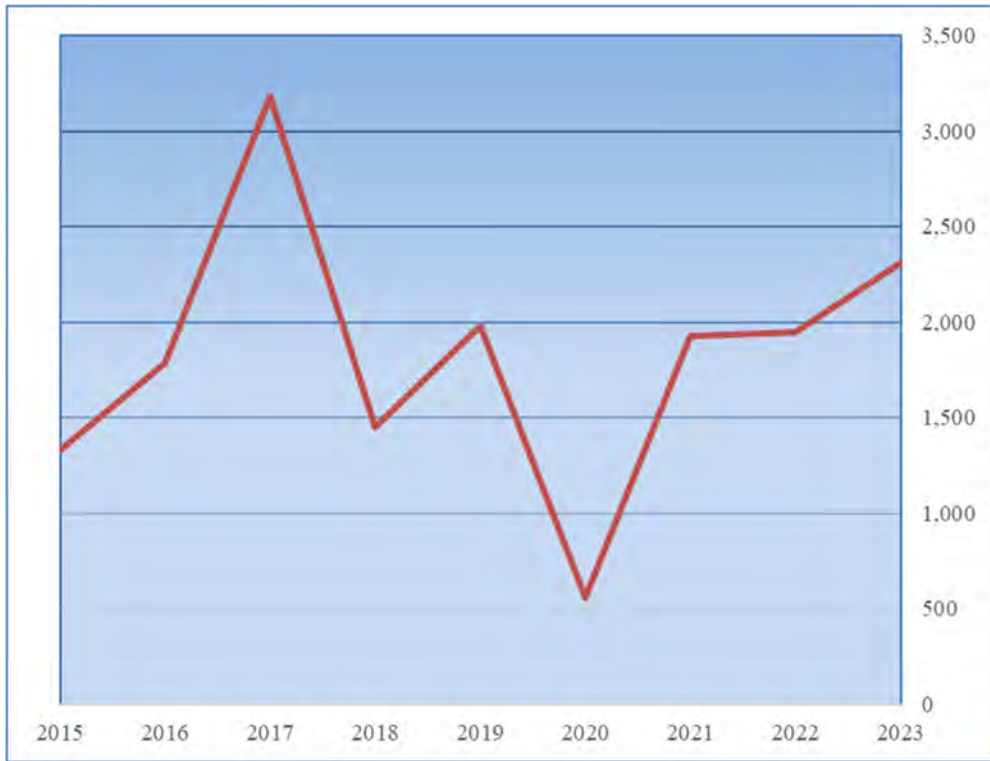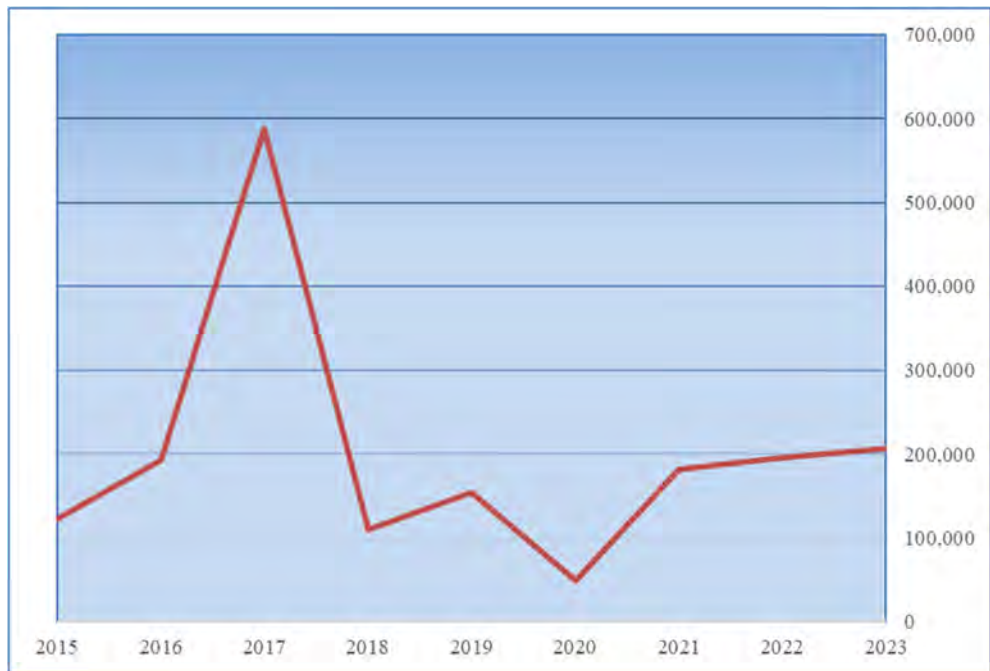*Figure 6 – Citizens' Outage Causes (percent of total outages)*

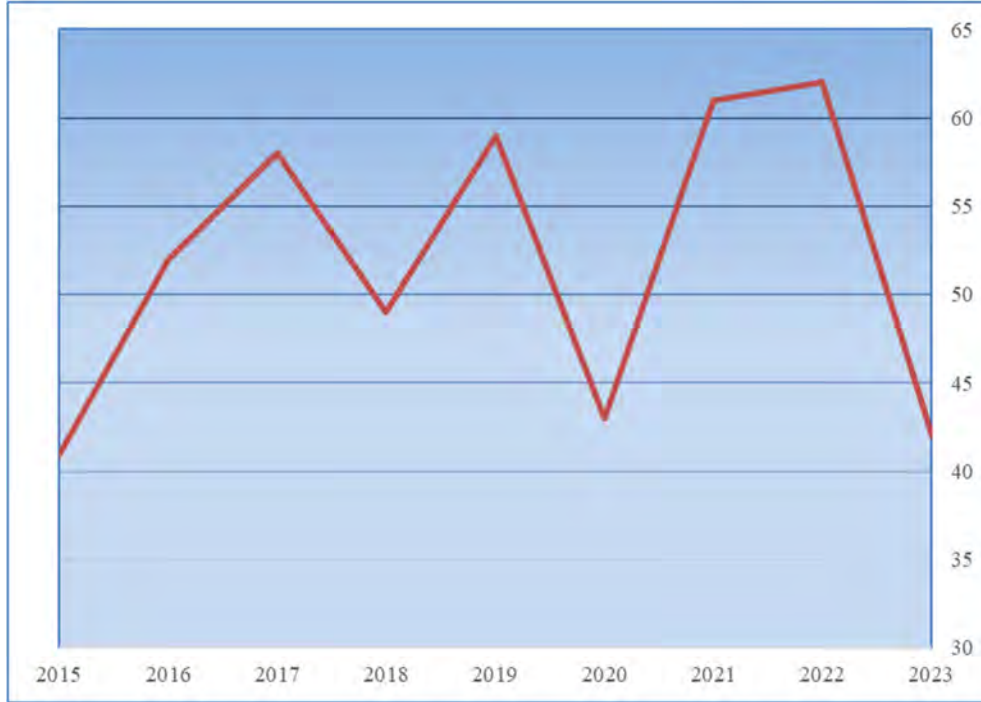*Figure 7 – Citizens' Outage Cause Tracking (number of incidents)*

Figure 8 – Citizens' Outage Tracking (number of Customers Interrupted)

Figure 9 – Citizens' Outage Tracking (Customer-Minutes of Interruptions, or CMI)

Figure 10 – Citizens' Outage Tracking (number of interruptions annually)

Duquesne Light Company

Duquesne Light Company (Duquesne) has a service territory of about 817 square miles with a well-developed distribution system serving about 611,458 customers.

In 2023, Duquesne experienced 4.5 million kilovolt-amps (kVA) of customer interruptions and 502 million kVA-minutes of CMI as compared to: 7.3 million kilovolt-amps (kVA) of customer interruptions and 1,060 million kVA-minutes of CMI in 2022; 7.3 million kVA customer interruptions and 1,355 million kVA-minutes of CMI in 2021; 6.5 million kVA customer interruptions and 857 million kVA-minutes of CMI in 2020; and 7.3 million kVA customer interruptions and 772 million kVA-minutes of CMI in 2019.

Duquesne experienced two Major Events in 2023. The Major Events impacted approximately 129,659 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 146 minutes in 2022 to 110 minutes in 2023; failed to achieve benchmark by 1.9%.

3-year average: Decreased from 155 minutes in 2022 to 148 minutes in 2023; failed to achieve standard by 24.1%.

SAIDI

Rolling 12-month: Decreased from 134 minutes in 2022 to 63 minutes in 2023; achieved benchmark by 49.9%.

3-year average: Decreased from 139 minutes in 2022 to 123 minutes in 2023; achieved standard by 19.4%

SAIFI

Rolling 12-month: Decreased from 0.92 outages in 2022 to 0.57 outages in 2023; achieved benchmark by 51.3%.

3-year average: Decreased from 0.90 outages in 2022 to 0.81 outages in 2023; achieved standard by 37.5%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 11 and 12 below. Duquesne's CAIDI performance greatly improved in 2023, as seen in Figure 11, but is still above benchmark. Management should place significant emphasis upon achieving CAIDI results at or below the "green" benchmark performance upper-control-limit-line for CAIDI. CAIDI is an important factor in gauging an EDC's response times to interruptions and thus will affect customer satisfaction in that area.

Beginning in 2004 and continuing through 2023, Duquesne's annual SAIFI benchmark performance trend has generally been positive, as shown in Figure 12. This positive performance trend, below the benchmark performance upper-control-limit-line, had been sustained since 2004 by Duquesne, and is considered under control. Duquesne is considered an excellent SAIFI benchmark performer. The Commission commends Duquesne for that accomplishment and encourages use of distribution system automation systems (smart grid systems).

Outage Causes

Figure 13 below shows the top five reported 2023 outage-cause categories reported by Duquesne, as a percentage, for the following three distinct performance metrics: KVA Minutes Interrupted, KVA Interrupted, and Number of Incidents. Trees were the top cause of outages and CMI. Over 28% of outages are caused by OROW trees.

Figure 14 below shows the historical trend of the top three main outage causes. Trees and equipment failures are the two most frequent outage causes that are negatively affecting Duquesne's distribution system reliability and resilience, as well as almost every EDC in Pennsylvania. Duquesne should continue to aggressively pursue cooperation with customers in removal of OROW vegetation that endangers distribution circuits. The reported outage-cause category of "Storms" should be reconsidered and eliminated to spread outages among more defined areas such as vegetation or equipment failures and such, as it can be said that the category of "Storms" only reveals other system deficiencies, such as equipment failure and vegetation trimming deficiencies.

General Reliability

Duquesne noted that achieving outstanding performance in system reliability continues to be one of its most important long-term objectives. Duquesne's Asset Management and System Planning groups perform ongoing analysis of reliability indices, root cause analysis of outages, and tracking and monitoring of other performance measures to identify improvement opportunities and optimize reliability. Duquesne stated that this long-term process includes making recommendations for capital projects such as circuit rehabilitation, new substations, and distribution circuits. This process also includes implementation of new advanced protection and coordination schemes on the distribution system that better localize customer outages and reduce momentary outages.

Duquesne stated that it continues its Emergent Work Process, which is used to identify problems, set priorities, and resolve reliability issues as quickly as possible. Duquesne field personnel perform daily field inspections and any abnormalities are logged into a database. This database is reviewed regularly and any high priority problems are identified and a course of action is determined. Analysis at the device level is used to identify small areas where customers have experienced multiple outages. Assessing only system-level or even circuit-level data may mask these isolated problems.

Duquesne indicated that several capital budget projects in 2023 targeted distribution reliability improvements, including pole replacement, substation rehabilitation, circuit load relief and voltage improvement, underground residential development (URD) rehabilitation, circuit rearrangement, and installation of additional automated remotely controlled pole top devices.

Duquesne noted the following specific programs, procedures, and ongoing maintenance activities supporting its reliability efforts:

- A Distribution Overhead Line Inspection Program, which includes infrared inspections that systematically identifies circuit problems for remedial action in advance of failure.

- Vegetation Management Maintenance Programs with the goal of reducing tree and branch failures through proactive pruning and removal to manage proper clearances. Duquesne finds that this program will help reduce the frequency of outages by addressing targeted tree failure conditions that typically result in physical damage to its facilities.

- An all-pulse-reclosing protection technology has been implemented on some 23kV circuits. This technology eliminates traditional "hard reclosing," thereby making it easier and faster to conduct repairs and restore circuits to normal operation, which enables customers to be restored more quickly. This technology also reduces stress and damage on the entire circuit since the breaker is no longer required to trip, also contributing to the reduction in momentary outages to customers.

- Line maintenance work of various types is regularly performed in order to maintain distribution plant. This work includes replacement of cross arms, arrestors, insulators, and other equipment on the overhead system as well as inspections and remedial work on the underground system.

- Storm Preparedness Training is conducted each year and Storm Review Meetings are held following major events. These meetings focus on the successes and challenges of the most recent emergency service restoration effort. Service restoration process improvements are made as needed to improve response time and effectiveness during the next restoration effort.

Conclusion

Trees and Equipment Failures are the top two outage causes that substantially negatively affect electrical reliability to Duquesne customers and contributed to over 65.4% of the total lost CMI (Duquesne uses kVA-minutes interrupted) in 2023.

Trees, and especially OROW trees, continue to be a chronic problem for Duquesne, as well as every EDC in Pennsylvania. The Commission recommends continued and increased efforts in vegetation management and emphasis on response times.

As shown in Figures 15 through 17, for 2023, Duquesne exhibited a marked improvement in its kVA interrupted, kVA minutes of interruption, and kVA interruptions. The Commission notes that this performance is the best since 2015 for Duquesne. Duquesne should continue to implement its programs to ensure consistent reliability performance of this quality.

Figure 18 below is included to indicate a growth in the number of customers served. Because Duquesne records their service indicators in kVA rather than customers individually, it is difficult to measure actual impact upon customers. However, the trends in kVA should equivocate to the impacts upon customers.
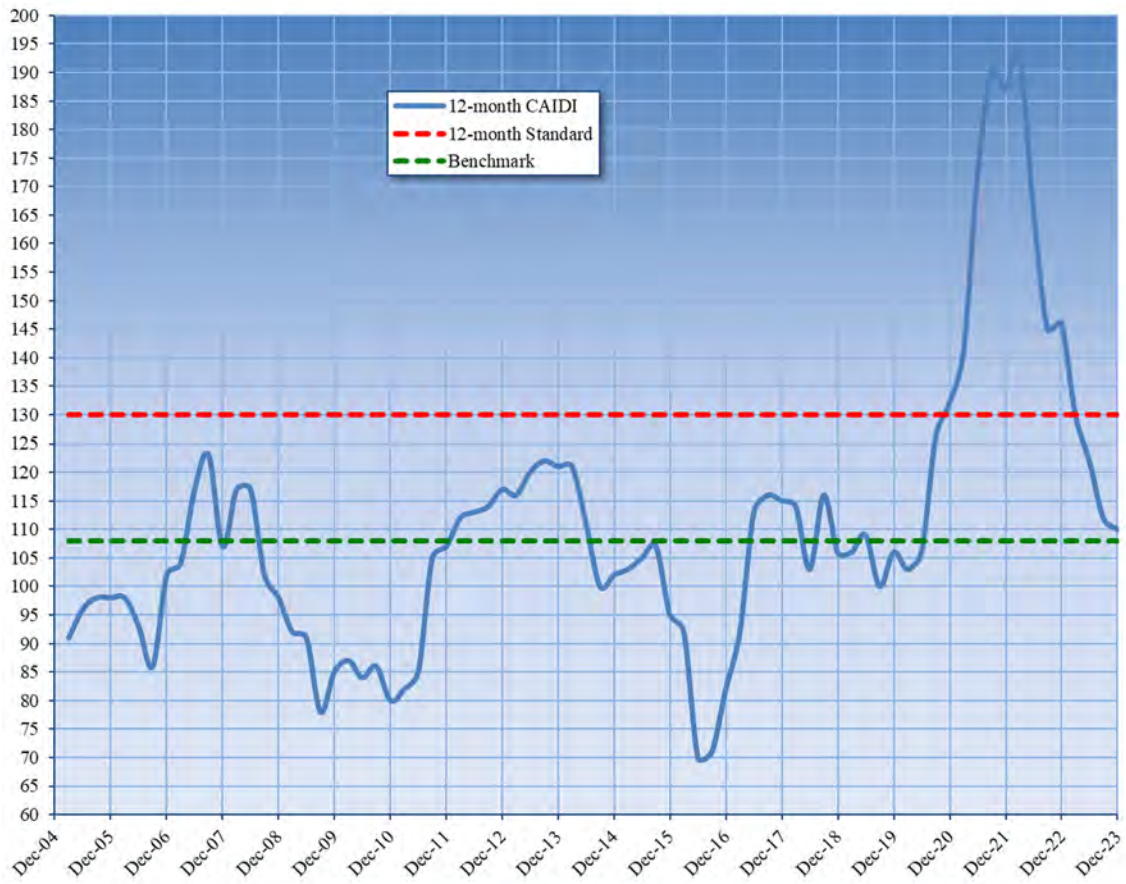
Figure 11 – Duquesne CAIDI (minutes)
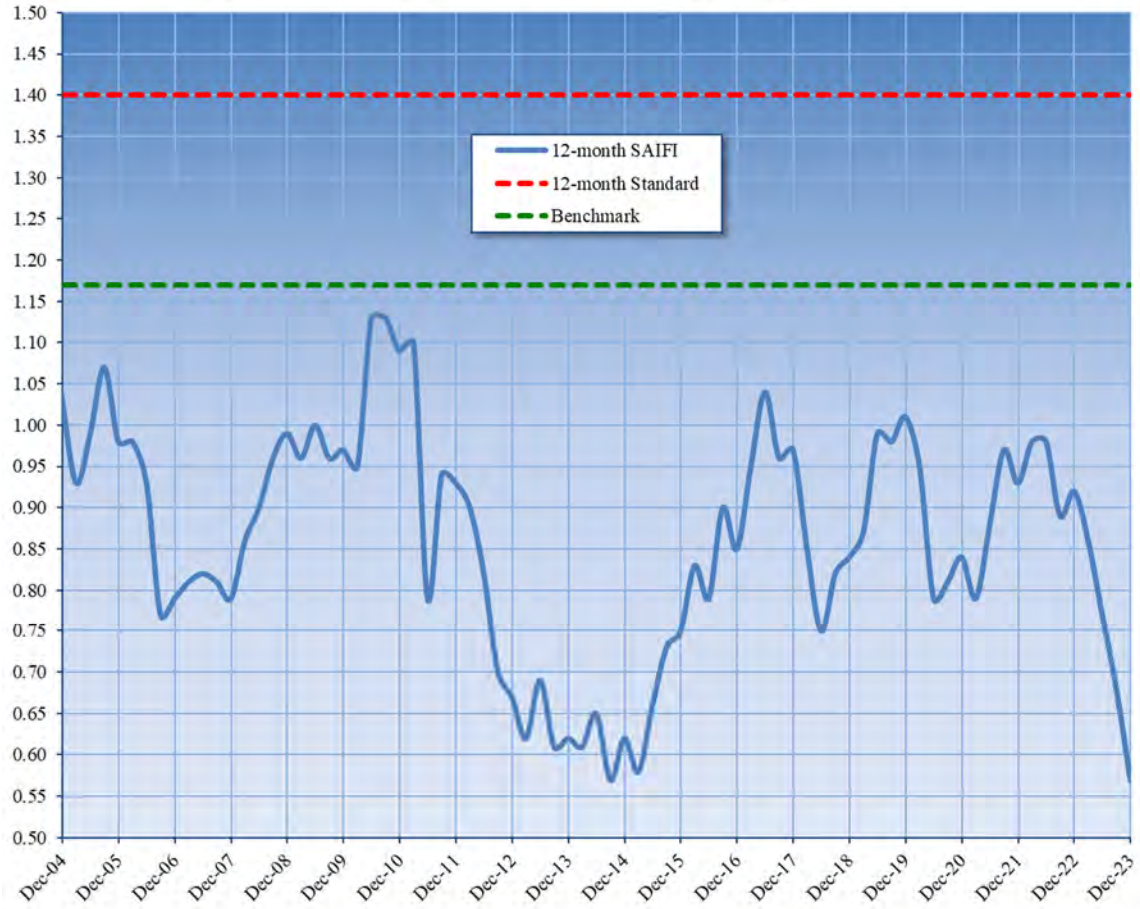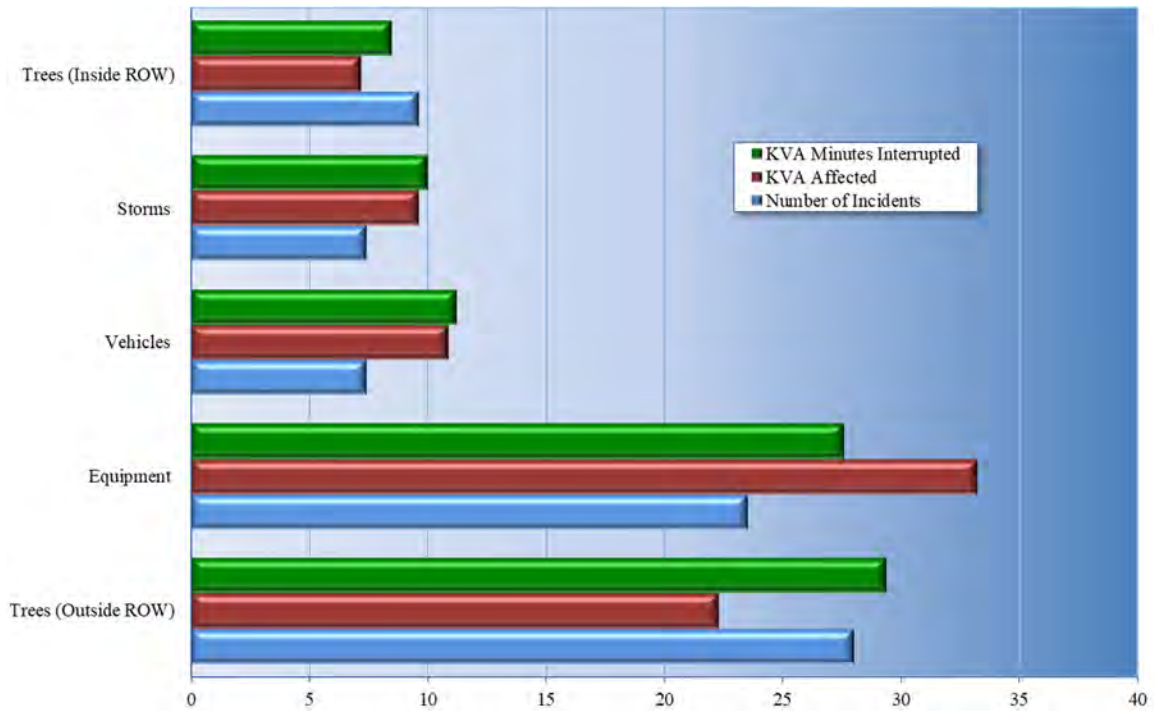
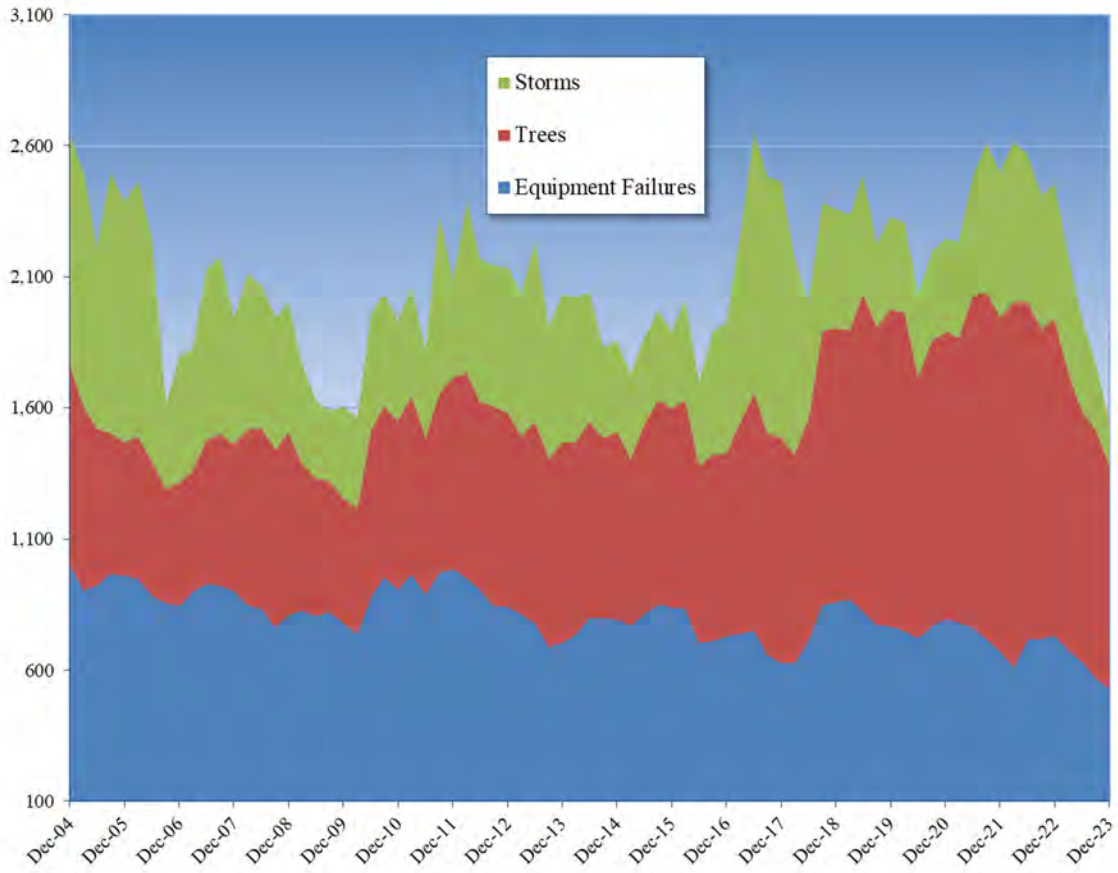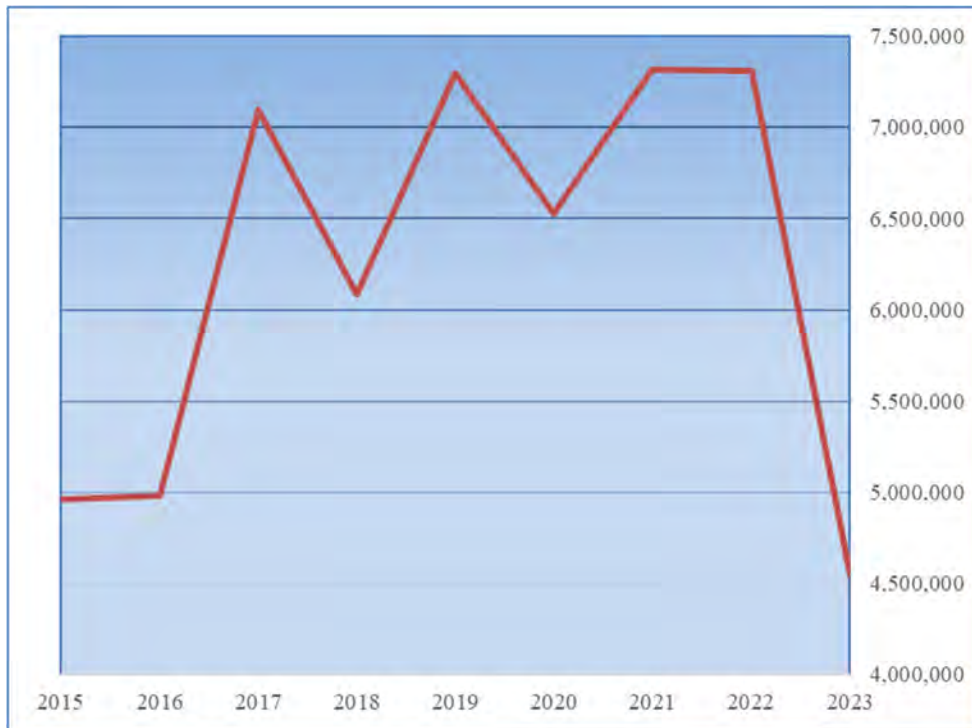*Figure 12 – Duquesne SAIFI (interruptions per customer)*

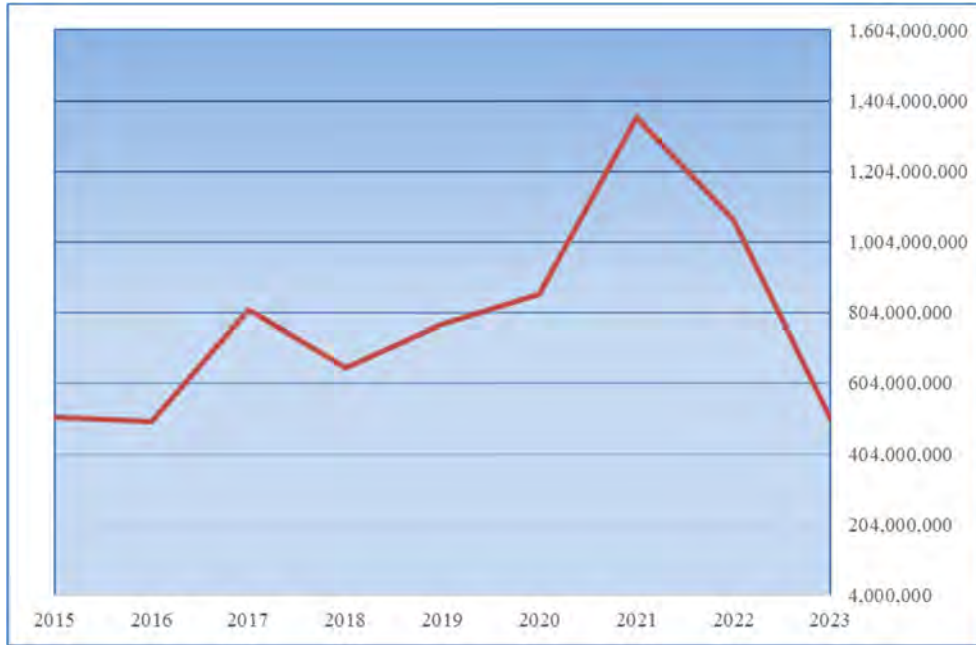*Figure 13 – Duquesne Outage Causes (percent of total outages)*

Figure 14 – Duquesne Outage Tracking (number of incidents)

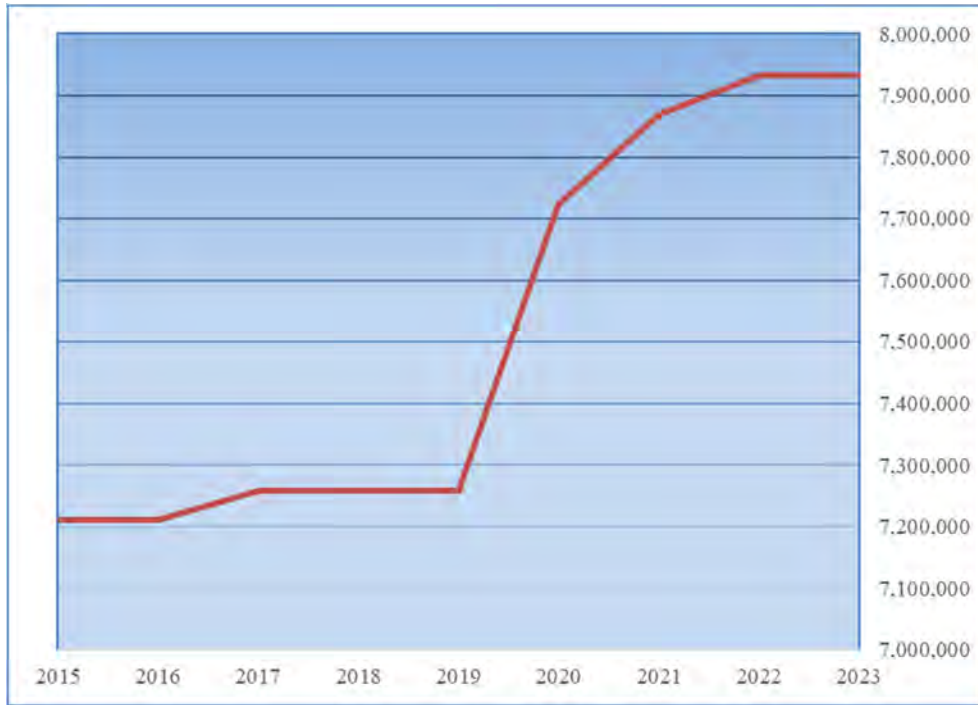*Figure 15 – Duquesne Outage Tracking (number of KVA Interrupted)*

Figure 16 – Duquesne Outage Tracking (KVA-Minutes of Interruptions, or CMI)

Figure 17 – Duquesne Outage Tracking (number of interruptions annually)

Figure 18 – Duquesne kVA Served (may reflect the number of customers served)

FE PA Companies

General Reliability

Overall, the FE PA EDCs exhibited a very slight improvement in reliability performance in 2023 as compared to 2022. However, all four EDCs continue to struggle to achieve benchmark performance for any of the three reliability metrics, with the exception of Penn Power's SAIFI.

