ELECTRIC SERVICE RELIABILITY IN PENNSYLVANIA

2020

PENNSYLVANIA PUBLIC UTILITY COMMISSION

PAPUC

PENNSYLVANIA ELECTRIC RELIABILITY REPORT 2020

July 2021

Published by:

Pennsylvania Public Utility Commission

Commonwealth Keystone Building

400 North St

Harrisburg, PA 17105-3265

www.puc.pa.gov

Technical Utility Services

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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.

Given the uncertainty of weather and other events that affect reliability performance, the Commission has stated EDCs shall set goals to achieve benchmark performance in order 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.

As mandated, EDCs report reliability performance metrics[5] 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 2020, 2019, 2018, 2017, and 2016. More detailed analysis can be found in Section 4, *EDC Reliability Performance Data*. Appendix A provides the 2020 rolling 12-month and rolling 3-year reliability metrics for all EDCs. **Of note, only four 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, 2020, only five of 11 EDCs achieved the standard performance metric, and only four of 11 EDCs achieved the benchmark metric in all three reliability performance categories.**

[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] Docket No. M-00991220.
[4] Id. at 25.
[5] For an explanation of performance standards, see Section 2, page 2.

In addition to monitoring EDCs' reliability performance, the Commission established inspection and maintenance standards for electric transmission and distribution systems.[6] 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 improved in some important areas. The EDCs improved markedly on the average number of outages experienced by customers, or SAIFI.[7] As seen in Appendix B, eight of the 11 EDCs achieved benchmark for SAIFI in 2020, as compared to only five in 2019. Also in 2020, 10 of the 11 EDCs performed better than the rolling 12-month performance standard for SAIFI, as compared to seven in 2019. It is hoped that this is 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. CAIDI is an important measure as it relates to average duration of a service outage, and EDCs will be expected to improve worsening CAIDI, but reducing service outages from occurring in the first place is crucial to improving reliability performance.

As noted in last year's report,[8] electric reliability and resilience[9] appears to be most challenged during storm activity that brings down off-right-of-way trees and limbs onto the distribution lines. As seen in Section 3, below, the number of impactful storms does not appear to be lessening and if the weather pattern of increasing severe storm continues, EDCs may struggle to struggle to achieve sustained benchmark performance. Trees, in particular off right-of-way (ROW) trees, again are the number one cause of outages and lost customer-minutes in Pennsylvania, as can be seen by the individual EDC performance details in Section 4, below.

Based on the findings of last year's 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 on the responses to the data request. The key takeaways from the discussion were:

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[6] Docket No. L-00040167.
[7] *See* Section 2, below, for an explanation of SAIFI and all other reliability metrics.
[8] The Electric Service Reliability In Pennsylvania 2019 report is available for download here: https://www.puc.pa.gov/General/publications_reports/pdf/Electric_Service_Reliability2019.pdf.
[9] 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.

- All but one of the EDCs have approved Long-Term Infrastructure Improvement Plans (LTIIPs),[10] which are designed to improve reliability and resiliency (storm hardening). Two of the EDCs are implementing their second LTIIP and have consistently achieved benchmark performance for SAIFI since 2015, even with the increasing impact of severe storms.[11] The EDCs and EAP noted that they view the LTIIP and Distribution System Improvement Charge (DSIC)[12] as key tools to help improve reliability, along with regular capital investment and recovery through base rate cases. The EDCs with LTIIPs noted that they have seen progress in improving reliability, but that the results of the investments would take time to be evident in consistent achievement of reliability metrics. PPL has the most mature LTIIP program and regularly achieves benchmark performance. The EDCs and EAP also noted that the organizations were open to discussing how performance-based rates may be a benefit to drive better reliability performance.[13]

- Weather and trees are the biggest impacts to the EDC's reliability performance. However, most tree problems are from off ROW. EDCs noted that they all have programs to try and address off ROW danger trees with landowners, but many fall-ins from off ROW vegetation come from what appear to be healthy trees that have grown tall enough to be a fall-in threat. EDCs noted they would welcome a discussion on any regulatory and/or legislative incentives to improve off ROW tree issues.

- All of the large EDCs utilize current reliability measurements based on methodologies developed by the Institute of Electrical and Electronics Engineers (IEEE) when benchmarking against other similar EDCs nationwide.[14] The primary differences between the IEEE and PUC methodologies relate to excludable events and how benchmarks are calculated.[15] TUS noted that it finds that the Commission definition of a Major Event is subjective and may be outdated as compared to the IEEE methodology.[16] Several EDCs indicated that they believe the IEEE methodology for excludable events (Major Events) provides better data in terms of identifying worst performing circuits, among other features. TUS and the EDCs noted that a change to incorporate the IEEE exclusion methodology would involve a larger discussion on the reliability benchmark measures, which necessarily involves a discussion of the statutory requirements for electric distribution reliability in

[10] The 9 EDCs with approved LTIIPs are Met-Ed, PECO, Penelec, Penn Power, Pike, PPL, West Penn, Duquesne Light, and UGI.
[11] PECO and PPL are both implementing their second LTIIPs at Docket Nos. P-2020-3020974, and P-2020-3020974, respectively. PECO and PPL have consistently achieved benchmark performance SAIFI.
[12] EDCs were allowed to file for the DSIC beginning in 2013. 66 Pa.C.S. § 1353. A utility must have an LTIIP in order to charge a DSIC. 66 Pa.C.S. § 1352. LTIIP regulations were enacted at 52 Pa. Code § 121.
[13] *See* 66 Pa.C.S. § 1330, and 52 Pa. Code § 69.3302 for the statute and Commission policy on alternate forms of ratemaking.
[14] The IEEE methodologies utilized by the EDCs are found at IEEE 1366-2012, *IEEE Guide for Electric Power Distribution Reliability Indices*.
[15] The Commission defines events that may be excluded from the calculation of EDC reliability statistics as Major Events, which are defined at 52 Pa. Code § 57.192. The IEEE methodology differs as exclusions are based on a statistical calculation of anomalous performance compared to average system performance, as contrasted to the Major Event definition where there may be some subjectivity as to when an "event" begins and ends.
[16] Some examples of where there were subjective differences between EDCs and TUS on what qualify as excludable events can be found at *Pennsylvania Electric Company v. Pennsylvania Public Utility Commission*, Order entered Dec. 1, 2011, at Docket No. M-2011-2265890, and *Request of Metropolitan Edison Company for Exclusion of Major Outage for Reliability Reporting Purposes*, Order entered Nov. 14, 2019, at Docket No. M-2018-3004552.

Pennsylvania. Several EDCs noted that other states have incorporated parts or all of the IEEE reliability methodologies and that they believed it provided a more dynamic measure of electric reliability.

- Also noted by EDCs and EAP was that the customer and customer experience should be part of the discussion to try and determine what are customers' expectations for electric reliability and the cost of that performance expectation through rates.

Reliability Collaborative

TUS and the Commission agreed with the EDCs that LTIIPs and the DSIC are effective tools in improving infrastructure and electric reliability and resiliency, although recognizing that results take time to develop. EDCs should continue to execute their LTIIP programs and other reliability improvement initiatives and TUS and the Commission will continually evaluate EDC reliability performance. However, there were a number of other reliability issues raised during the October 16 discussion as noted above. In order for the Commission to more fully inform any subsequent electric reliability policies or actions pursuant to those issues, the Commission initiated a reliability collaborative, via Secretarial Letter, and invited the EDCs, EAP, and Statutory Advocates to participate.[17]

The reliability collaborative will focus on reviewing the electric distribution reliability regulations. Particular attention will be paid to the calculation of the reliability performance metrics; 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 off ROW trees on electric reliability.

The first meeting of the collaborative will be on July 21, 2021, and subsequent meeting dates and times will be determined at the initial meeting. The Commission anticipates completing the collaborative process within 9 months, at the conclusion of which, TUS will prepare an internal report for consideration by the Commission.

[17] The Secretarial Letter was served on June 3, 2021, at Docket No. M-2021-3024513.

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.[18]

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).[19] 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. 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.

The Commission also established reliability benchmark and standard values to measure the performance of each EDC. 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. 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 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]

[18] 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.
[19] For more information on CAIDI and SAIFI, see Section 2.
[20] 52 Pa. Code § 57.197(a).
[21] 52 Pa. Code § 57.194(h)(1).

Section 2 –Reliability Performance Measures

Reliability Performance Metrics

The Commission's benchmarks and standards are based on 4 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:

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 (less than 5 minutes) interruptions for every customer served during reporting period.[22]

Additional information and data reported by EDCs:

- 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.[23]
- Reliability performance on the 5% of worst performing circuits and a corrective action plan to increase the reliability of these circuits.

Major Events

In order 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:[24]

- 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

[22] 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.
[23] This information is collected and trended by EDCs to reduce customer outages and improve system reliability.
[24] *See* 52 Pa. Code § 57.192.

- 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 5 years from 1994-98. 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.

The performance rolling **12-month average** is 120% of the benchmark for the large EDCs and 135% for the small EDCs.[25] 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 2016, 2017 and 2018 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 evaluation: Performance is above **benchmark**, but below **standard**, and may require additional review and action if the EDC is chronically above

[25] Large EDCs currently include Duquesne Light, Met-Ed, Penelec, Penn Power, PECO, PPL and West Penn. Small EDCs include: UGI, Citizens', Pike County and Wellsboro.

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 Investigation & Enforcement Bureau for further action.

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

CAIDI of 140 evaluation: 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 Investigation & Enforcement Bureau 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.[26] In addition, Commission staff may initiate an investigation to determine whether an EDC is providing reliable service.[27]

Benchmarks and standards for EDC reliability performance and actual reliability metrics for 2018 are located in Appendix 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.[28] 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 2020 (effective January 2022 through December 2023) for Duquesne Light, PECO, PPL, Citizens', Pike County and Wellsboro.

- Filed in October 2019 (effective January 2021 through December 2022) for FirstEnergy (Met-Ed, Penelec, Penn Power and West Penn Power) and UGI

The plans are subject to acceptance or rejection by the Commission. Most EDCs proposed modifications to the standards for some programs or parts of programs. Appendix C describes the

[26] *See* 52 Pa. Code § 57.195(g).
[27] *See* 52 Pa. Code § 57.197(a).
[28] *See* 52 Pa. Code § 57.198.

exemptions that were requested by the EDCs and provides a summary of the explained justification for said exemptions.[29]

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

Section 3 – 2020 Outage Response Review

Overview

Tables 2A, 2B, 2C, and 2D, below, present a breakdown of reportable outage events (ROEs)[30] summarized for 2020 (46 events) as compared to 2019 (52 events), 2018 (35 events), and 2017 (50 events).

Table 2E, details the number of ROEs from 1993 through 2020. 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 2G, 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 2F details the number of customers affected by ROEs from 1993 through 2020. In 2020, a total of 2,431,842 of customers were negatively affected by ROEs as compared to 1,988,188 customers in 2019; 2,548,905 in 2018; 1,309,960 in 2017; 779,512 in 2016; and 619,474 in 2015.

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

Table 2G, details the cumulative number of ROEs by EDC from 2011 through 2020.

[29] *See* 52 Pa. Code § 57.198(c).

[30] Service outages reports are required under 52 Pa. Code § 67.1. The reporting threshold for a 67.1 reportable outage event is 5 percent of total customers or 2,500 customers, whichever is less, for 6 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 2020

EDC	Date	Customers Affected	Cause
Duquesne	4/8/20	60,383	Severe thunderstorms, high winds
Duquesne	6/10/20	15,403	Severe thunderstorms (high winds)
Duquesne	7/10//20	22,463	Severe thunderstorms (high winds)
Duquesne	8/27/20	49,383	Severe thunderstorms, lightning, high winds
Duquesne	11/15/20	41,224	High winds and heavy rains
Met-Ed	4/9/20	35,145	Severe thunderstorms, high winds
Met-Ed	6/3/20	88,597	Severe thunderstorms (Derecho)
Met-Ed	7/22/20	32,732	Severe thunderstorms (high winds)
Met-Ed	8/4/20	101,559	Tropical storm Isaias
Met-Ed	8/28/20	16,986	Severe thunderstorms, lightning, high winds
Met-Ed	11/1/20	27,210	Cold front, wind storm, heavy rains
Met-Ed	11/15/20	33,816	High winds and heavy rains
Met-Ed	12/24/20	6,863	High winds, freezing rain, heavy rains
PECO	6/3/20	456,480	Severe thunderstorms (Derecho)
PECO	8/4/20	404,363	Tropical storm Isaias
PECO	8/7/20	50,996	Severe thunderstorms
PECO	8/28/20	27,895	Severe thunderstorms, lightning, high winds
PECO	11/15/20	33,293	High winds and heavy rains
PECO	12/24/20	85,772	High winds and heavy rains
Penelec	1/12/20	14,816	Storms, strong winds and heavy rain
Penelec	4/7/20	24,599	Severe thunderstorms, high winds
Penelec	4/17/20	13,629	Wet, heavy snow storm
Penelec	8/27/20	48,298	Severe thunderstorms, lightning, high winds
Penelec	9/7/20	21,571	Severe thunderstorms
Penelec	11/1/20	29,112	Cold front, wind storm, heavy rains
Penelec	11/15/20	90,058	High winds and heavy rains
Penn Power	6/10/20	10,405	Severe thunderstorms (high winds)
Penn Power	11/15/20	10,599	High winds and heavy rains
Pike	12/25/20	1,871	High winds and rains (fallen tree damage)
PPL	4/9/20	38,010	Wind storm
PPL	4/13/20	49,065	Rain and high winds
PPL	6/3/20	14,479	Severe thunderstorms (Derecho)
PPL	8/4/20	71,624	Tropical storm Isaias
PPL	8/27/20	33,216	Severe thunderstorms, lightning, high winds
PPL	11/1/20	42,194	Cold front, wind storm, heavy rains
PPL	11/15/20	33,109	High winds and heavy rains
PPL	12/24/20	30,248	High winds and heavy rains
West Penn	1/11/20	14,996	Storms, strong winds and heavy rain
West Penn	3/29/20	18,524	Storms, strong winds and heavy rain
West Penn	4/8/20	59,885	Severe thunderstorms, high winds, tornadic
West Penn	6/10/20	27,342	Severe thunderstorms (high winds)
West Penn	7/10/20	18,790	Severe thunderstorms (high winds)
West Penn	8/27/20	44,469	Severe thunderstorms, lightning, high winds
West Penn	9/30/20	4,361	Failed insulator caused fire
West Penn	11/15/20	60,268	High winds and heavy rains
West Penn	11/1/20	15,741	Cold front, wind storm, heavy rains

Table 2B –67.1 Reportable Outage Events Summary 2019

EDC	Date	Customers Affected	Cause
Citizens	4/15/2019	2,695	EF-1 tornado and trees
Duquesne	10/31/2019	15,087	Storm and trees
Duquesne	6/29/2019	12,139	Storm and trees
Duquesne	2/24/2019	140,183	storm and trees
Duquesne	5/29/2019	9,892	Storm and trees
Met-Ed	10/31/2019	21,407	Storm and trees
Met-Ed	11/27/2019	11,941	Storm and trees
Met-Ed	12/1/2019	31,854	Storm and trees
Met-Ed	2/24/2019	38,466	Storm and trees
Met-Ed	5/14/2019	4,303	Vehicle hit pole
Met-Ed	3/3/2019	13,773	Storm and trees
Met-Ed	5/29/2019	35,280	Storm and trees
PECO	10/16/2019	44,333	Storm and trees
PECO	10/31/2019	127,899	Storm and trees
PECO	2/24/2019	86,026	Storm and trees
PECO	4/26/2019	37,301	Storm and trees
PECO	5/29/2019	73,791	Storm and trees
PECO	6/29/2019	54,564	Storm and trees
PECO	7/17/2019	45,619	Storm and trees
PECO	7/2/2019	21,947	Storm and trees
PECO	7/22/2019	106,410	Storm and trees
Penelec	10/31/2019	64,619	Storm and trees
Penelec	12/1/2019	28,538	Storm and trees
Penelec	2/24/2019	106,374	Storm and trees
Penelec	5/29/2019	26,192	Storm and trees
Penelec	5/19/2019	11,066	Storm and trees
Penelec	7/19/2019	13,734	Storm and trees
Penelec	8/17/2019	48,429	Storm and trees
Penelec	4/19/2019	9,031	Storm and trees
Penelec	4/14/2019	31,221	Storm and trees
Penelec	1/1/2019	27,979	Storm and trees

Table 2B (cont'd) –67.1 Reportable Outage Events Summary-2019

EDC	Date	Customers Affected	Cause
Penn Power	2/24/2019	36,177	Storm and trees
PPL	11/27/2019	19,989	Storm and trees
PPL	2/24/2019	79,031	Storm and trees
PPL	4/14/2019	50,884	Storm and trees
PPL	5/19/2019	20,778	Storm and trees
PPL	5/29/2019	16,982	Storm and trees
PPL	6/28/2019	18,331	Storm and trees
PPL	7/21/2019	11,794	Storm and trees
PPL	10/16/2019	19,863	Storm and trees
PPL	10/31/2019	80,586	Storm and trees
PPL	12/1/2019	17,094	Storm and trees
UGI	4/15/2019	11,703	Storm and trees
UGI	8/15/2019	5,845	Storm and trees
West Penn	1/1/2019	14,036	Storm and trees
West Penn	10/22/2019	5,220	Equipment failure
West Penn	10/31/2019	27,274	Storm and trees
West Penn	11/27/2019	24,959	Storm and trees
West Penn	12/17/2019	7,214	Storm and trees
West Penn	2/24/2019	177,232	Storm and trees
West Penn	5/29/2019	26,194	Storm and trees
West Penn	6/29/2019	14,909	Storm and trees