FE PA utilizes core programs in its four EDCs to support cost-effective and reliable service. These programs include, but are not limited to:

- Inspection and Maintenance (I&M): FE PA's I&M practices are designed to assist in determining the need for, and prioritization of, the repair or replacement of distribution system components and facilities. Poles showing incipient decay or poles that are thirty-five years old or older will be manually bored or inspected by the use of a Resistograph. The Resistograph is a sophisticated electronically controlled drill that provides increased accuracy, when compared to manual drilling, in measuring the relative density of wood in timber structures. Driven by a drill motor, a long, thin needle is inserted into the wood pole in order to assess its density, structural integrity, and shell thickness.

- Vegetation Management: FE PA performs vegetation management on its distribution circuits in order to promote the continued safe and reliable operation of its distribution system. The vegetation management program specification is designed to support line reliability, maintain access, make repairs, or restore service and to support safe and reliable service. The vegetation management program specification prunes vegetation to achieve required cycle clearance, with all circuits on four to five years of cycle clearance, which includes: removing selected incompatible trees within the clearing zone corridor; removing certain defective limbs that are overhanging primary conductors; controlling selected incompatible brush mechanically or using herbicide, or both; relieving limbs causing mechanical strain on secondary/service lines; and removing targeted OROW priority trees that are dead, dying, diseased, and leaning or significantly encroaching the corridor.

  - Portions of a circuit that experience high customer interruption minutes due to vegetation-caused outages may be targeted to include the removal of certain healthy limbs which overhang primary conductors based on tree species and condition.
  - In response to damage caused by the Emerald Ash Borer, a program to proactively remove OROW Ash Trees has been implemented.
  - Post-storm circuit patrols target the areas with high tree-related outages. Circuit patrols identify trees damaged in a storm that may eventually lead to a future outage. Once identified, the tree is removed. In addition, damaged equipment identified as part of the circuit patrol is repaired or replaced.

- Customers Experiencing Multiple Interruptions (CEMI): FE PA noted that the CEMI program is aimed to reduce frequent or repeated outages for affected clusters of customers or frequently operated devices.

- Load Forecasting and Distribution Planning: FE PA noted that the load forecasting application is used to estimate future substation and circuit loading based upon historical load data and the planning criteria guidelines are then used to provide a consistent approach for planning the safe, reliable, orderly, and economic expansion of the distribution system.

- Circuit Protection: FE PA circuit protection practices are aimed at achieving safety and security for the public and employees, maximizing service reliability to customers, minimizing damage to distribution equipment, and establishing a consistent process and set of application standards for distribution circuit protection.

- LTIIP: the FE PA EDCs first began to execute their respective LTIIP programs in 2016. These plans include expenditures and programs designed to adequately maintain and improve the efficiency, safety, adequacy, and reliability of the distribution system. In January 2020, the Commission approved FE PA's second LTIIP (LTIIP II), which spans the five-year period of 2020 through 2024 and focuses on two areas: asset health and outage exposure.[33] Asset health focuses on maintaining the system in a state of good repair while outage exposure focuses on minimizing the impact of customer outages. LTIIP II includes initiatives and expenditures within these two focus areas that are designed to maximize sustained reliability over the long-term. FE PA noted that it will file for its third LTIIP in 2024.

FE PA noted that in addition to the reliability programs above, it also utilizes various strategies to efficiently respond to customer and equipment outages. These include, but are not limited to:

- Minimizing Outage Impact: FE PA noted that it incorporates design philosophies that support grid operation resulting in maximized reliability. These philosophies include instantaneous breaker tripping on select circuits, circuit sectionalizing devices, and remote device operation (such as supervisory control and data acquisition) to minimize the impact of an outage when possible.

- Storm Exercises: Each FE PA EDC performs an annual storm exercise. FE PA noted that a well-designed exercise provides a low-risk environment to test and validate capabilities, familiarize personnel with plans, procedures, roles, and responsibilities, and foster meaningful interaction and communication across internal and external organizations.

- Summer Readiness: FE PA noted that Summer is the time when most electric utilities experience the highest system loads and most damaging storms. In order to prepare for this period of the year, FE PA EDCs performed summer readiness activities such as capacitor inspections, substation inspections, transmission system reliability and capability review, and post-storm reviews to identify and disseminate lessons learned after significant events.

- Smart Meters: FE PA has completed mass deployment of smart meters to customers across Pennsylvania. FE PA noted that smart meter installation is a step toward a more modernized electric system that will enable automated meter readings. Smart meters also assist during outage restoration periods, especially when there are a significant number of single customer outages, by allowing the FE PA EDCs to ping the meter to determine if a customer's service has been restored.

- Incident Command System (ICS): FE PA is beginning to utilize a more formalized ICS structure, which is designed to enable effective and efficient incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organization. By expanding the use of ICS, FE PA notes that its incident response ability is improved, and reliability is enhanced by utilizing a common system for incident response personnel (both intrastate and interstate).

FE PA indicated that to support best industry practices, it participates in various external organizations such as the Electric Power Research Institute, the IEEE, and the Energy Association of Pennsylvania, which focus on topics like reliability, power quality, regulatory issues, distribution planning, vegetation management, risk mitigation, distributed energy resources and more. To ensure continuous improvement, FE PA noted that it has a team comprised of reliability engineers to perform an internal review of reliability projects, expenditures, and performance, and to develop an overarching strategy for long-term reliability maintenance and improvements.

Proposed Solutions

FE PA noted that it analyzes its outage data to develop solutions for improving reliability. To address outages caused by trees, FE PA performs cycle-based tree trimming which removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes targeted OROW priority trees. FE PA noted that it is limited in its ability to legally address OROW vegetation management. However, FE PA identifies OROW priority trees for removal that are dead, dying, diseased, leaning, and significantly encroaching the corridor when customer consent is obtained or easement rights permit. Trees identified as a potential cause of a future outage are removed to prevent an interruption of electrical service to FE PA customers. FE PA continues its program to mitigate trees subject to damage from the Emerald Ash Borer.

To reduce the likelihood of equipment failure outages, FE PA follows I&M programs that set forth schedules for regular inspections of distribution and substation facilities. These programs are geared towards specific components such as capacitors, poles, circuits, transformers, radio-controlled switches, substations, and reclosers. Equipment identified is repaired or replaced as appropriate.

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[33] *See, Petition of Metropolitan Edison Company for Approval of its Long-Term Infrastructure Improvement Plan*, et al., at Docket Nos. P-2019-3012618, et al.

Metropolitan Edison Company

Metropolitan Edison Company (Met-Ed) has a service territory of about 3,300 square miles that serves about 580,873 customers.

In 2023, Met-Ed experienced 739,898 customer interruptions and 149.2 million CMI as compared to: 760,672 customer interruptions and 121.8 million CMI in 2022; 772,644 customer interruptions and 133.4 million CMI in 2021; 724,138 customer interruptions and 108.4 million CMI in 2020; and 874,452 customer interruptions and 143.3 million CMI in 2019.

Met-Ed experienced one Major Event in 2023. The Major Event impacted over 69,436 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Increased from 160 minutes in 2022 to 202 minutes in 2023; failed to achieve benchmark by 72.4%.
3-year average:	Increased from 161 minutes in 2022 to 178 minutes in 2023; failed to achieve standard by 38.2%.

SAIDI

Rolling 12-month:	Increased from 211 minutes in 2022 to 257 minutes in 2023; failed to achieve benchmark by 90.3%.
3-year average:	Increased from 211 minutes in 2022 to 234 minutes in 2023; failed to achieve standard by 43.3%.

SAIFI

Rolling 12-month:	Decreased from 1.32 outages in 2022 to 1.27 outages in 2023; failed to achieve benchmark by 10.4%.
3-year average:	Remained at 1.31 outages in 2023; failed to achieve standard by 3.4%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 19 and 20 below. Met-Ed reported a MAIFI of 0.301 for 2023. Beginning in 2004, Met-Ed's CAIDI performance trend has been worsening, and from 2013 to present has been trending significantly upward. Met-Ed's 2023 rolling 12-month CAIDI is above both the benchmark and standard upper-control-limit-lines. More management attention is needed to address the recent poor CAIDI performance and return the trend line below the "green" benchmark performance upper-control-limit-line. Vegetation control may improve repair times by reducing larger and more damaging foliage contacts and overhanging canopy trees and limbs including off right of way trees.

Beginning in 2004, Met-Ed 's SAIFI performance, as seen in Figure 20 below, has been erratic and frequently above the benchmark. From 2007 onward, the overall trend has been continually above benchmark, except for a brief period in 2013 through 2014 when Met-Ed's performance was positive and below the "green" benchmark performance upper-control-limit-line. As of December 2023, SAIFI remained below the "red" standard performance upper-control limit-line, but still above the benchmark measure. By all measures this shows the continuation of unacceptable performance.

Outage Causes

Figure 21 below, shows the top five reported outage cause categories in 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. OROW Trees and equipment failure were the top causes of outages and CMI. Approximately 57.1% of CMI was caused by OROW Trees and Equipment Failure.

Figure 22 below, shows the historical trend of the top three outage causes. Trees and Equipment Failure are the two most frequent causes of power outages that are significantly negatively affecting Met-Ed's distribution system reliability and resilience, as well as every EDC in Pennsylvania.

Conclusion

Trees and Equipment Failure are the top two outage causes that are substantially negatively affecting electrical reliability to Met-Ed's customers. Beginning in 2004, Met-Ed's CAIDI and SAIFI benchmark performance has been inconsistent and frequently out-of-control. Met-Ed's overall CAIDI performance trend is troubling, with a continuing trend above Benchmark and Standard performance upper-control-limit-lines.   Met-Ed has not achieved benchmark performance for SAIFI sinch 2014. The Commission recommends that increased management attention is needed to bring Met-Ed's failing reliability performance back into control and to sustain the trend line below the "green" benchmark performance upper-control-limit-line. While Met-Ed and the other FE PA Companies have seen some minor improvement in SAIFI in 2023, the Commission expects to see improvement in reliability for the FirstEnergy Companies in 2024, especially as it relates to CAIDI.

The Commission recommends increased efforts in vegetation management and emphasis on response times.

The Commission recognizes that, overall, Met-Ed's reliability performance is declining as witnessed by the data shown below. As can be seen in Figure 23 below, the number of Met-Ed customers interrupted annually improved somewhat but is still higher than in 2015. As shown in Figure 24 below, CMI continues to trend upward. Figure 25 below shows a significant increase in the number of interruption events since 2015.
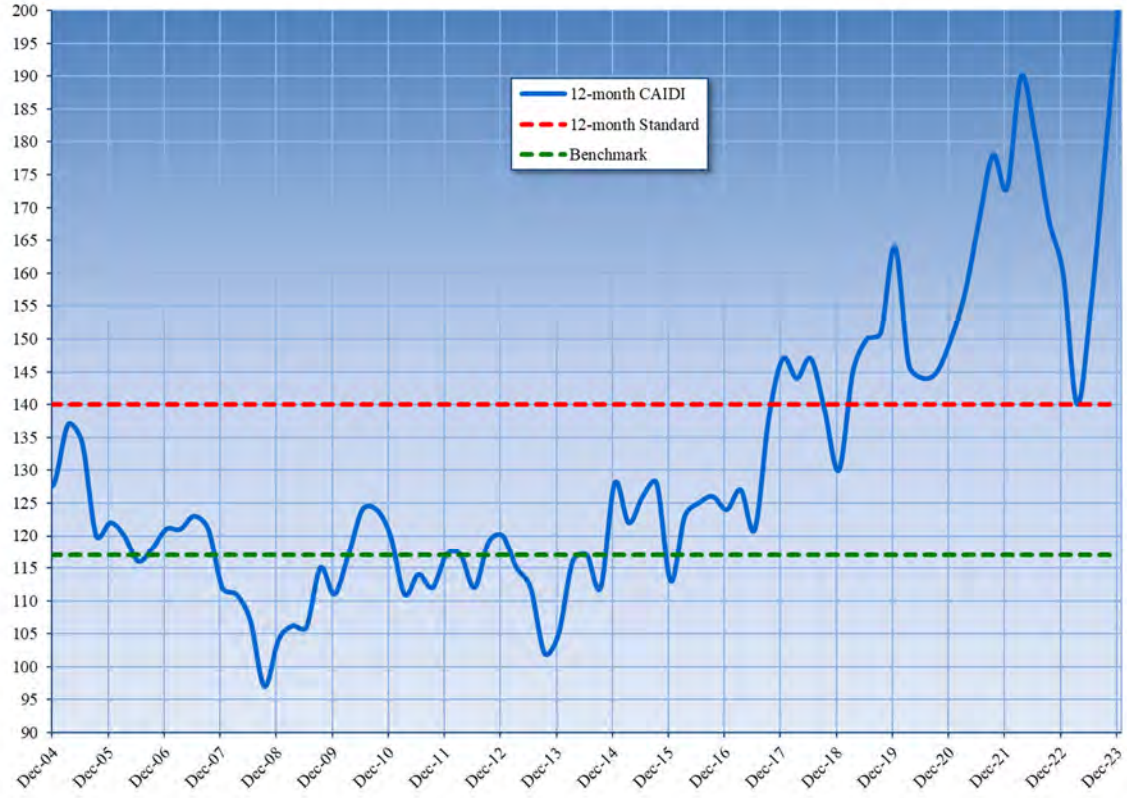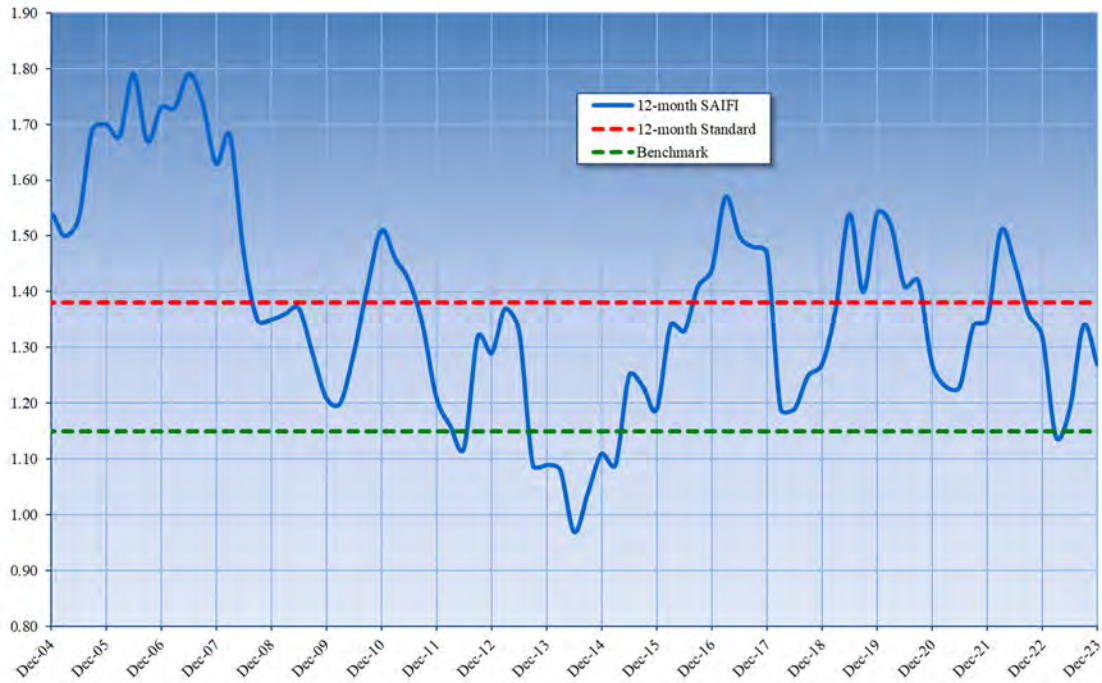
Figure 19 – Met-Ed CAIDI (minutes)

Figure 20 – Met-Ed SAIFI (interruptions per customer)
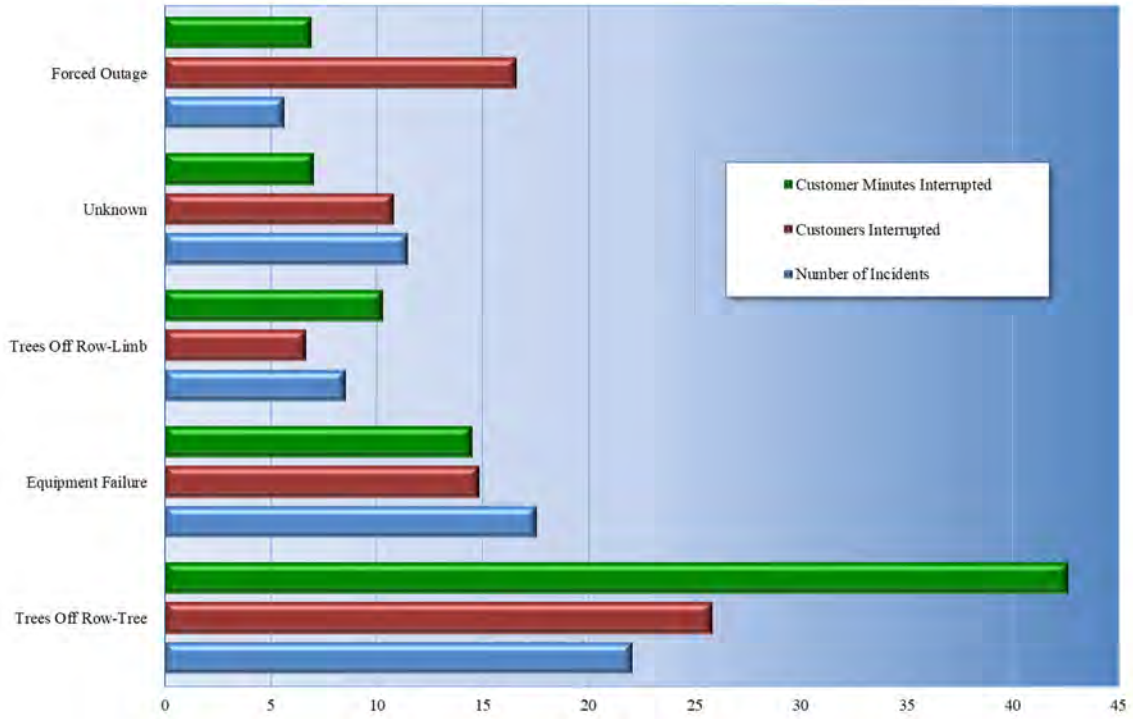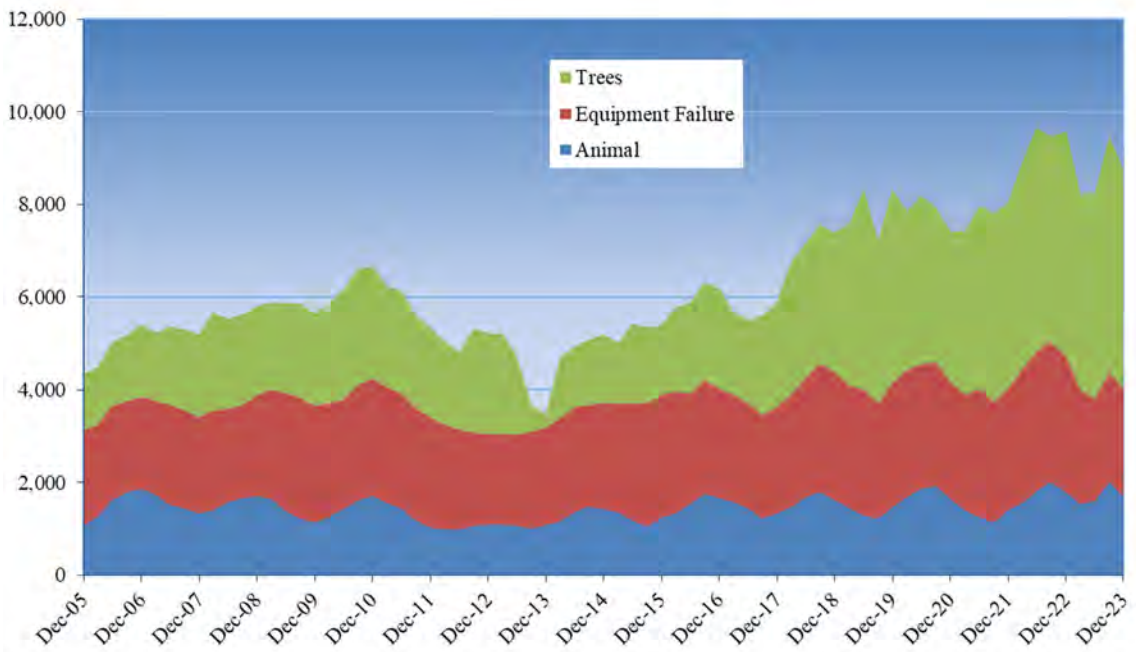
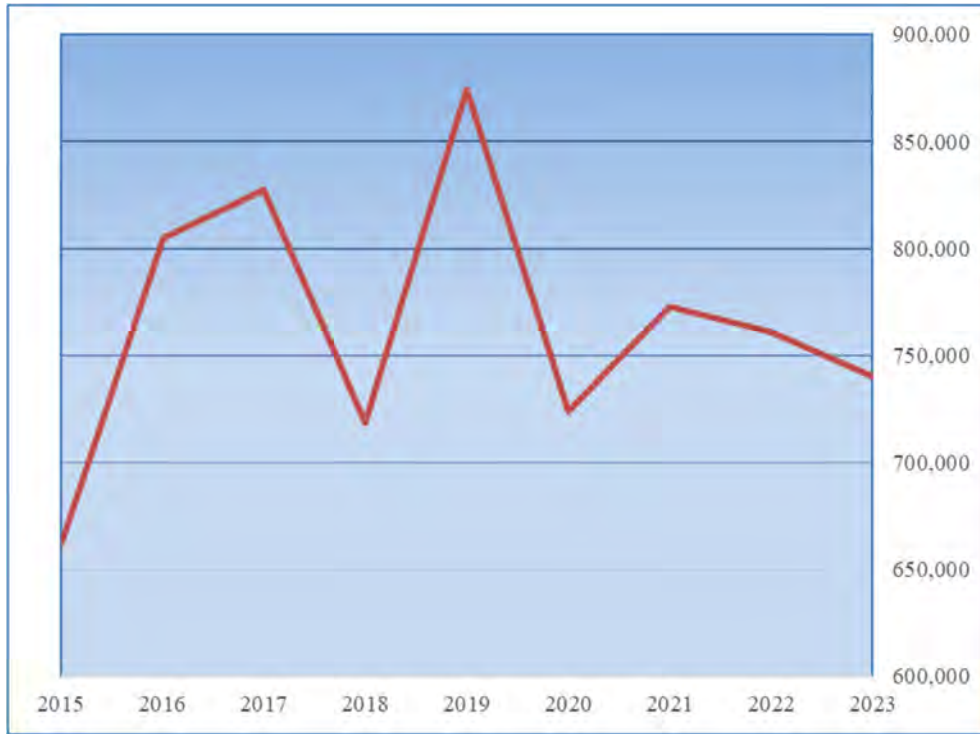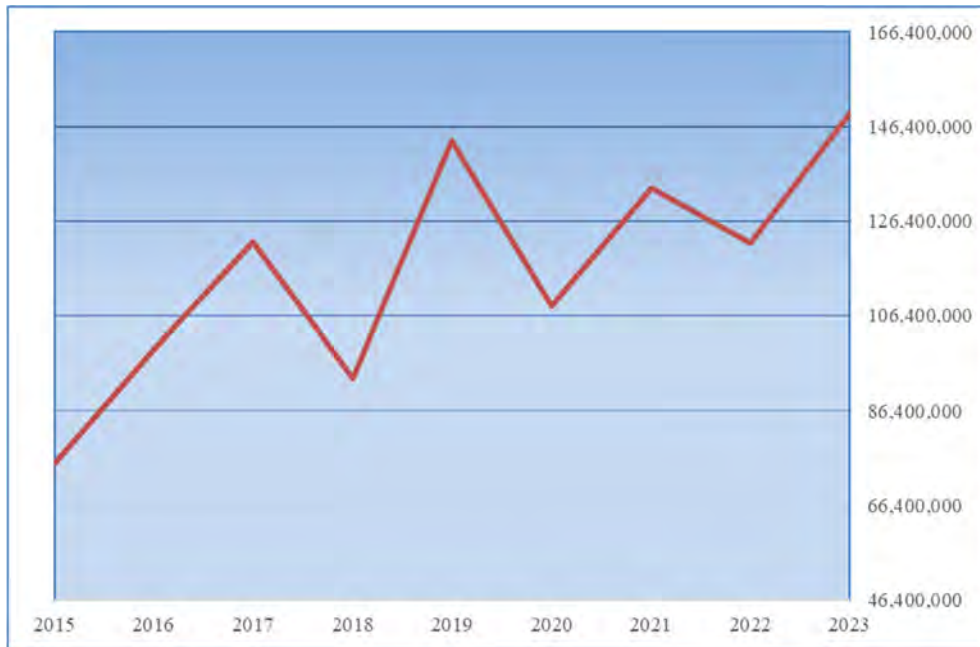*Figure 21 – Met-Ed Causes (percent of total outages)*

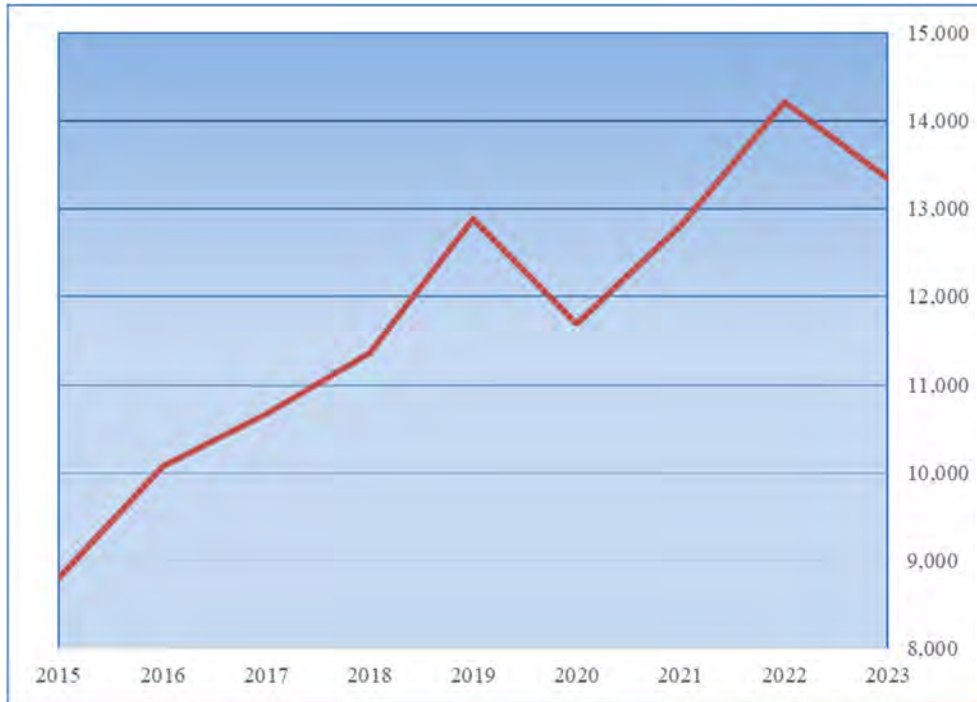*Figure 22 – Met-Ed Outage Tracking (number of incidents)*

Figure 23 – Met-Ed Outage Tracking (number of customers interrupted)

Figure 24 – Met-Ed Outage Tracking (Customer-Minutes of Interruptions, or CMI)

Figure 25 – Met-Ed Outage Tracking (number of interruptions annually)

Pennsylvania Electric Company

Pennsylvania Electric Company (Penelec) has a service territory of about 17,600 square miles serving approximately 585,139 customers.

In 2023, Penelec experienced 938,093 interruptions and 177.5 million CMI as compared to: 1,062,923 interruptions and 211.1 million CMI in 2022; 1,065,004 customer interruptions and 160.5 million CMI in 2021; 914,716 customer interruptions and 124.1 million CMI in 2020; and 995,121 customer interruptions and 146.1 million CMI in 2019.

Penelec experienced one Major Event in 2023. The Major Event impacted 126,310 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 199 minutes in 2022 to 189 minutes in 2023; failed to achieve benchmark by 61.7%.

3-year average: Increased from 162 minutes in 2022 to 180 minutes in 2023; failed to achieve standard by 39.3%.

SAIDI

Rolling 12-month: Decreased from 364 minutes in 2022 to 303 minutes in 2023; failed to achieve benchmark by 104.9%

> **3-year average:** Increased from 285 minutes in 2022 to 315 minutes in 2023; failed to achieve standard by 75.9%.

SAIFI

> **Rolling 12-month:** Decreased from 1.83 outages in 2022 to 1.60 outages in 2023; failed to achieve benchmark by 27.0%.
> **3-year average:** Increased from 1.75 outages in 2022 to 1.76 outages in 2023; failed to achieve standard by 26.4%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown below in Figures 33 and 34. Penelec reported a MAIFI of 0.488 for 2023. Beginning in 2004, Penelec's CAIDI performance trend has been inconsistent and frequently out of control. In 2021, Penelec's rolling 12-month CAIDI increased to just at the standard performance upper-control-limit-line. Penelec's CAIDI soared to 199 at the end of 2022, which is the highest level ever experienced since the reporting period began in 2004. Penelec's CAIDI improved some in 2023 but was still far above both benchmark and standard. With CAIDI performance at this level, Penelec is required to assert more management attention to address the inconsistent performance and return CAIDI performance trend line to below the "green" benchmark performance upper-control-limit-line. Improved response times and shortened repair times will prove essential to maintaining CAIDI at or below the benchmark level. It is believed that management must focus upon improving CAIDI. The Commission expects improved response and repair times and thus improved CAIDI values.

Beginning in 2004, Penelec's SAIFI performance trend has been inconsistent and frequently outside of acceptable tolerances. From 2008 through 2022, the overall trend has been continually trending negative. For the last six calendar years, Penelec's SAIFI was above both the benchmark and standard performance upper-control-limit-lines. Penelec's overall SAIFI performance trend is outside of acceptable limits, even with its improved SAIFI performance in 2023. Management must direct more attention to the poor SAIFI performance and work to move the trend line to a point below the "green" benchmark performance upper-control-limit-line. Focus upon automatic sectionalizing, auto transfer and smart grid may well prove to move and maintain SAIFI below the benchmark. Improved vegetation management is also a key to improving service reliability.

Outage Causes

Figure 35 below, shows the top five reported outage-cause categories in 2022, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees OROW, Equipment Failure and Wind were the leading causes of CMI. Trees OROW and Equipment Failure were the leading causes of the number of outage incidents.

Figure 36 below, shows the historical trend of the top three outage causes. Equipment failure and trees are the two most frequent outage causes that are significantly negatively affecting Penelec's distribution system reliability and resilience, as well as almost every EDC in Pennsylvania.

Conclusion

Trees and Equipment Failure are the top two outage causes that negatively affect electrical reliability to Penelec customers. In 2022, trees and equipment failure outage causes contributed to over 52% of the total CMI.

Beginning in 2004, Penelec's CADI and SAIFI benchmark performance has been erratic and frequently outside of acceptable tolerances. Reliability metrics at these current levels are unacceptable and FE PA through its LTIIP needs to address the inconsistent CAIDI and SAIFI performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line.

The Commission recommends increased efforts in vegetation management, increased utilization of LTIIP processes, and emphasis on improving response times.

The Commission recognizes that, overall, Penelec reliability performance is declining as witnessed by the data shown below. As Figures 37 through 39 below indicate, Penelec's performance, while slightly improving in 2023, is still well below that of its performance in 2015.

Figure 33 – Penelec CAIDI (minutes)
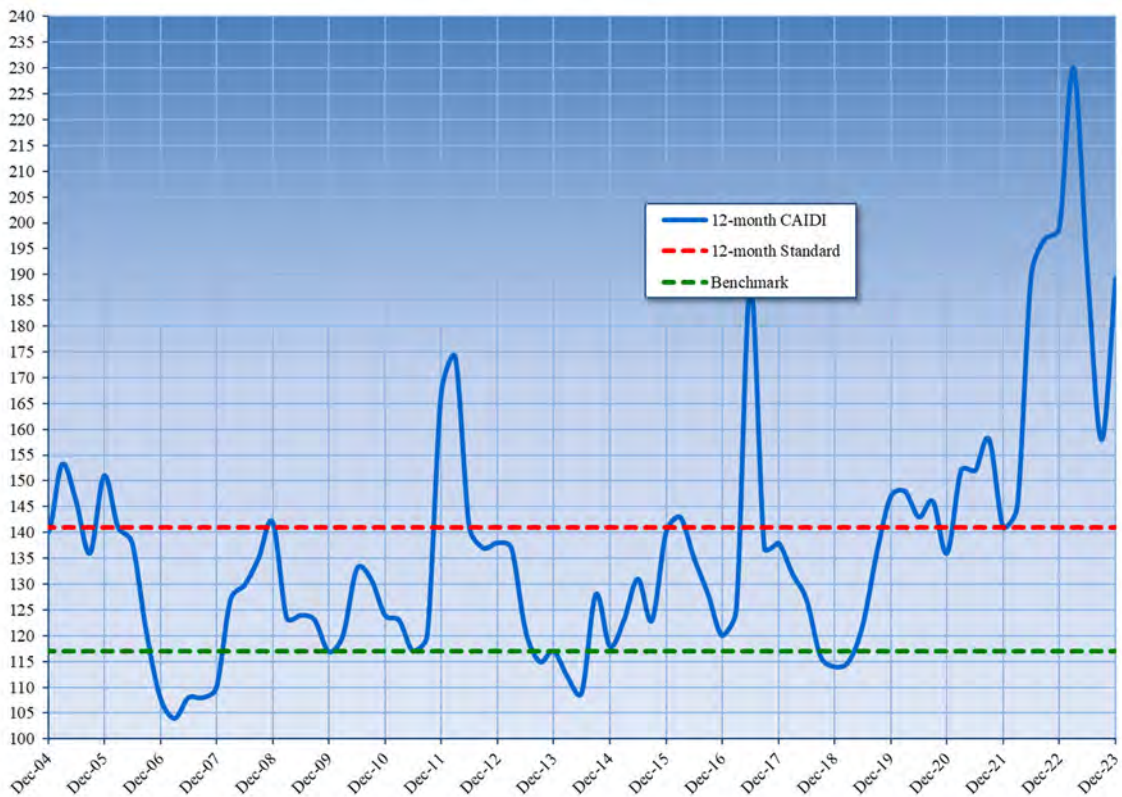
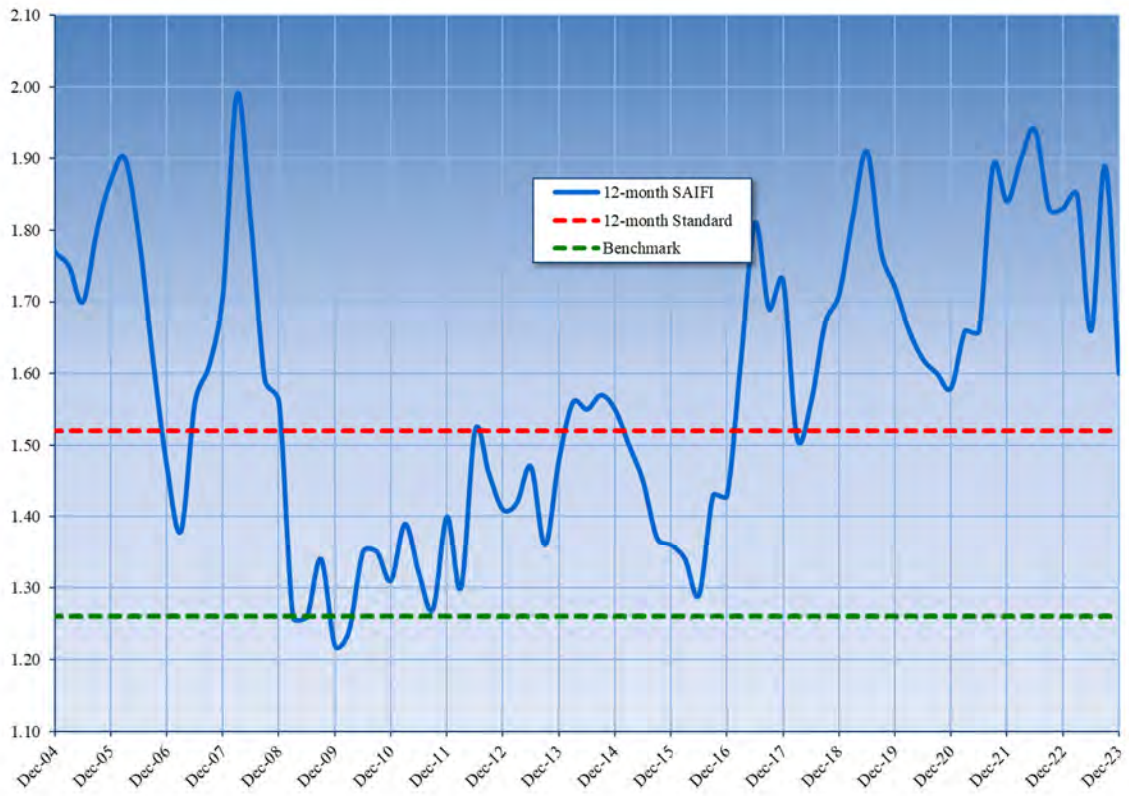*Figure 34 – Penelec SAIFI (interruptions per customer)*

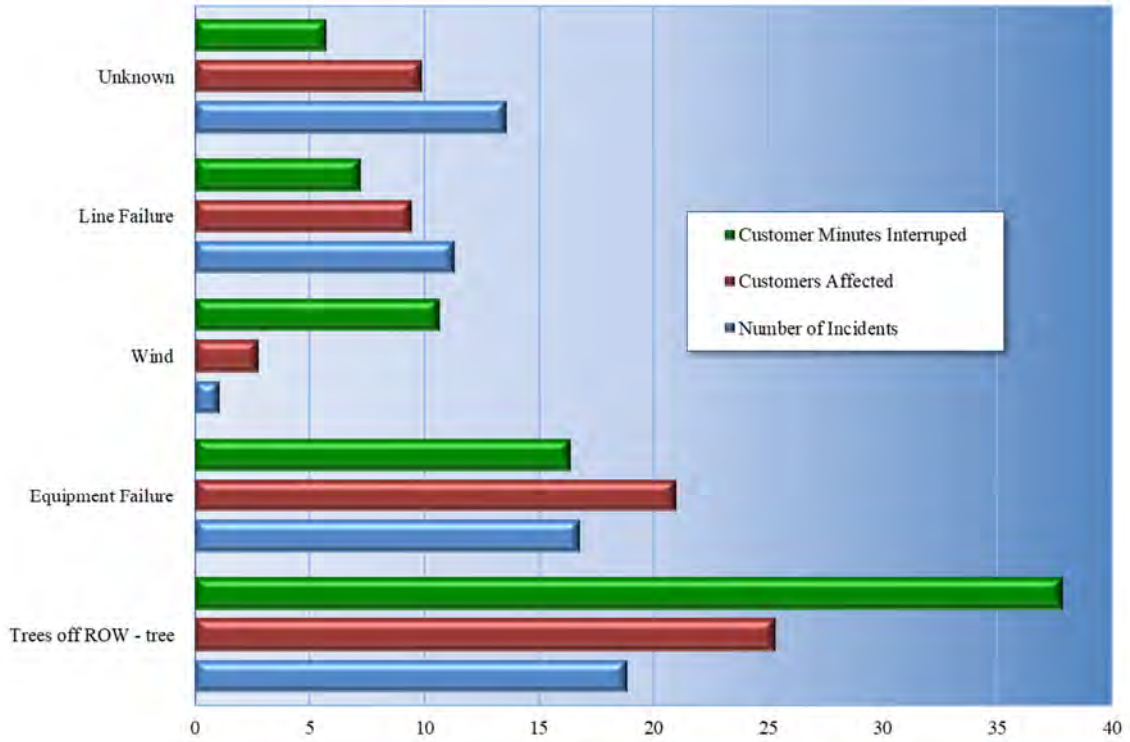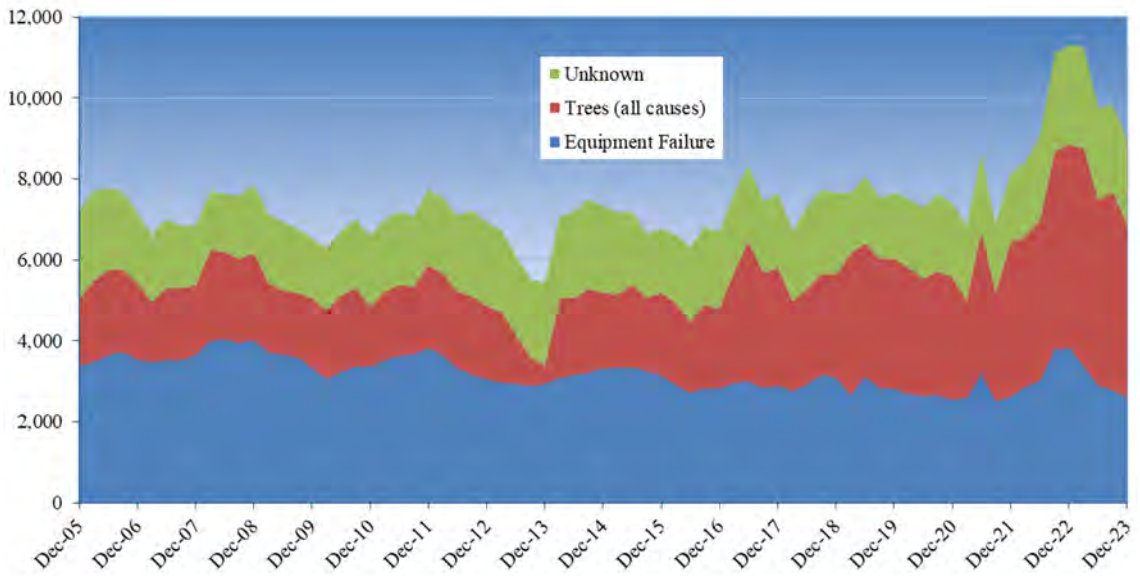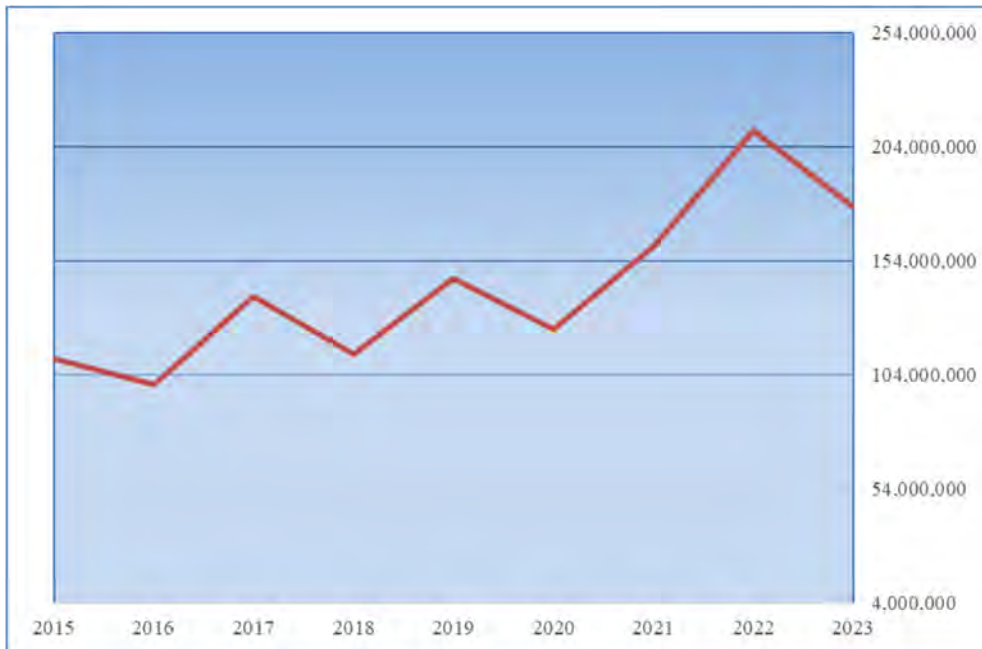*Figure 35 – Penelec Outage Causes (percent of total outages)*

Figure 36 – Penelec Outage Tracking (number of incidents)

Figure 37 – Penelec Outage Tracking (number of Customers Interrupted)

Figure 38 – Penelec Outage Tracking (Customer-Minutes of Interruptions, or CMI)

Figure 39 – Penelec Outage Tracking (number of interruptions annually)

Pennsylvania Power Company

Pennsylvania Power Company (Penn Power) has a service territory of about 1,100 square miles that serves approximately 171,259 customers.

In 2023, Penn Power experienced 132,740 customer interruptions and 20.8 million CMI, as compared to: 166,749 customer interruptions and 22.3 million CMI in 2022; 166,681 customer interruptions and 21.6 million CMI in 2021; 159,907 customer interruptions and 29.6 million CMI in 2020; and 226,745 customer interruptions and 29.2 million CMI in 2019.

Penn Power experienced two Major Events in 2023. The Major Events impacted 109,683 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Increased from 134 minutes in 2022 to 157 minutes in 2023; failed to achieve benchmark by 55.0%.
3-year average:	Decreased from 149 minutes in 2022 to 140 minutes in 2023; failed to achieve standard by 26.0%.

SAIDI

Rolling 12-month:	Decreased from 133 minutes in 2022 to 121 minutes in 2023; failed to achieve benchmark by 7.4%.
3-year average:	Decreased from 147 minutes in 2022 to 128 minutes in 2023; achieved standard by 6.1%.

SAIFI

Rolling 12-month:	Decreased from 0.99 outages in 2022 to 0.78 outages in 2023; achieved benchmark by 30.4%.
3-year average:	Decreased from 0.99 outages in 2022 to 0.92 outages in 2023; achieved standard by 24.9%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown below in Figures 40 and 41. Penn Power reported a MAIFI of 0.018 for 2023. Beginning in 2016, Penn Power's CAIDI performance trend has been inconsistent and frequently outside of acceptable tolerances. Penn Power's rolling 12-month CAIDI has been trending higher and frequently exceeding the "red" standard performance upper-control-limit-line. CAIDI performance is currently above the 12-month benchmark and standard performance levels. The Commission expects more management attention to address the inconsistent performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line. Improved response times and shortened repair times may well prove essential to maintaining CAIDI at or below the benchmark level. It is suggested that management focus upon improving these aspects of Penn Power's operations.

Penn Power's SAIFI performance for 2023 was improved and finished at a level below the benchmark upper-control-limit-line. FE PA management should continue to focus attention to ensure consistent SAIFI performance is sustained thus ensuring the trend line remains below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 42 below, shows the top five outage cause categories in 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees OROW, Trees OROW-Limb, and Equipment Failure were the leading cause of CMI and customers affected. Over 68.35% of CMI was caused by trees and equipment failures.

Figure 43 below shows the historical trend of the top three outage causes. Trees, Animal, and Bird were the three most frequent causes of power outages for Penn Power. Most EDCs have equipment failure and trees as the two most frequent outage-causes. Penn Power should examine its animal guarding and protections to reduce outages caused by animals and birds.

Conclusion

Trees OROW and Equipment Failure are the top two outage causes that substantially negatively affect electrical reliability to Penn Power customers in terms of CMI and total customers impacted.

Beginning in 2004, Penn Power's CAIDI and SAIFI benchmark performance has been inconsistent. FE PA through its LTIIP will need to address the inconsistent CAIDI performance to reduce outage lengths and SAIFI performance to sustain the trend line below the "green" benchmark performance upper-control-limit-line. The Commission recommends continued and increased efforts in vegetation management and emphasis on response times.

The Commission recognizes that, overall, Penn Power's reliability performance struggles most with the duration of outages. While fewer customers are being interrupted annually, customers are out of service longer and possibly more frequently. As can be seen in Figure 44 below, the number of Penn Power's customers interrupted annually is trending downward. However, as shown in Figure 45 below, CMI is still higher than it was in 2015. Figure 46 was showing an overall and steady increase in actual interruption events until 2023.
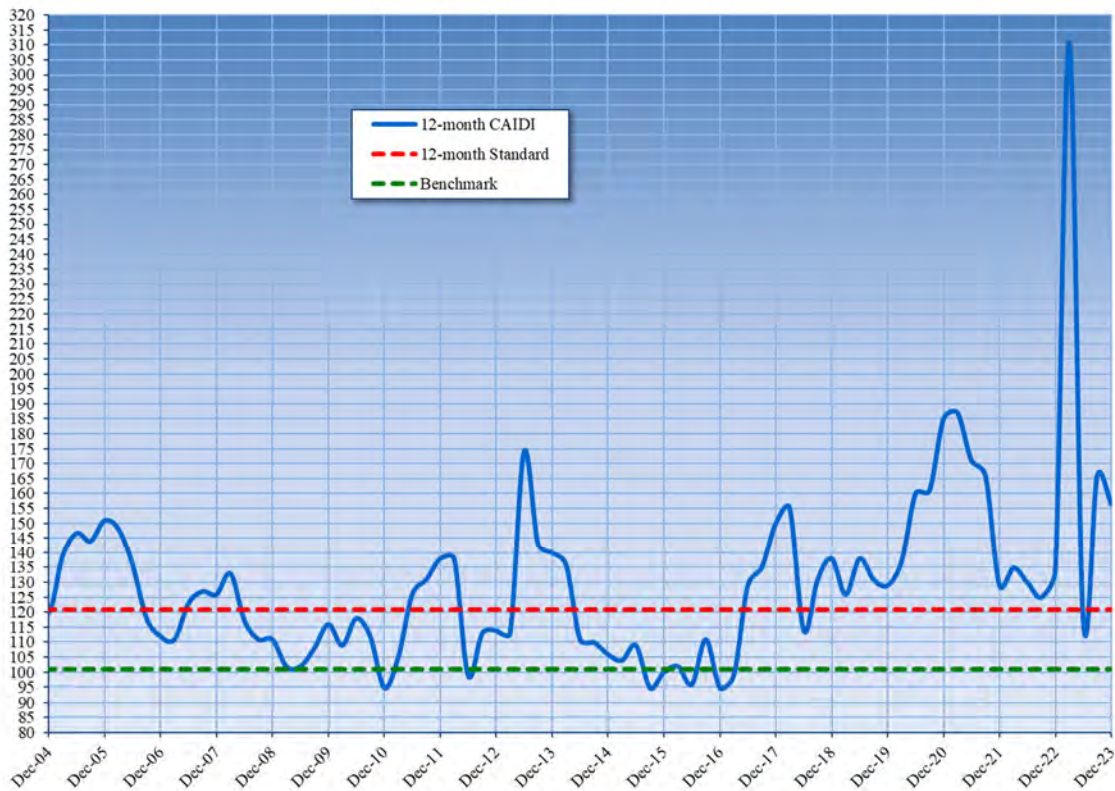
Figure 40 – Penn Power CAIDI (minutes)

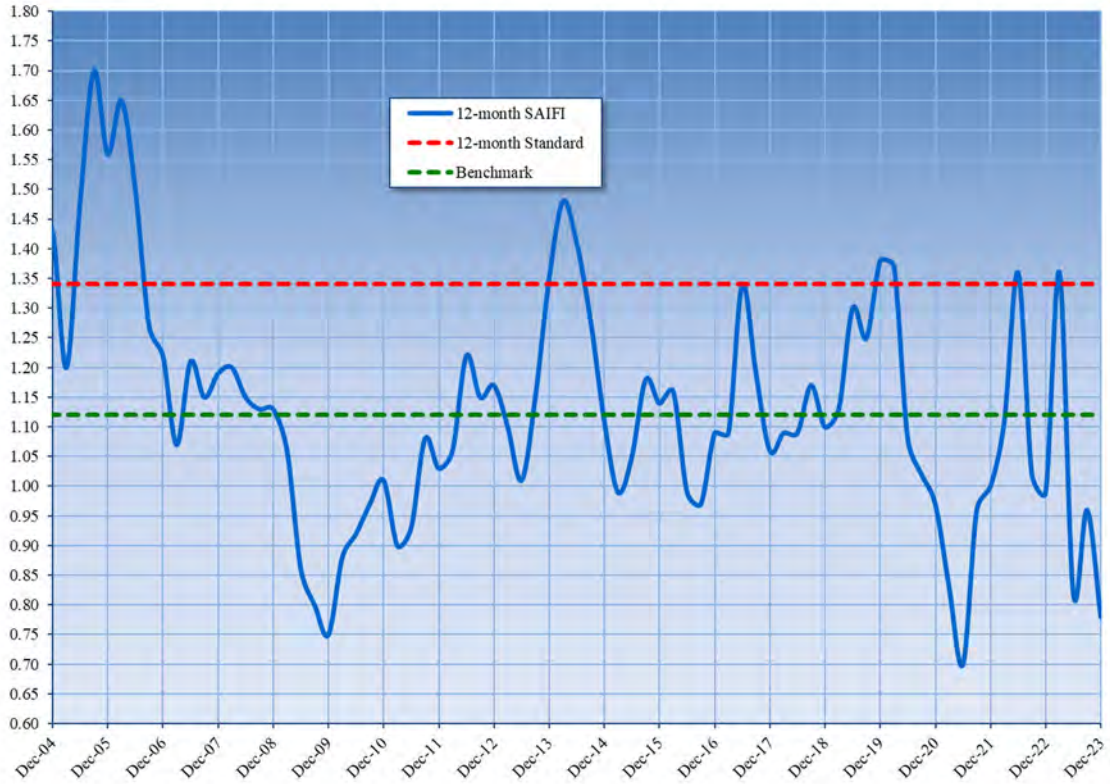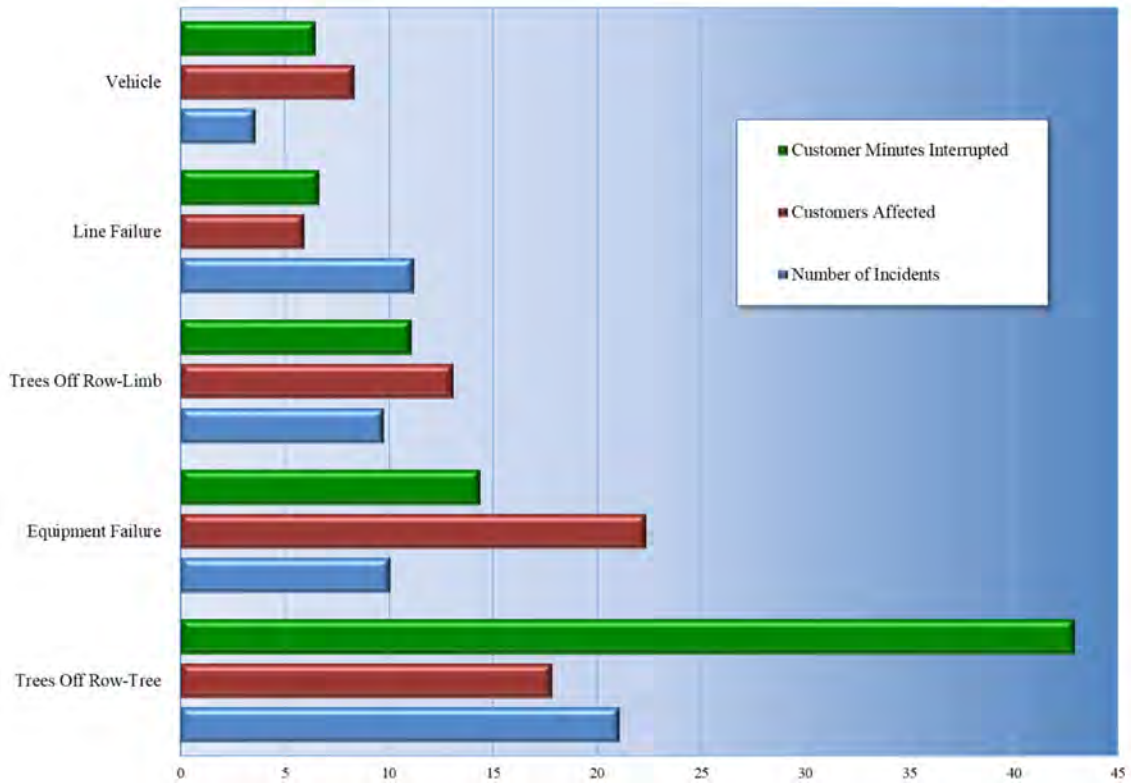*Figure 41 – Penn Power SAIFI (interruptions per customer)*
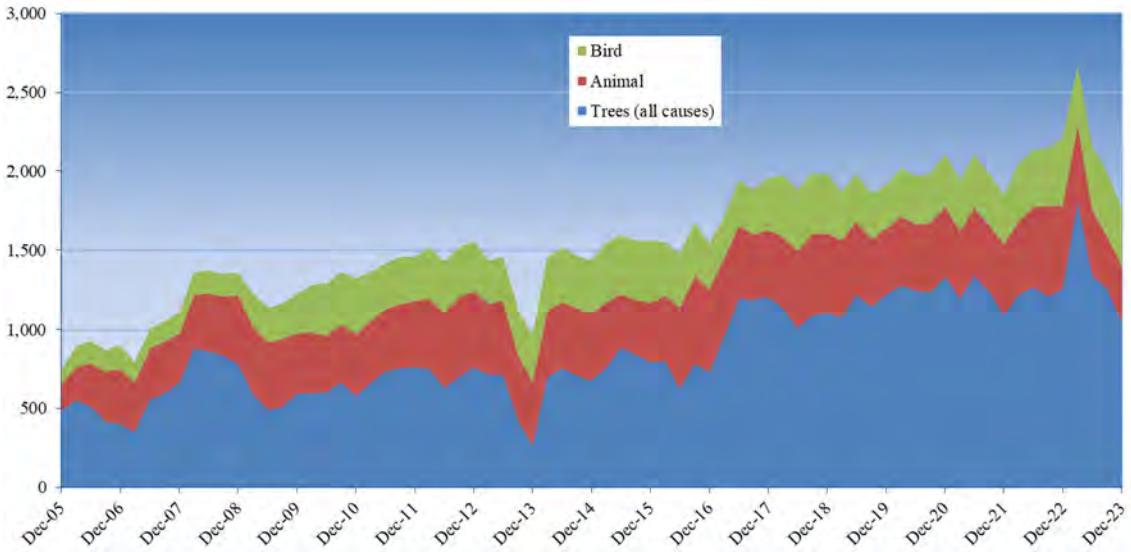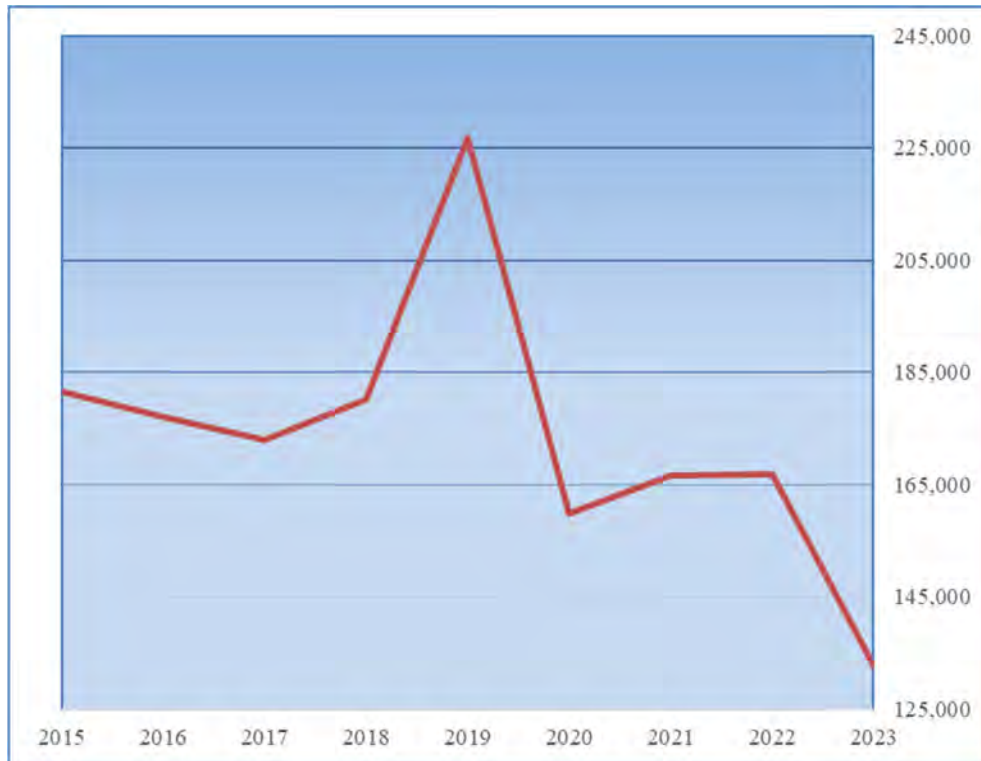

Figure 42 – Penn Power Outage Causes (percent of total outages)

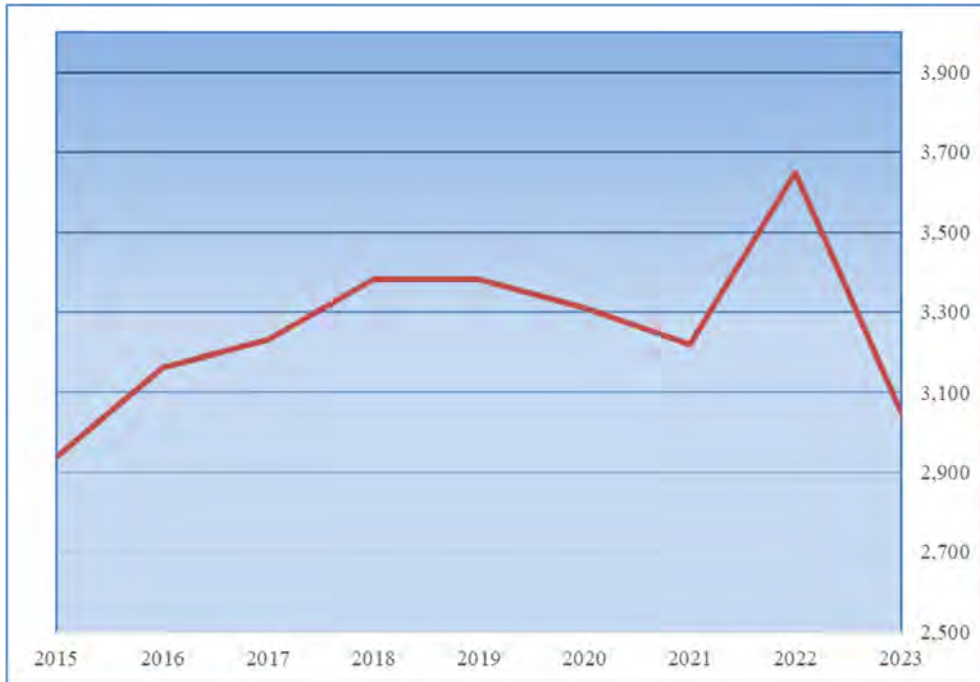*Figure 43 – Penn Power Outage Tracking (number of incidents)*

Figure 44 – Penn Power Outage Tracking (number of Customers Interrupted)

Figure 45 – Penn Power Outage Tracking (Customer-Minutes of Interruptions CMI)

Figure 46 – Penn Power Outage Tracking (number of interruptions annually)

West Penn Power Company

West Penn Power Company (West Penn) has a service territory of about 10,400 square miles and serves about 727,499 customers.