Table 2C –67.1 Reportable Outage Events Summary-2018

EDC	Date	Customers Affected	Cause
Duquesne	11/15/2018	63,344	Rain, Snow, Sleet
Duquesne	7/4/2018	31,482	Thunderstorms and rain
Duquesne	9/9/2018	19,170	Heavy rain
Met-Ed	11/15/2018	30,893	Rain, Snow, Sleet
Met-Ed	3/2/2018	272,928	Heavy rain
Met-Ed	4/4/2018	13,784	Weather
Met-Ed	5/15/2018	111,902	Weather
Met-Ed	6/17/2018	2,601	Cascading trees
Met-Ed	8/17/2018	18,766	Thunderstorms and high winds
PECO	11/2/2018	44,737	Thunderstorms and high winds
PECO	3/7/2018	191,272	Weather
PECO	5/2/2018	603,697	Weather
PECO	7/22/2018	55,681	Thunderstorms and high winds
PECO	7/3/2018	59,019	Thunderstorms and high winds
PECO	11/16/2018	27,699	Thunderstorms and high winds
Penelec	3/2/2018	90,856	Snow and wind
Penelec	4/4/2018	74,192	Weather
Penelec	5/15/2018	15,307	Weather
Penelec	5/4/2018	16,369	Thunderstorms and high winds
Penn Power	3/2/2018	8,688	Weather
Penn Power	11/16/2018	43,919	Thunderstorms and high winds
Pike	3/3/2018	2,101	Snow and wind
PPL	4/5/2018	51,721	Wind
PPL	4/15/2018	13,953	Rain and wind
PPL	7/23/2018	35,402	Rain and wind
PPL	3/2/2018	261,341	Wind
PPL	5/15/2018	121,963	Rain and wind
PPL	11/15/2018	15,673	Thunderstorms and high winds
West Penn	10/20/2018	9,424	Rain and wind
West Penn	3/2/2018	21,196	Weather
West Penn	4/4/2018	35,435	Weather
West Penn	5/15/2018	23,143	Weather
West Penn	5/4/2018	7,176	Thunderstorms and high winds
West Penn	5/15/2018	23,143	Weather
West Penn	11/15/2018	75,322	Thunderstorms and high winds

Table 2D –67.1 Reportable Outage Events Summary-2017

EDC	Date	Customers Affected	Cause
Duquesne	2/12/2017	19,735	Rain and high winds
Duquesne	3/1/2017	12,406	Thunderstorms and high winds
Duquesne	5/1/2017	47,548	Thunderstorms and high winds
Duquesne	6/13/2017	25,809	Thunderstorms and high winds
Duquesne	8/4/2017	20,799	Thunderstorms and heavy rain
Duquesne	11/19/2017	11,126	High winds- mesovortices
Met-Ed	2/12/2017	29,409	High winds
Met-Ed	2/25/2017	34,202	Thunderstorms and high winds
Met-Ed	3/1/2017	12,147	Thunderstorms and high winds
Met-Ed	3/10/2017	6,686	Suspected failed insulator on 34.5 kV line
Met-Ed	6/19/2017	27,711	Thunderstorms and high winds
Met-Ed	9/5/2017	47,610	Thunderstorms and heavy rain
Met-Ed	10/29/2017	18,315	High winds
PECO	1/23/2017	76,899	Rain and high winds
PECO	3/7/2017	39,124	Substation fire
PECO	6/21/2017	42,293	Thunderstorms and high winds
Penelec	2/12/2017	25,562	High winds
Penelec	3/1/2017	29,326	Thunderstorms and high winds
Penelec	3/8/2017	34,764	Thunderstorms and high winds
Penelec	5/1/2017	102,198	Thunderstorms and high winds
Penelec	5/5/2017	12,668	NYSEG 115 kV line failure
Penelec	6/18/2017	39,736	Thunderstorms and high winds
Penelec	7/20/2017	12,268	Thunderstorms and high winds
Penelec	8/4/2017	14,163	Thunderstorms and heavy rain
Penelec	8/19/2017	25,674	Thunderstorms and heavy rain
Penelec	11/5/2017	16,641	Thunderstorms and heavy rain
Penn Power	3/8/2017	16,557	Thunderstorms and high winds
Penn Power	5/1/2071	11,249	Thunderstorms and high winds
PPL	2/12/2017	19,429	High winds
PPL	2/25/2017	22,239	High winds
PPL	3/1/2017	12,649	Thunderstorms and high winds
PPL	3/27/2017	8,972	Transmission line crossarm failed during storm
PPL	5/1/2017	25,741	Thunderstorms and high winds
PPL	5/5/2017	16,343	Thunderstorms and high winds
PPL	9/5/2017	14,895	Thunderstorms and heavy rain
PPL	10/29/2017	36,521	High winds
PPL	11/19/2017	9,613	High winds
PPL	7/20/2017	7,530	Thunderstorms and high winds
Wellsboro	5/6/2017	6,341	Failed substation bus insulator
West Penn	2/8/2017	13,802	Snow and wind
West Penn	2/12/2017	27,067	High winds
West Penn	3/1/2017	33,836	Thunderstorms and high winds
West Penn	3/8/2017	28,404	Thunderstorms and high winds
West Penn	5/1/2017	77,458	Thunderstorms and high winds
West Penn	6/23/2017	18,595	Thunderstorms and high winds
West Penn	7/28/2017	19,901	Thunderstorms and heavy rain
West Penn	8/4/2017	41,924	Thunderstorms and high winds
West Penn	8/19/2017	10,773	Thunderstorms and heavy rain
West Penn	8/22/2017	25,888	Thunderstorms and heavy rain
West Penn	11/18/2017	19,414	High winds

Table 2E – Total 67.1 Reportable Events for EDCs 1993-2020

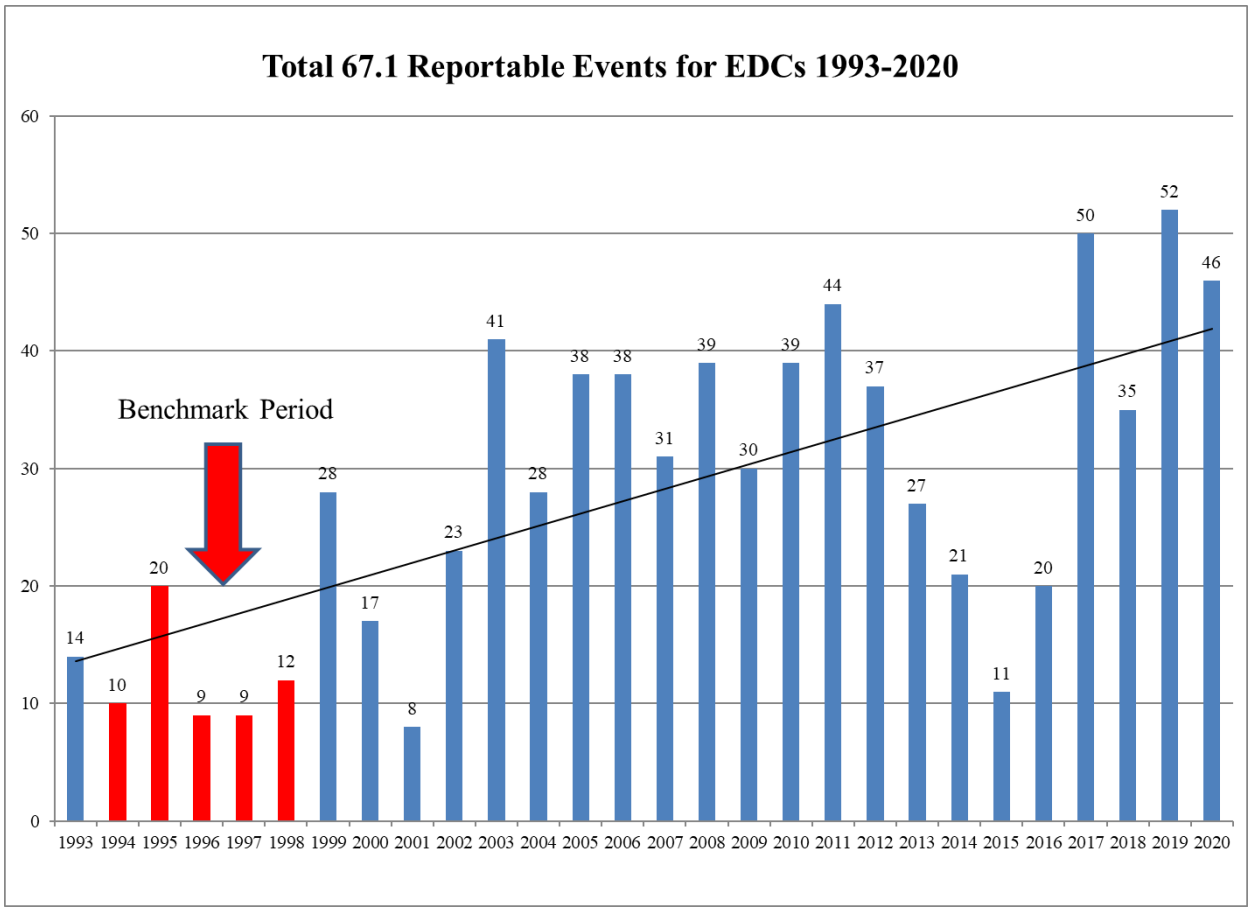


Table 2F – Total Customers Affected by 67.1 Reportable Events 1993-2020

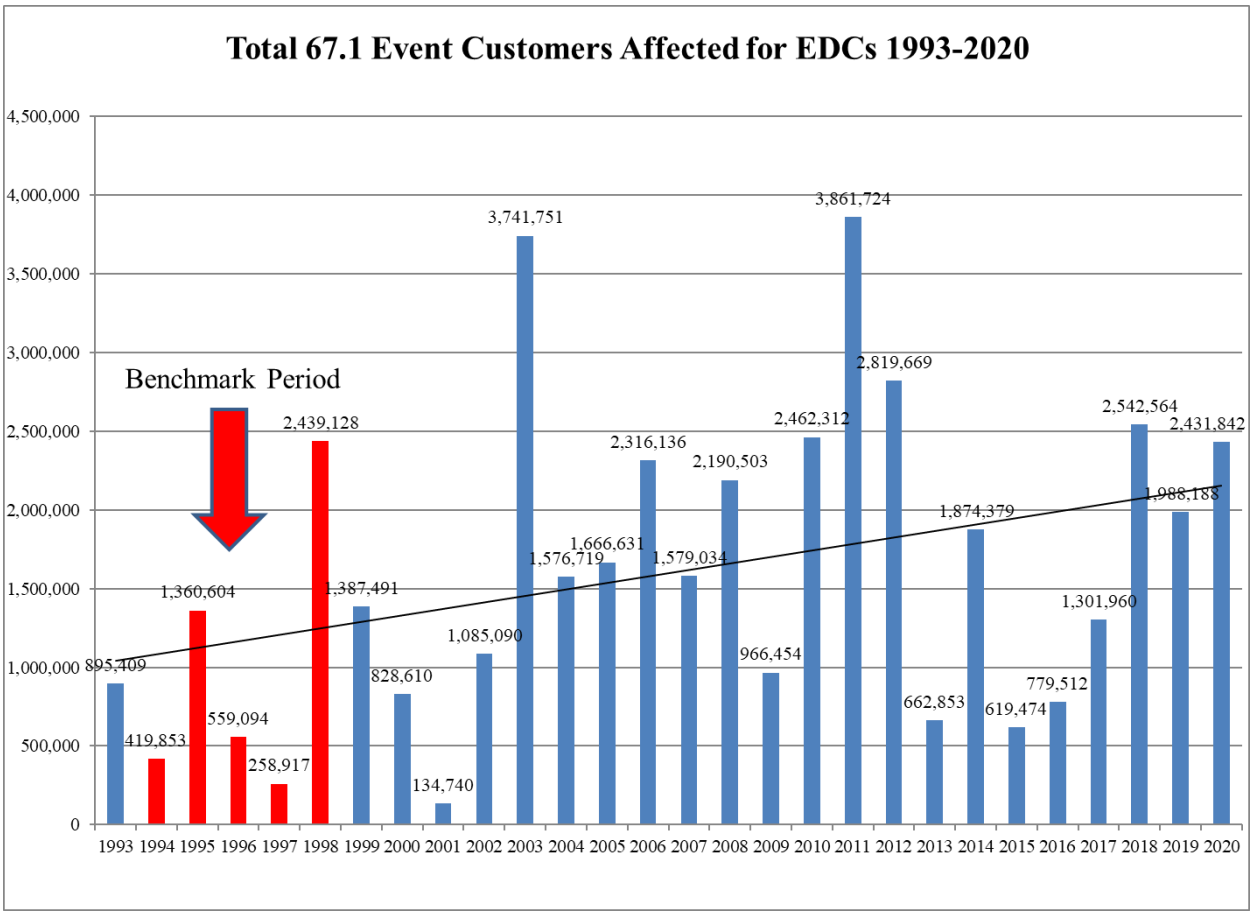
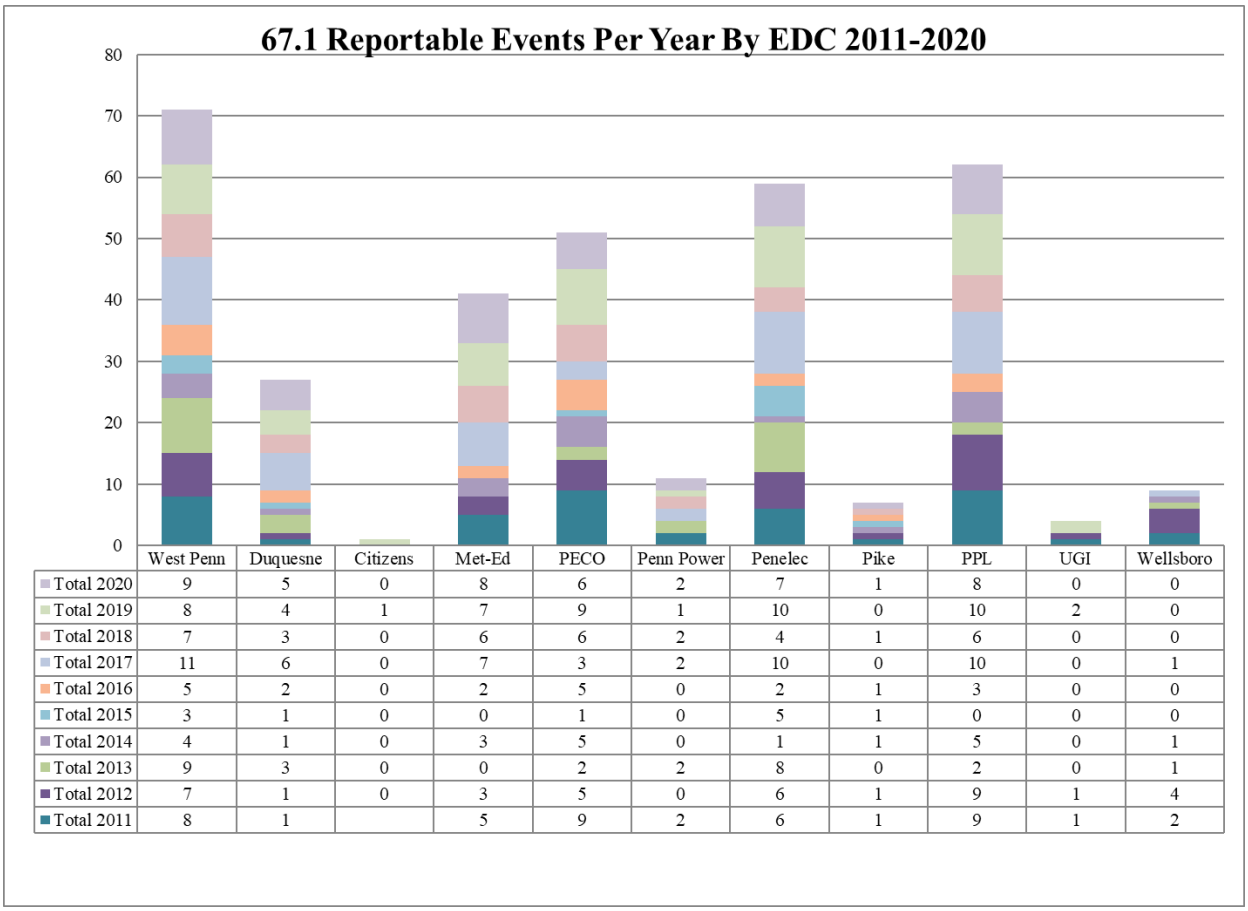


Table 2G –67.1 Reportable Events by EDC 2011-2020



	West Penn	Duquesne	Citizens	Met-Ed	PECO	Penn Power	Penelec	Pike	PPL	UGI	Wellsboro
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
Total 2013	9	3	0	0	2	2	8	0	2	0	1
Total 2012	7	1	0	3	5	0	6	1	9	1	4
Total 2011	8	1		5	9	2	6	1	9	1	2

Major Events

In 2020 as in 2019, the resilience of Pennsylvania's electrical system was challenged with a substantial amount of severe storm activity. Pennsylvania customers were adversely affected with approximately 1.3 million customers impacted by major storm events in 2020 as compared to 573,700 customers impacted in 2019. In 2020, there were 29 Major Event exclusion requests as compared to 23 in 2019, 29 in 2018, 13 in 2017, and 11 in 2016. Note that Major Events are excludable from EDC's reliability indices and the additional customer outages and customer-minutes-interrupted are not added to the reliability metrics.