In 2023, West Penn experienced 779,396 customer interruptions and 207.5 million CMI as compared to: 957,562 customer interruptions and 264.3 million CMI in 2022; 910,590 customer interruptions and 174.5 million CMI in 2021; 806,924 customer interruptions and 173.9 million CMI in 2020; and 851,338 customer interruptions and 140.3 million CMI in 2019.

West Penn experienced two Major Events in 2023. The Major Events impacted 128,911 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI
Rolling 12-month:	Decreased from 276 minutes in 2022 to 266 minutes in 2023; failed to achieve benchmark by 56.6%.
3-year average:	Increased from 228 minutes in 2022 to 245 minutes in 2023; failed to achieve standard by 30.9%.

SAIDI
Rolling 12-month:	Decreased from 364 minutes in 2022 to 285 minutes in 2023; failed to achieve benchmark by 59.3%.
3-year average:	Increased from 282 minutes in 2022 to 297 minutes in 2023; failed to achieve standard by 36.9%.

SAIFI
Rolling 12-month:	Decreased from 1.32 outages in 2022 to 1.07 outages in 2023; failed to achieve benchmark by 1.9%.
3-year average:	Decreased from 1.23 outages in 2022 to 1.22 outages in 2023; failed to achieve standard by 4.9%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 75 and 76 below. West Penn's CAIDI performance has historically been erratic. However, from 2014 through part of 2019, CAIDI had been positively below the "green" benchmark performance upper-control-limit-line. Beginning in March 2020, West Penn's rolling 12-month CAIDI increased above the benchmark upper-control-limit-line and 10 minutes above the standard. In 2021, West Penn's CAIDI returned to below the rolling 12-month standard, but still above benchmark. Beginning early 2022, and continuing through the remainder of 2023, CAIDI increased to an unacceptable level of 266 minutes. FE PA management attention is required to return West Penn to the positive CAIDI trend it has previously exhibited between 2014 and 2019. Improved response times and shortened repair times may well prove essential to maintaining CAIDI at or below the benchmark level. The Commission recognizes that with the

introduction of more system automation the CAIDI metric becomes more representative of actual customer interruption duration.

Beginning in 2004, West Penn's SAIFI performance trend has been erratic. From 2017 through 2020, West Penn's SAIFI performance had been moving toward benchmark level. West Penn's SAIFI did show improvement in 2023 but FE PA needs to apply a major effort to ensure SAIFI performance at or below the benchmark level and should continue that effort to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 77 below, shows the top five reported outage cause categories for 2022, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees OROW and Line Failure were the leading cause of outages and CMI. About 56% of CMI is caused by trees and 15% are caused by equipment and line failures.

Figure 78 below shows historical trend of the top three main outage causes. Trees and Equipment Failure are the two most impactful outage causes that are significantly negatively affecting West Penn's distribution system reliability and resilience, as well as most every EDC in Pennsylvania.

Conclusion

The Trees OROW and Equipment Failure causes are the top two outage causes that substantially negatively affect electrical reliability to West Penn customers. In 2022, these outage causes contributed to over 57% of the total CMI. Both categories are indicative of the need for increased vegetation management efforts.

West Penn's SAIFI and SAIDI performance continue to need much more management effort to establish a trend line heading downward to a point below the "green" benchmark performance upper-control-limit-line. It is recommended that West Penn increase its efforts in vegetation management and on improving outage response times. West Penn would do well to maximize their LTIIP efforts to increase storm hardening and increase automatic sectionalizing.

As can be seen in Figures 79 through 81, West Penn exhibited some improvement in the number of customers impacted by outages and in the number of interruption events. However, CMI is still well above the level in 2015 and, correspondingly, West Penn's SAIDI and CAIDI for 2023 are well above both benchmark and standard.
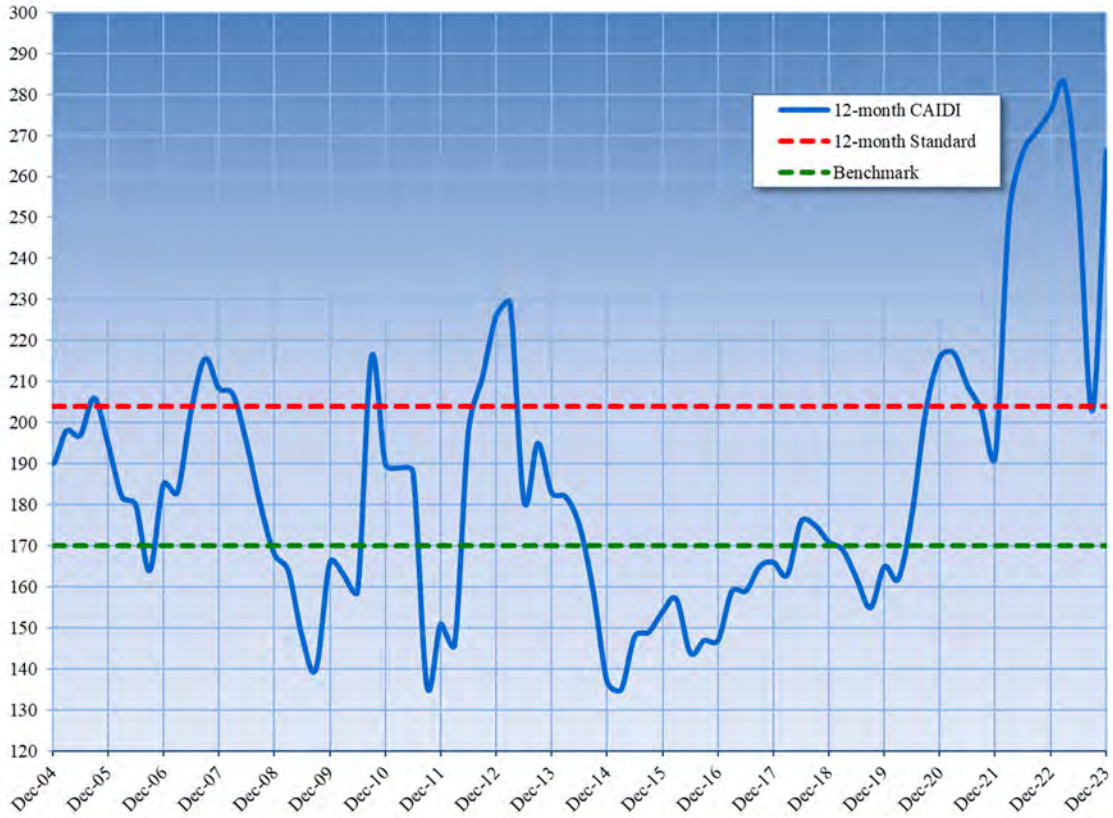
Figure 75 – West Penn CAIDI (minutes)

Figure 76 – West Penn SAIFI (interruptions per customer)
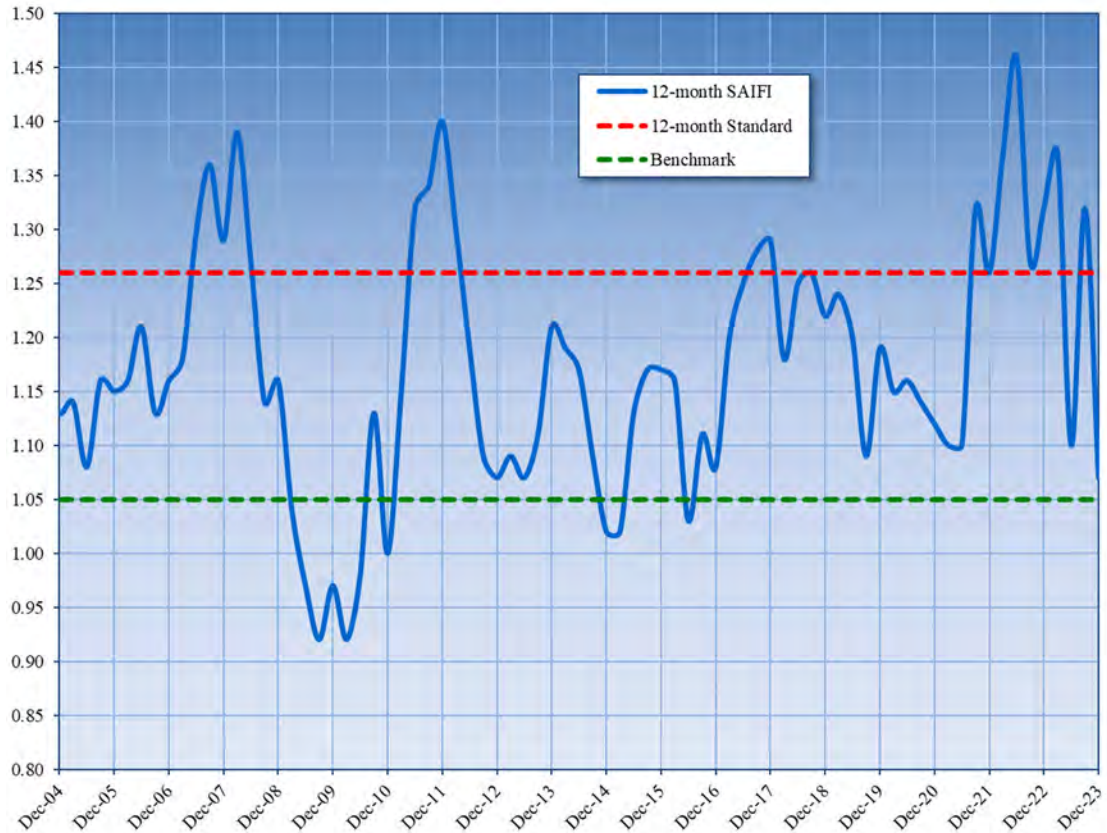
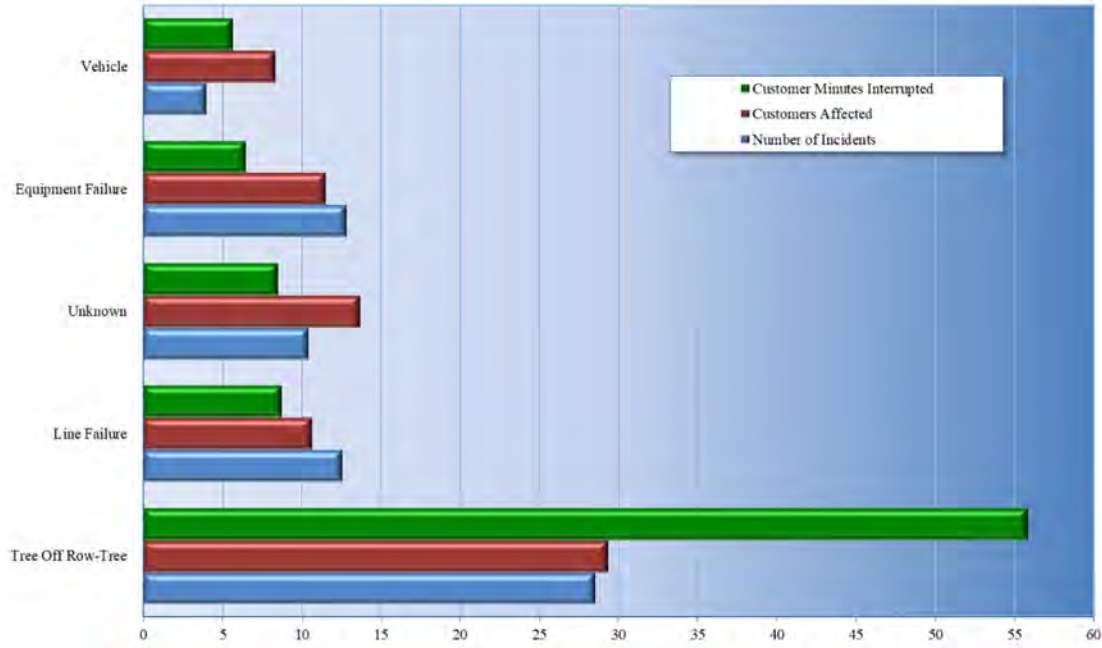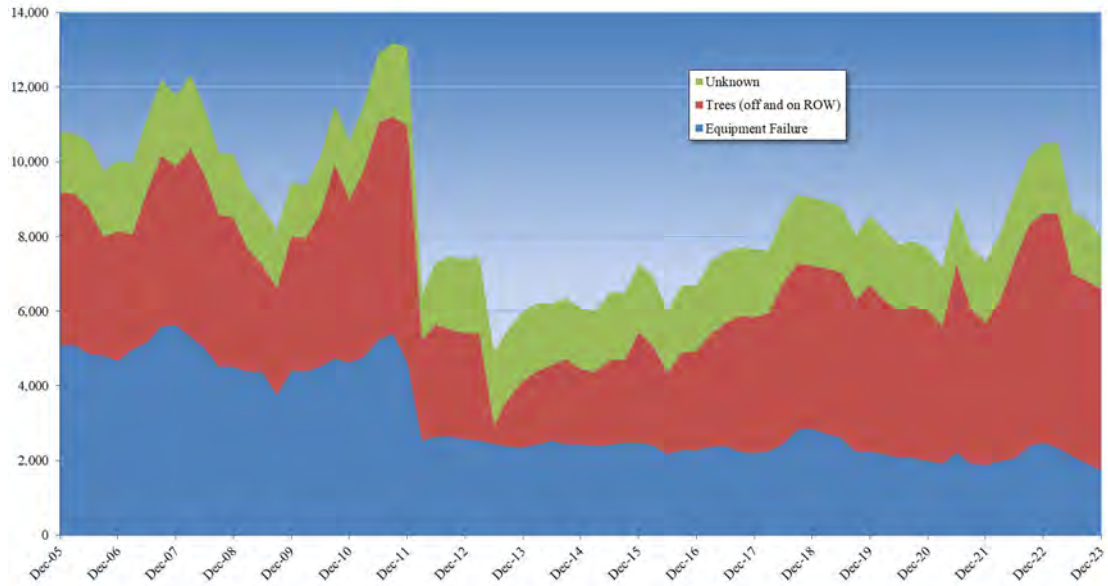*Figure 77 – West Penn Outage Causes (percent of total outages)*

Figure 78 – West Penn Outage Tracking (number of incidents)
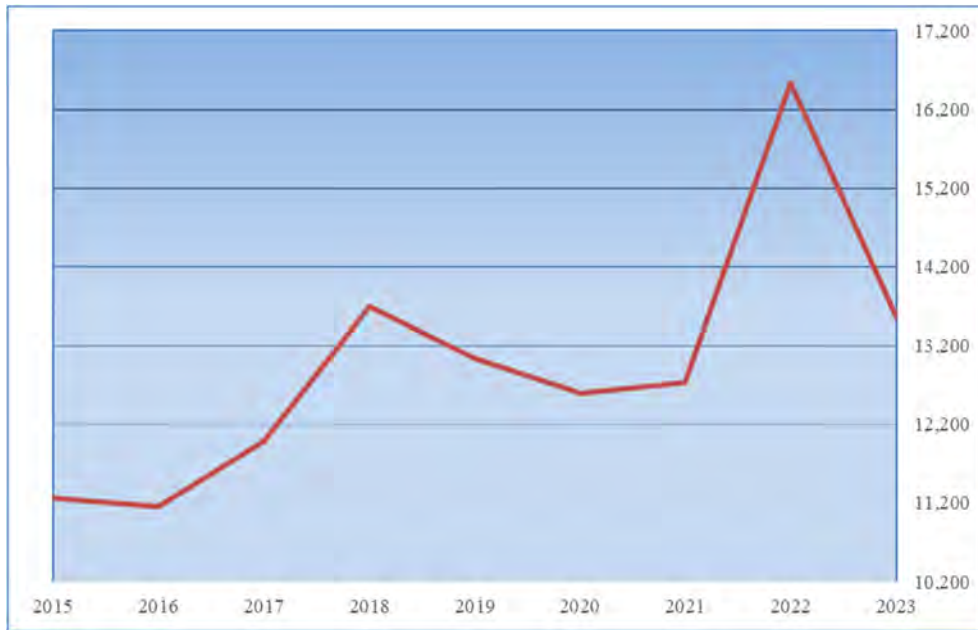
Figure 79 – West Penn Outage Tracking (number of Customers Interrupted)

Figure 80 – West Penn Outage Tracking (Customer-Minutes of Interruptions CMI)

Figure 81 – West Penn Outage Tracking (number of interruptions annually)

PECO Energy Company

PECO Energy Company (PECO) has a service territory of about 2,000 square miles that serves a well-developed distribution system serving about 1.69 million customers.

In in 2023, PECO experienced 1.3 million customer interruptions and 174 million CMI as compared to: 1.2 million customer interruptions and 119 million CMI in 2022; 1.48 million customer interruptions and 275 million CMI in 2021; 1.51 million customer interruptions and 203 million CMI in 2020; and 1.80 million customer interruptions and 341 million CMI in 2019.

PECO experienced no Major Events in 2023.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Increased from 99 minutes in 2022 to 138 minutes in 2023; failed to achieve benchmark by 23.2%.
3-year average:	Increased from 140 minutes in 2022 to 141 minutes in 2023; failed to achieve standard by 14.9%.

SAIDI

Rolling 12-month:	Increased from 71 minutes in 2022 to 103 minutes in 2023; achieved benchmark by 25.4%.	
3-year average:	Decreased from 119 minutes in 2022 to 113 minutes in 2023; achieved standard by 32.5%.	

SAIFI

Rolling 12-month:	Increased from 0.71 outages in 2022 to 0.74 outages in 2023; achieved benchmark by 39.8%.	
3-year average:	Decreased from 0.83 outages in 2022 to 0.78 outages in 2023; achieved standard by 42.5%.	

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 26 and 27 below. PECO reported a MAIFI of 0.80 for 2023. Beginning in December 2012, PECO's CAIDI benchmark performance trend has been positive, as shown to be below the "green" benchmark performance upper-control limit-line. This positive performance trend, below the benchmark performance upper-control limit-line, has been consistently sustained by PECO until 2019, when PECO's CAIDI began to have significant variances from benchmark and standard performance. During 2022, PECO's CAIDI improved greatly to a level well below benchmark level. However, PECO's CAIDI at the end of 2023 was again above benchmark and standard. Management should continue to work on improving PECO's CAIDI performance in 2024 to maintain current performance levels.

Beginning in December 2012, PECO's SAIFI benchmark performance trend has been positive, as shown below on Figure 27. This positive performance trend, below the benchmark performance upper-control-limit-line, has been consistently achieved by PECO, and is considered under control. PECO is considered an excellent SAIFI benchmark performer.

Outage Causes

Figure 28 below shows the reported 2023 outage-cause categories, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Vegetation-Broken/Uprooted was the top cause of CMI, number of incidents, and customers affected.

Figure 29 below, shows historical trend of the top three main outage causes. Equipment failure and Vegetation (all categories) are the two most frequent outage causes that are significantly and negatively affecting PECO's distribution system reliability and resilience, as well as nearly every EDC in Pennsylvania.

General Reliability

PECO noted that its program for providing reliable electric service is multifaceted. It starts with a transmission and distribution system that is designed and built to reliable standards. Under a formal, comprehensive, predictive, and preventive maintenance program, equipment receives maintenance to ensure its safe, reliable operation. Vegetation in the proximity of the system is

pruned and controlled via a funded, well-managed program that protects the electric facilities while respecting the beauty and environmental importance of the vegetation.

PECO noted that it has also implemented a program to upgrade construction in areas of high vegetation interruptions and continues to install reclosers and other protective equipment to limit impacts when interruptions do occur. In response to invasive insects that cause ash tree deaths, PECO has increased its focus on the removal of ash trees through dedicated mitigation plans and vegetation management programs. In 2021, PECO executed the first year of its second LTIIP with additional capital investments to construct reliability-related improvements over the period from 2021 through 2025. PECO noted that the LTIIP is focused on storm hardening and resiliency, cable replacements, and substation retirements with related distribution system upgrades.

PECO stated that when interruptions to electric service do occur, customer calls and instant reports from its smart meters are noted in a computer-aided outage management system, which associates calls and meter reports with information about the distribution system configuration to construct probable trouble groupings. These outage reports quickly appear on the screens for the operations center personnel. The current outage management system has kept pace with technology through upgrades made available by the manufacturer and has been enhanced with information from the Advanced Meter Operating System.

PECO noted that it also continues to install and upgrade the latest proven and cost-effective technology in support of reliability and safe, efficient operations. Examples include computers in the vehicles of field workers, smart electronic meters with communications and diagnostic capabilities, electronically controlled switching, and communication equipment to automatically reroute power around problem areas, a new geographic information system (GIS), and a state-of the-art central distribution system management computer system.

Conclusion

PECO's CAIDI performance in 2023 worsened but PECO has sustained SAIFI benchmark performance and is considered an excellent SAIFI benchmark performer. TUS finds that PECO, like many of the Pennsylvania EDCs, should re-examine and potentially increase efforts to manage vegetation.

The Commission recommends continued and increased LTIIP efforts to improve equipment and reduce equipment caused interruptions. PECO should continue or increase vegetation management and increase emphasis on response times.

The Commission recognizes that, overall, PECO's service to its customers is improving and currently registers as one of the best efforts by an EDC in Pennsylvania. PECO's improvement and current efforts can be witnessed by the data shown below.

As can be seen in Figure 30 below, the number of PECO customers interrupted annually is trending downward. As shown in Figure 31 below, CMI is also trending downward, despite the uptick in 2023, and has improved over the past four years. Figure 32 below shows an overall reduction in actual interruption events since 2019. The Commission recognizes this as a positive achievement and recommends that PECO's efforts continue.
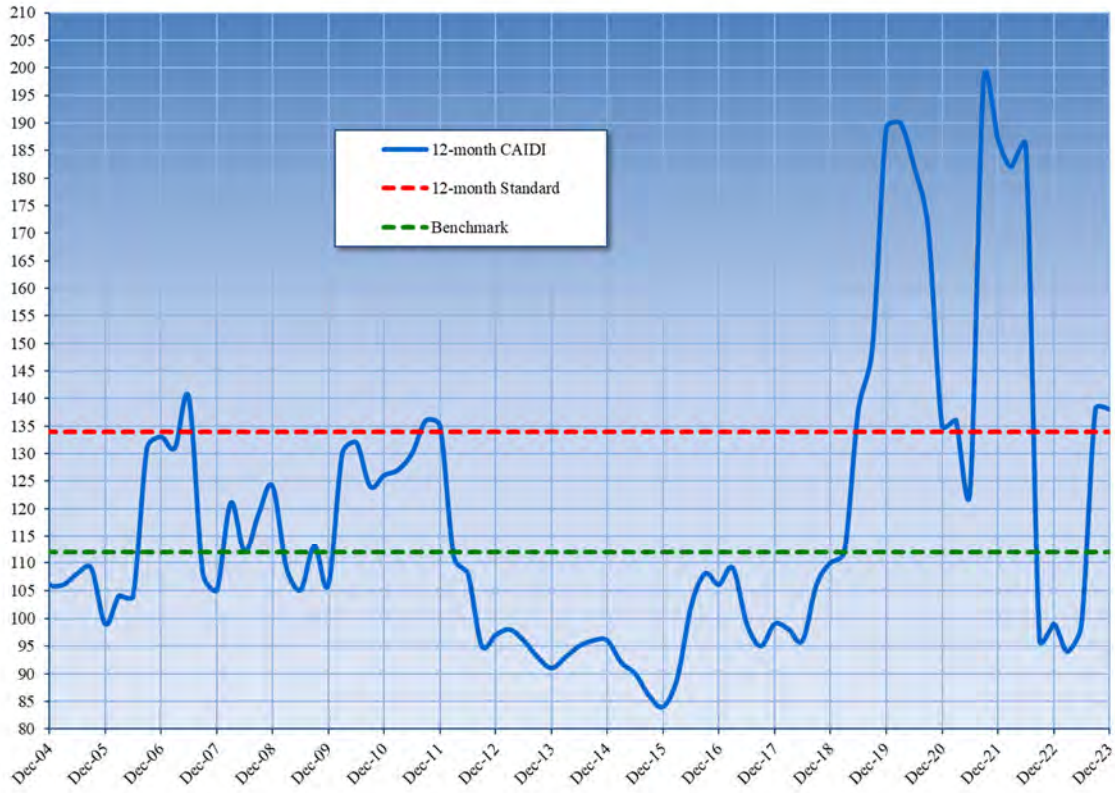
Figure 26 – PECO CAIDI (minutes)

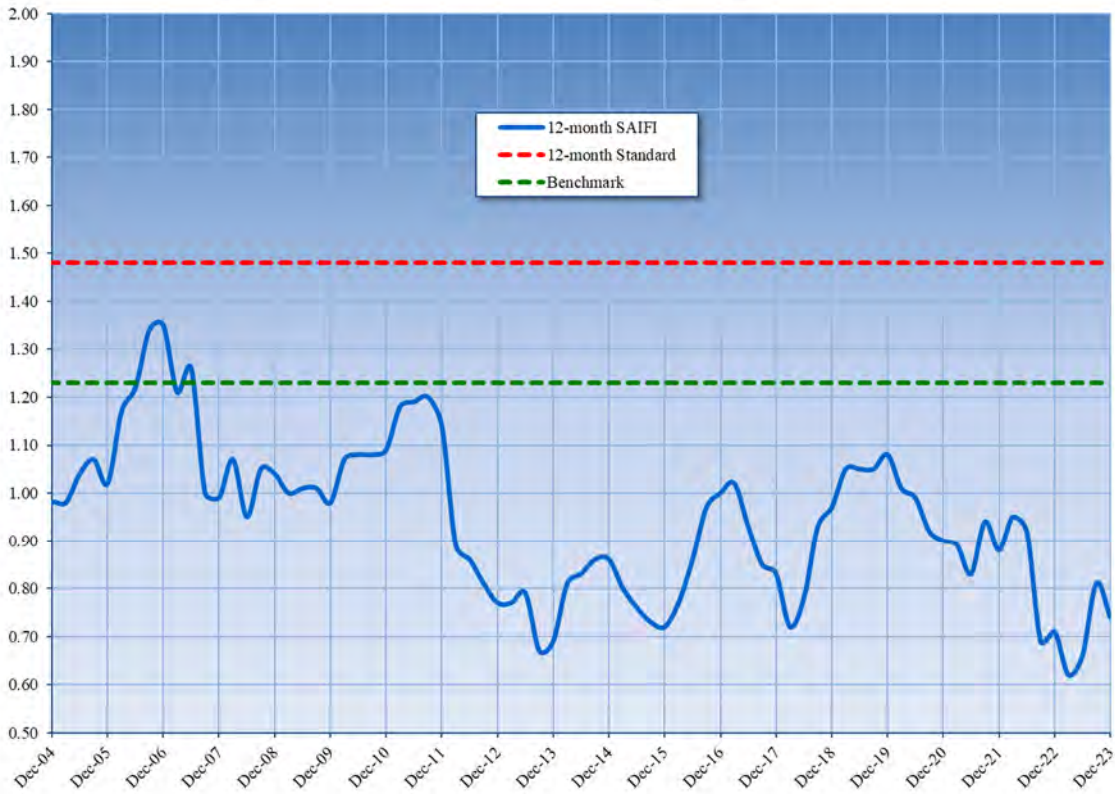*Figure 27 – PECO SAIFI (interruptions per customer)*