Major Events for 2020, 2019, 2018, 2017, and 2016 are shown below in Tables 3A, 3B, 3C, 3D, and 3E, respectively.

Table 3A – 2020 Major Events

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	1/24/220	1,020	Storm	43,584
Citizens	7/8/2020	2,463	Storm	441,304
Citizens	8/27/2020	2,070	Storm	532,190
Citizens	9/30/2020	1,326	Tree limb	149,992
Citizens	11/15/2020	1,326	Animal	116,984
Duquense	4/8/2020	60,383	Storm	297,908,154
Met-Ed	6/3/2020	88,597	Storm	unreported
Met-Ed	8/4/2020	101,559	Storm	63,898,614
PECO	6/3/2020	456,480	Storm	unreported
PECO	8/4/2020	404,363	Storm	unreported
Penelec	11/15/2020	90,058	Storm	44,332,143
Pike	3/16/2020	1,882	Loss of load from main feed	54,578
Pike	5/29/2020	2,670	Failed cross arm	480,600
Pike	8/4/2020	525	Storm	432,199
Pike	11/23/2020	2,371	Equipment failure	1,990,054
Pike	12/25/2020	1,871	Off-right-of-way tree	678,727
UGI	11/23/2020	10,665	Equipment failure	unreported
Wellsboro	4/21/2020	1,515	Storm	229,923
Wellsboro	5/9/2020	6,203	Loss of load from main feed	379,807
Wellsboro	5/28/2020	1,705	Tree	99,572
Wellsboro	6/18/2020	1,515	Unkown fault on line	30,931
Wellsboro	6/27/2020	767	Splice failure	145,257
Wellsboro	7/30/2020	1,515	Circuit fault	36,915
Wellsboro	8/4/2020	6,302	Loss of load from main feed	701,937
Wellsboro	8/8/2020	6,301	Loss of load from main feed	451,056
Wellsboro	8/19/2020	1,041	Bird into arrestor	89,232
Wellsboro	8/23/2020	869	Animal	104,898
Wellsboro	10/15/2020	1,517	Off-right-of-way tree	83,237
Wellsboro	10/21/2020	714	Equipment failure	68,508
	Totals	**1,259,593**	**Totals**	**413,480,396**

Table 3B – 2019 Major Events

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	1/8/2019	1,811	vehicle hit pole	278,001
Citizens	4/15/2019	2,695	Wind and trees	757,999
Citizens	5/29/2019	1,379	Wind and trees	65,664
Citizens	6/26/2019	868	Wind and trees	65,679
Citizens	9/11/2019	1,114	Wind and trees	112,647
Duquesne	2/24/2019	140,183	Winter storm	772,081,564
Penelec	2/24/2019	106,374	Winter storm	28,827,618
Penelec	10/31/2019	64,234	Wind and trees	18,082,778
Penn Power	2/24/2019	36,177	Winter storm	20,219,291
Pike	2/25/2019	2,434	Winter storm	429,968
UGI	4/15/2019	11,703	Thunderstorm and wind	5,791,636
Wellsboro	2/24/2019	2,057	Winter storm	457,081
Wellsboro	4/3/2019	709	Wind and trees	123,425
Wellsboro	4/15/2019	707	Wind and trees	20,562
Wellsboro	6/14/2019	1,505	Vehicle hit pole	474,529
Wellsboro	7/19/2019	2,132	Wind and trees	312,340
Wellsboro	8/11/2019	750	Lightening	163,320
Wellsboro	9/21/2019	1,150	Equipment failure	148,741
Wellsboro	10/9/2019	6,343	Transmission breaker trip	266,406
Wellsboro	10/28/2019	6,343	Equipment failure	507,440
Wellsboro	10/31/2019	2,485	Wind and trees	472,432
Wellsboro	12/2/2019	3,315	Ice and trees	970,233
West Penn	2/24/2019	177,232	Winter storm	151,122,575
	Totals	**573,700**	**Totals**	**1,001,751,929**

Table 3C – 2018 Major Events

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	3/2/2018	1,541	Winter Storm Riley	84,788
Citizens	5/15/2018	2,535	Rain and Wind	259,570
Citizens	7/21/2018	1,026	Ash Tree	94,797
Citizens	8/4/2018	1,022	Ash Tree	77,216
Citizens	9/10/2018	2,172	12 kV Bus Raccoon Fault	293,140
Citizens	11/15/2018	7,003	Snow and Ice	838,839
Duquesne	11/15/2018	63,344	Winter Storm Avery	106,227,566
Met-Ed	1/23/2018	408	Flood Waters	669,120
Met-Ed	3/2/2018	273,398	Winter Storm Riley	580,726,537
Met-Ed	5/15/2018	111,894	Thunderstorm and Winds	79,685,165
Met-Ed	7/21/2018	62,511	Excessive Rain	9,869,127
PECO	3/2/2018	603,697	Winter Storm Riley	746,216,384
PECO	3/7/2018	191,272	Winter Storm Quinn	115,649,601
Penelec	1/12/2018	187	Flood Waters	230,799
Penelec	3/1/2018	76,703	Winter Storm Riley	24,639,302
Penelec	8/13/2018	2,863	Flood Waters	3,444,136
Penelec	4/3/2018	62,262	Rain and Wind	13,104,058
Penn Power	1/18/2018	2,456	Proactive Low Voltage Interruption	2,988,702
Penn Power	6/23/2018	24,867	Conductor Fault	312,737
Penn Power	11/15/2018	43,919	Winter Storm Avery	42,702,369
Pike	3/2/2018	2,101	Winter Storm Riley/Quinn	422,777,649
Pike	9/6/2018	2,680	Orange & Rockland Lightning Strike	1,628,082
PPL	3/2/2018	261,341	Winter Storm Riley/Quinn	355,173,459
Wellsboro	7/22/2018	6,433	Fallen Tree (Penelec 34.5 issue)	1,627,549
Wellsboro	12/1/2018	947	34.5 kV FirstEnergy line disruption	143,803
West Penn	2/15/2018	2,947	Flood Waters	1,602,386
West Penn	6/20/2018	1,122	Flood Waters	4,012,943
West Penn	9/8/2018	72,408	Rain and Wind	19,429,879
West Penn	11/15/2018	75,322	Winter Storm Avery	126,314,611
	Totals	**1,960,381**	**Totals**	**2,660,824,314**

Table 3D – 2017 Major Events

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	5/27/2017	1,015	Squirrel	77,248
Citizens	7/3/2017	1,411	Squirrel	84,660
Citizens	7/4/2017	1,411	Squirrel	126,990
Citizens	9/30/2017	6,995	Wind	83,832
Penelec	5/1/2017	95,607	Rain and high winds	74,396,630
Penelec	7/23/2017	1,111	Flood waters	513,839
Penn Power	3/8/2017	16,557	Snow and wind	5,402,116
Penn Power	11/5/2017	19,298	Thunder Storm and wind	3,493,432
Pike	2/13/2017	786	Snow and wind	55,432
Wellsboro	5/6/2017	6,341	Substation bus insulator failure	1,166,744
West Penn	5/1/2017	77,458	Thunderstorms and high winds	45,309,142
West Penn	6/23/2017	1,665	Flood waters	1,745,883
West Penn	7/28/2017	3,748	Flood waters	2,568,850
	Totals	**233,403**	**Totals**	**135,024,798**

Table 3E – 2016 Major Events

EDC	Date	Customers Affected	Cause	Total Customer Minutes Interrupted
Citizens	3/30/2016	1,409	Three phase polymer insulator failed	132,895
Citizens	11/8/2016	1,008	homeowner cut down tree into line	41,468
Citizens	11/19/2016	1,833	Rain and high winds	248,388
Penelec	11/2/2016	1,794	Flash Flood near Ralston	1,804,107
Pike County	2/16/2016	1,795	Mylar baloons caught in power line	10,770
Pike County	2/24/2016	1,067	Rain and high winds	185,055
Pike County	8/13/2016	627	Rain and high winds	474,908
Pike County	9/19/2016	2,518	Motor vehicle hit utility pole	1,476,882
Wellsboro	4/3/2016	2,015	Rain and high winds	362,700
Wellsboro	8/8/2016	897	Bear in conductors	56,511
Wellsboro	12/26/2016	6,097	Transmission line failure	1,195,012
	Totals	**21,060**	**Totals**	**5,988,696**

Review of Long-Duration Outage Events

There were two long-duration outage events (those with outages lasting six or more days) in 2020. There was also a high-impact event that was restored within four days. A description for each event is listed below.

- A "Derecho" high wind event caused a total of 559,076 customer outages in three EDC territories on June 3, 2020. As a result of the Derecho, PECO had a long-duration event with 456,480 outages and final PECO restoration occurred on June 9, 2020.[31]
- Hurricane Isaias caused a total of 577,546 customer outages in 3 EDC territories on August 4, 2020. As a result of the hurricane, PECO had a long-duration event with final restoration occurring on Aug. 10, 2021. The storm caused PECO to have the 3rd most outages in their history at 404,363.
- A rain and windstorm event on Nov. 15, 2020, caused over 302,367 customer outages in and impacted the service territories of 7 EDCs. Most customers were restored within the first 48 hours and the last customer was restored on Nov. 18, 2020.

Section 4 –EDC Reliability Performance Data

Statewide Summary

Rolling 12-month Benchmark Performance Compliance

The 2020 end of year reliability data for **12-month CAIDI, SADI, and SAIFI Benchmark performance compliance** submitted by the 11 EDCs indicates:

[31] Information on the Derecho may be found on the National Weather Service website here: https://www.weather.gov/phi/EventReview20200603.

- Four EDCs achieved the **CAIDI Benchmark**, while seven EDCs failed to achieve the CAIDI benchmark (Figure 1).
- Seven EDCs achieved the **SAIDI Benchmark**, while four EDCs failed to achieve the SAIDI benchmark (Figure 2).
- Eight EDCs achieved the **SAIFI Benchmark**, while three EDCs failed to achieve the SAIFI benchmark (Figure 3).

Figure 1 – 2020 CAIDI Comparison (percent above or below benchmark)

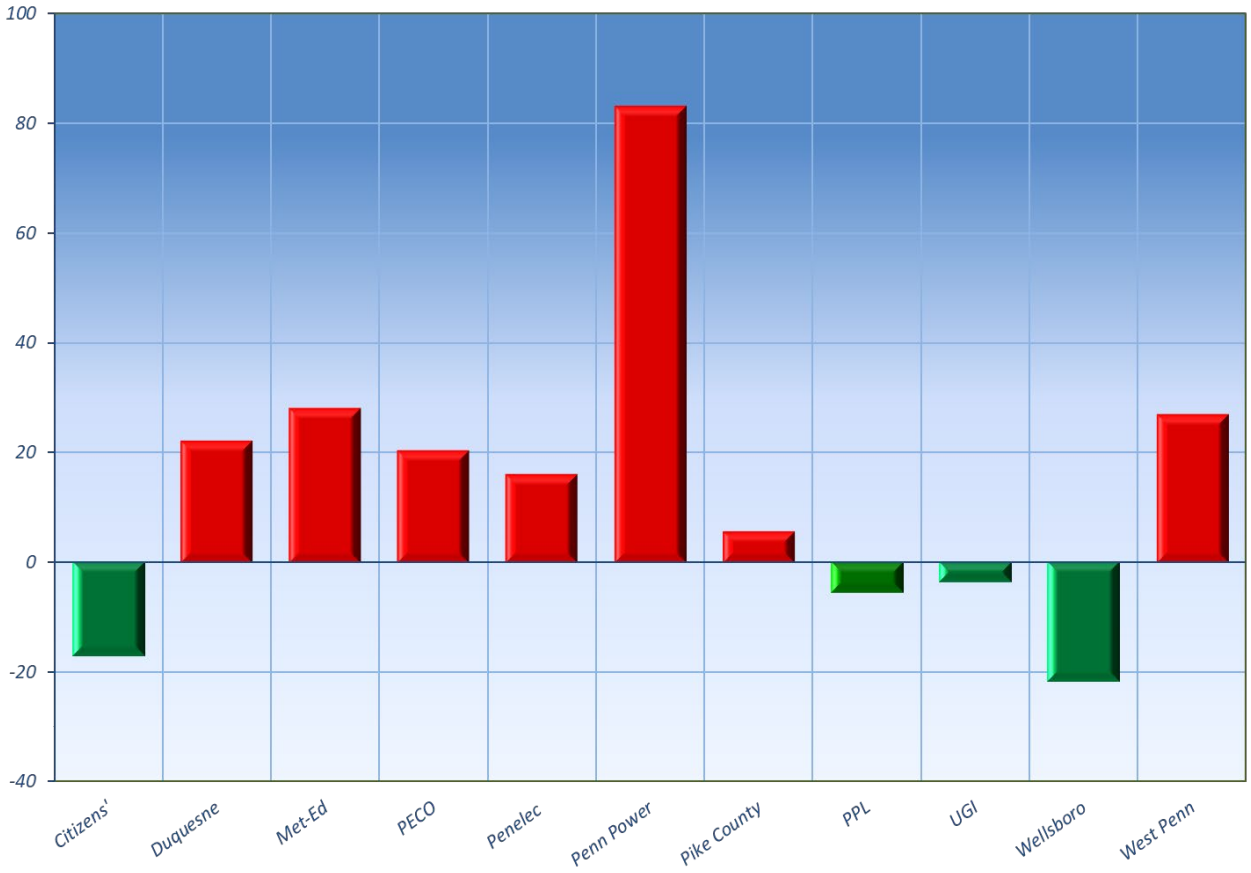
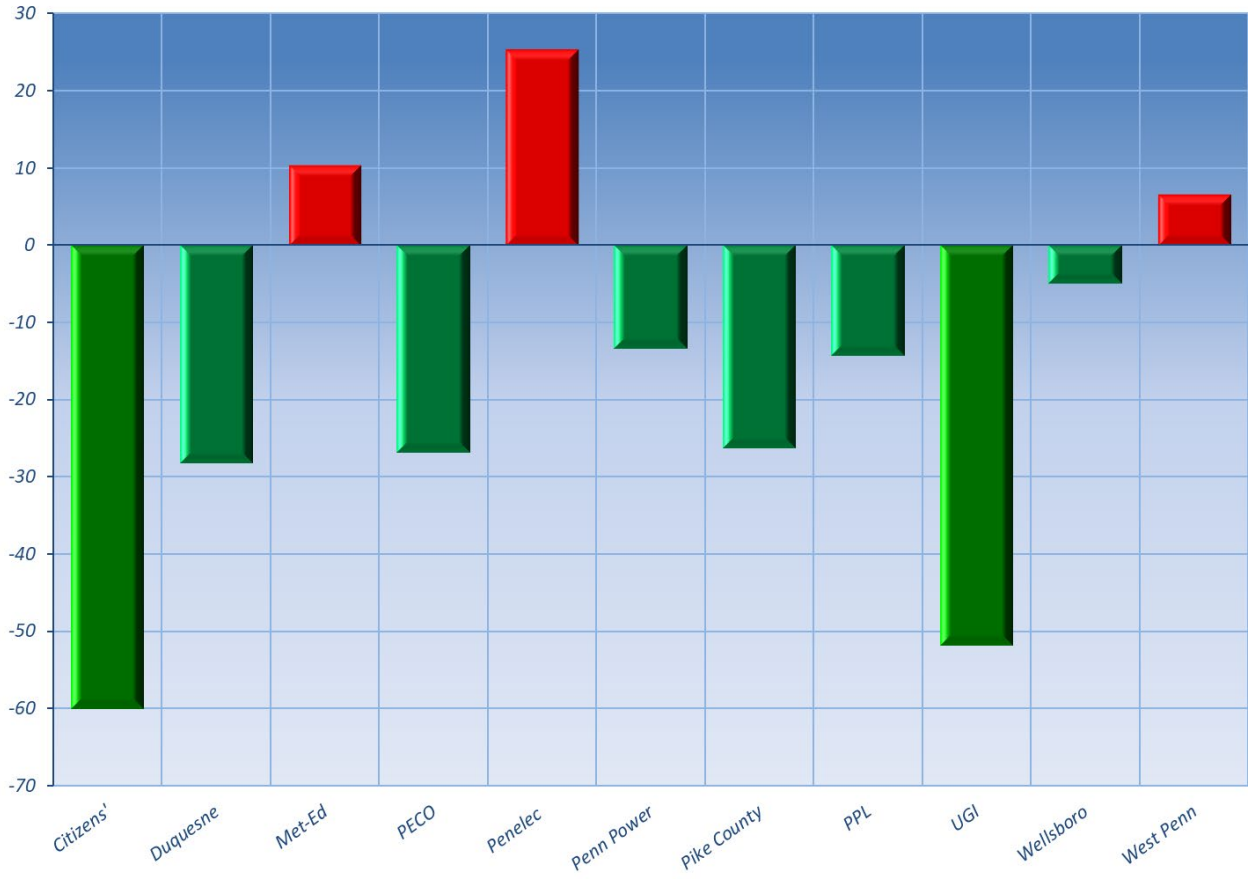


Figure 2 – 2019 SAIDI Comparison (percent above or below benchmark)

Figure 3 – 2019 SAIFI Comparison (percent above or below benchmark)



Rolling 3-year Average (2018-2020) Performance Compliance

Appendix A provides the 2020 results for the 12-month average and 3-year average reliability performance metrics for individual EDCs.