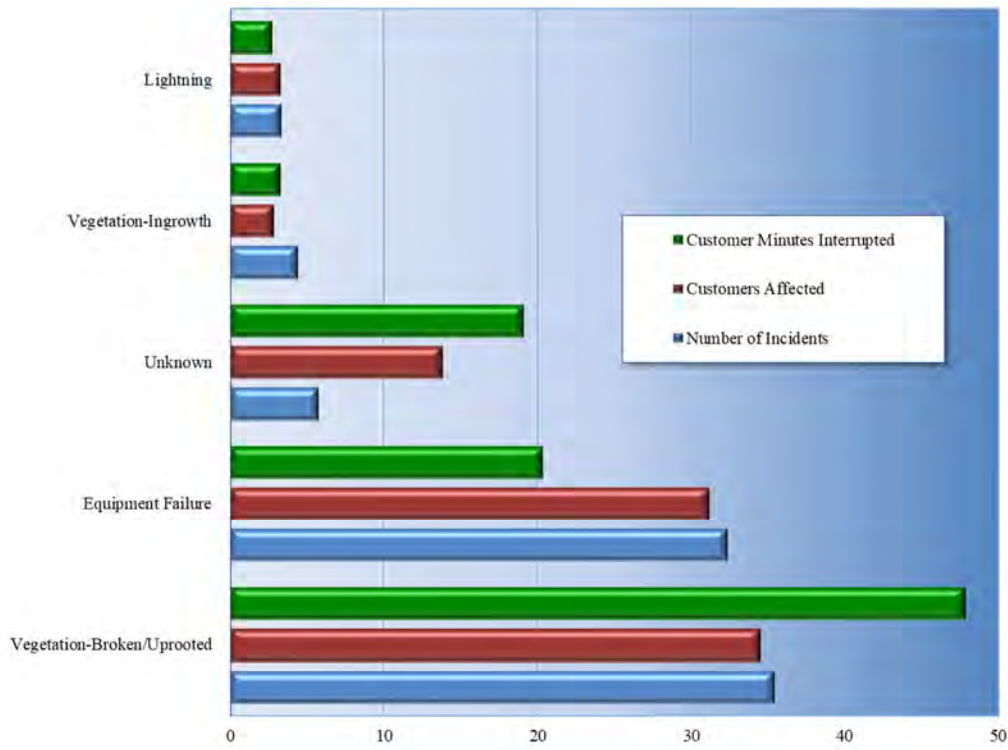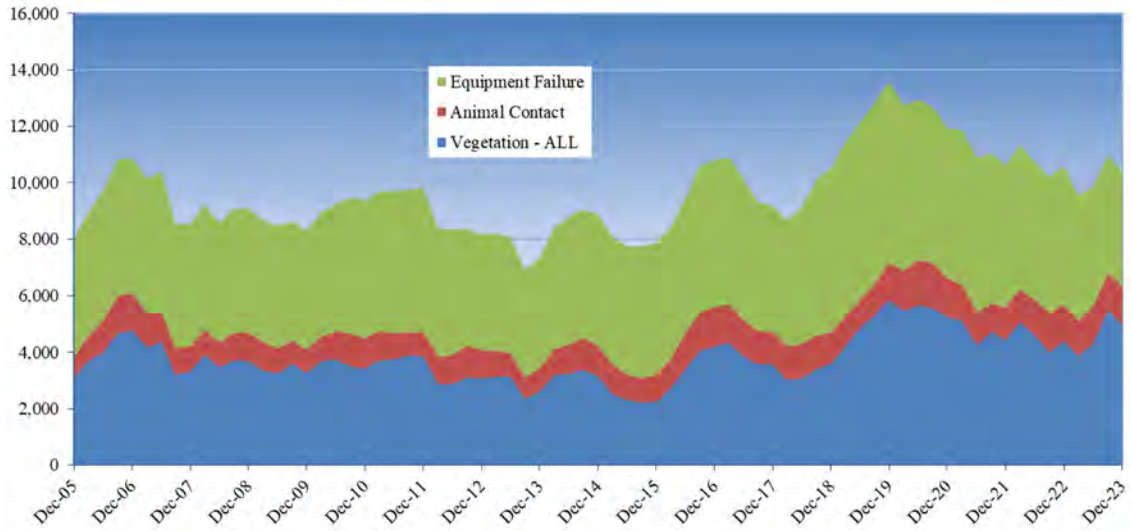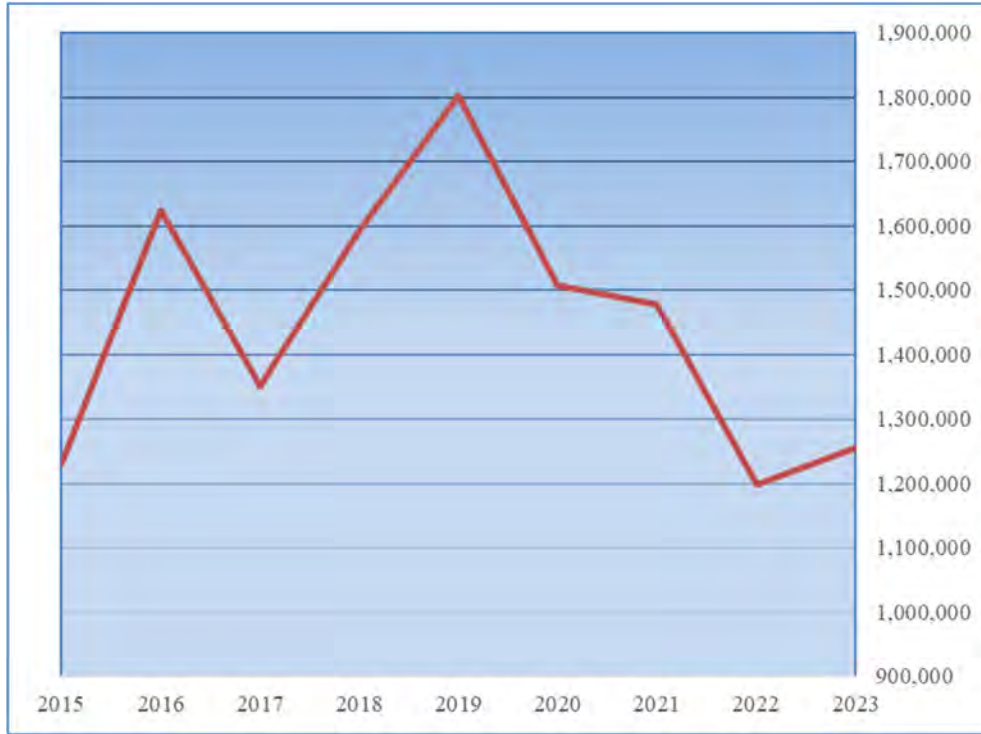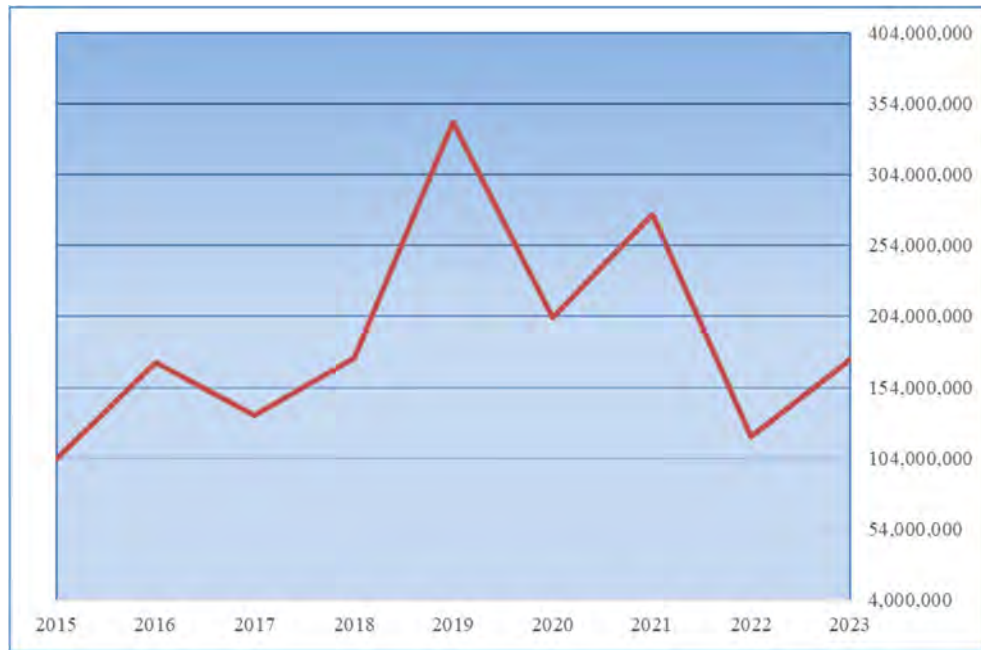*Figure 28 – PECO Outage Causes (percent of total outages)*

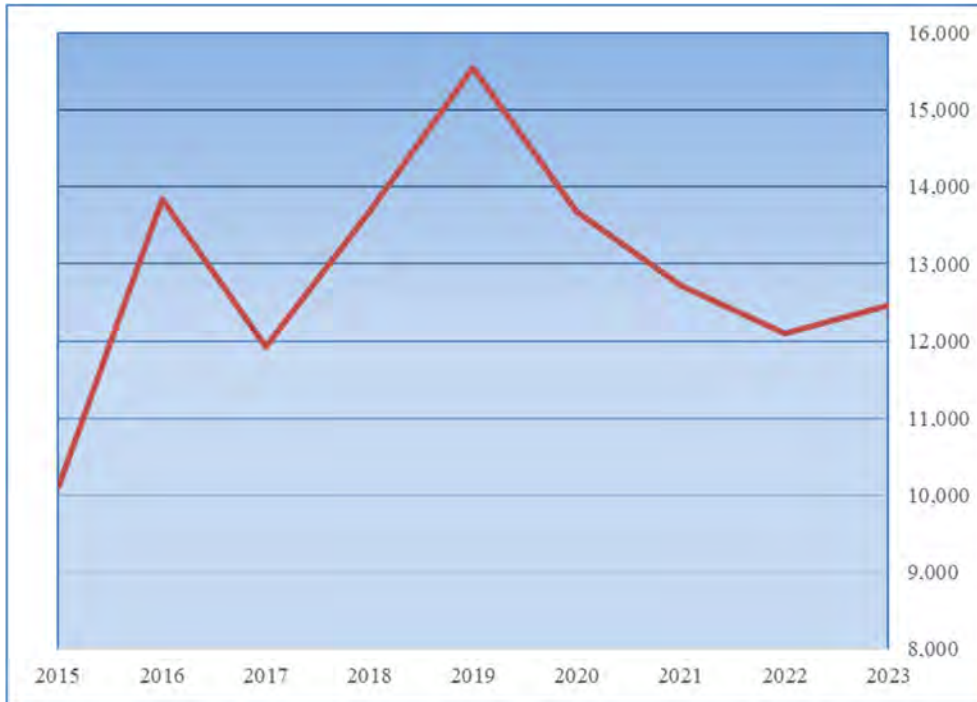*Figure 29 – PECO Outage Tracking (number of incidents)*

Figure 30 – PECO Outage Tracking (number of Customers Interrupted)

Figure 31 – PECO Outage Tracking (Customer-Minutes of Interruptions, or CMI)

Figure 32 – PECO Outage Tracking (number of interruptions annually)

Pike County Light & Power Company

Pike County Light & Power Company (Pike) has a relatively small operating service area of approximately 44 square miles with about 5,333 customers. The Pike service territory is primarily fed from two 34.5 kV feeders that originate from Orange and Rockland Utilities (ORU). The Borough of Matamoras is served by two 13.2 kV feeders from a substation with backup tie capability to distribution circuitry from ORU. The substation is normally fed by a 34.5 kV feed from ORU circuit 116-2-34, with backup service being provided by ORU 34.5 kV circuit 116-434 through an automatic transfer scheme at the substation. The western portion of the Pike service territory is supplied by a radial feed from the ORU circuit 116-4-34.

In 2023, Pike experienced 4,584 customer interruptions and 437,709 CMI as compared to: 2,646 customer interruptions and 420,975 CMI in 2022; 6,890 customer interruptions and 1,058,853 CMI in 2021; 2,356 customer interruptions and 432,428 CMI in 2020: and 1,870 customer interruptions and 331,335 CMI in 2019.

CAIDI/SAIDI/SAIFI EVALUATION

CAIDI

> **Rolling 12-month:**   Decreased from 159 minutes in 2022 to 95 minutes in 2023; achieved benchmark by 45.4%.

3-year average: Decreased from 165 minutes in 2022 to 136 minutes in 2023, achieved standard by 29.3%.

SAIDI

Rolling 12-month: Increased from 79 minutes in 2022 to 82 minutes in 2023; achieved benchmark by 22.6%.

3-year average: Remained at 126 minutes in 2023; achieved standard by 2.6%.

SAIFI

Rolling 12-month: Increased from 0.50 outages in 2022 to 0.86 outages in 2023; failed to achieve benchmark by 41.0%.

3-year average: Increased from 0.78 outages in 2022 to 0.92 outages in 2023; failed to achieve standard by 37.3%.

CAIDI/SAIDI/SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 47 and 48 below. From 2004 through 2019, Pike's CAIDI performance had been erratic and frequently above the "green" benchmark performance upper-control-limit-line and "red" 12-month standard. Pike's CAIDI performance has improved during late 2019 as it returned to benchmark levels, and from 2020 through 2023 it has remained near or even below the benchmark. More management attention is needed to ensure consistent CAIDI performance is sustained below the "green" benchmark performance upper-control-limit-line. The Commission views CAIDI as an important indication of an EDCs ability to respond to, repair and return to service customers that are experiencing an electric service outage.

Pike's SAIFI performance trend has been overall positive during the years of 2015 through 2022. However, in 2018, 2021, and again in 2023, Pike's SAIFI exceeded the 12-month standard. Significant management attention is needed to maintain SAIFI performance below the "green" benchmark performance upper-control-limit-line. The Commission generally views SAIFI performance as an indicator of an EDC's system hardening and outage resistance. Coupled with the weather conditions experienced, it demonstrates the ability to withstand outages.

Outage Causes

Figure 49 below shows the top five reported outage cause categories in 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Tree Contact and Unknown-Other created the greatest number of incidents and CMI. Approximately 20% of outages and 32% of CMI are caused by Unknown-Other. Approximately 60% of CMI are caused by Tree Contact. More management attention should be directed at reducing the number of causes attributed to Unknown-Other as that categorization does not lend itself to providing substantive analysis of those events from a reliability perspective.

Figure 50 below shows the historical trend of the top three main outage causes. Tree Contact is the most frequent outage cause that is significantly negatively affecting Pike's distribution system reliability and resilience, as well as most every EDC in Pennsylvania.

General Reliability

Pike noted most outages, customers affected, and customer-minutes of interruption are primarily the result of vegetation contacts. Pike noted that in prior years, the Company has been effective in removing danger trees but that in recent years external environmental factors such as the Emerald Ash Borer have increased the risk associated with tree contact outages to the Company's distribution system. Pike stated that it prioritizes and aggressively removes danger trees within utility ROW zones and works with individual customers and municipalities to remove those that that exist outside of Pike's ROW areas. Pike noted that it also works with the Milford Shade Tree Commission to address danger trees that represent a hazard to the general public as well as the Company's electrical system located within and outside of right-of-way areas.

Pike noted that in 2023 its pole inspection program returned to its 12-year cycle after accelerating inspections in 2022. 60 poles failed inspection and were replaced during the year out of approximately 300 poles that were inspected.

Pike stated that the leading cause of outages was tree contact and that the service reliability program targeted to manage these outages is the 34.5 kV circuit three-year, cycle-based tree clearance program. Pike noted that the 13.2 kV circuits are on 5-year cycle. Pike noted that the focus of its 2023 vegetation management program was on an overgrown ROW exiting the rear of the Matamoras Substation and heading west to Interstate 84. Pike stated that it is unknown when the ROW was last maintained, however, it was overgrown with vegetation on both sides and under the existing pole line. Pike indicated that it completed an LTIIP reliability project involving reconductoring of the existing 34.5 kV circuit and the construction of a new 13.2 kV underbuild to serve as a backup feed to the radial circuit feeding the commercial area along Route 209 in the Town of Westfall. Pike noted that the vegetation removal involved ground-to-sky clearing of the ROW to allow for the new circuit and ingress/egress onto the ROW, which had been limited by the vegetation prior to removal. Pike stated that hot-spot trimming continued on an as-needed basis, and that Pike worked with local municipalities to remove danger trees (specifically, emerald ash trees) as they were identified or at the request of the individual municipalities.

Conclusion

From 2019 through 2023, Pike had improved CAIDI performance. However, Pike did exceed the 12-month standard level for SAIFI in 2021 and 2023. It is expected that Pike will direct more management attention to SAIFI and maintain levels below the "green" benchmark performance upper-control-limit-line. Consistent management attention is needed in the future to sustain the CAIDI trend line below the "green" benchmark performance upper control-limit-line. The Commission recommends continued and increased efforts in vegetation management and use of LTIIP funding to improve system hardening and resiliency.

The Commission recognizes that, overall, Pike appears to have somewhat stabilized its reliability performance, as witnessed by the data shown above and below. Pike is demonstrating effort and SAIFI has generally been at or below benchmark with exception of 2021 and 2023. CAIDI is also more under control as historical CAIDI performance from 2008 through 2018 was very erratic.

As can be seen in Figure 51 below, the number of Pike's customers interrupted annually is on a very slight upward trend. As shown in Figures 52 and 53 below, CMI and actual interruption events are generally maintaining their level with the exceptions of 2018 and 2021.

Figure 47 – Pike County CAIDI (minutes)
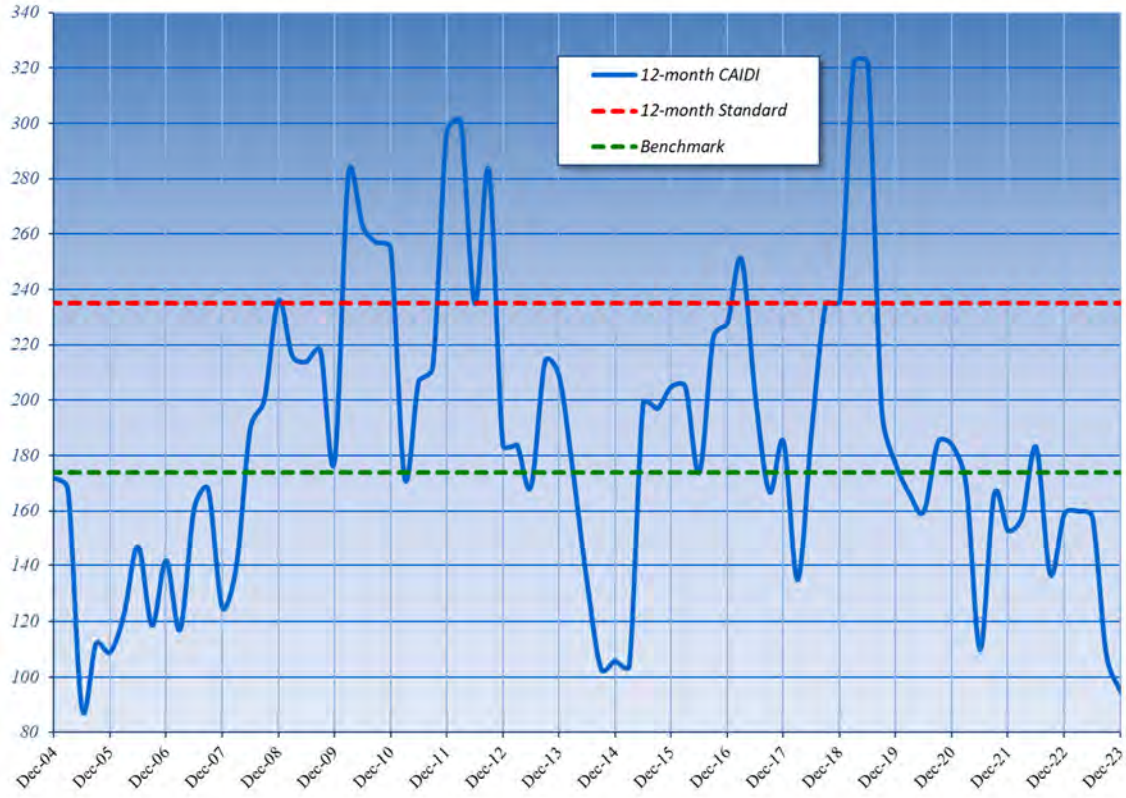
Figure 48 – Pike County SAIFI (interruptions per customer)

Figure 49 – Pike County Outage Causes (percent of total outages)

Figure 50 – Pike County Outage Tracking (number of incidents)

Figure 51 – Pike County Outage Tracking (number of Customers Interrupted)

Figure 52 – Pike County Outage Tracking (Customer-Minutes of Interruptions CMI)

Figure 53 – Pike County Outage Tracking (number of interruptions annually)

PPL Electric Utilities Corporation

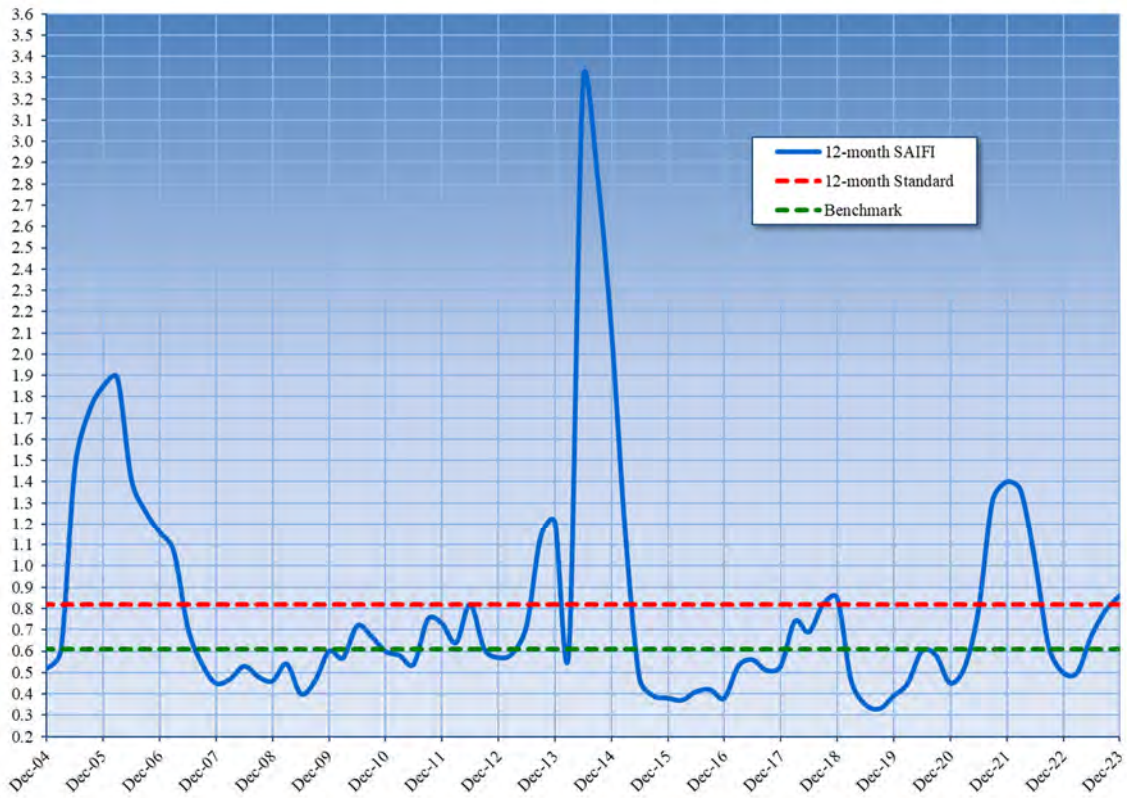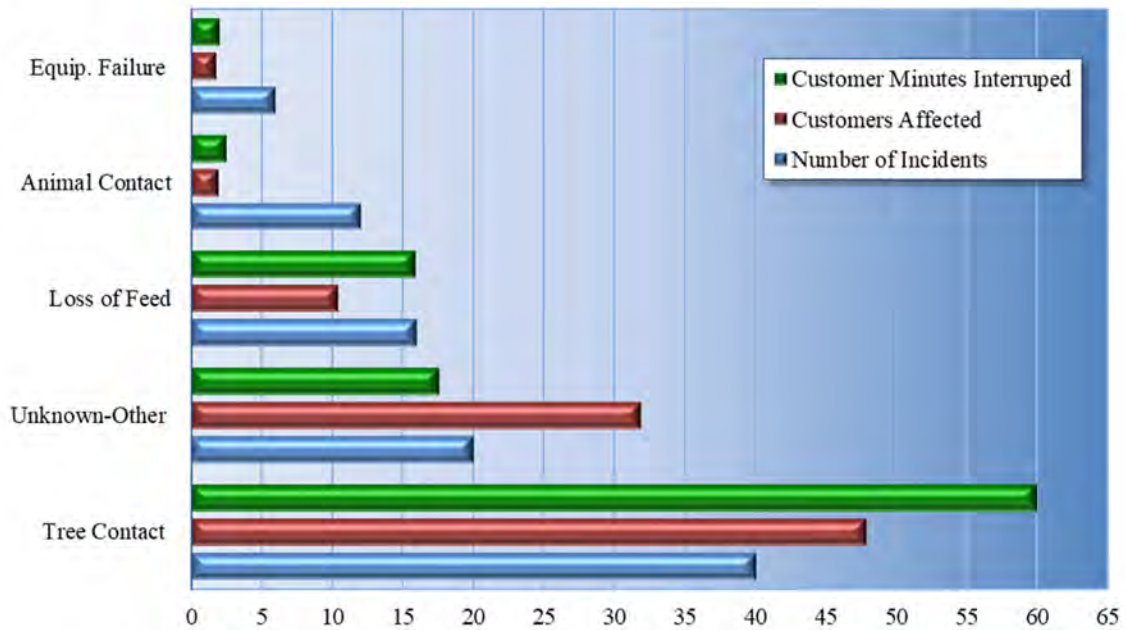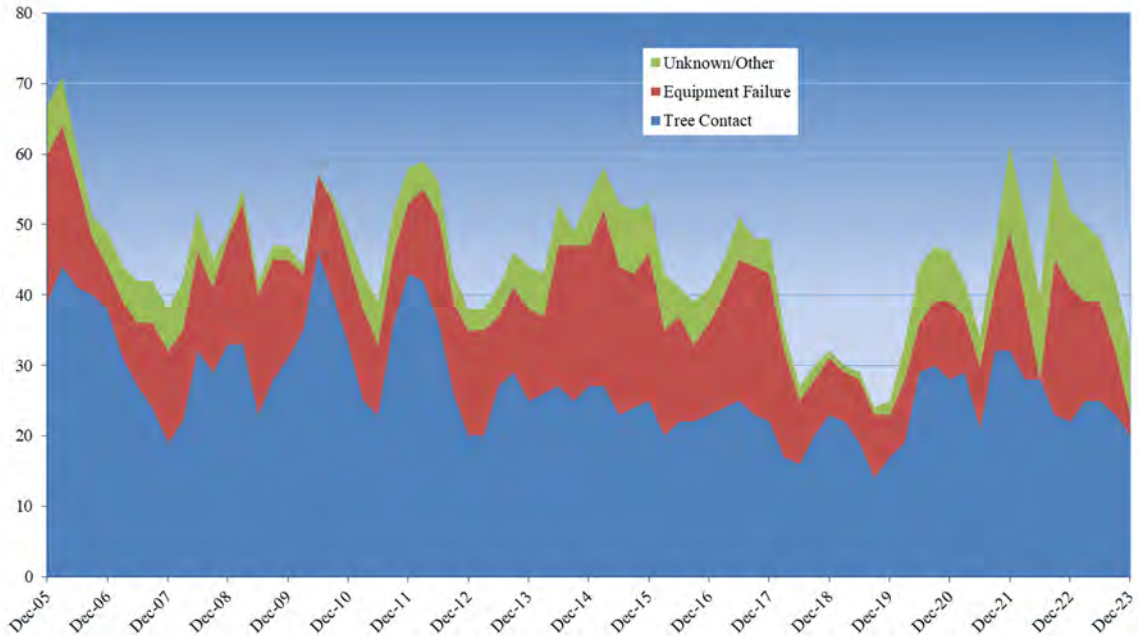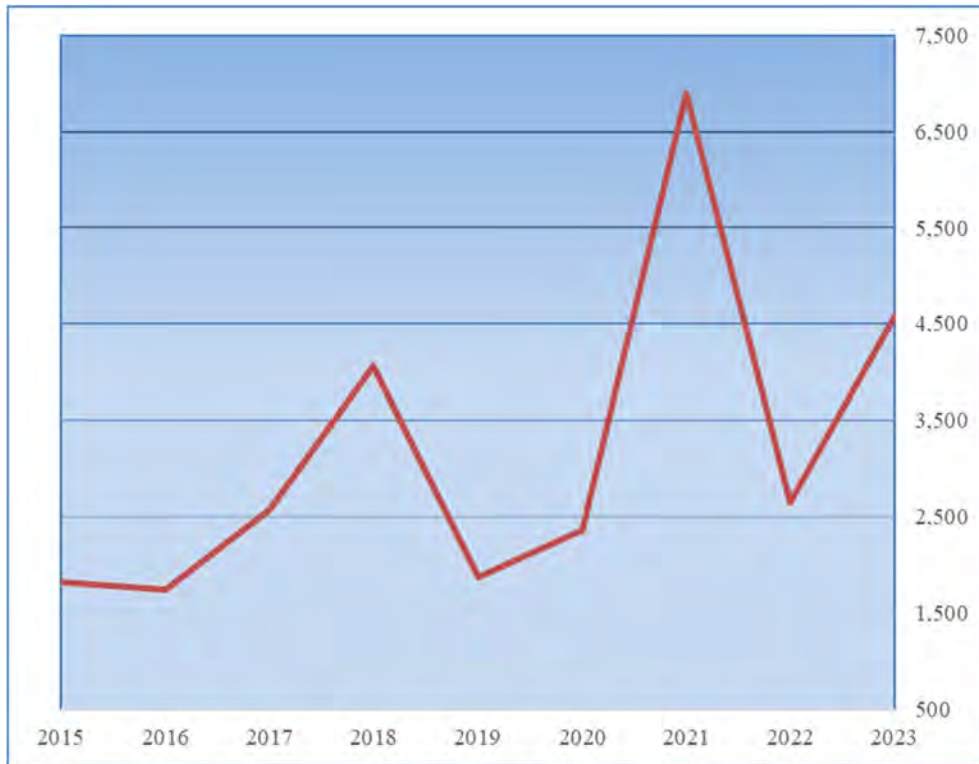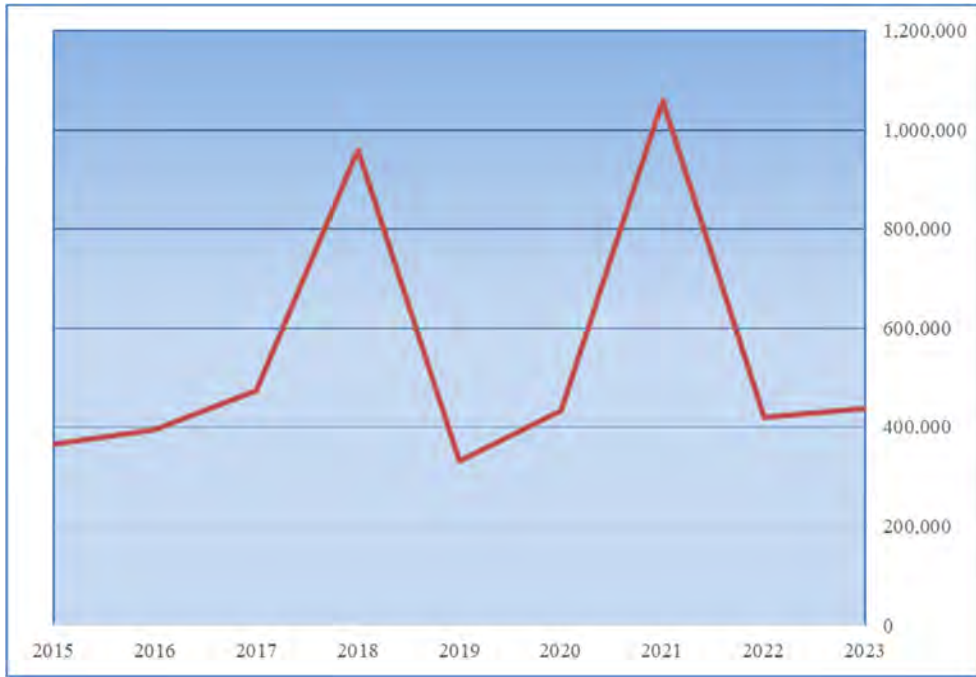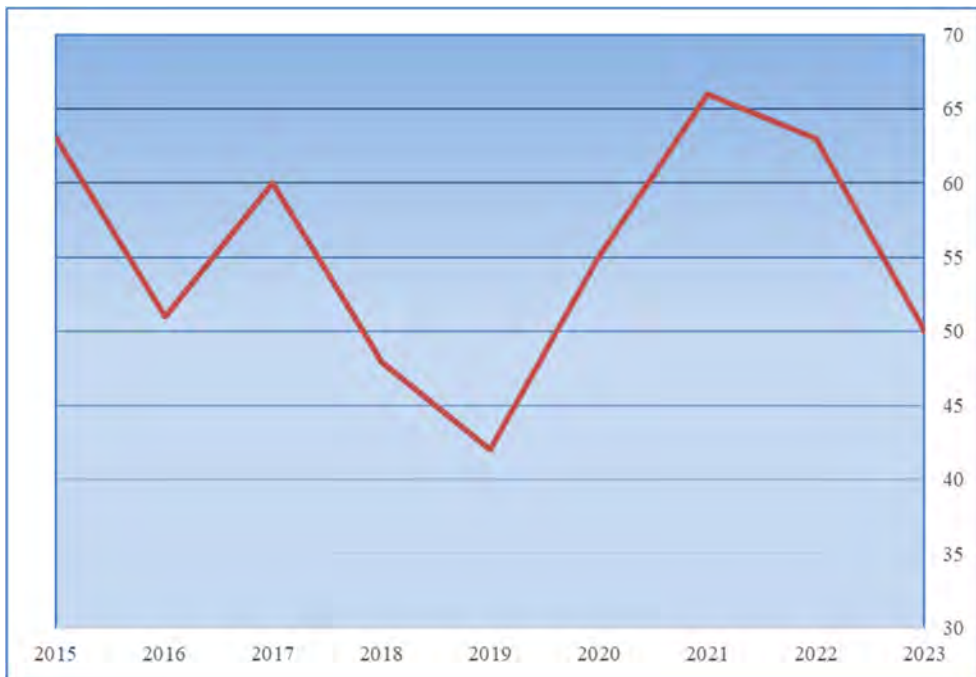PPL Electric Utilities Corporation (PPL) has a service territory of about 10,000 square miles and serves approximately 1.46 million customers.

In 2023, PPL experienced 1.1 million customer interruptions and 214.4 million CMI as compared to: 1.3 million customer interruptions and 206.4 million CMI in 2022; 1.2 million customers interruptions and 245.4 million CMI in 2021; 1.2 million customers interruptions and 166.4 million customer-minutes in 2020; and 1.2 million customer interruptions and 213.9 million CMI in 2019.

PPL did not experience a Major Event in 2023.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Increased from 164 minutes in 2022 to 189 minutes in 2023; failed to achieve benchmark by 30.3%.
3-year average:	Increased from 163 minutes in 2022 to 180 minutes in 2023; failed achieve standard by 12.5%.

SAIDI

Rolling 12-month:	Increased from 142 minutes in 2022 to 147 minutes in 2023; failed to achieve benchmark by 3.5%.
3-year average:	Increased from 143 minutes in 2022 to 153 minutes in 2023; achieved standard by 11.0%.