Six EDCs (Met-Ed, PECO, Penelec, Penn Power, Pike County, and PPL) failed to meet the rolling 3-year **CAIDI performance standard**.

Three EDCs (Met-Ed, Penelec, and West Penn) failed to meet the rolling 3-year **SAIFI performance standard**.

Three EDCs (Met-Ed, Penelec, and Penn Power) 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 3 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.

Duquesne Light Company

Duquesne Light Company (Duquesne) has a service territory of about 817 square miles with a well-developed distribution system serving about 590,000 customers.

In 2020, Duquesne experienced 6.4 million kilovolt-amps (kVA) customer interruptions and 857 million kVA-minutes of customer-minutes interrupted as compared to: 7.3 million kVA customer interruptions and 772 million kVA minutes of customer-minutes interrupted in 2019; 6.1 million kilovolt-amps customer interruptions and 647 million kVA-minutes of customer-minutes interrupted in 2018; 7.1 million kVA of customer interruptions and 813 million kVA-minutes of customer-minutes interrupted in 2017; and 5 million kVA of customer interruptions and 497 million kVA-minutes of customer-minutes interrupted in 2016. (Note these numbers exclude major events)

Duquesne experienced one Major Event on April 8, 2020, where Duquesne customers experienced a loss of 298 million kVA-minutes of customer-minutes interrupted not included in the total above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 106 minutes in 2019 to 132 minutes in 2020; failed to achieve benchmark by 22%.

3-year average: Increased from 109 minutes in 2019 to 115 minutes in 2020; achieved standard by 4%.

SAIDI

Rolling 12-month: Increased from 106 minutes in 2019 to 111 minutes in 2020; achieved benchmark by 12%.

3-year average: Remained unchanged at 102 minutes in 2020; achieved standard by 33%.

SAIFI

Rolling 12-month: Decreased from 1.01 outages in 2019 to 0.84 outages in 2020; achieved benchmark by 28%.

3-year average: Decreased from 0.94 outages in 2019 to 0.90 outages in 2020; achieved standard by 31%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 4 and 5. Duquesne's CAIDI performance has improved the past three years, as seen in Figure 4, but has significantly declined for 2020. Management should continue to work to sustain the trend line below the "green" benchmark performance upper-control-limit-line for CAIDI.

Beginning in December 2004, Duquesne's SAIFI benchmark performance trend has been positive, as shown in Figure 5. This positive performance trend, below the benchmark performance upper-control-limit-line, has been sustained since 2004 by Duquesne, and is considered under control. Duquesne is considered an excellent SAIFI benchmark performer.

Outage Causes

Figure 6 shows the reported 2020 outage-cause categories, 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 customer-minutes (KVA minutes) interrupted. Over 30% of outages are caused by Trees (outside ROW).

Figure 7 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.

General Reliability

Duquesne notes that it continues its reliability management work programs and resilience storm hardening activities. Duquesne notes the following specific programs, procedures, and ongoing maintenance activities supporting its reliability efforts:

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

- Rights-of-Way Vegetation Management Maintenance Program, which has the goal of reducing tree and branch failures through proactive pruning and removal to manage proper clearances. Duquesne Light believes that this program will help reduce the frequency of outages by addressing targeted tree failure conditions that typically result in physical damage to our facilities.

- Duquesne has an all pulse-reclosing protection technology that has been implemented on some of its 23 kilovolt (kV) circuits. This technology eliminates traditional "hard reclosing," thereby making it easier and faster to conduct repairs and restore circuits to normal operation, enabling customers to be restored more quickly. Duquesne also notes that this technology reduces stress and damage on the entire circuit because the breaker is no longer required to trip, also contributing to the reduction in momentary outages to customers.

- Duquesne notes that 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. Duquesne notes that these meetings focus on the successes and failures 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.

Duquesne notes that it continues to implement its Commission-approved Long-Term Infrastructure Improvement Plan (LTIIP to accelerate its infrastructure program.[32] Duquesne also notes that in 2020, the Commission completed its periodic review of Duquesne Light's LTIIP, finding that the plan is "designed adequately to ensure and maintain safe, adequate, reasonable, and reliable service and that DLC has substantially adhered to its plan."[33]

Conclusion

Trees and Equipment failures are the top 2 outage causes that substantially negatively affect electrical reliability to Duquesne customers and contributed to over 60% of the total lost customer-minutes interrupted (Duquesne uses kVA- minutes interrupted) in 2020, and does not include any lost customer-minutes caused by Major Events.

Trees, and especially off-right-of-way trees, continue to be a chronic problem for Duquesne, as well as every EDC in Pennsylvania. The ongoing reliability collaborative described in the Executive Summary will hopefully provide a venue to develop some mitigation solutions to this issue.

[32] *See Petition of Duquesne Light Company for Approval of its Long-Term Infrastructure Improvement Plan*, Order entered April 20, 2017, at Docket No. P-2016-2540046.
[33] *See Periodic Review of Duquesne Light Company's Long-Term Infrastructure Improvement Plan*, Order entered Oct. 29, 2020, at Docket No. M-2020-3019708.

Figure 4 Duquesne CAIDI (minutes)

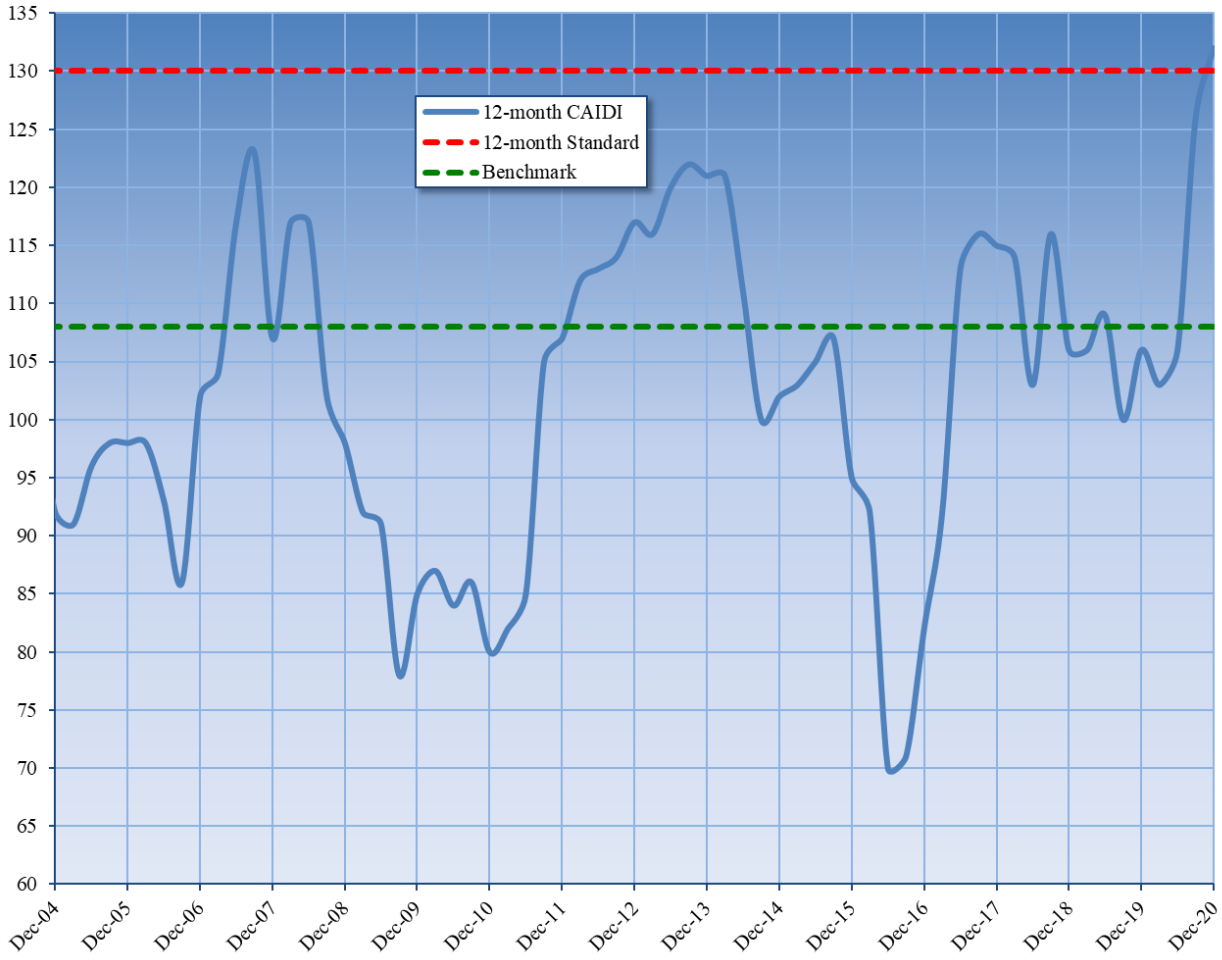


***Figure 5 Duquesne SAIFI (Interruptions Per Cus**tomers)*

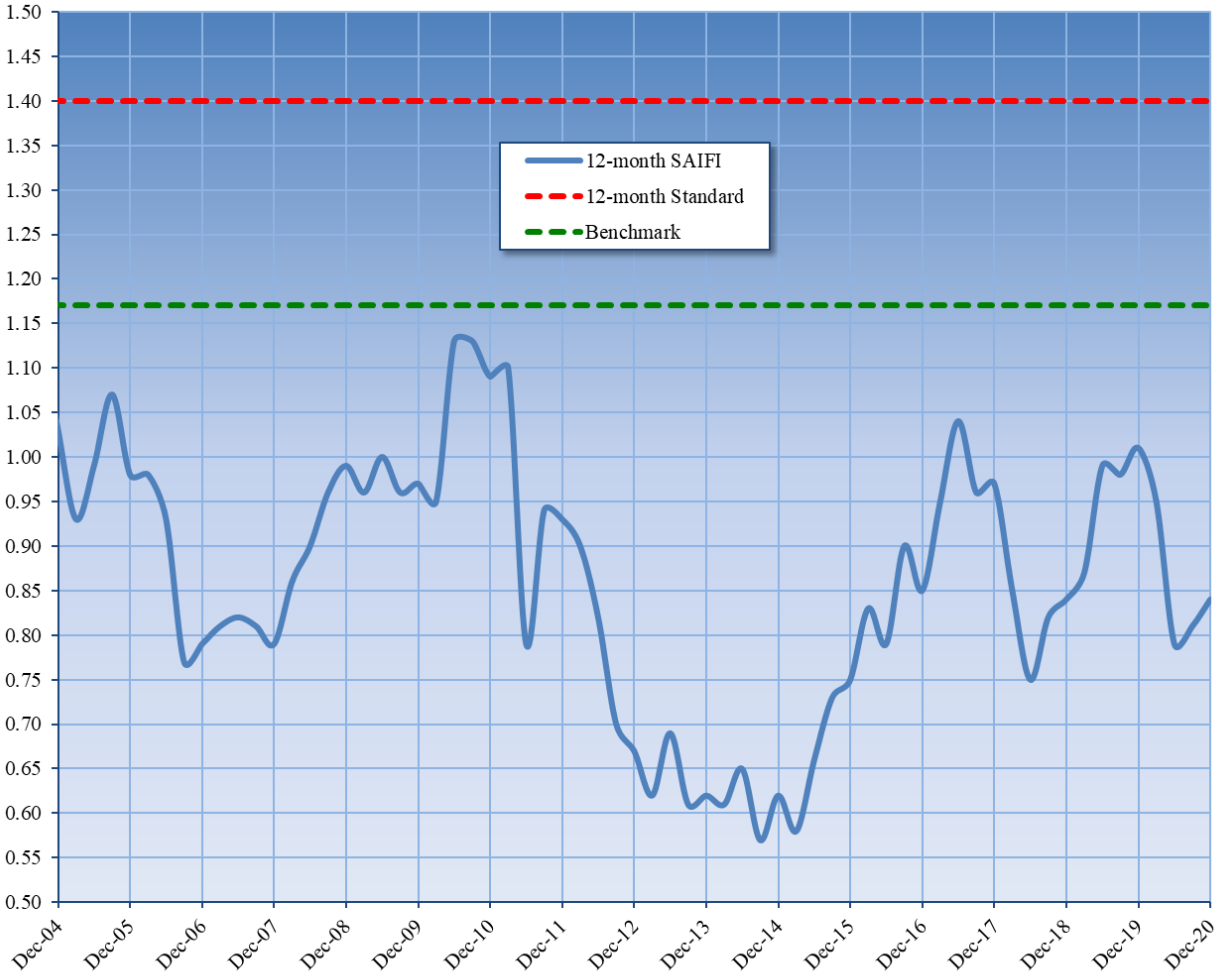


Figure 6 Duquesne Outage Causes (percent of total outages)

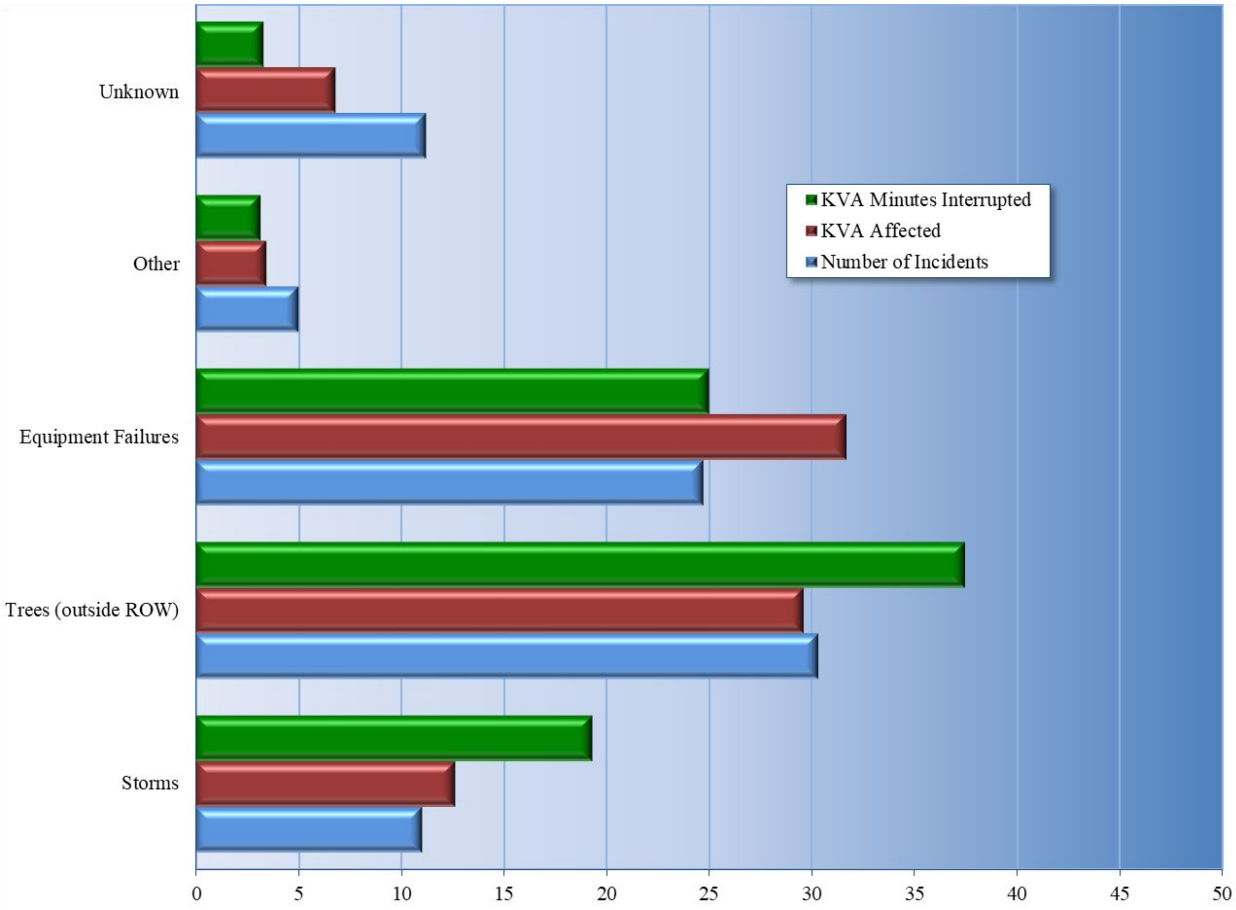
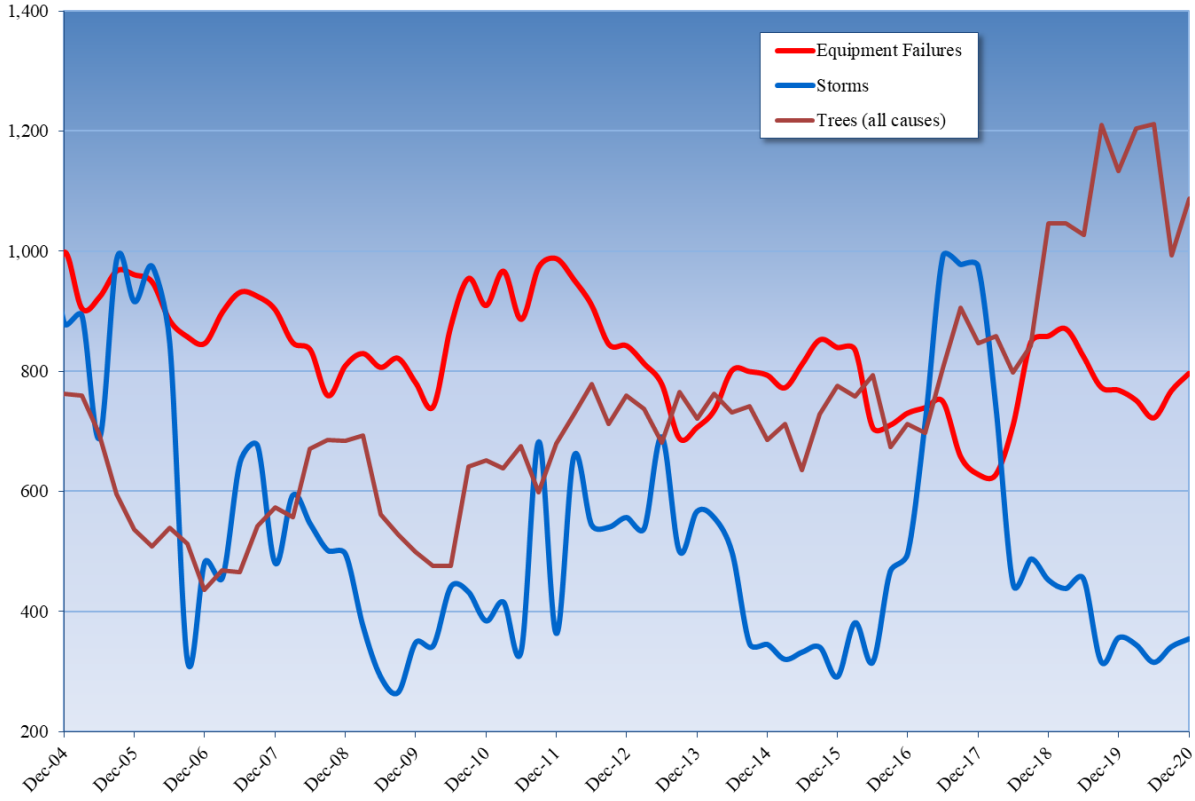


Figure 7 Duquesne Outage Tracking (number of incidents)



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 1.7 million customers.