SAIFI

Rolling 12-month:	Decreased from 0.87 outages in 2022 to 0.78 outages in 2023; achieved benchmark by 20.4%.
3-year average:	Decreased from 0.87 outages in 2022 to 0.85 outages in 2023; achieved standard by 21.0%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 54 and 55 below. PPL reported a MAIFI of 0.30 for 2023. Beginning in 2004, PPL's CAIDI performance trend has generally been below standard and sometimes below benchmark. However, CAIDI performance beginning in 2017 has been erratic and frequently above both benchmark and standard. PPL's CAIDI for 2021 was 187, which surpassed both the benchmark and standard upper-control-limit lines. CAIDI performance improved some in 2022, but remains above the benchmark measure at the end of 2023. Management should intensify its efforts to improve CAIDI performance and return performance to levels consistently below the "green" benchmark performance upper-control-limit line. The Commission views CAIDI as an indicator of an EDC's ability to respond to, repair and return to service customers following an

outage. It is understood that with the improved system automation that the CAIDI metric will show increases. However, the very use of system automation by an EDC tends to make CAIDI a more valuable indicator of customer outage times and hence actual response to customer interruptions.

Beginning in December 2013, PPL's SAIFI benchmark performance trend has been positive, as shown in Figure 55 below. This positive performance trend, below the benchmark performance upper-control-limit-line, has been consistently sustained by PPL, and is considered under control.

PPL is considered an excellent SAIFI benchmark performer. This trend is also indicative of PPL's increasing use of system automation (Smart Grid) devices.

Outage Causes

Figure 56 below shows the top five reported outage cause categories in 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees were the top cause of outages and customer minutes interrupted. Approximately 70% of CMI is caused by trees and approximately 14% of CMI is caused by equipment failure. The Commission notes a concern with the sharp increase in tree-related outages for PPL from 2015 to present. The Commission is concerned that possible reductions, or insufficient increases, in vegetation management expenditures may be responsible for this increase in tree-related issues. Management should review the present efforts and strategies to evaluate effectiveness. The Commission also recognizes that changes in precipitation levels will affect vegetation growth and hence increase the numbers of outages.

Figure 57 below shows the historical trend of the top three main outage causes. Tree Related and Equipment Failures are the two most frequent outage causes that are significantly negatively affecting PPL's distribution system reliability and resilience, as well as almost every EDC in Pennsylvania.

General Reliability

PPL rolling 12-month SAIFI at the end of 2023 was 0.78, which was an improvement from its performance in 2022. PPL noted its ongoing focus around preventing customer interruptions through system automation, vegetation management and asset performance continues to directly support overall strong reliability results.

PPL stated that it continues to drive high levels of reliability performance through programs such as:

- Commitment to providing safe, reliable, affordable service to PPL's customers.

- A Strategic vegetation management program.

- Continued strategic investment in distribution automation technology such as:

  o Multi and single-phase Smart Grid Initiative.

- o Increased leverage of its Automated Distribution Management System (ADMS).

- o Full implementation of Fault Isolation and System Restoration (FISR) technology automatically restoring more than 1.9 million customers since 2015.

- Strategic data-driven reliability investments including asset replacement, and system improvements that include storm hardening standards.

- An increased focus on remediating momentary outages before they become permanent outages.

- Continued focus on outage response improvements.

- Moving to data-driven, condition-based maintenance programs

PPL noted that the 2023 results were achieved in a year of record storm frequency. PPL noted that in 2023 it experienced 45 total storm events, which is the most on record for PPL (beginning with 2002). PPL also noted that it had the second most on record in terms of PUC-reportable events (ROEs – see Section 3, above) in 2023 with 14 ROEs.

In terms of CAIDI performance, PPL noted that it was heavily impacted by storms and was 30% above benchmark. PPL stated that its more weather-normalized IEEE CAIDI was 142.5, versus the non-weather normalized PUC value of 188.7. PPL noted that with 2023 storms at record frequency, along with automated systems preventing and converting outages to momentary interruptions, higher CAIDI values are not unexpected. However, PPL noted that is has several initiatives that it continues to evaluate as it looks to improve CAIDI. Some of these strategic initiatives include:

- Optimizing resource planning and scheduling.

- Setting Restore vs. Repair strategy early on in storm response.

- Resource Strategy/Optimization.

- Resource scheduling and prearranging resource availability.

- Leveraging data technology to isolate impact and dispatching of resources needed to address outages.

Conclusion

Tree Related and Equipment Failures are the top two outage causes that negatively affect electrical reliability to PPL customers. PPL's CAIDI performance in 2023 was above both benchmark and standard. Management attention is required to move CAIDI performance below the "green" benchmark performance upper-control-limit line. CAIDI is a measure of customer restoration that in terms of the duration of the experienced outage and can be improved by decreased response and repair times.

SAIFI is a measure of outage frequency and PPL has sustained SAIFI benchmark since 2012 and is considered an excellent SAIFI benchmark performer. This is very indicative of the results the Commission would expect from a company such as PPL that has been a leader in implementing advanced technology such as Smart Grid and other forms of system automation.

The Commission recommends continued and increased efforts in vegetation management, equipment replacement and upgrades through the LTIIP, and a continuing emphasis on improving response times.

The Commission recognizes, overall, that PPL's reliability performance in terms of CMI and number of interruption events is beginning to decline as witnessed by the data shown in Figures 59 and 60 below. As can be seen in Figure 58 below, the number of PPL customers interrupted annually has decreased the past three years, which is encouraging. However, as shown in Figures 59 and 60, since 2015 CMI and the number of customer interruption events are both significantly increasing year-over-year and this is an impact on the customer experience and needs to be addressed by reducing CAIDI.

Figure 54 – PPL CAIDI (minutes)

Figure 55 – PPL SAIFI (interruptions per customer)
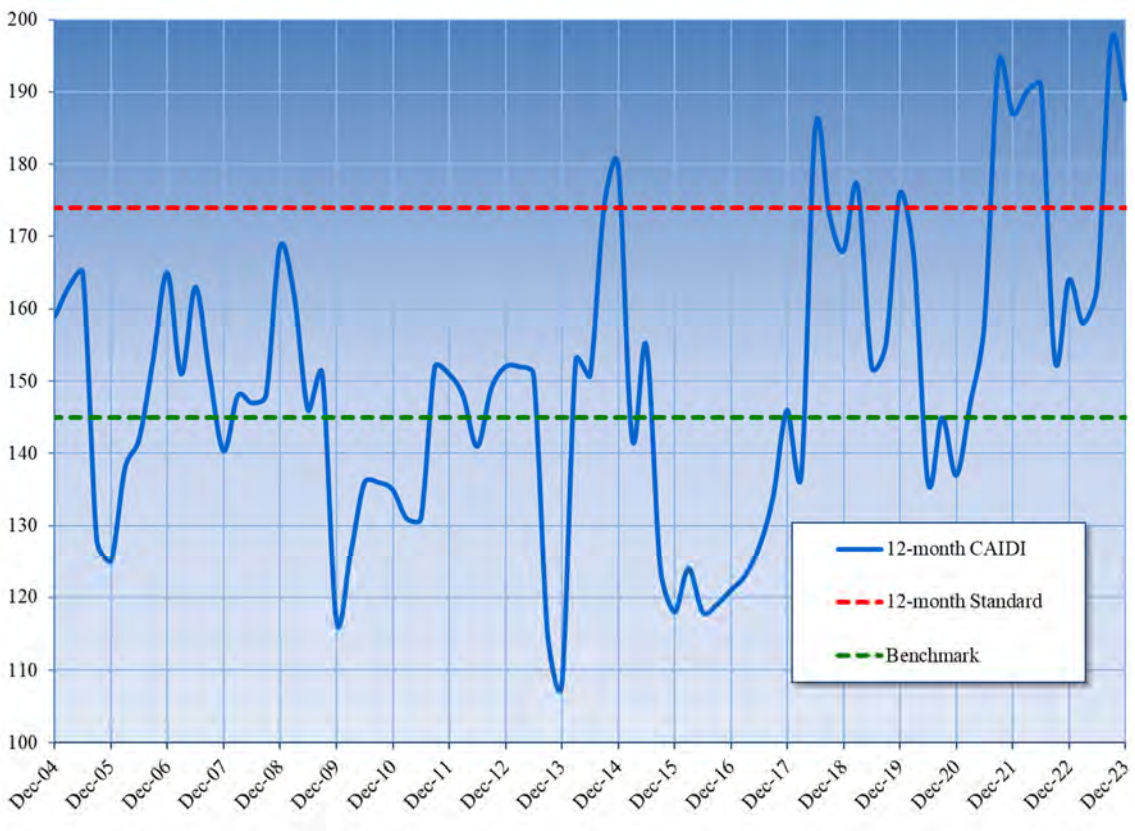
Figure 55 – PPL SAIFI (interruptions per customer)

Figure 56 – PPL Outage Causes (percent of total outages)

Figure 56 – PPL Outage Causes (percent of total outages)
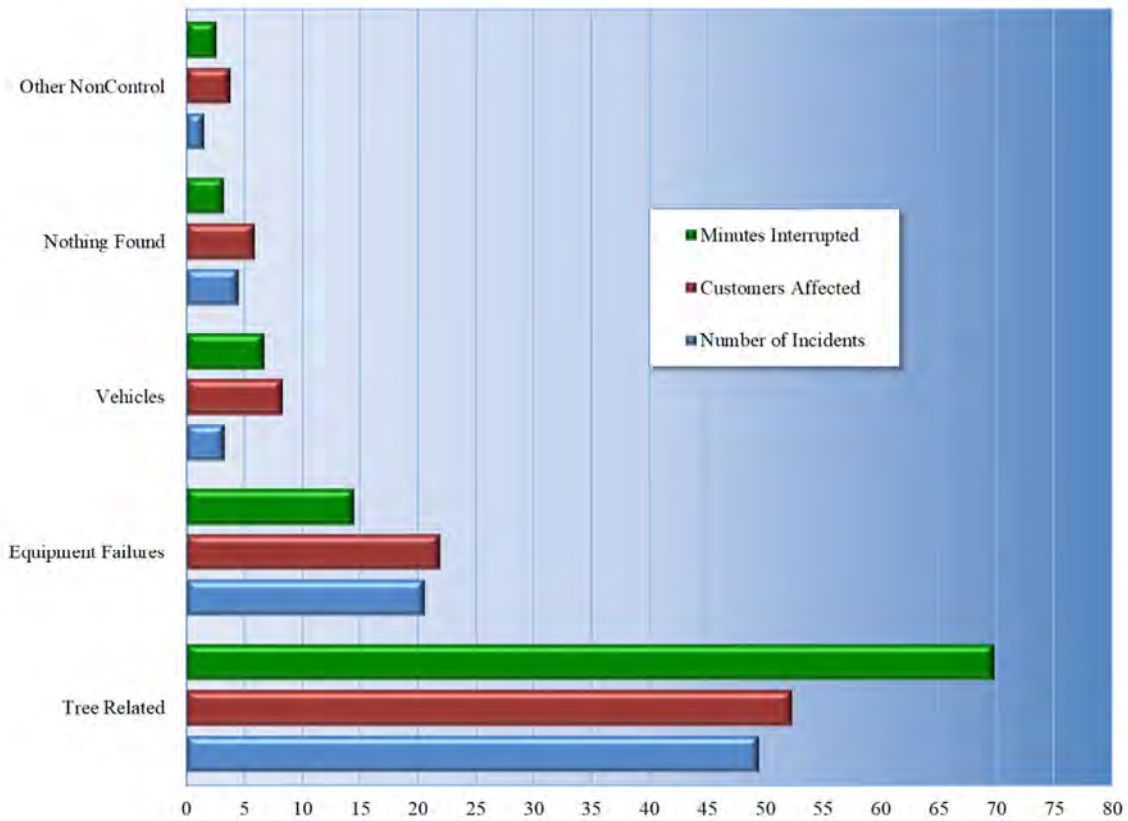
Figure 57 – PPL Outage Tracking (number of incidents)
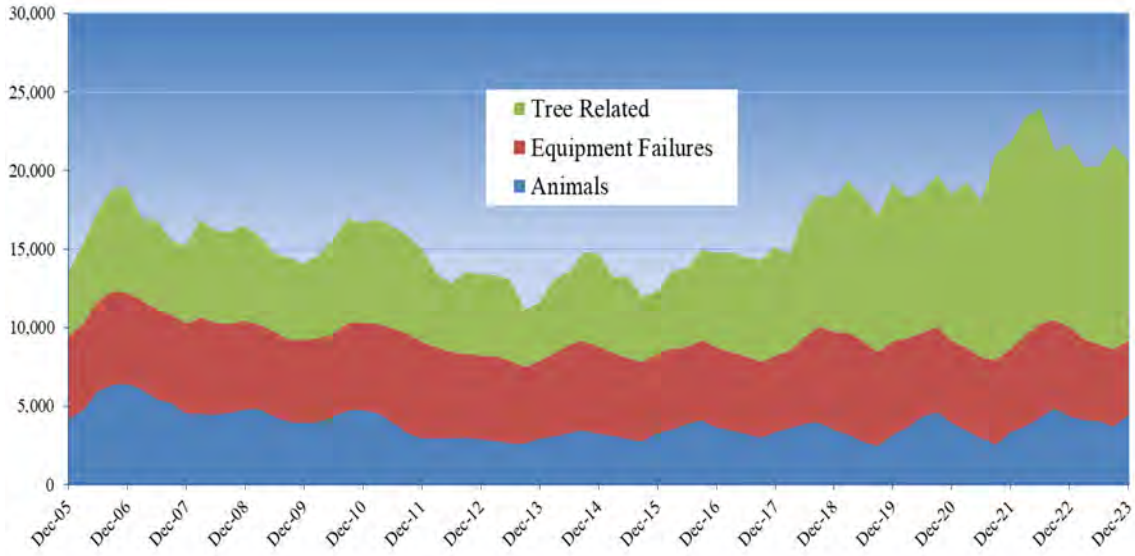
Figure 58 – PPL Outage Tracking (number of Customers Interrupted)
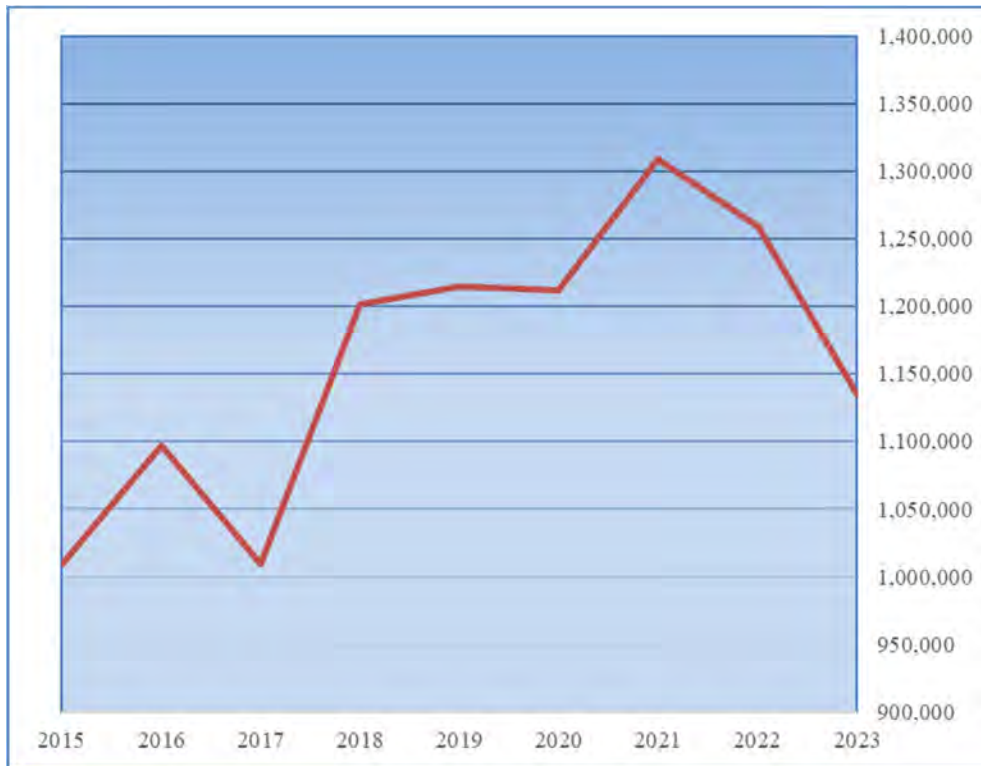
Figure 59 - PPL Outage Tracking (Customer-Minutes of Interruptions CMI)

Figure 60 – PPL Outage Tracking (number of interruptions annually)

UGI Utilities Inc.

UGI Utilities, Inc., (UGI) has a service territory of about 410 square miles and serves about 62,446 customers.

In 2023, UGI experienced 33,872 customer interruptions and 3.8 million CMI as compared to: 54,075 customer interruptions and 8.4 million CMI in 2022; 58,992 customer interruptions and 7.9 million CMI in 2021; 25,110 customer interruptions and 4.1 million CMI in 2020; and 59,946 customer interruptions and 11.3 million CMI in 2019.
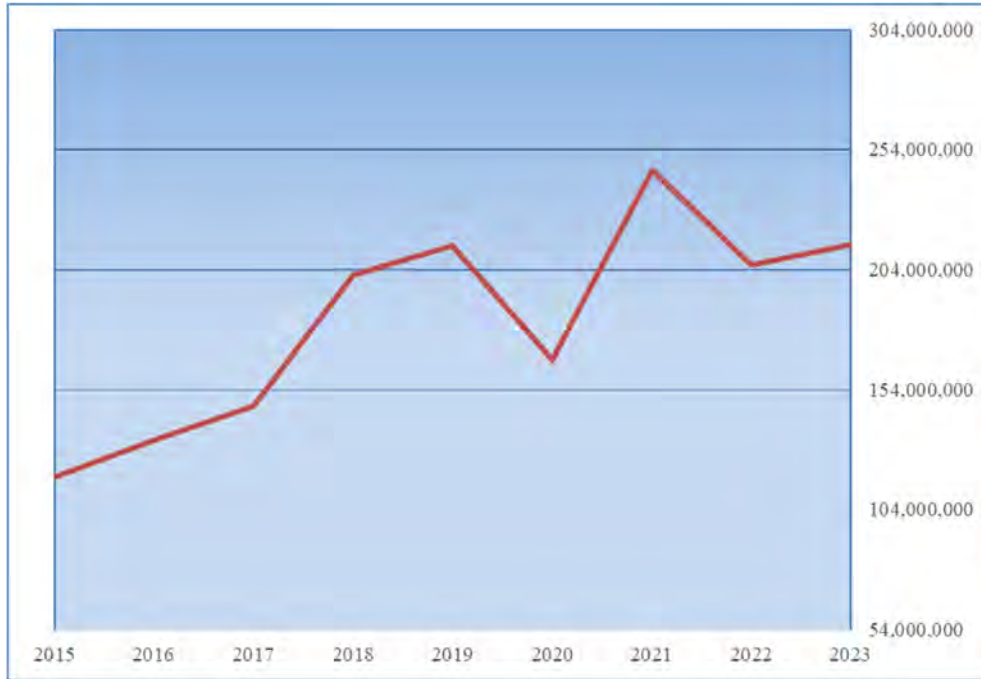
UGI experienced two Major Events in 2023. The Major Events impacted 17,472 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Decreased from 156 minutes in 2022 to 112 minutes in 2023; achieved benchmark by 33.7%.
3-year average:	Decreased from 151 minutes in 2022 to 134 minutes in 2023; achieved standard by 28.0%.

SAIDI

Rolling 12-month:	Decreased from 135 minutes in 2022 to 61 minutes in 2023; achieved benchmark by 56.4%.
3-year average:	Decreased from 109 minutes in 2022 to 108 minutes in 2023; achieved standard by 36.7%.

SAIFI

Rolling 12-month:	Decreased from 0.87 outages in 2022 to 0.54 outages in 2023; achieved benchmark by 34.9%.
3-year average:	Increased from 0.74 outages in 2022 to 0.79 outages in 2023; achieved standard by 13.6%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI performance trends are shown below in Figures 61 and 62. UGI failed to attain benchmark CAIDI performance in 2018 and 2019, as shown on to be above the "green" benchmark performance upper-control-limit-line. However, UGI did achieve better-than-benchmark CAIDI performance in 2020 through 2023.

UGI's SAIFI performance in 2018 and 2019 was inconsistent, as shown in Figure 62 to be above the "green" benchmark performance upper-control-limit-line. However, prior to 2018, UGI was a consistent SAIFI benchmark performer and in 2020 matched its best annual SAIFI performance (2015). UGI's SAIFI was above benchmark for both 2021 and 2022 but UGI's 2023 SAIFI was well below benchmark. More management attention is needed to keep SAIFI performance consistently below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 63 below, shows the top five reported outage cause categories in 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees, Animal, and Equipment Failure were the leading causes of the number of incidents. Trees were the leading cause of CMI. Over 58% of CMI was caused by Trees.

Figure 64 below shows the historical trend of the top three main outage causes. Trees, Animal and Equipment Failure are the three most frequent outage causes that are significantly negatively affecting UGI's distribution system reliability and resilience. As noted previously in this report, trees and equipment failures are the prominent causes of outages experienced by almost every EDC in Pennsylvania.

General Reliability

UGI noted that it conducted a review of the rolling 12-month fourth quarter and found that the most significant contributions to the reliability metrics were associated with weather-initiated vegetation issues with equipment failures also being a notable contributor to the metrics. UGI stated that OROW tree-related outages initiated by severe weather events continue to be the primary source of interruptions and minutes interrupted. UGI noted that it continues to focus on key capital reliability initiatives in addition to maintaining an aggressive vegetation management program to reduce the frequency of interruptions during high-wind and other severe weather events. UGI noted that it continues operating at an elevated resource level to increase hazard tree removals and continues the process of reducing the vegetation trim cycles from nearly six years to a goal of four and a half years.

UGI stated that it addresses equipment failures through its LTIIP as it continues to replace aging system components such as wood poles, porcelain insulators, underground cable and open wire secondar. UGI noted that it also recognized a high number of animal related outages over the last year which has resulted in additional steps to increase animal guard protection in substations and review distribution animal guarding standards.

UGI noted that weather has been identified as a significant factor for initiating vegetation-related outages. UGI noted that it continues to storm harden its system through infrastructure upgrades, such as constructing inter-substation tie lines, relocations, adding sectionalizing points, and maintaining an aggressive vegetation management program to mitigate damages from frequent weather events. To aid in overall system reliability, UGI noted that it continues to add Distribution Automation (DA) devices, controllable from its Control Center, reducing outage duration by providing remote switching capability. When eventually coupled with fault location, isolation and service restoration technology (FLISR), UGI expects to reduce the amount of sustained customer interruptions and customer minutes interrupted on many poorly performing feeders.

Conclusion

Trees and Equipment Failure are two of the leading causes of outages that negatively affect electrical reliability to UGI customers. In 2023, Trees and Equipment Failure outage causes

contributed to over 76% of total CMI. The Commission notes that an increased focus on vegetation management is key to achieving and maintaining consistent reliability performance.

UGI has continued to improve its CAIDI and SAIFI performance over the past three years. Management focus should be on sustaining the CAIDI and SAIFI trend lines below the "green" benchmark performance upper-control-limit-lines. The Commission recommends continued and increased efforts in vegetation management and increased emphasis on response times.

The Commission recognizes that, overall, UGI's reliability, especially as related to the number of interruption events, may be worsening over time as witnessed by the data shown below. UGI's performance for customers interrupted, CMI, and interruption events improved in 2023, but needs to be sustained. As can be seen in Figure 67 below, there is an overall increase in actual interruption events since 2015.
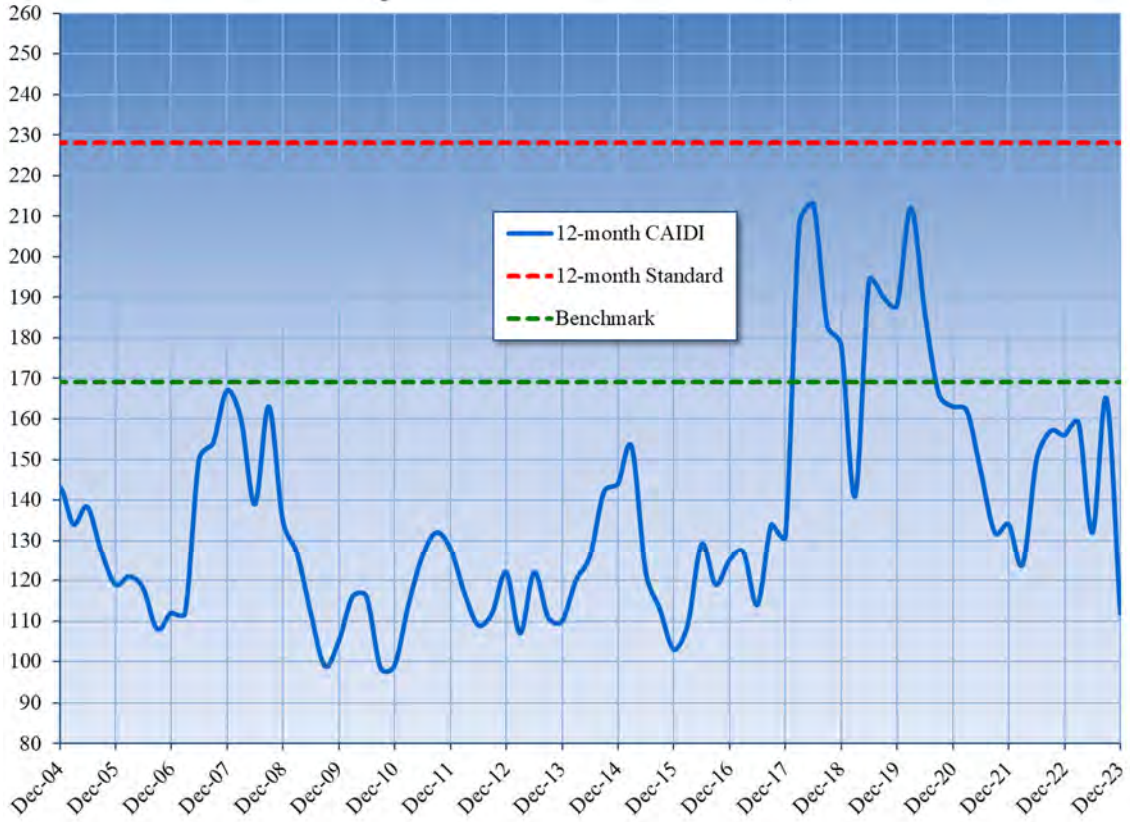
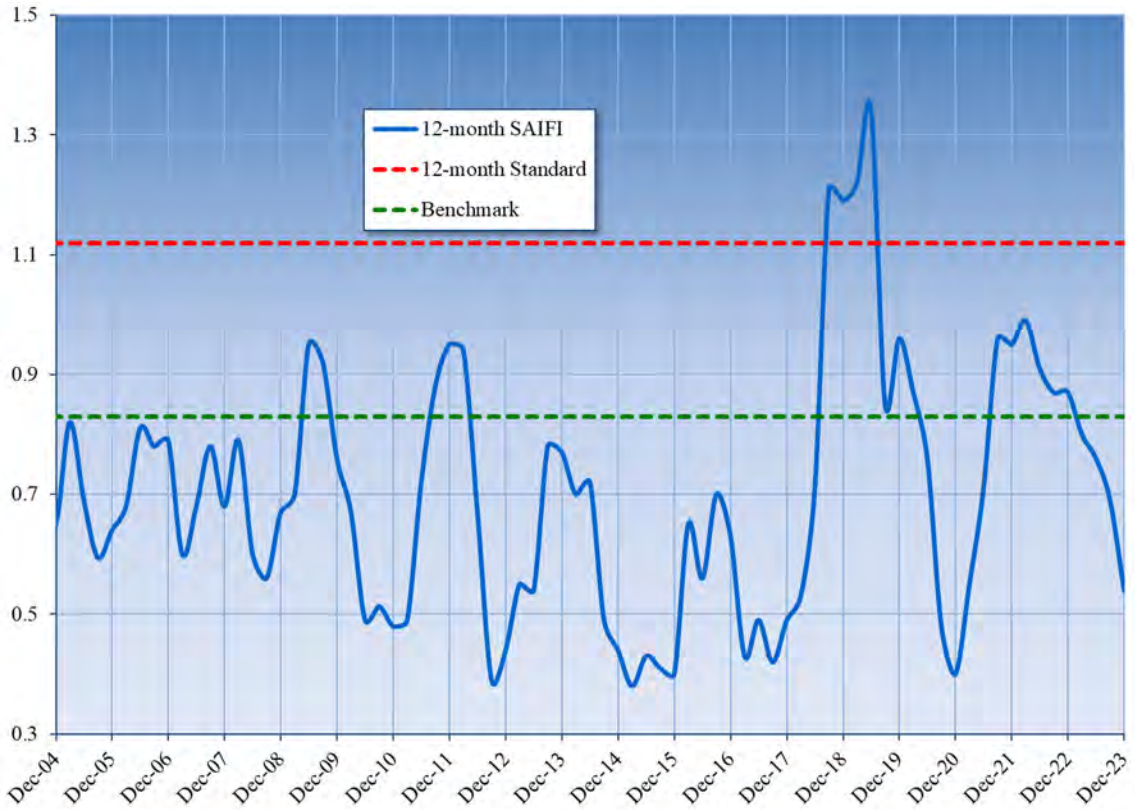*Figure 61 – UGI CAIDI (minutes)*

Figure 62 – UGI SAIFI (interruptions per customer)

Figure 63 – UGI Outage Causes (percent of total outages)
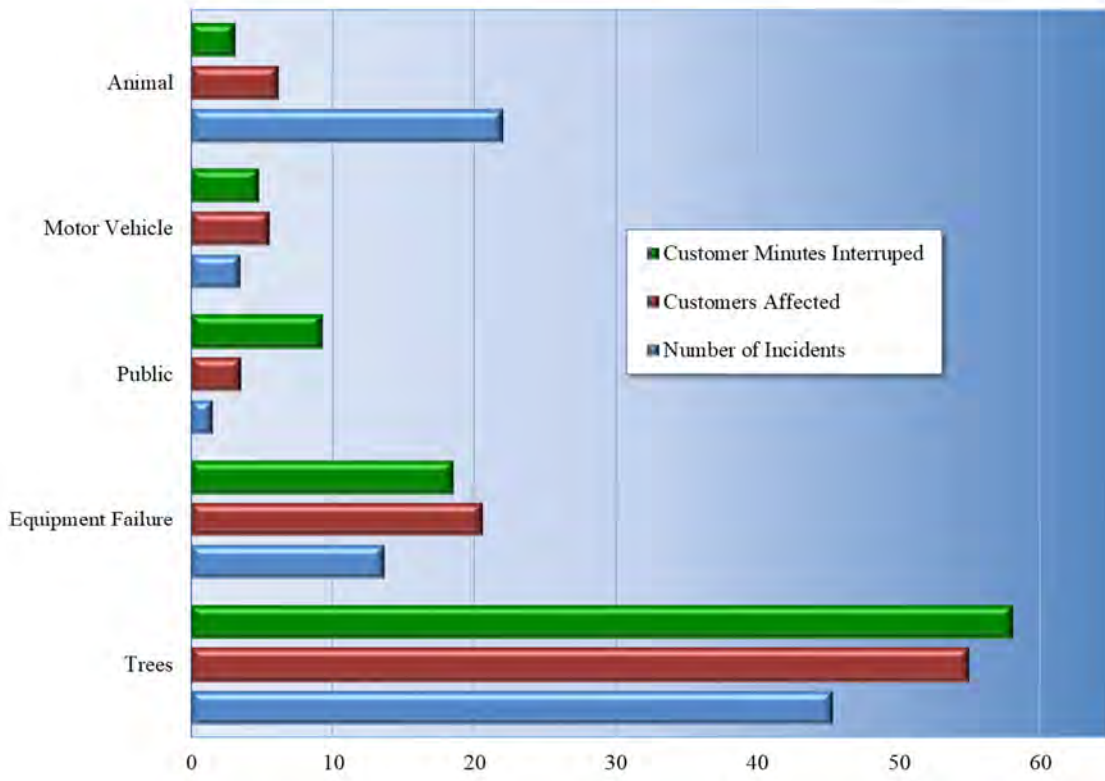
Figure 64 – UGI Outage Tracking (number of incidents)
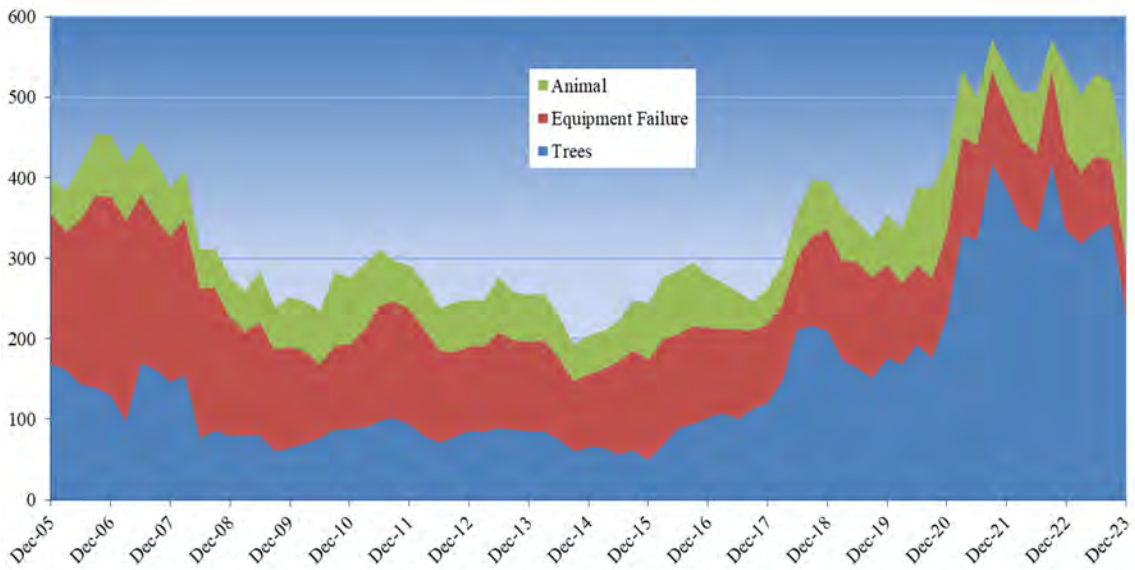
Figure 65 – UGI Outage Tracking (number of Customers Interrupted)
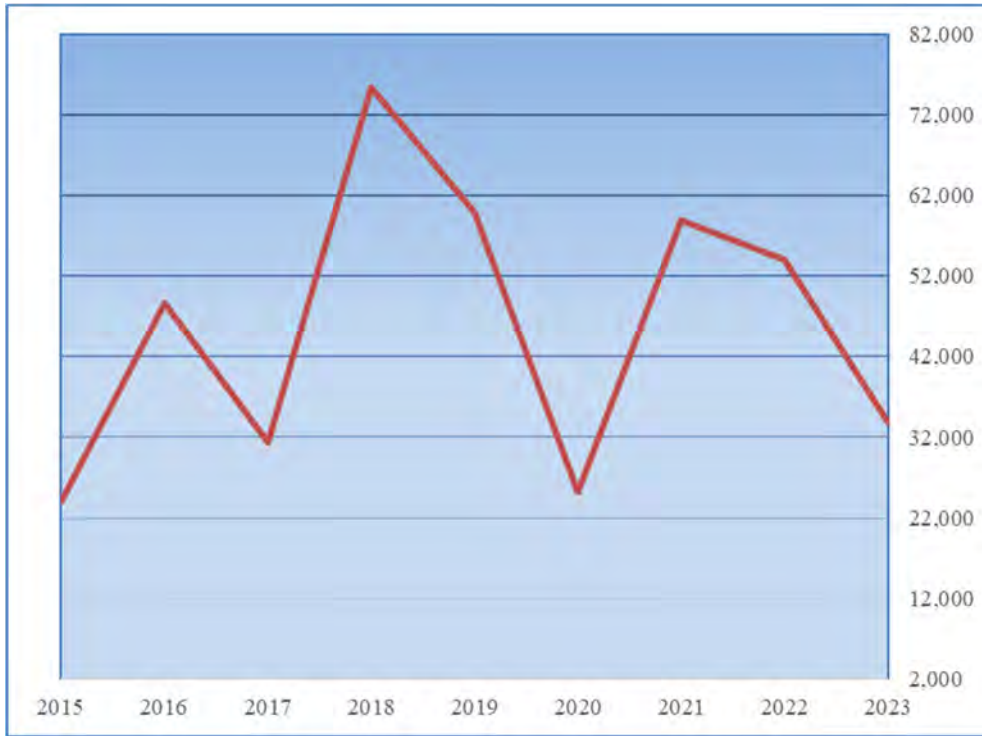
Figure 66 – UGI Outage Tracking (Customer-Minutes of Interruptions, or CMI)
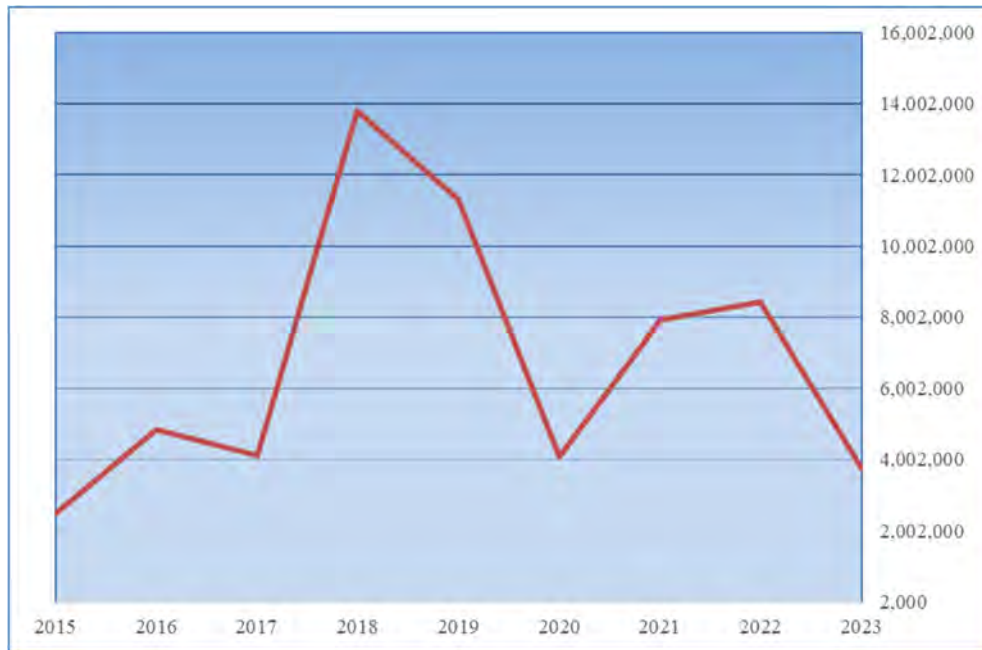
Figure 67 – UGI Outage Tracking (number of interruptions annually)
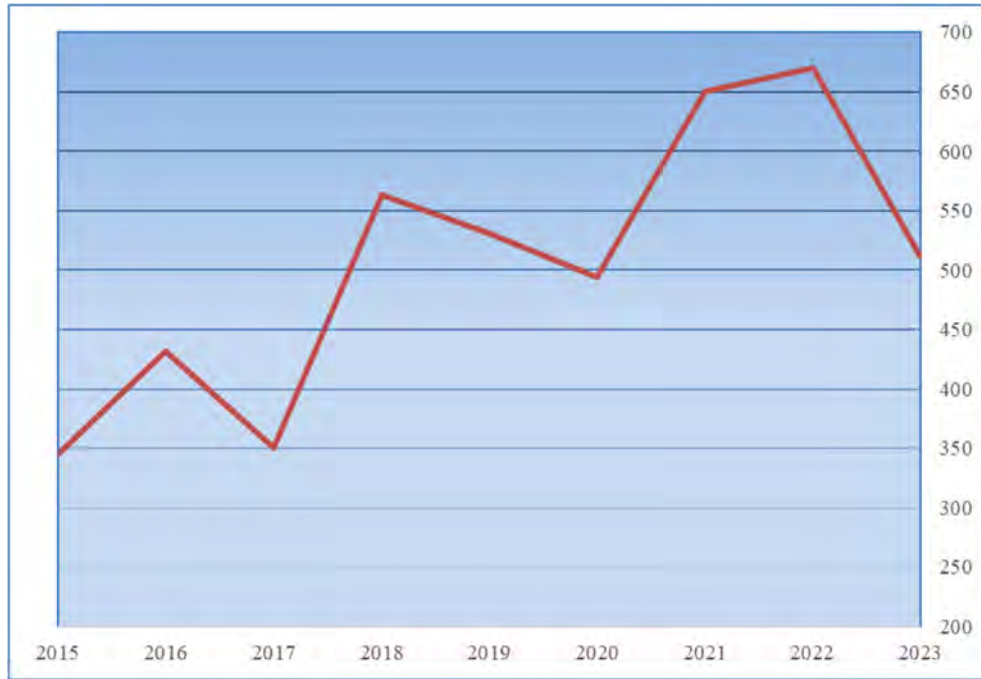
Wellsboro Electric Company

Wellsboro Electric Company (Wellsboro) has a service territory of about 178 square miles and serves about 6,439 customers.

In 2023, Wellsboro experienced 8,822 customer interruptions and 1 million CMI as compared to: 7,024 customer interruptions and 0.92 million CMI in 2022; 5,922 customer interruptions and 0.85 million CMI in 2021; 7,543 customer interruptions and 0.7 million CMI in 2020; and 4,815 customer interruptions and 0.7 million CMI in 2019.

Wellsboro experienced eight Major Events in 2023. The Major Events impacted 15,331 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month:	Decreased from 130 minutes in 2022 to 114 minutes in 2023; achieved benchmark by 8.1%
3-year average:	Increased from 124 minutes in 2022 to 129 minutes in 2023; achieved standard by 4.9%.

SAIDI

Rolling 12-month:	Increased from 142 minutes in 2022 to 155 minutes in 2023; failed to achieve benchmark by 1.3%.

3-year average: Increased from 130 minutes in 2022 to 143 minutes in 2023; achieved standard by 22.5%.

SAIFI

Rolling 12-month: Increased from 1.09 outages in 2022 to 1.37 outages in 2023; failed to achieve benchmark by 11.4%.

3-year average: Increased from 1.06 outages in 2022 to 1.13 outages in 2023; achieved standard by 16.3%.

CAIDI and SAIFI Performance

Historical rolling 12-month CAIDI and SAIFI reliability performance trends are shown in Figures 68 and Figure 69 below. Wellsboro's 2023 SAIFI performance worsened as shown to be above the "green" benchmark performance upper-control-limit-line. Wellsboro had achieved annual benchmark SAIFI performance from 2019 through 2022. Wellsboro's CAIDI performance in 2023 was improved and again below benchmark. Increased management attention is needed to ensure SAIFI performance is returned below the "green" benchmark performance upper-control-limit-line and that CAIDI is more consistently at or below benchmark.

Outage Causes

Figure 70 below, shows the top five reported outage cause categories for 2023, as a percentage, for the following three distinct performance metrics: CMI, Customers Affected, and Number of Incidents. Trees OROW were the top cause of CMI. Over 83% of CMI is caused by Trees OROW.

Figure 71 below, shows the historical trend of the leading three main outage causes. Trees (all causes) and Animals are the two most frequent outage causes.

General Reliability

Wellsboro noted that it will continue tree trimming 70-75 miles of conductor per year which amounts to a circuit or a portion of a circuit each year and maintains a tree-trimming cyber of approximately five years. Wellsboro stated that it identified hot spot trimming on the downtown three phase portion of its system. Danger trees were identified for both on and OROW during the year and urgent removals were dealt with immediately. Wellsboro noted that other danger trees are prioritized and removed as funding is available.

Wellsboro stated that it reconductored six miles of line in 2023 in addition to other group operated switches that it installed in order to create tie points in the system. Wellsboro noted that it plans to reconductor another six miles of line and work to build another tie point in 2024. Wellsboro noted that this will provide reliability to the circuits allowing an alternate feed.

Wellsboro is also pursuing federal grant funds from the Pennsylvania Department of Environmental Protection's Energy Programs Office in order to continue resiliency and automation work on the circuits where a loop exists. Wellsboro noted that it continues to participate in and gather information from various industry best practice groups. These groups include members from diverse utility groups such as the Pennsylvania Rural Electric Association,

the Energy Association of Pennsylvania, and the National Rural Electric Cooperative Association. Wellsboro noted that it will continue to implement best practices defined by these groups as appropriate.

Conclusion

Wellsboro achieved benchmark performance for CAIDI in 2023. However, Wellsboro's SAIFI and SAIDI metrics remain at a level above the rolling 12-month benchmark. Wellsboro also experienced eight Major Events in 2023 and the impacts of those events were excluded from those reliability metric calculations. Wellsboro should continue to implement its reliability improvement plans to reduce the impact of severe weather to avoid Major Events and large customer disruption events. More management attention is also needed to sustain SAIFI below the "green" benchmark performance level.

As shown in Figures 72 and 73, below, Wellsboro is seeing a significant increase in the number of customers impacted by outage events and CMI. However, as shown below in Figure 74, Wellsboro is experiencing less outage events. This indicates that Wellsboro should continue to examine and install locations for sectionalizing of circuits in order to lessen the number of customers impacted by events. However, while sectionalizing may reduce the number of customers impacted by an outage, it could possibly lead to increased CAIDI reliability metrics as the outages may be of longer duration. The Commission finds that in this regard, the CAIDI metric is becoming more realistic of the customer's experienced interruption duration, rather than a general average as determined by aggregate data. As this occurs, the drivers of these metrics; response times, repair times and overall restoration times, will have more effect on the results. The Commission posits that an emphasis on Vegetation Management efforts and automatic sectionalizing would improve Wellsboro's customer service.
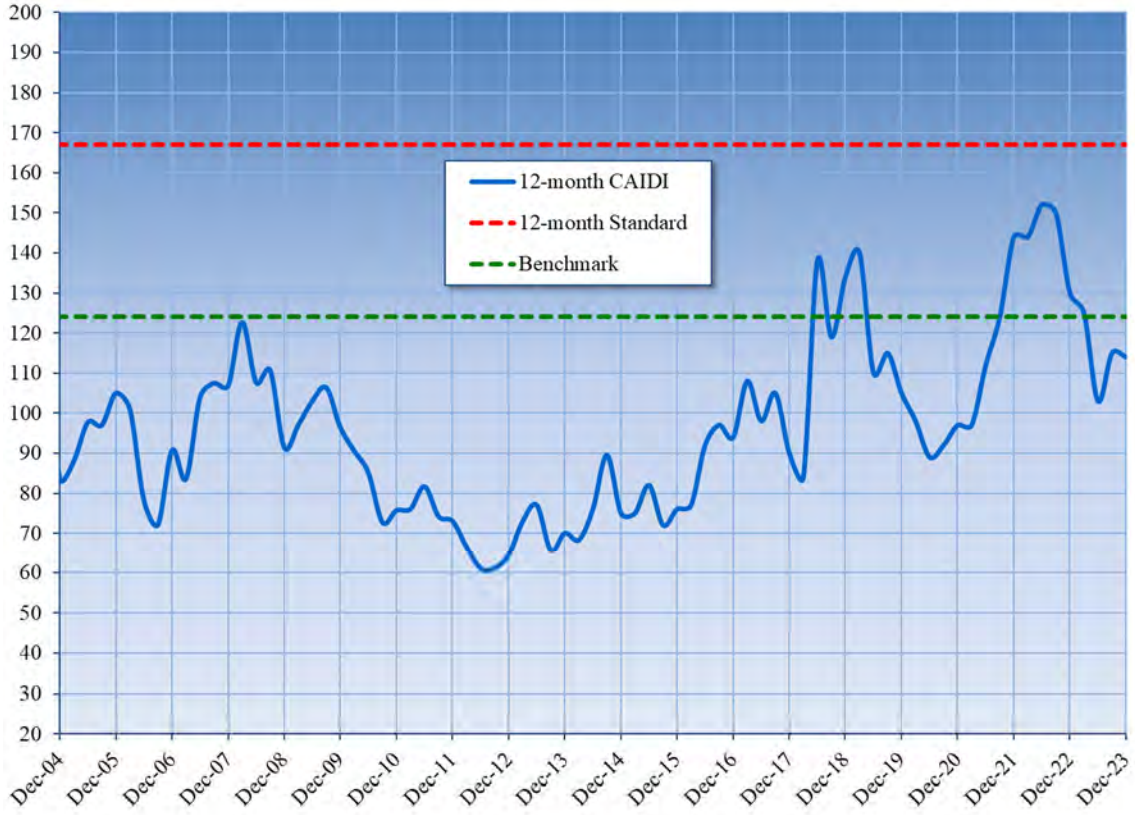
Figure 68 – Wellsboro CAIDI (minutes)
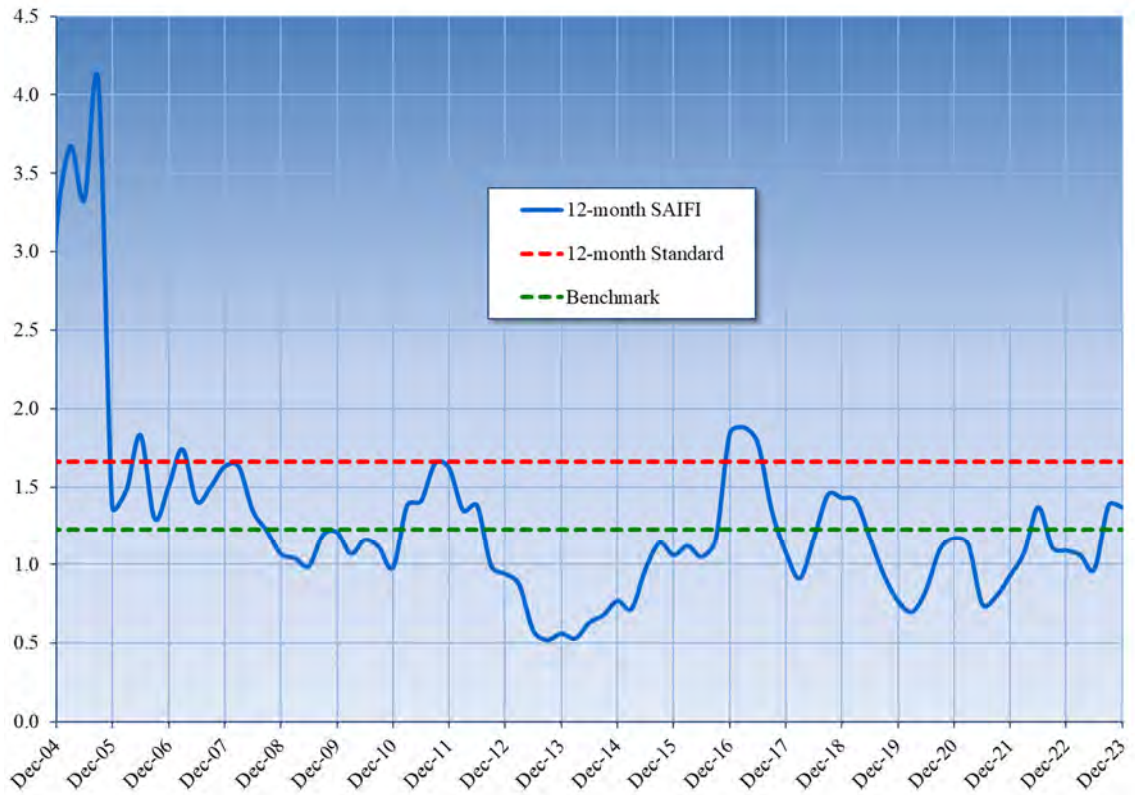

Figure 69 – Wellsboro SAIFI (interruptions per customer)

Figure 70 – Wellsboro Outage Causes (percent of total outages)
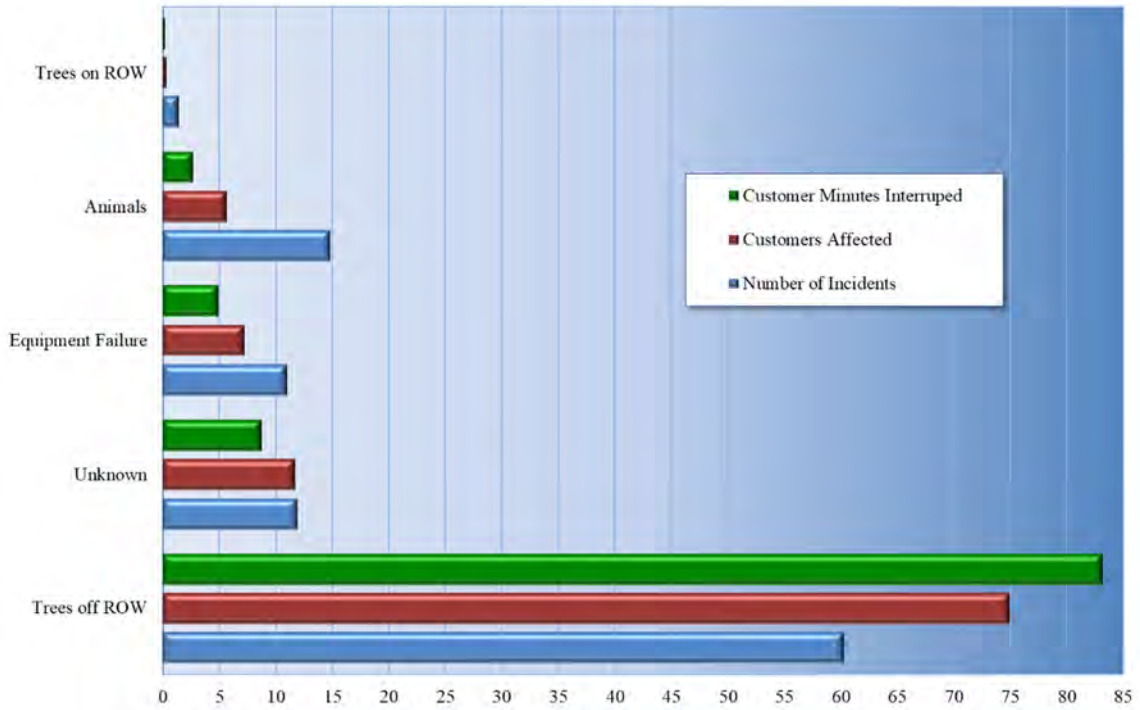
Figure 71 – Wellsboro Outage Tracking (number of incidents)
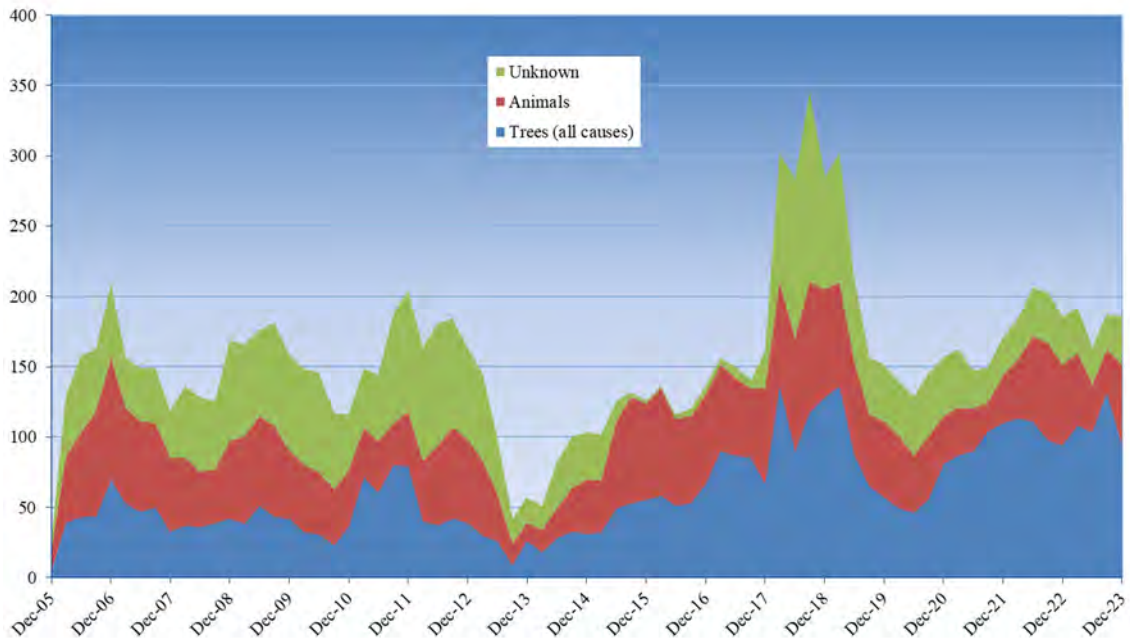
Figure 72 – Wellsboro Outage Tracking (number of Customers Interrupted)
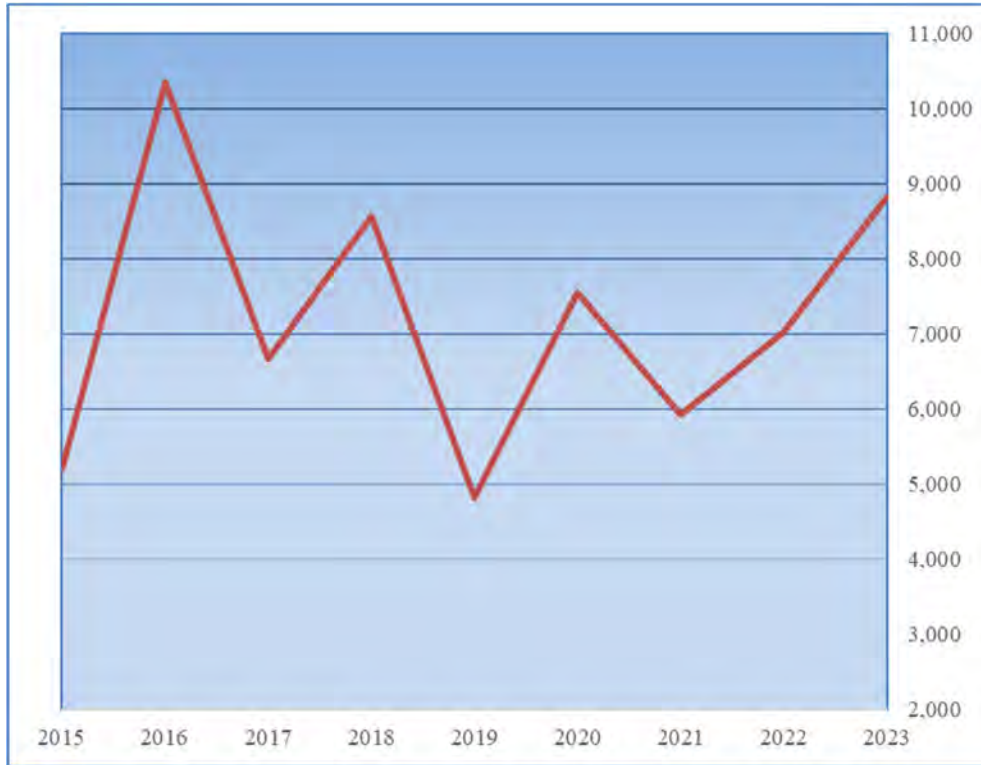
Figure 73 – Wellsboro Outage Tracking (Customer-Minutes of Interruptions CMI)
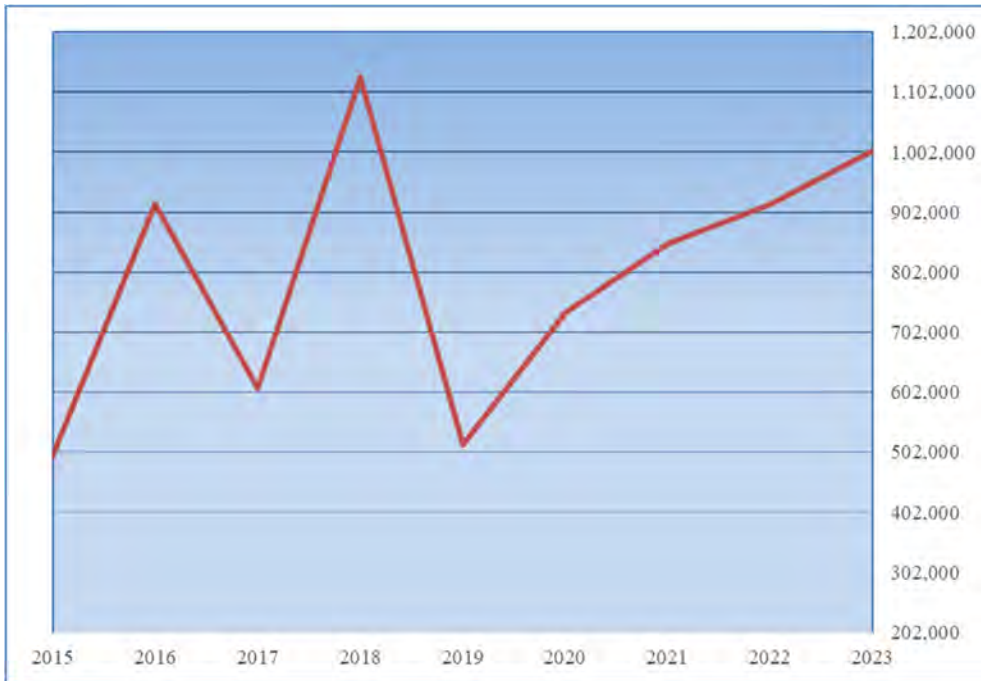
Figure 74 – Wellsboro Outage Tracking (number of interruptions annually)
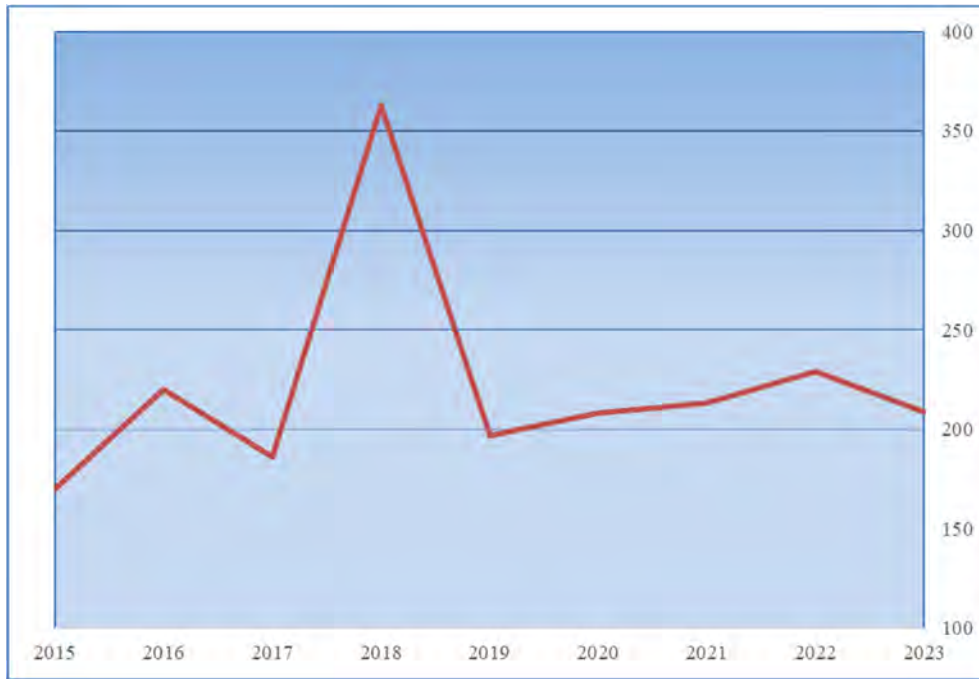
Section 5 – Conclusion

Based on the information in this report and its Appendices, it can be seen that, with few exceptions, the reliability performance of the EDCs has continued to degrade with regard to CMI and the number of interruption events. As shown in each EDC's section above and Figures 82 through 84, below, CMI and interruption event reliability performance has exhibited a declining trend since 2015. Of the seven large EDCs, none have achieved CAIDI benchmark performance for the rolling 12-months ending in December 2023 and only one (PECO) achieved CAIDI benchmark for any of four rolling 12-month quarters of 2023. Of the four small EDCs, only two (UGI and Citizens') achieved CAIDI benchmark for all four rolling 12-month quarters of 2023. Overall, EDCs have demonstrated worsening CAIDI performance for the past three years.