In 2020, PECO experienced 1.51 million customer interruptions and 203 million customer-minutes interrupted as compared to: 1.80 million customer interruptions and 341 million customer-minutes interrupted in 2019; 1.59 million customers interruptions and 174.6 million customer-minutes interrupted in 2018; 1.35 million customer interruptions and 134.0 million customer-minutes interrupted in 2017; and 1.62 million customer interruptions and 171.6 million customer-minutes interrupted in 2016. (Note these numbers exclude major events.)

PECO experienced two Major Events in 2020 on June 3 and August 4. Each Major Event impacted over 400,000 customers, which are not included in the total above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 189 minutes in 2019 to 135 minutes in 2020; failed to achieve benchmark by 21%.

3-year average: Increased from 133 minutes in 2019 to 145 minutes in 2020; failed to achieve standard by 18%.

SAIDI

Rolling 12-month: Decreased from 205 minutes in 2019 to 122 minutes in 2020; achieved benchmark by 12%.

3-year average: Increased from 131 minutes in 2019 to 144 minutes in 2020; achieved standard by 14%.

SAIFI

Rolling 12-month: Decreased from 1.08 outages in 2019 to 0.90 outages in 2020; achieved benchmark by 27%.

3-year average: Increased from 0.96 outages in 2019 to 0.98 outages in 2020; achieved standard by 27%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 8 and 9. 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 performance spiked far above standard. PECO's CAIDI performance in 2020 was significantly better, but still slightly above the rolling 12-month Standard, and far above the rolling 12-month Benchmark. Management should continue to work on improving PECO's CAIDI performance in 2021.

Beginning with December 2012, PECO's SAIFI benchmark performance trend has been positive, as shown on the chart 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 achieved by PECO, and is considered under-control. PECO is considered an excellent SAIFI benchmark performer.

Outage Causes

Figure 10 shows the reported 2019 outage-cause categories, as a percentage, for the following 3 distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Tree-related issues (includes vegetation in-growth and vegetation broken/uprooted) were the top cause of customer-minutes interrupted and tied with equipment failure for the number of incidents. In terms of customers affected, the top cause was tree-related issues at approximately 44% and the second leading cause was equipment failure at approximately 35%.

Figure 11 shows historical trend of the top three main outage causes. Equipment failure and tree-related are the two most frequent outage causes that are significantly negatively affecting PECO's distribution system reliability and resilience, as well as nearly every EDC in Pennsylvania.

General Reliability

PECO notes that the total storm interruptions in 2019 and 2020 were elevated, which negatively impacted CAIDI. As part of its reliability program, PECO notes that in order to address tree-related issues it has a well-managed vegetation management program that protects the electric

facilities while respecting the beauty and environmental importance of the vegetation. In response to invasive insects that cause ash tree deaths, PECO notes that it has increased its rate of removal of ash trees under a dedicated mitigation program.

In 2020, PECO notes that it completed the execution of its System 2020 LTIIP, with additional capital investments to construct reliability-related improvements over the period 2016 through 2020 focused on storm hardening and resiliency, cable replacements, and substation retirements with related distribution system upgrades.[34] PECO notes that it is increasing and enhancing these investments in its 2021-2025 LTIIP II.[35] PECO also notes that it increased its investment in replacement of overhead components and infrastructure and underground cable, and in adding reclosers to its distribution system in the years 2018 through 2020.

PECO notes 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

Trees and Equipment Failures are the top two outage causes that substantially negatively affect electrical reliability to PECO customers. In 2020, trees and equipment failure outage causes contributed to over 85% of the total lost customer-minutes as compared to 82% in 2019.

PECO experienced over 21 ROEs from 2018 through 2020, which appear to have negatively impacted CAIDI in particular. PECO has sustained CAIDI and SAIFI benchmark performance beginning in 2011 and 2006, respectively, and is considered an excellent SAIFI benchmark performer. However, CAIDI performance requires continued management attention.

[34] *See Petition of PECO Energy Company for Approval of their Electric Long-Term Infrastructure Improvement Plan*, Order entered October 22, 2015, at Docket No. P-2015-2471423.
[35] *See Petition of PECO Energy Company for Approval of its Second Long-Term Infrastructure Improvement Plan for its Electric Operations,* Order entered November 19, 2020, at Docket No. P-2020-3020974.

Figure 8 PECO CAIDI (minutes)

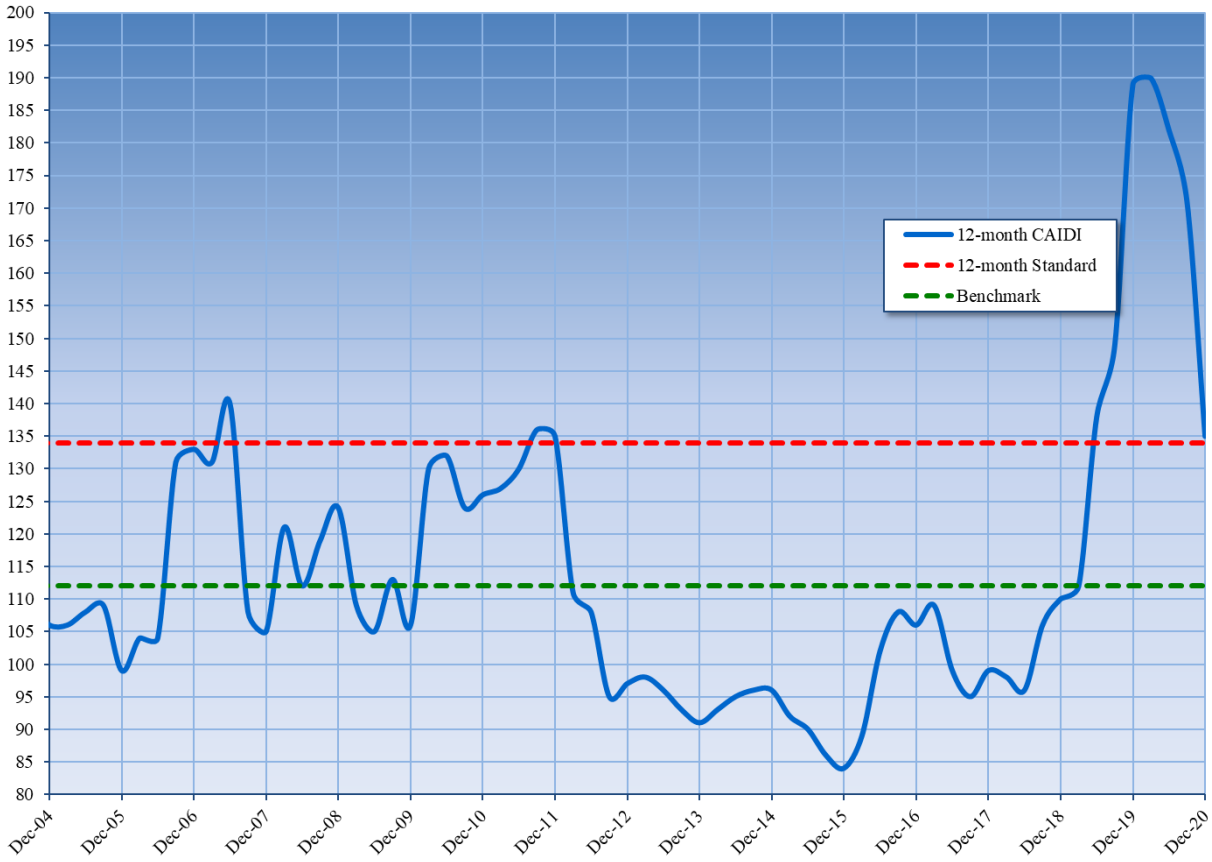


Figure 9 PECO SAIFI (interruptions per customer)

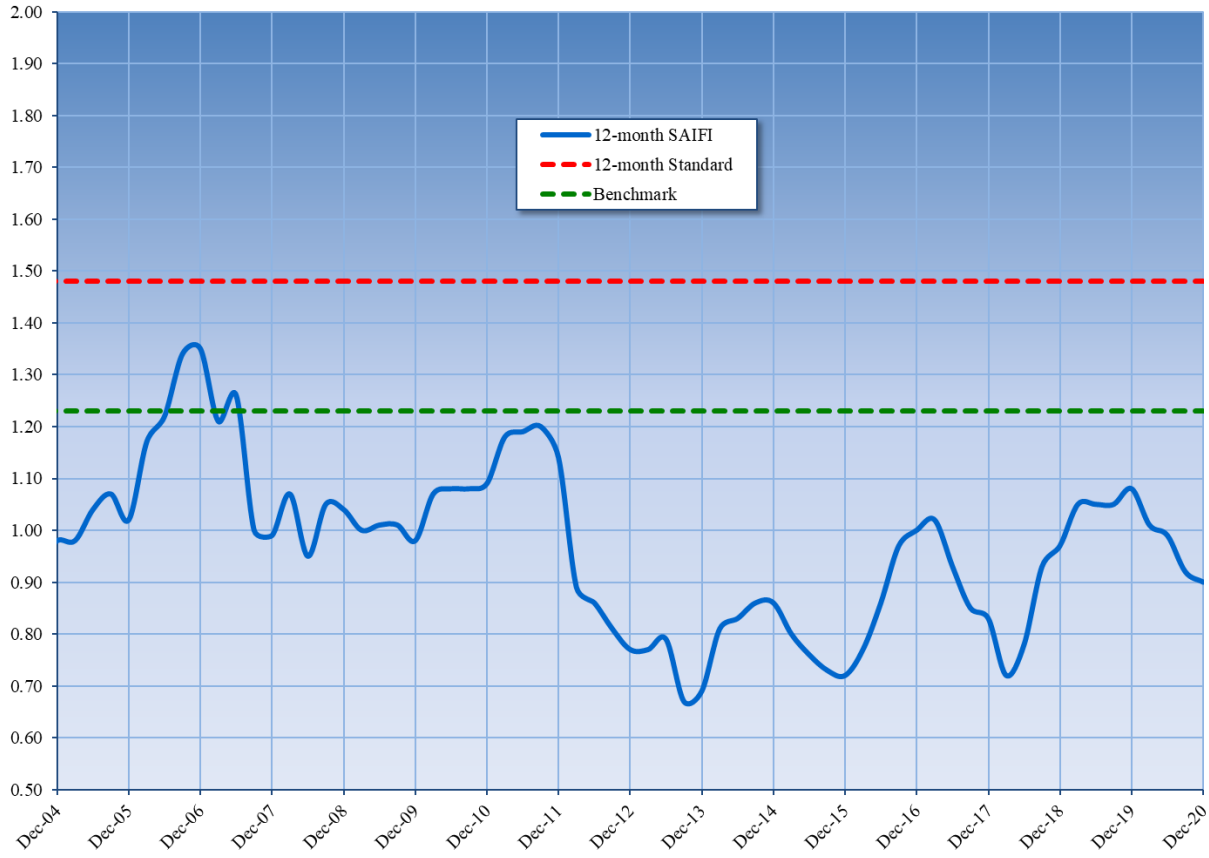


Figure 10 PECO Outage Causes (percent of total outages)

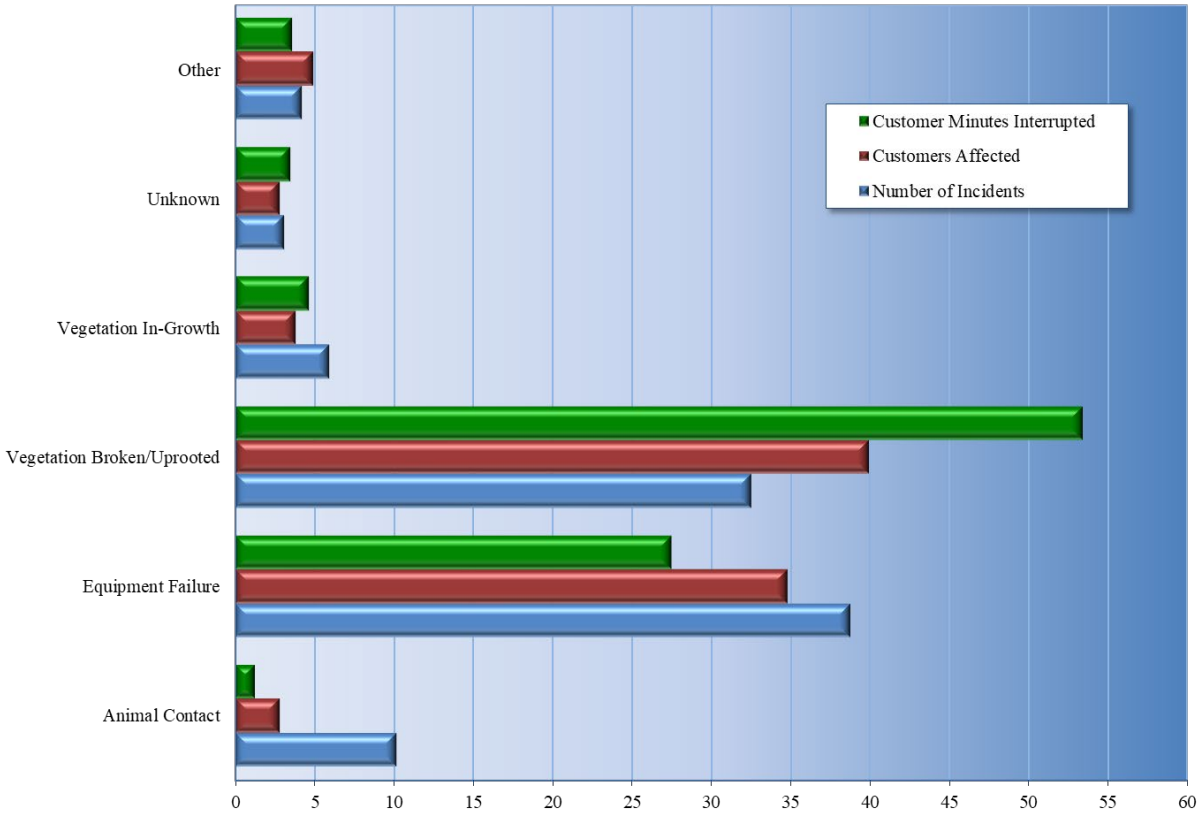
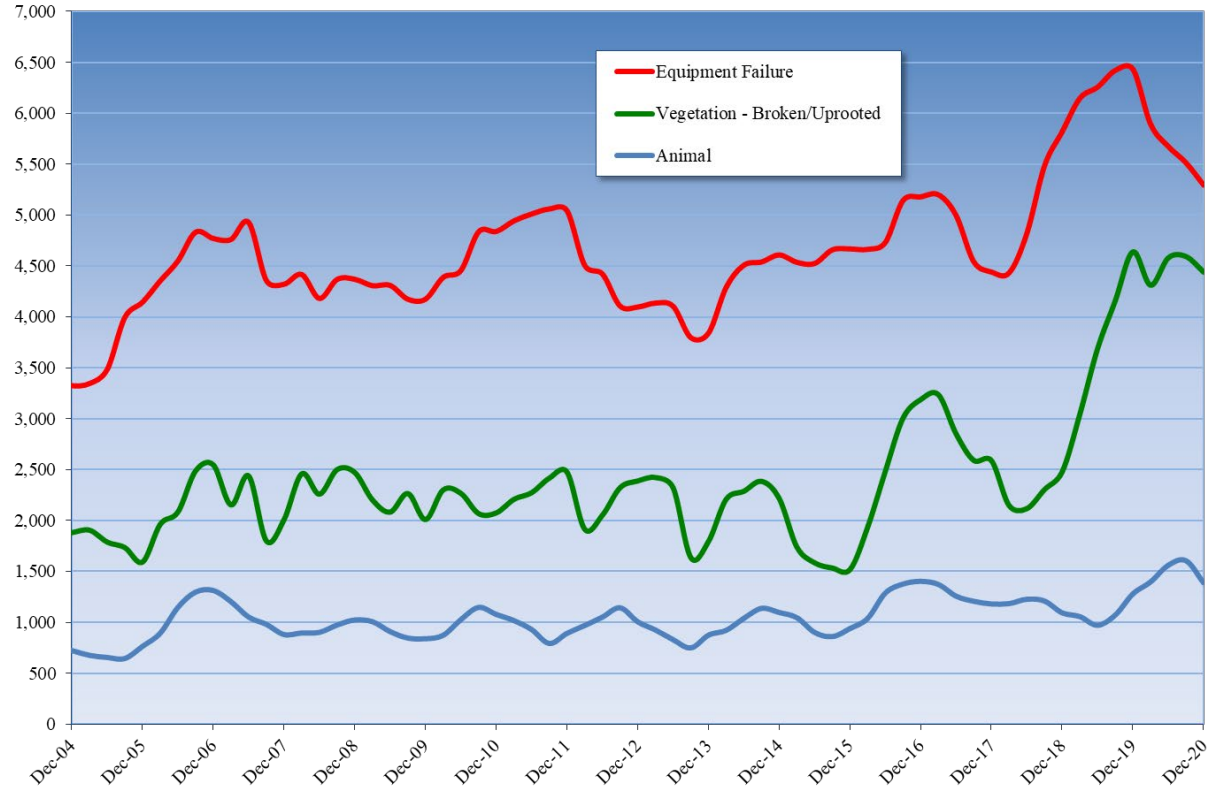


Figure 11 PECO Outage Tracking (number of incidents)



PPL Electric Utilities Corporation

PPL Electric Utilities Corporation (PPL) has a service territory of about 10,000 square miles and serves approximately 1.4 million customers.

In 2020, PPL experienced 1.2 million customers interruptions and 166.4 million customer-minutes interrupted as compared to: 1.2 million customer interruptions and 213.9 million customer-minutes interrupted in 2019; 1.2 million customer interruptions and 201.5 million customer-minutes interrupted in 2018; 1 million customer interruptions and 147.2 million customer-minutes interrupted in 2017; and 1.1 million customer interruptions and 132.9 million customer-minutes interrupted in 2016. (Note these numbers exclude major events.)

PPL did not experience a Major Event in 2020.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 176 minutes in 2019 to 137 minutes in 2020; achieved benchmark by 6%.

3-year average: Decreased from 163 minutes in 2019 to 160 minutes in 2020; failed achieve standard by less than 1%.

SAIDI

Rolling 12-month: Decreased from 150 minutes in 2019 to 116 minutes in 2020; achieved benchmark by 18%.

3-year average: Increased from 132 minutes in 2019 to 136 minutes in 2020; achieved standard by 21%.

SAIFI

Rolling 12-month: Decreased from 0.85 outages in 2019 to 0.84 outages in 2020; achieved benchmark by 14%.

3-year average: Increased from 0.80 outages in 2019 to 0.84 outages in 2020; achieved standard by 22%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 12 and 13. Beginning in 2004, PPL's CAIDI performance trend has been erratic, but PPL's CAIDI for 2020 was below both the benchmark and standard upper-control-limit-lines. It appears management should continue its on CAIDI performance to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Beginning in December 2013, PPL's SAIFI benchmark performance trend has been positive, as shown on the chart 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 PPL, and is considered under control. PPL is considered an excellent SAIFI benchmark performer.

Outage Causes

Figure 14 shows the reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Trees were the top cause of outages and customer-minutes interrupted. Over 42% of outages are caused by trees, and 26% are caused by equipment failure.

Figure 15 shows the historical trend of the top three main outage causes. Trees and equipment failure are the two most frequent outage causes that are significantly negatively affecting PPL's distribution system reliability and resilience, as well as every EDC in Pennsylvania.

General Reliability

PPL notes that in 2020 customers continued to experience top quartile industry reliability. PPL notes that its rolling 12-month SAIFI finished at 0.84, which was an improvement over 2019 and its best performance since 2017. PPL also notes its ongoing focus around preventing customer interruptions through system automation, vegetation management and asset performance continues to directly support overall strong reliability results, with over 200,000 customer outages eliminated in 2020 through automation. PPL states that this level of SAIFI performance is directly related to its high levels of customer satisfaction, with outages being reduced by 27% since 2011.

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

- Commitment to providing safe, reliable, affordable service to its customers.
- An extensive vegetation management program.
- Continued investment in distribution automation technology such as:
    - Multi and single-phase Smart Grid Initiative.
    - Increased leverage of PPL's Automated Distribution Management System (ADMS).
    - Full implementation of Fault Isolation and System Restoration (FISR) technology automatically restoring more than one 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.

PPL notes that its 2020 performance was achieved during a year of continued storm frequency and intensity. PPL notes that in 2020 it saw a recent peak of 27 total storms (eight of which were PUC ROEs), which is second only to the 28 events of 2006. PPL notes that the National Oceanic and Atmospheric Administration (NOAA) average severe wind gust magnitude for Pennsylvania was at the highest level since 2010.

In terms of CAIDI performance, PPL notes that the number of storms experienced in 2020 was consistent with the last four years of higher frequency and greater magnitude. PPL notes that this factor, along with the automated system design in preventing and converting outages to momentary interruptions, higher un-weather normalized CAIDI values are not unexpected. However, PPL notes that a number of initiatives have been put into place that have begun to improve CAIDI performance. These strategic areas include:

- Optimization of resource planning and scheduling through:
    - Increasing the impact of PPL's system first responders.
    - Setting Restore vs. Repair strategy.
    - Resource Strategy - balancing resources and outage volume.
    - Smart Dispatching.

- Leveraging technology investments – advanced metering infrastructure (AMI), automated distribution management system (ADMS), and Smart Grid.
- Resource Optimization.
- Storm Strategy.
- Leverage technology for quicker assessment.

Conclusion

Trees and Equipment Failures are the top two outage causes that negatively affect electrical reliability to PPL customers. In 2020, tree-related outages contributed to almost 65% of the total lost customer-minutes.

PPL's CAIDI performance is now below Benchmark. Management attention is required to sustain CAIDI performance below the "green" benchmark performance upper-control-limit-line. PPL has sustained SAIFI benchmark since 2012 and is considered an excellent SAIFI benchmark performer.

Figure 12 PPL CAIDI (minutes)

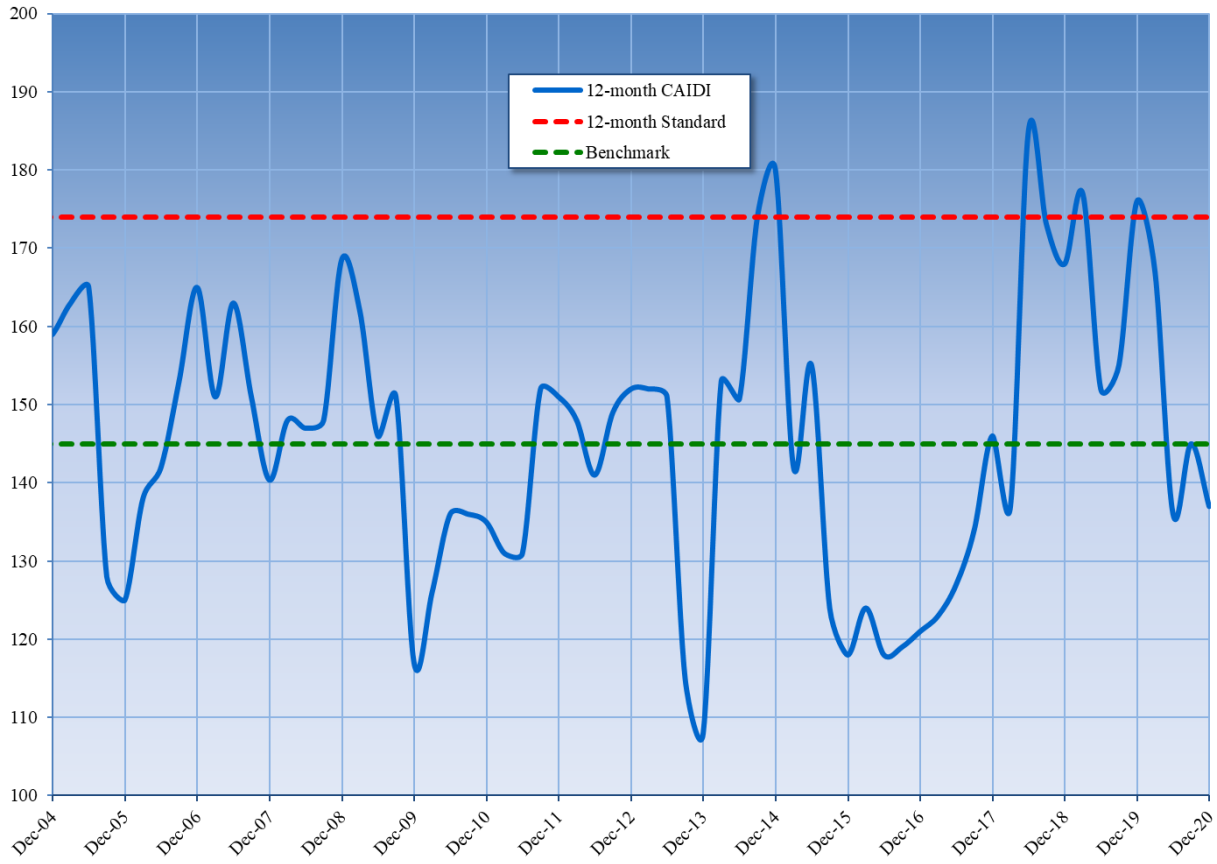


Figure 13 PPL SAIFI (interruptions per customer)

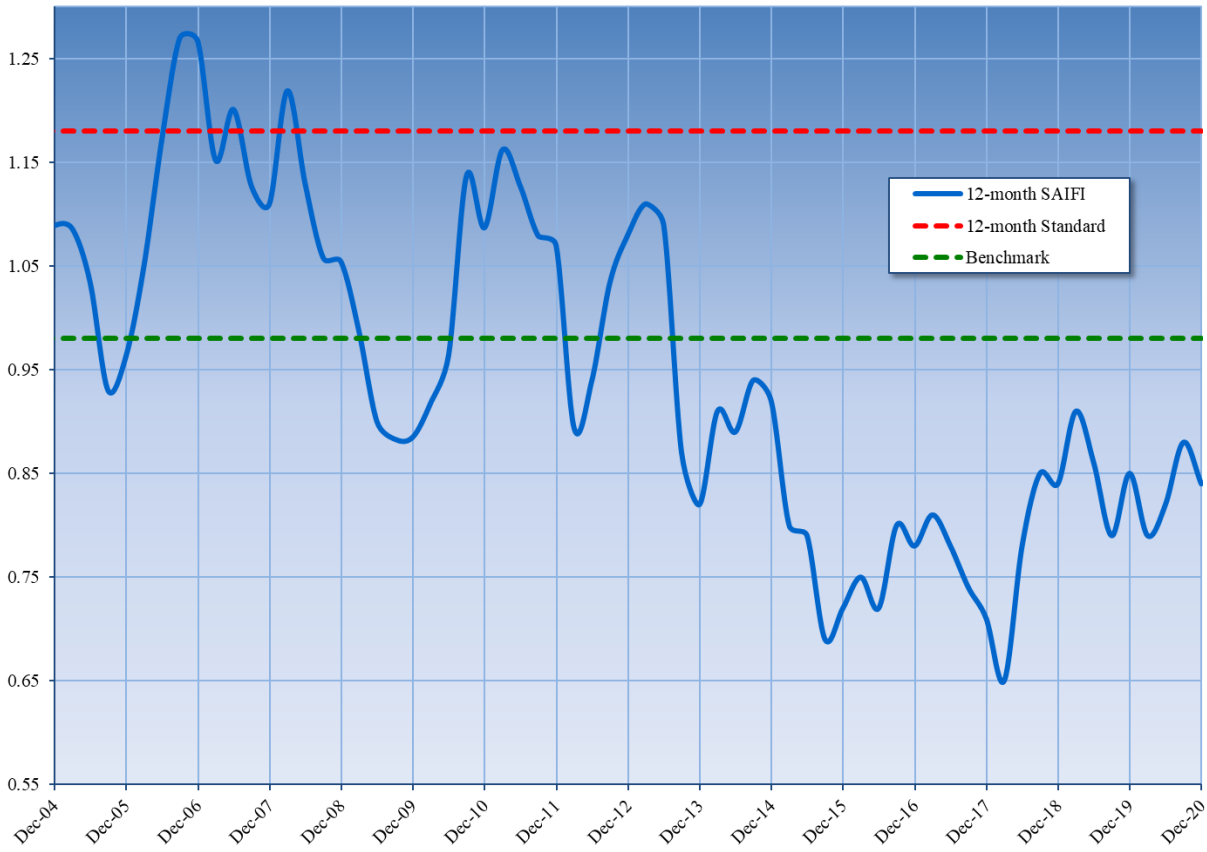


Figure 14 PPL Outage Causes (percent of total outages)

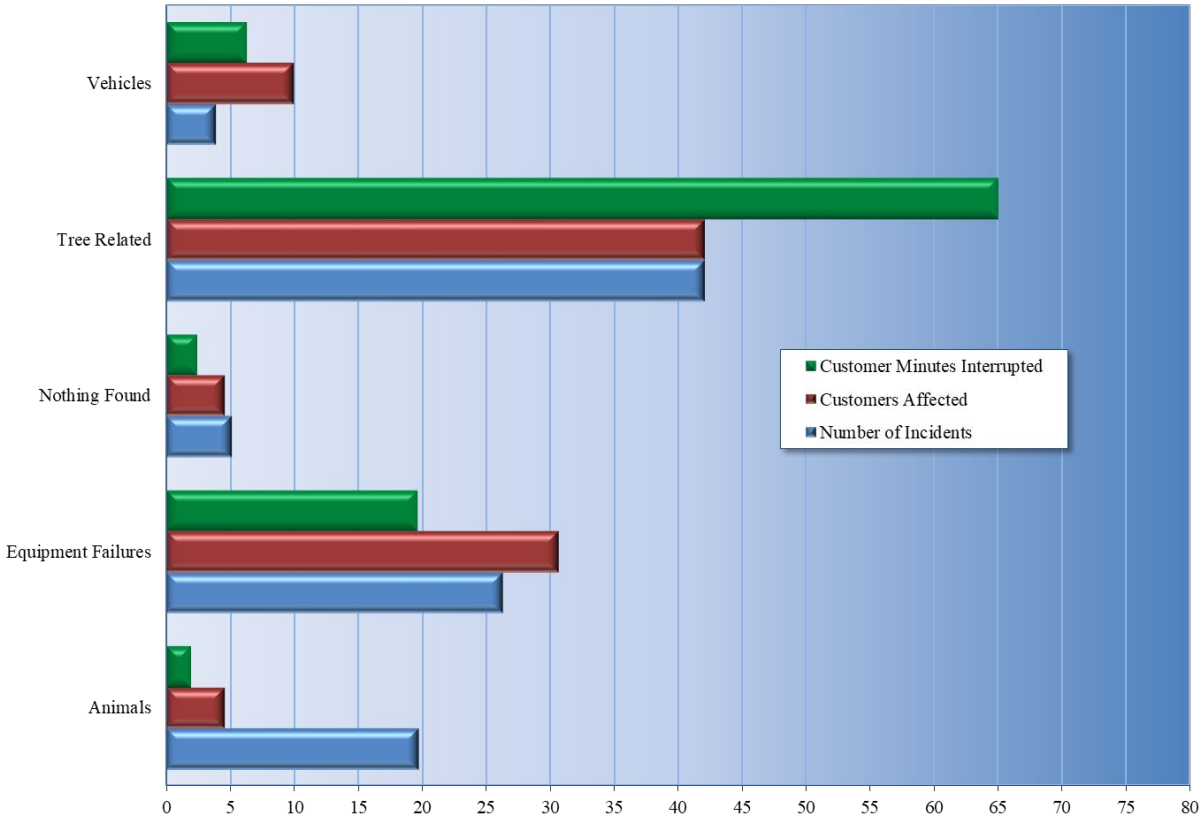
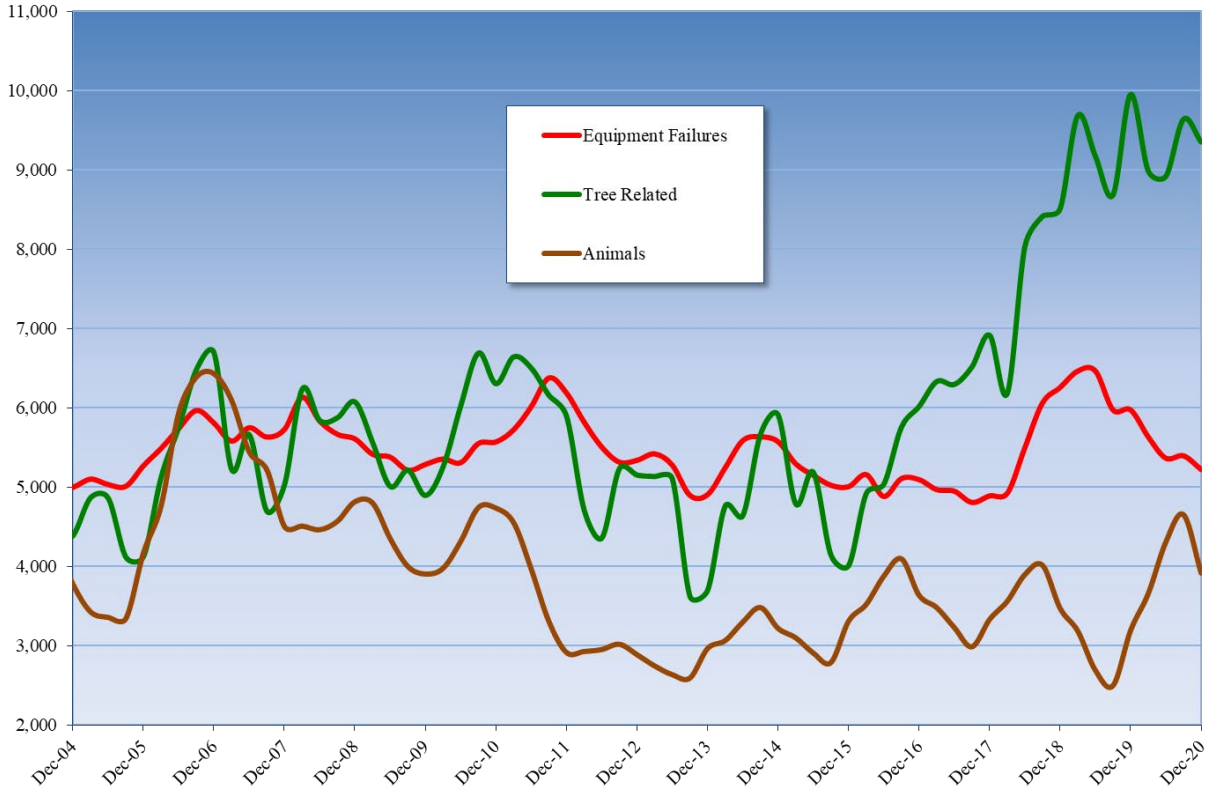


Figure 15 PPL Outage Tracking (number of incidents)



Metropolitan Edison Company

Metropolitan Edison Company (Met-Ed) has a service territory of about 3,300 square miles that serves about 569,900 customers.