CAIDI is an important measure as it relates to the average duration of a service outage. TUS views CAIDI as an important metric because it is a measure of resiliency and thus a good measure of an EDC's customer service. TUS notes that CAIDI is highly dependent upon the EDCs ability to respond to outages and restoration times. EDCs will be expected to improve worsening CAIDI. As noted above, as the EDCs install more sectionalizing devices (reclosers, etc.) that reduce the number of customers impacted by a sustained outage, it could possibly lead to increased CAIDI reliability metrics as the outages may be of longer duration. The Commission finds that in this regard, the CAIDI metric is becoming more realistic of the customer's experienced interruption duration, rather than a general average as determined by aggregate data.

In effect, CAIDI is moving toward being more realistic and representative of the average customer interruption length. As this occurs, the improvement of the drivers of these metrics such as response times, repair times and overall restoration times, will have more effect on the results.

As seen in Appendix B, only four of the 11 EDCs achieved benchmark for SAIFI in all rolling 12-month quarters in 2023, as compared to three in 2022 and four in 2021. In 2020, six of the EDCs achieved benchmark for SAIFI in all of the rolling 12-month quarters. In 2023, six of the 11 EDCs achieved the rolling 12-month SAIFI standard in all four rolling 12-month quarters, as compared to five in 2022, six in 2021 and eight in 2020. TUS views SAIFI as an important metric to focus on improving as it relates directly to the number of service outages experienced by a customer. Reducing service outages from occurring in the first place is crucial to improving reliability performance. As noted in the Executive Summary, the three EDCs that have expended the most capital through their LTIIPs have been the most consistent in achieving benchmark SAIFI performance the past three years (Duquesne, PECO, and PPL).

For all EDCs except Duquesne, approximately 5.03 million customers experienced interruptions in 2022 as compared to approximately 5.47 million in 2022, 5.78 million in 2021 and 5.36 million in 2020. Duquesne calculates customer outages as kVA disrupted, rather than individual customers. Duquesne saw approximately 4.5 million kVA interrupted in 2023, which was a significant drop from the approximate 7.3 million kVA interrupted in both 2022 and 2021. Customer interruption data for all EDCs (excluding Duquesne) can be seen in figure 82 below. As shown in Figure 83 below, total CMI for all EDCs (except Duquesne) decreased slightly to 948 million in 2023, as compared to 954 million in 2022, 1.02 billion in 2021 and 811 million in 2020.

Even though it slightly declined in 2023, EDCs continue to experience increasing numbers of outages annually, *i.e.,* outage events that lead to customers experiencing sustained interruptions. Outages have increased from an annual level of 60,218 in 2015 to 81,786 in 2023, which is an increase of approximately 36%. See Figure 84 below. The number of PA EDC customers served (excluding Duquesne) has only increased from 5,192,839 in 2015 to 5,289,271 in 2023, or approximately 1.9%, as shown in figure 85 below.

EDCs are experiencing a significant increase in vegetation-caused outages since 2015. In December 2015 there were 14,462 outages reportedly caused by vegetation. By December 2023 the annual figure had risen to 31,680 outages attributed to vegetation problems, which is an increase of approximately 120%. See Figure 86 below.

As noted in Section 3 of this report, EDCs experienced 49 reportable outage events (ROEs) in 2023. EDCs had 42 ROEs in 2022 and 63 ROEs in 2021. The 63 ROEs in 2021 were the highest number reported to the Commission since 1994 (the first year of the five-year benchmarking period). All of the ROEs were caused by weather impacts on the EDC distribution systems. Noting this fact is not to excuse a slip in reliability performance of the EDCs, but rather to reiterate the importance of EDCs continuing to invest in reliability improvement and resiliency to weather events. As the EDCs continue to accelerate infrastructure improvement and to work on improving reliability and resilience through their LTIIPs the Commission will expect to see

those numbers drop as increased automatic sectionalizing, storm hardening, and newer equipment is installed.

Another factor in reducing the number of events is the improvement of vegetation management by the EDCs. TUS expects all EDCs to review their vegetation management programs as vegetation issues are the number one cause of service outages for EDCs. Currently nine of the 11 EDCs have approved LTIIPs. As seen in this report's Executive Summary, TUS agrees with the EDCs that LTIIPs are an important tool in the toolbox for addressing failing infrastructure and improving resiliency. However, vegetation management is not an eligible project category for LTIIPs. As noted, EDCs should review their vegetation management programs to ensure that expenditures and procedures are most efficiently and effectively directed at the main cause of service outages. TUS also notes that it expects to see improvements in reliability as EDCs continue to execute their LTIIPs.

Figure 82 – ALL EDCs (except Duquesne) Customers Interrupted

Figure 83 – ALL EDCs (except Duquesne) Customer-Minutes of Interruptions, or CMI
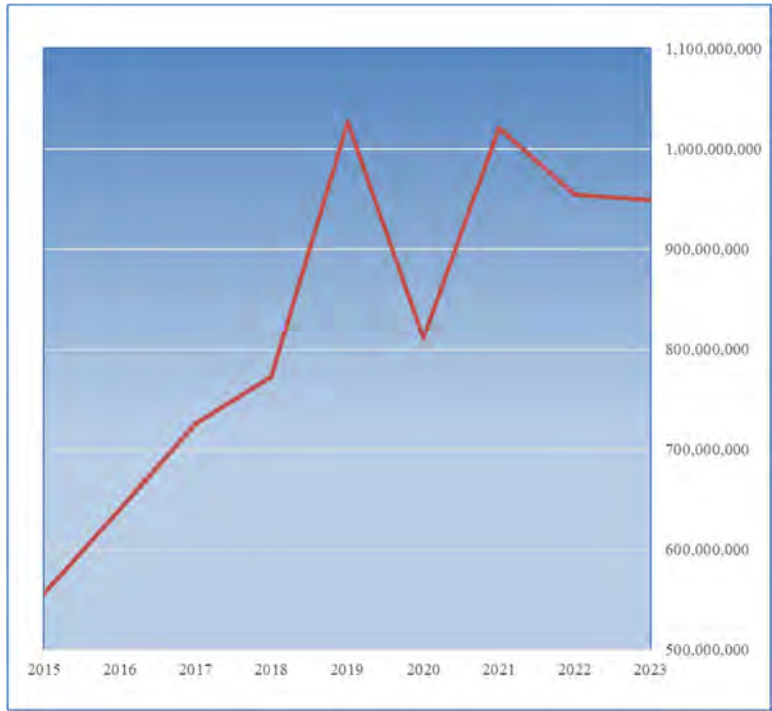
Figure 84 – ALL EDCs (except Duquesne) Number of Interruptions Annually

Figure 85 – ALL EDCs (except Duquesne) Number of Customers Served[34]

Figure 86 – Outage Causes ALL EDCs as Reported by EDCs for 2014-2023

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[34] The drop in customers in 2016 was primarily due to PECO's effort to remove inactive accounts with their GIS update.

Appendix A – Electric Reliability Metrics

12-Month Average Electric Reliability Indices for 2023

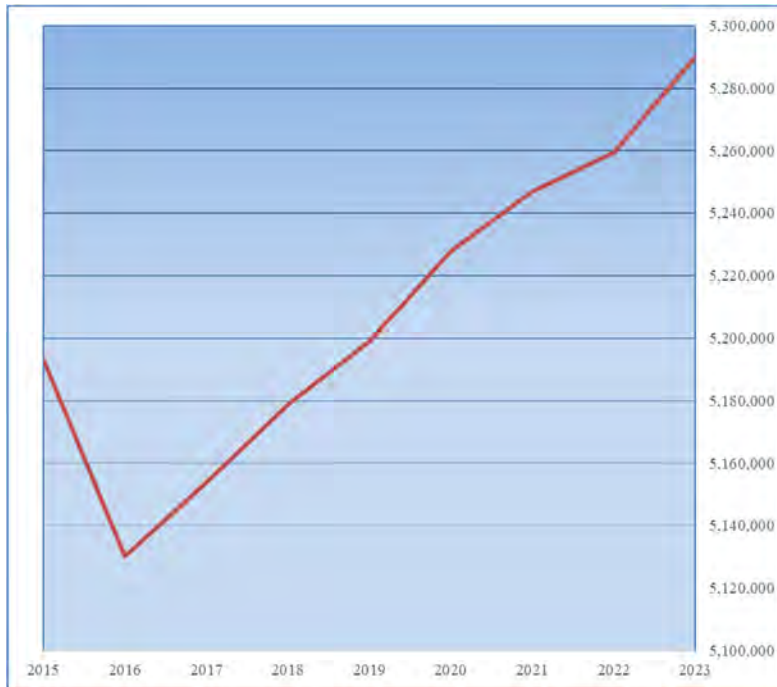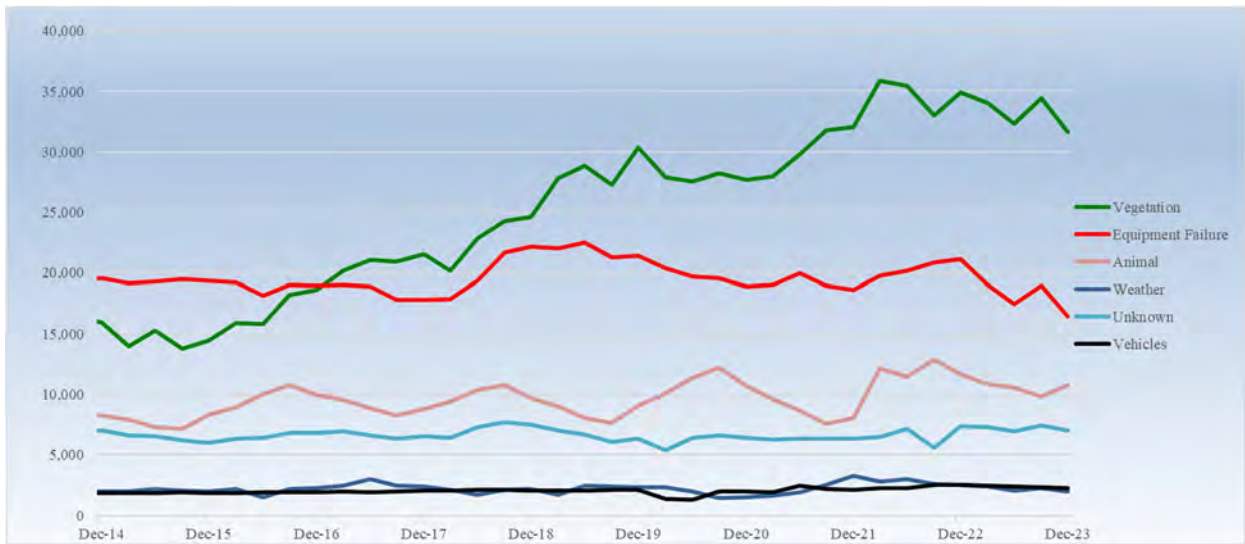| *Customer Average Interruption Duration Index (CAIDI)- min/yr/cust*				*% Above (+) or*	*% Above (+) or*
EDC	*Dec-23*	*Benchmark*	*Standard*	*Below (-) Benchmark*	*Below (-) Standard*
Citizens'	*90*	*105*	*141*	*-14.5%*	*-36.3%*
Duquesne Light	*110*	*108*	*130*	*1.9%*	*-15.4%*
Met-Ed (FE)	*202*	*117*	*140*	*72.4%*	*44.0%*
PECO	*138*	*112*	*134*	*23.2%*	*3.0%*
Penelec (FE)	*189*	*117*	*141*	*61.7%*	*34.2%*
Penn Power (FE)	*157*	*101*	*121*	*55.0%*	*29.3%*
Pike County	*95*	*174*	*235*	*-45.4%*	*-59.6%*
PPL	*189*	*145*	*174*	*30.3%*	*8.6%*
UGI	*112*	*169*	*228*	*-33.7%*	*-50.9%*
Wellsboro	*114*	*124*	*167*	*-8.1%*	*-31.7%*
West Penn (FE)	*266*	*170*	*204*	*56.6%*	*30.5%*
System Average Interruption Frequency Index (SAIFI)- outages/yr/cust				*% Above (+) or*	*% Above (+) or*
EDC	*Dec-23*	*Benchmark*	*Standard*	*Below (-) Benchmark*	*Below (-) Standard*
Citizens'	*0.32*	*0.20*	*0.27*	*60.0%*	*18.5%*
Duquesne Light	*0.57*	*1.17*	*1.40*	*-51.3%*	*-59.3%*
Met-Ed (FE)	*1.27*	*1.15*	*1.38*	*10.4%*	*-8.0%*
PECO	*0.74*	*1.23*	*1.48*	*-39.8%*	*-50.0%*
Penelec (FE)	*1.60*	*1.26*	*1.52*	*27.0%*	*5.3%*
Penn Power (FE)	*0.78*	*1.12*	*1.34*	*-30.4%*	*-41.8%*
Pike County	*0.86*	*0.61*	*0.82*	*41.0%*	*4.9%*
PPL	*0.78*	*0.98*	*1.18*	*-20.4%*	*-33.9%*
UGI	*0.54*	*0.83*	*1.12*	*-34.9%*	*-51.8%*
Wellsboro	*1.37*	*1.23*	*1.66*	*11.4%*	*-17.5%*
West Penn (FE)	*1.07*	*1.05*	*1.26*	*1.9%*	*-15.1%*
System Average Interruption Duration Index (SAIDI)- min/yr/cust				*% Above (+) or*	*% Above (+) or*
EDC	*Dec-23*	*Benchmark*	*Standard*	*Below (-) Benchmark*	*Below (-) Standard*
Citizens'	*29*	*21*	*38*	*38.1%*	*-23.7%*
Duquesne Light	*63*	*126*	*182*	*-49.9%*	*-65.3%*
Met-Ed (FE)	*257*	*135*	*194*	*90.3%*	*32.4%*
PECO	*103*	*138*	*198*	*-25.4%*	*-48.0%*
Penelec (FE)	*303*	*148*	*213*	*104.9%*	*42.4%*
Penn Power (FE)	*121*	*113*	*162*	*7.4%*	*-25.1%*
Pike County	*82*	*106*	*194*	*-22.6%*	*-57.7%*
PPL	*147*	*142*	*205*	*3.5%*	*-28.3%*
UGI	*61*	*140*	*256*	*-56.4%*	*-76.2%*
Wellsboro	*155*	*153*	*278*	*1.3%*	*-44.2%*
West Penn (FE)	*285*	*179*	*257*	*59.3%*	*11.0%*

Note: **GREEN** *= better than benchmark;* **RED** *= worse than standard;* **BLACK** *= between benchmark and standard.*

Performance Benchmark. An EDC's performance benchmark is calculated by averaging the EDC's annual, system-wide reliability performance indices over the five-year period directly prior to the implementation of electric restructuring (1994 to 1998). The benchmark is the level of performance that the EDC should strive to achieve and maintain.

Three-Year Average Electric Reliability Indices for 2021-2023

Customer Average Interruption Duration Index (CAIDI)-min/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2021	2022	2023	Average	Standard	Below (-) Standard
Citizens'	94	101	90	95	115	-17.4%
Duquesne Light	187	146	110	148	119	24.1%
Met-Ed (FE)	173	160	202	178	129	38.2%
PECO	187	99	138	141	123	14.9%
Penelec (FE)	151	199	189	180	129	39.3%
Penn Power (FE)	129	134	157	140	111	26.0%
Pike County	153	159	95	136	192	-29.3%
PPL	187	164	189	180	160	12.5%
UGI	134	156	112	134	186	-28.0%
Wellsboro	144	130	114	129	136	-4.9%
West Penn (FE)	192	276	266	245	187	30.9%
System Average Interruption Frequency Index (SAIFI)-outages/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2021	2022	2023	Average	Standard	Below (-) Standard
Citizens'	0.27	0.27	0.32	0.29	0.22	30.3%
Duquesne Light	0.93	0.92	0.57	0.81	1.29	-37.5%
Met-Ed (FE)	1.35	1.32	1.27	1.31	1.27	3.4%
PECO	0.88	0.71	0.74	0.78	1.35	-42.5%
Penelec (FE)	1.84	1.83	1.60	1.76	1.39	26.4%
Penn Power (FE)	1.00	0.99	0.78	0.92	1.23	-24.9%
Pike County	1.40	0.50	0.86	0.92	0.67	37.3%
PPL	0.91	0.87	0.78	0.85	1.08	-21.0%
UGI	0.95	0.87	0.54	0.79	0.91	-13.6%
Wellsboro	0.93	1.09	1.37	1.13	1.35	-16.3%
West Penn (FE)	1.26	1.32	1.07	1.22	1.16	4.9%
System Average Interruption Duration Index (SAIDI)-min/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2021	2022	2023	Average	Standard	Below (-) Standard
Citizens'	26	28	29	27	25	9.5%
Duquesne Light	173	134	63	123	153	-19.4%
Met-Ed (FE)	233	211	257	234	163	43.3%
PECO	164	71	103	113	167	-32.5%
Penelec (FE)	277	364	303	315	179	75.9%
Penn Power (FE)	129	133	121	128	136	-6.1%
Pike County	216	79	82	126	129	-2.6%
PPL	170	142	147	153	172	-11.0%
UGI	127	135	61	108	170	-36.7%
Wellsboro	133	142	155	143	185	-22.5%
West Penn (FE)	242	364	285	297	217	36.9%

Note: **GREEN** = better than standard; **RED** = worse than standard.

Performance Standard. An EDC's performance standard is a numerical value that represents the minimal performance allowed for each reliability index for a given EDC. Performance standards are based on a percentage of each EDC's historical performance benchmarks.

Appendix B – Reliability Performance Scorecard Results 2021-2023

2023 EDC Performance Scorecard										
Metrics achieved **GREEN**		Benchmark Metrics not achieved **YELLOW**				Standard Metrics not achieved **RED**				
		Rolling 12-Month								
		Benchmark Score				Standard Score				
EDCs	[1]Metrics	[2]BM	Q1	Q2	Q3	Q4	[3]STD	Q1	Q2	Q3	Q4
Large EDCs										
Duquesne Light	CAIDI	108	130	122	112	110	130	130	122	112	110
	SAIDI	126	111	95	76	63	182	111	95	76	63
	SAIFI	1.17	0.86	0.77	0.68	0.57	1.40	0.86	0.77	0.68	0.57
PECO	CAIDI	112	94	99	138	138	134	94	99	138	138
	SAIDI	138	59	65	112	103	198	59	65	112	103
	SAIFI	1.23	0.62	0.66	0.81	0.74	1.48	0.62	0.66	0.81	0.74
PPL	CAIDI	145	158	163	197	189	174	158	163	197	189
	SAIDI	142	125	132	172	147	205	125	132	172	147
	SAIFI	0.98	0.79	0.81	0.87	0.78	1.18	0.79	0.81	0.87	0.78
Met-Ed (FirstEnergy)	CAIDI	117	140	155	178	202	140	140	155	178	202
	SAIDI	135	160	185	237	257	194	160	185	237	257
	SAIFI	1.15	1.14	1.19	1.34	1.27	1.38	1.14	1.19	1.34	1.27
Penelec (FirstEnergy)	CAIDI	117	230	190	158	189	141	230	190	158	189
	SAIDI	148	425	317	299	303	213	425	317	299	303
	SAIFI	1.26	1.85	1.66	1.89	1.60	1.52	1.85	1.66	1.89	1.60
Penn Power (FirstEnergy)	CAIDI	101	311	117	166	157	121	311	117	166	157
	SAIDI	113	422	96	159	121	162	422	96	159	121
	SAIFI	1.12	1.36	0.82	0.96	0.78	1.34	1.36	0.82	0.96	0.78
West Penn (FirstEnergy)	CAIDI	170	282	254	203	266	204	282	254	203	266
	SAIDI	179	386	280	268	285	257	386	280	268	285
	SAIFI	1.05	1.37	1.10	1.32	1.07	1.26	1.37	1.10	1.32	1.07
Small EDCs										
Citizens'	CAIDI	105	95	84	92	90	141	95	84	92	90
	SAIDI	21	27	31	43	29	38	27	31	43	29
	SAIFI	0.20	0.28	0.37	0.47	0.32	0.27	0.28	0.37	0.47	0.32
Pike County	CAIDI	174	160	158	108	95	235	160	158	108	95
	SAIDI	106	81	107	85	82	194	81	107	85	82
	SAIFI	0.61	0.50	0.67	0.79	0.86	0.82	0.50	0.67	0.79	0.86
UGI	CAIDI	169	159	132	165	112	228	159	132	165	112
	SAIDI	140	127	100	113	61	256	127	100	113	61
	SAIFI	0.83	0.80	0.76	0.69	0.54	1.12	0.80	0.76	0.69	0.54
Wellsboro	CAIDI	124	125	103	115	114	167	125	103	115	114
	SAIDI	153	133	100	158	155	278	133	100	158	155
	SAIFI	1.23	1.06	0.97	1.38	1.37	1.66	1.06	0.97	1.38	1.37
[1]CAIDI	(Customer Average Interruption Duration Index) - Measures average power restoration time (minutes) for every customer who lost power during this year.										
SAIDI	(System Average Interruption Duration Index) - Measures average outage duration time (minutes) for every customer served during this year.										
SAIFI	(System Average Interruption Frequency Index) - Measures average frequency of power interruptions for every customer served during this year.										
[2]BM	(Benchmark) - EDC's attained performance baseline score prior to electric restructuring. Calculated by averaging historical performance metrics over the five-year period directly prior to electric restructuring (1994 to 1998).										
[3]STD	(Standard) - EDC's upper limit performance value. CAIDI STD & SAIFI STD is calculated by multipling BM by 120% for large EDCs and 135% for small EDCs. SAIDI STD is calculated by multiplying CAIDI STD x SAIFI STD.										

2022 EDC Performance Scorecard

| Metrics achieved | GREEN | Benchmark Metrics not achieved | YELLOW | | Standard Metrics not achieved | | RED | |

| | | Rolling 12-Month | | | | | | | | |
| | | Benchmark Score | | | | Standard Score | | | | |
EDCs	[1]Metrics	[2]BM	Q1	Q2	Q3	Q4	[3]STD	Q1	Q2	Q3	Q4
Large EDCs											
Duquesne Light	CAIDI	108	193	166	145	146	130	193	166	145	146
	SAIDI	126	190	162	130	134	182	190	162	130	134
	SAIFI	1.17	0.98	0.98	0.89	0.91	1.40	0.98	0.98	0.89	0.91
PECO	CAIDI	112	182	186	96	99	134	182	186	96	99
	SAIDI	138	173	170	67	71	198	173	170	67	71
	SAIFI	1.23	0.95	0.92	0.69	0.71	1.48	0.95	0.92	0.69	0.71
PPL	CAIDI	145	190	191	153	164	174	190	191	153	164
	SAIDI	142	185	183	125	142	205	185	183	125	142
	SAIFI	0.98	0.97	0.96	0.82	0.87	1.18	0.97	0.96	0.82	0.87
Met-Ed (FirstEnergy)	CAIDI	117	190	181	168	160	140	190	181	168	160
	SAIDI	135	288	262	229	211	194	288	262	229	211
	SAIFI	1.15	1.51	1.45	1.36	1.32	1.38	1.51	1.45	1.36	1.32
Penelec (FirstEnergy)	CAIDI	117	145	190	197	199	141	145	190	197	199
	SAIDI	148	275	369	360	364	213	275	369	360	364
	SAIFI	1.26	1.90	1.94	1.83	1.83	1.52	1.90	1.94	1.83	1.83
Penn Power (FirstEnergy)	CAIDI	101	135	130	125	134	121	135	130	125	134
	SAIDI	113	149	176	128	133	162	149	176	128	133
	SAIFI	1.12	1.11	1.36	1.02	0.99	1.34	1.11	1.36	1.02	0.99
West Penn (FirstEnergy)	CAIDI	170	251	266	271	276	204	251	266	271	276
	SAIDI	179	344	388	344	364	257	344	388	344	364
	SAIFI	1.05	1.37	1.46	1.27	1.32	1.26	1.37	1.46	1.27	1.32
Small EDCs											
Citizens'	CAIDI	105	98	112	98	101	141	98	112	98	101
	SAIDI	21	22	22	19	28	38	22	22	19	28
	SAIFI	0.20	0.22	0.20	0.19	0.27	0.27	0.22	0.20	0.19	0.27
Pike County	CAIDI	174	158	183	137	159	235	158	183	137	159
	SAIDI	106	215	188	85	79	194	215	188	85	79
	SAIFI	0.61	1.36	1.03	0.62	0.50	0.82	1.36	1.03	0.62	0.50
UGI	CAIDI	169	124	150	157	156	228	124	150	157	156
	SAIDI	140	122	136	136	135	256	122	136	136	135
	SAIFI	0.83	0.99	0.91	0.87	0.87	1.12	0.99	0.91	0.87	0.87
Wellsboro	CAIDI	124	144	152	150	130	167	144	152	150	130
	SAIDI	153	155	207	166	142	278	155	207	166	142
	SAIFI	1.23	1.08	1.37	1.11	1.09	1.66	1.08	1.37	1.11	1.09

[1]CAIDI	(Customer Average Interruption Duration Index) - Measures average power restoration time (minutes) for every customer who lost power during this year.
SAIDI	(System Average Interruption Duration Index) - Measures average outage duration time (minutes) for every customer served during this year.
SAIFI	(System Average Interruption Frequency Index) - Measures average frequency of power interruptions for every customer served during this year.
[2]BM	(Benchmark) - EDC's attained performance baseline score prior to electric restructuring. Calculated by averaging historical performance metrics over the five-year period directly prior to electric restructuring (1994 to 1998).
[3]STD	(Standard) - EDC's upper limit performance value. CAIDI STD & SAIFI STD is calculated by multipling BM by 120% for large EDCs and 135% for small EDCs. SAIDI STD is calculated by multiplying CAIDI STD x SAIFI STD.

2021 EDC Performance Scorecard										
Metrics achieved	**GREEN**	Benchmark Metrics not achieved	**YELLOW**			Standard Metrics not achieved				**RED**
		Rolling 12-Month								
		Benchmark Score				Standard Score				
EDCs	[1]Metrics	[2]**BM**	Q1	Q2	Q3	Q4	[3]**STD**	Q1	Q2	Q3	Q4
Large EDCs											
Duquesne Light	CAIDI	108	141	172	190	187	130	141	172	190	187
	SAIDI	126	112	151	184	173	182	112	151	184	173
	SAIFI	1.17	0.79	0.88	0.97	0.93	1.40	0.79	0.88	0.97	0.93
PECO	CAIDI	112	136	123	134	187	134	136	123	134	187
	SAIDI	138	121	102	198	164	198	121	102	198	164
	SAIFI	1.23	0.89	0.83	0.94	0.88	1.48	0.89	0.83	0.94	0.91
PPL	CAIDI	145	147	158	194	187	174	147	158	194	187
	SAIDI	142	130	126	176	170	205	130	126	176	170
	SAIFI	0.98	0.89	0.79	0.91	0.91	1.18	0.89	0.79	0.91	0.91
Met-Ed (FirstEnergy)	CAIDI	117	157	168	178	173	140	157	168	178	173
	SAIDI	135	193	206	237	233	194	193	206	237	233
	SAIFI	1.15	1.23	1.23	1.34	1.35	1.38	1.23	1.23	1.34	1.35
Penelec (FirstEnergy)	CAIDI	117	152	152	158	151	141	152	152	158	151
	SAIDI	148	253	252	299	277	213	253	252	299	277
	SAIFI	1.26	1.66	1.66	1.89	1.84	1.52	1.66	1.66	1.89	1.84
Penn Power (FirstEnergy)	CAIDI	101	187	171	166	129	121	187	171	166	129
	SAIDI	113	154	119	159	129	162	154	119	159	129
	SAIFI	1.12	0.83	0.70	0.96	1.00	1.34	0.83	0.70	0.96	1.00
West Penn (FirstEnergy)	CAIDI	170	217	209	203	192	204	217	209	203	192
	SAIDI	179	240	230	268	242	257	240	230	268	242
	SAIFI	1.05	1.10	1.10	1.32	1.26	1.26	1.10	1.10	1.32	1.26
Small EDCs											
Citizens'	CAIDI	105	88	78	94.1	94	141	88	78	94.1	94
	SAIDI	21	14	15	21.8	25.6	38	14	15	21.8	25.6
	SAIFI	0.20	0.16	0.19	0.23	0.27	0.27	0.16	0.19	0.23	0.27
Pike County	CAIDI	174	170	110	166	153	235	170	110	166	153
	SAIDI	106	89	88	219	216	194	89	88	219	216
	SAIFI	0.61	0.52	0.79	1.31	1.40	0.82	0.52	0.79	1.31	1.40
UGI	CAIDI	169	162	147	132	134	228	162	147	132	134
	SAIDI	140	89	104	127	127	256	89	104	127	127
	SAIFI	0.83	0.55	0.71	0.96	0.95	1.12	0.55	0.71	0.96	0.95
Wellsboro	CAIDI	124	97	112	124	144	167	97	112	124	144
	SAIDI	153	110	83	99	133	278	110	83	99	133
	SAIFI	1.23	1.13	0.75	0.80	0.93	1.66	1.13	0.75	0.80	0.93

[1]CAIDI	(Customer Average Interruption Duration Index) - Measures average power restoration time (minutes) for every customer who lost power during this year.
SAIDI	(System Average Interruption Duration Index) - Measures average outage duration time (minutes) for every customer served during this year.
SAIFI	(System Average Interruption Frequency Index) - Measures average frequency of power interruptions for every customer served during this year.
[2]BM	(Benchmark) - EDC's attained performance baseline score prior to electric restructuring. Calculated by averaging historical performance metrics over the five-year period directly prior to electric restructuring (1994 to 1998).
[3]STD	(Standard) - EDC's upper limit performance value. CAIDI STD & SAIFI STD is calculated by multipling BM by 120% for large EDCs and 135% for small EDCs. SAIDI STD is calculated by multiplying CAIDI STD x SAIFI STD.

Appendix C – Deviations to Inspection and Maintenance Intervals

Deviations to Inspection and Maintenance (I&M) Intervals (Group 1) Submitted October 2023, effective Jan. 1, 2025 – Dec. 31, 2026

Company	Deviation Requested	Justification
FE PA: Penelec, Penn Power, Met-Ed, and West Penn Power	Pole loading calculations	Approved previously in the Jan. 1, 2013-Dec. 31, 2014, I&M Plan.
UGI Electric	Pole loading calculations	Approved previously in the Jan. 1, 2021-Dec. 31, 2022, I&M Plan.

Deviations to Inspection and Maintenance Intervals (Group 2) Submitted October 2022, effective Jan. 1, 2024 – Dec. 31, 2025

Company	Deviation Requested	Justification
Citizens'	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan.
Duquesne	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
Duquesne	Overhead line inspections	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
Duquesne	Overhead transformer inspections	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
Duquesne	Above-ground pad-mounted transformers	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PECO	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PECO	Above-ground pad-mounted transformers	Approved previously in the Jan. 1, 2020- Dec. 31, 2021, I&M Plan
Pike County	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PPL	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PPL	Overhead line inspections	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PPL	Overhead transformer inspections	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PPL	Pad mounted and belowground transformer inspections	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan
PPL	Recloser inspections	Approved previously in the Jan. 1, 2014- Dec. 31, 2015, I&M Plan
PPL	Substation inspections	Provisional approved in the Jan. 1, 2017- Dec. 31, 2018, I&M Plan (docket M-2009-2094773)
Wellsboro	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec. 31, 2013, I&M Plan

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