In 2020, Met-Ed experienced 724,138 customer interruptions and 108.4 million customer-minutes interrupted as compared to: 874,452 customer interruptions and 143.3 million customer-minutes interrupted in 2019; 713,881 customer interruptions and 92.8 million customer-minutes interrupted in 2018; 827,461 customer interruptions and 121.9 million customer-minutes interrupted in 2017; and 804,947 customer interruptions and 99.6 million customer-minutes interrupted in 2016.

Met-Ed experienced two Major Events in 2020 on June 3 and August 4. Those Major Events impacted over 189,000 customers, which is not reflected in the totals above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 164 minutes in 2019 to 150 minutes in 2020; failed to achieve benchmark by 28%.

3-year average: Increased slightly from 147 minutes in 2019 to 148 minutes in 2020; failed to achieve standard by 15%.

SAIDI

Rolling 12-month: Decreased from 253 minutes in 2019 to 190 minutes in 2020; failed to achieve benchmark by 41%.

3-year average: Decreased from 212 minutes in 2019 to 203 minutes in 2020; failed to achieve standard by 24%.

SAIFI

Rolling 12-month: Decreased from 1.54 outages in 2019 to 1.27 outages in 2020; failed to achieve benchmark by 10%.

3-year average: Decreased from 1.43 outages in 2019 to 1.36 outages in 2020; failed to achieve standard by 7%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown on Figures 16 and 17. Beginning in 2004, Met-Ed 's CAIDI performance trend has been erratic, and from 2013 to present has been trending negative. While improved somewhat over 2019, Met-Ed's 2020 rolling 12-month CAIDI is above both benchmark and standard upper-control-limit-lines. It appears the CAIDI performance trend is outside of acceptable tolerances, and more management attention is needed to address the inconsistent CAIDI performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Beginning in 2004, Met-Ed 's SAIFI performance trend has been consistently outside of acceptable tolerances. From 2007 onward, the overall trend has been continually negative, except for a brief period in 2013-2014 when Met-Ed's performance was positive and below the "green" benchmark performance upper-control-limit-line. Met-Ed's SAIFI performance in 2020 was improved and its rolling 12-month SAIFI was below the "green" standard performance upper-control-limit-line, but still above the benchmark measure.

Outage Causes

Figure 18 shows the top reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Equipment failure (which includes line failure) and off right-of-way (ROW) trees were the top causes of outages, customers affected, and customer-minutes interrupted. About 66% of Customer-minutes Interrupted is caused by equipment failure and trees.

Figure 19 shows the historical trend of the top five main 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.

General Reliability

In 2016, Met-Ed started to execute LTIIP. This plan includes expenditures and programs designed to accelerate repairment, improvement or replacement of aging infrastructure in order to adequately maintain and improve the efficiency, safety, adequacy, and reliability of the distribution system. On Jan. 18, 2019, Met-Ed filed a Petition for Approval of Modification of its LTIIP in order to increase overall spending in the 2019 program year. The Petition was approved, as filed,

through an Order entered on May 23, 2019.[36] On Aug. 30, 2019, Met-Ed, along with the other FirstEnergy Companies (Penelec, Penn Power, and West Penn) filed petitions for second LTIIPs for the years 2020 through 2024. The petitions were approved through an Order entered on Jan. 16, 2020.[37]

The PUC has also been performing extra monitoring of Met-Ed's work management system and Reliability Improvement Plan (RIP) beginning in 2015 as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[38] Met-Ed's second LTIIP is designed to continue the reliability improvement efforts from the 2015 RIP.

Met-Ed notes while SAIFI and CAIDI are not at benchmark, improvement was seen in those measures from 2019 and Met-Ed believes the benefits of LTIIP work are coming to fruition and improvement is taking place.

Met-Ed notes that it employs various programs to strengthen the durability and flexibility of the electric system. Met-Ed notes that it utilizes core programs to support cost-effective and reliable service. These programs include, but are not limited to:

- Inspection and Maintenance (I&M) – Met-Ed notes that its I&M Practices are designed to assist the FirstEnergy Companies in determining the need for, and prioritization of, the repair or replacement of distribution system components and facilities.

- Vegetation Management

    - Routine cycle tree trimming removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes off right-of-way priority trees.

    - 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.

    - FirstEnergy has a program to proactively remove ash trees off ROW was implemented in response to damage caused by the Emerald Ash Borer.

    - 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.

[36] *See Petition of Metropolitan Edison Company for Approval of Modification of its Long-Term Infrastructure Improvement Plan*, at Docket No. P-2015-2508942.
[37] *See Petition of Metropolitan Edison Company for Approval of its Long-Term Infrastructure Improvement Plan,* at Docket No. P-2019-3012618.
[38] Final Order entered Nov 5, 2015, at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

- Customers Experiencing Multiple Interruptions (CEMI) – FirstEnergy's CEMI program is aimed to reduce frequent or repeated outages for affected clusters of customers or frequently operated devices.

- Load Forecasting and Distribution Planning – FirstEnergy's load forecasting application is used to estimate future substation and circuit loading based upon historical load data. 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 – FirstEnergy's 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 FirstEnergy companies first began to execute their respective LTIIP programs in 2016. In 2020, the Companies filed the Cost Effectiveness report at the completion of its first LTIIP. FirstEnergy's second LTIIPs span the period 2020 through 2024 and are focused on two areas: asset health and outage exposure. Asset health focuses on maintaining the system in a state of good repair while outage exposure focuses on minimizing the impact of customer outages.

- Minimizing Outage Impact – FirstEnergy notes that its companies incorporate 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 – all FirstEnergy companies perform an annual storm exercise. FirstEnergy notes 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.

- Smart Meters – the FirstEnergy Companies have completed mass deployment of smart meters to customers across Pennsylvania. 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 Companies to ping the meter to determine if a customer's service has been restored.

- Incident Command System (ICS) – the FirstEnergy Companies are 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, the Companies' incident response ability is improved, and reliability is enhanced by utilizing a common system for incident response personnel (both intrastate and interstate).

Conclusion

Trees and Equipment Failure are the top two outage causes that substantially negatively affect electrical reliability to Met-Ed customers. In 2020, the trees and equipment failure outage causes contributed to over 60% of the total lost customer-minutes and did not include any lost customer-minutes caused by Major Events.

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 standard and benchmark performance upper-control-limit-lines. Met-Ed's SAIFI was below standard and showed improvement from 2019, but continued 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. The Commission expects to see continuing improvement in reliability for the FirstEnergy Companies in 2021.

Figure 16 Met-Ed CAIDI (minutes)

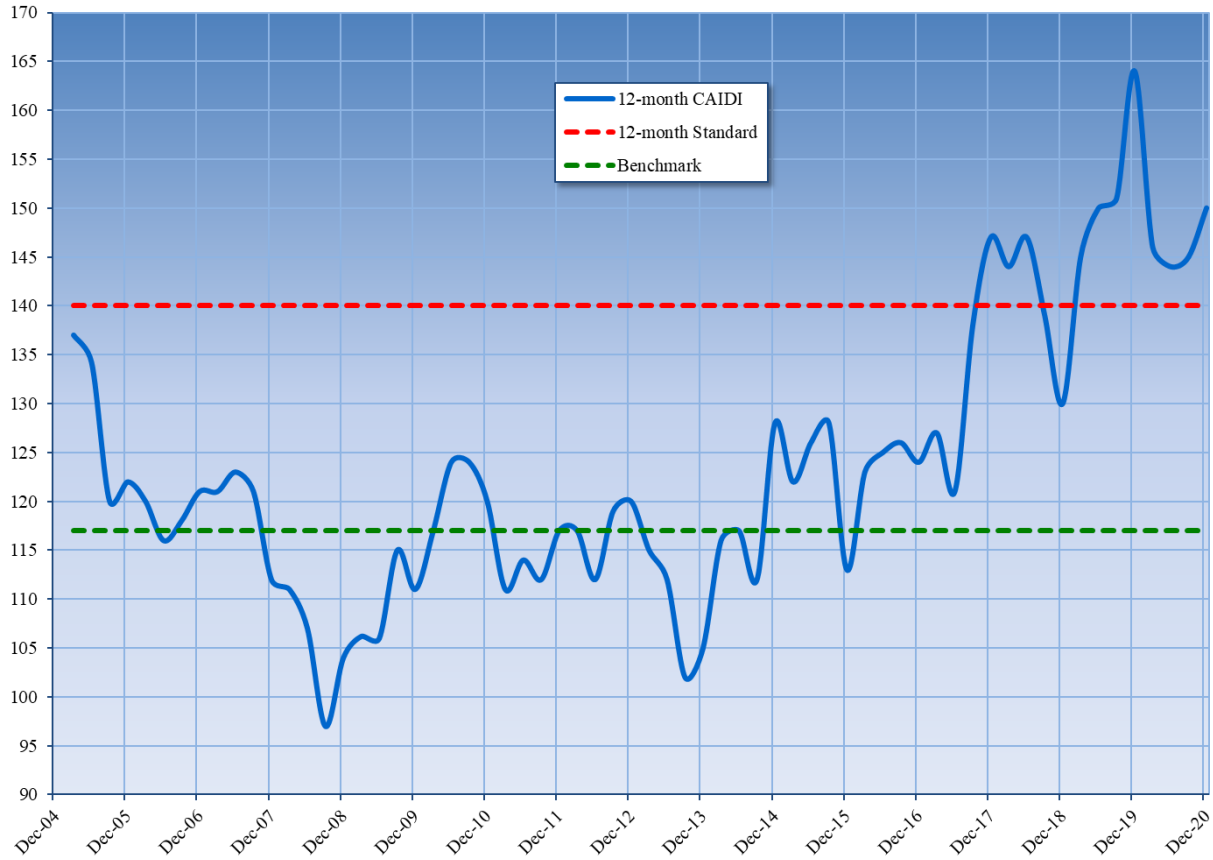


Figure 17 Met-Ed SAIFI (interruptions per customer)

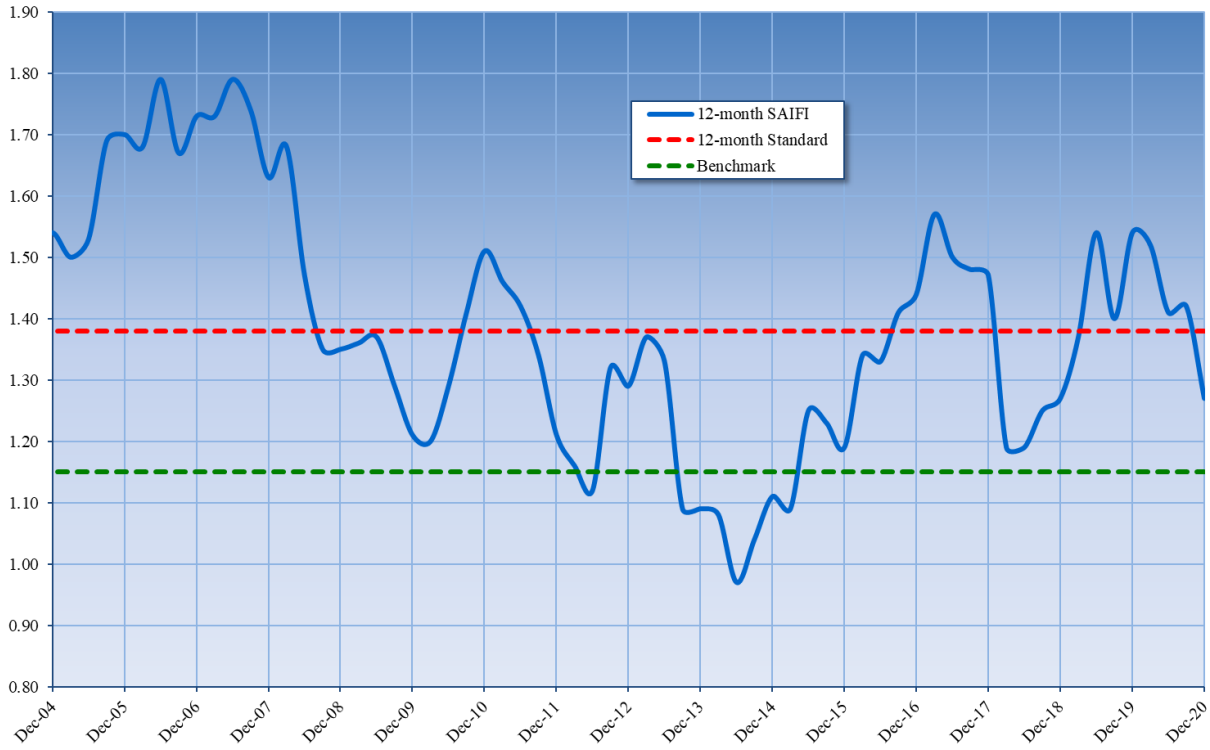


Figure 18 Met-Ed Outage Causes (percent of total outages)

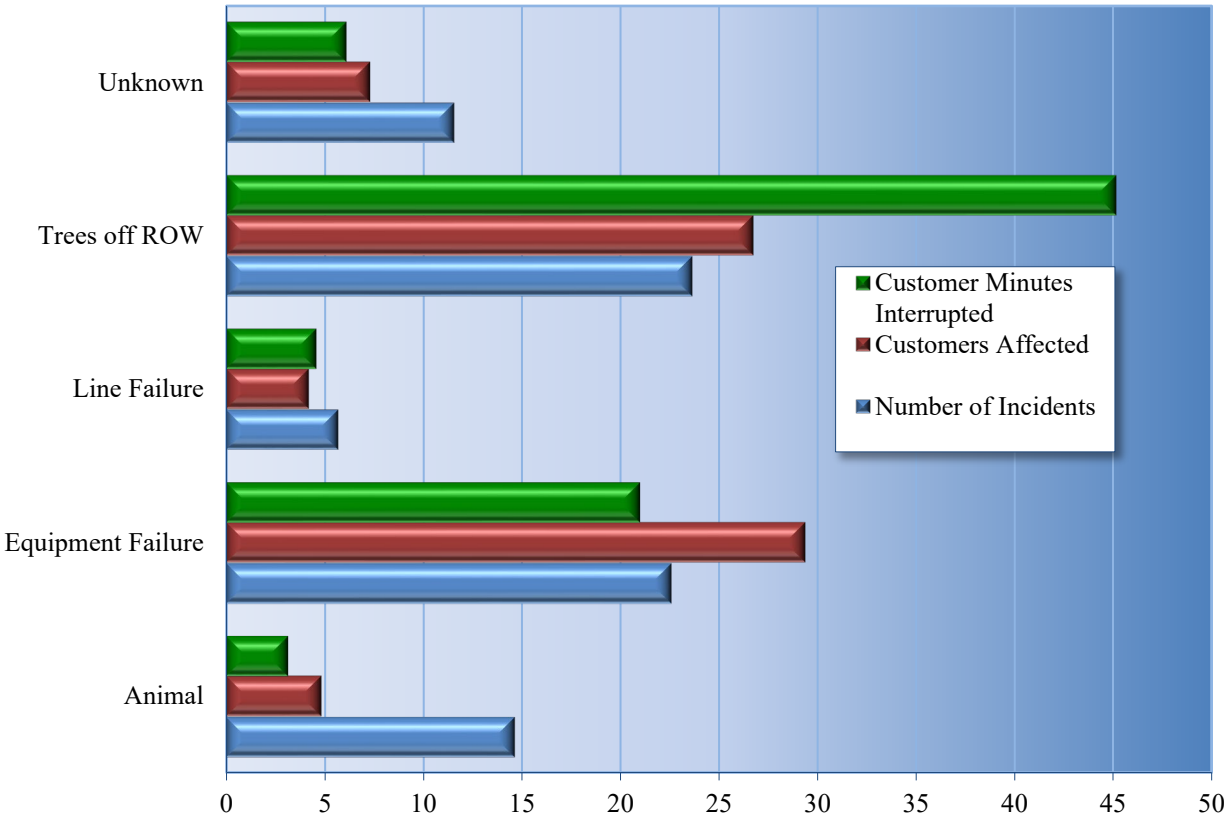
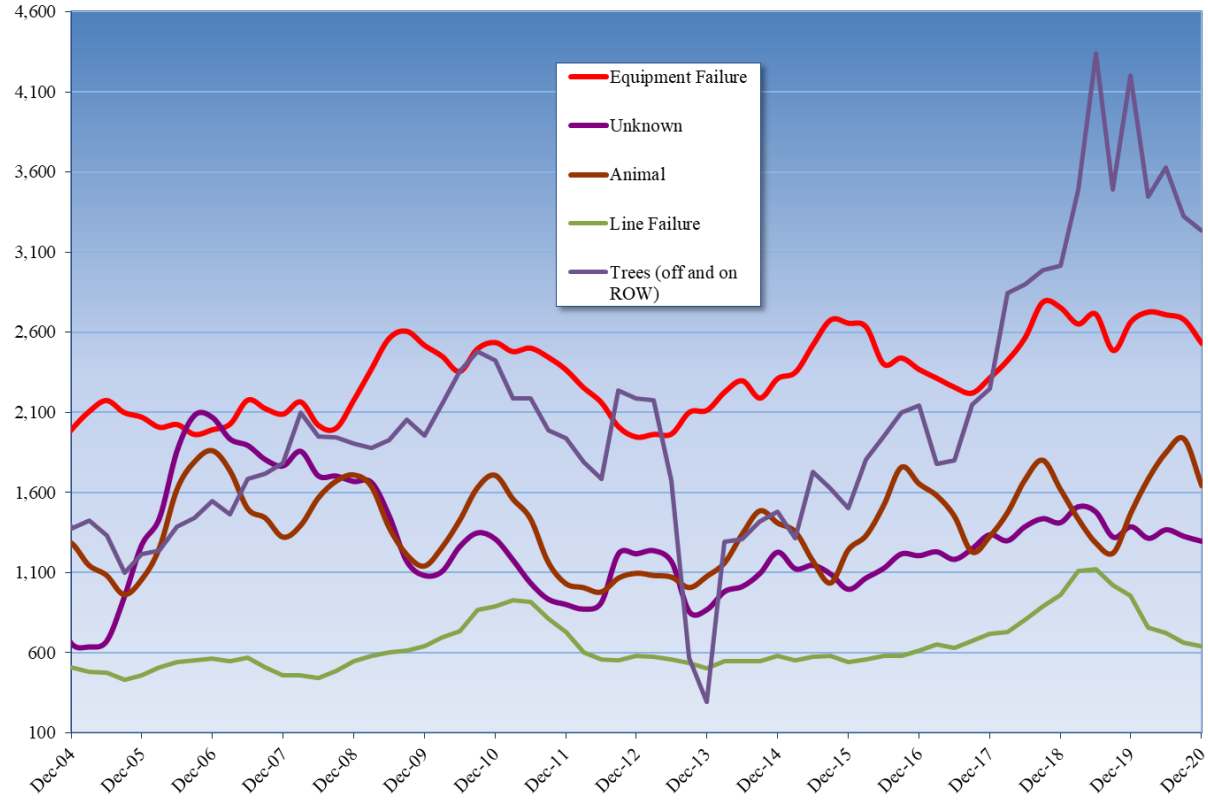


Figure 19 Met-Ed Outage Tracking (number of incidents)



Pennsylvania Electric Company

Pennsylvania Electric Company (Penelec) has a service territory of about 17,600 square miles serving approximately 580,000 customers.

In 2020, Penelec experienced 914,716 customer interruptions and 124.1 million customer-minutes interrupted as compared to 995,121 customer interruptions and 146.1 million customer-minutes interrupted in 2019; 992,756 customer interruptions and 113.1 million customer-minutes interrupted in 2018; 1 million customer interruptions and 138.5 million customer-minutes interrupted in 2017, and 833,315 customer interruptions and 99.6 million customer-minutes interrupted in 2016.

Penelec experienced one Major Event in 2020 on November 15. This Major Event impacted over 90,000 customers, which is not reflected in the total above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 147 minutes in 2019 to 136 minutes in 2020; failed to achieve benchmark by 16%.

3-year average: Decreased slightly from 133 minutes in 2019 to 132 minutes in 2020; failed to achieve standard by 3%.

SAIDI

Rolling 12-month: Decreased from 252 minutes in 2019 to 214 minutes in 2020; failed to achieve benchmark by 45%

3-year average: Decreased from 229 minutes in 2019 to 220 minutes in 2020; failed to achieve standard by 23%.

SAIFI

Rolling 12-month: Decreased from 1.72 outages in 2019 to 1.58 outages in 2020; failed to achieve benchmark by 25%.

3-year average: Decreased from 1.72 outages in 2019 to 1.67 outages in 2020; failed to achieve standard by 20%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 20 and 21. Beginning in 2004, Penelec's CAIDI performance trend has been inconsistent and frequently out of control. In 2020, Penelec's rolling 12-month CAIDI was below the standard performance upper-control-limit-line. However, CAIDI performance requires more management attention to address the inconsistent performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Beginning in 2004, Penelec's SAIFI performance trend has been inconsistent and frequently outside of acceptable tolerances. From 2004 through 2019, the overall trend has been continually trending negative. For the last four calendar years, Penelec's SAIFI was above both the benchmark and standard performance upper-control-limit-lines. It appears Penelec's overall SAIFI performance trend is outside of acceptable limits, and more management attention is needed to address the inconsistent SAIFI performance and to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 22 shows the top reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Equipment failure (which includes line failure) and off ROW trees were the top cause of outages, customers affected, and customer-minutes interrupted. Over 60% of customer minutes interrupted was caused by equipment failure and trees.

Figure 23 shows the historical trend of the top five main outage causes. Equipment failure and trees and are the two most frequent outage-causes that are significantly negatively affecting Penelec's distribution system reliability and resilience, as well as every EDC in Pennsylvania.

General Reliability

In 2016, Penelec started to execute its LTIIP. The LTIIP included expenditures and programs designed to accelerate repairment, improvement or replacement of aging infrastructure in order to adequately maintain and improve the efficiency, safety, adequacy, and reliability of the distribution system. On Jan. 18, 2019, Penelec filed a Petition for Approval of Modification of its Long-Term Infrastructure Improvement Plan in order to increase overall spending in the 2019 program year.

The Petition was approved, as filed, through an Order entered on May 23, 2019.[39] On Aug. 30, 2019, Penelec, along with the other FirstEnergy Companies (Met-Ed, Penn Power, and West Penn) filed petitions for second LTIIPs for the years 2020 through 2024. The petitions were approved through an Order entered on Jan. 16, 2020.[40]

The PUC also has been performing extra monitoring of Penelec's work management system and Reliability Improvement Plan (RIP) beginning in 2015 as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[41] Penelec's second LTIIP is designed to continue the reliability improvement efforts from the 2015 RIP.

Penelec notes while its rolling 12-month SAIFI and CAIDI are not at benchmark, improvement was seen in those measures from 2019 and Penelec believes the benefits of LTIIP work are coming to fruition and improvement is taking place.

Penelec notes that it employs various programs to strengthen the durability and flexibility of the electric system. Penelec notes that it utilizes core programs to support cost-effective and reliable service. These programs include, but are not limited to:

- Inspection and Maintenance (I&M) – Penelec notes that its I&M Practices are designed to assist the FirstEnergy Companies in determining the need for, and prioritization of, the repair or replacement of distribution system components and facilities.

- Vegetation Management

    - Routine cycle tree trimming removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes off right-of-way priority trees.

    - 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.

    - FirstEnergy has a program to proactively remove ash trees off ROW was implemented in response to damage caused by the Emerald Ash Borer.

    - 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.

[39] *See Petition of Pennsylvania Electric Company for Approval of Modification of its Long-Term Infrastructure Improvement Plan*, at Docket No. P-2015-2508936.
[40] *See Petition of Pennsylvania Electric Company for Approval of its Long-Term Infrastructure Improvement Plan* at Docket No. P-2019-3012615.
[41] Final Order entered Nov 5, 2015, at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

- Customers Experiencing Multiple Interruptions (CEMI) – FirstEnergy's CEMI program is aimed to reduce frequent or repeated outages for affected clusters of customers or frequently operated devices.

- Load Forecasting and Distribution Planning – FirstEnergy's load forecasting application is used to estimate future substation and circuit loading based upon historical load data. 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 – FirstEnergy's 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 FirstEnergy companies first began to execute their respective LTIIP programs in 2016. In 2020, the Companies filed the Cost Effectiveness report at the completion of its first LTIIP. FirstEnergy's second LTIIPs span the period 2020 through 2024 and are focused on two areas: asset health and outage exposure. Asset health focuses on maintaining the system in a state of good repair while outage exposure focuses on minimizing the impact of customer outages.

- Minimizing Outage Impact – FirstEnergy notes that its companies incorporate 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 – all FirstEnergy companies perform an annual storm exercise. FirstEnergy notes 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.

- Smart Meters – the FirstEnergy Companies have completed mass deployment of smart meters to customers across Pennsylvania. 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 Companies to ping the meter to determine if a customer's service has been restored.

- Incident Command System (ICS) – the FirstEnergy Companies are 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, the Companies' incident response ability is improved, and reliability is enhanced by utilizing a common system for incident response personnel (both intrastate and interstate).

Conclusion

Trees and Equipment Failure are the top two outage causes that negatively affect electrical reliability to Penelec customers. In 2019, trees and equipment failure outage causes contributed to over 60% of the total lost customer-minutes and does not include any lost customer-minutes caused by Major Events.

Beginning in 2004, Penelec's CADI and SAIFI benchmark performance has been erratic and frequently outside of acceptable tolerances. Penelec through its RIP and LTIIP will need to address the inconsistent CAIDI and SAIFI performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line. The Commission expects to see continuing improvement in reliability for the FirstEnergy Companies in 2021.

Figure 20 Penelec CAIDI (minutes)

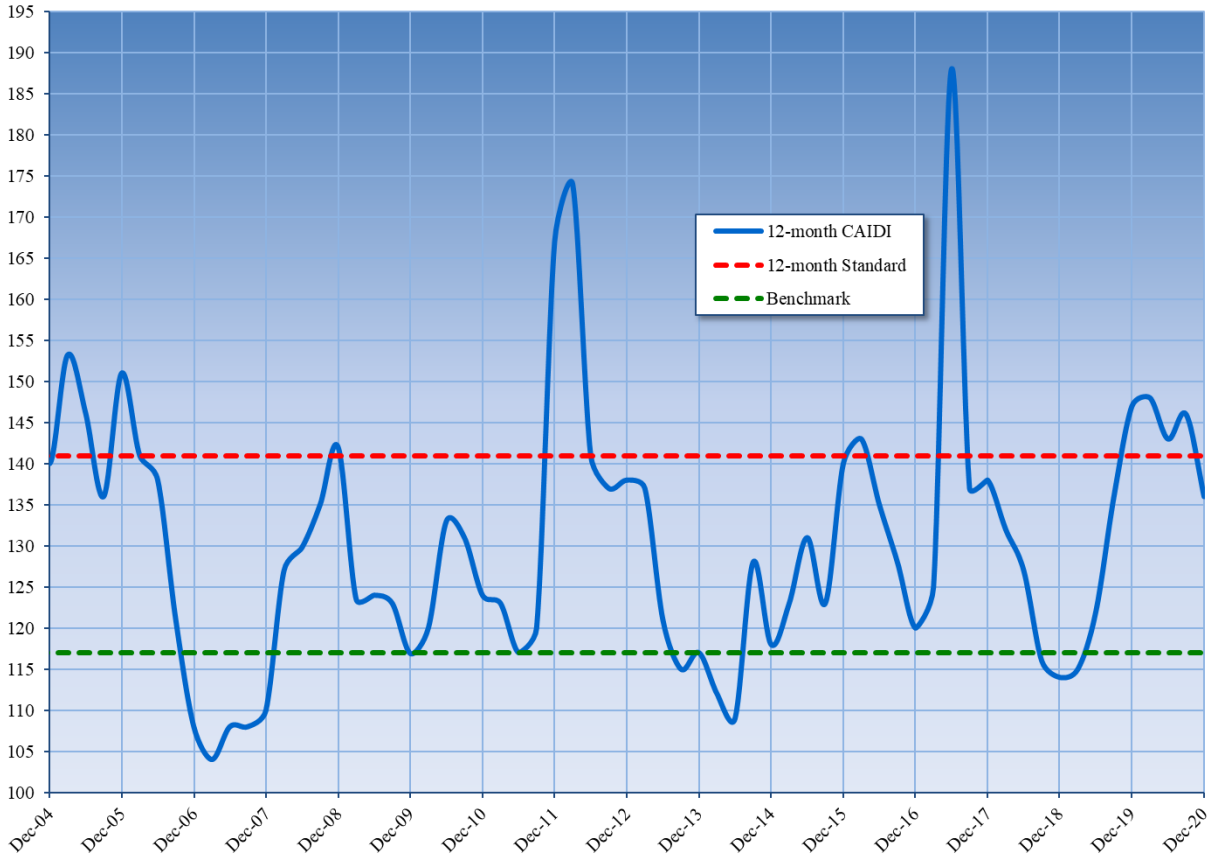


Figure 21 Penelec SAIFI (interruptions per customer)

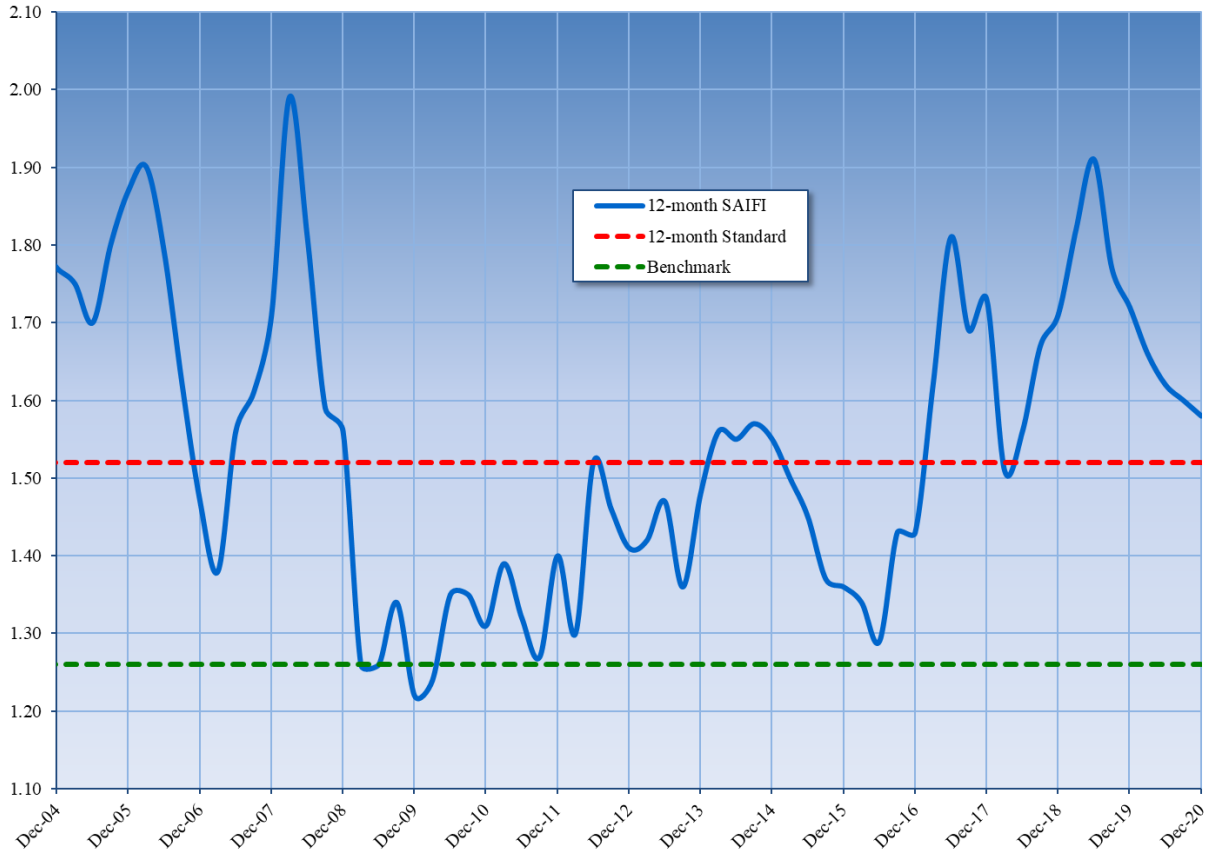


Figure 22 Penelec Outage Causes (percent of total outages)

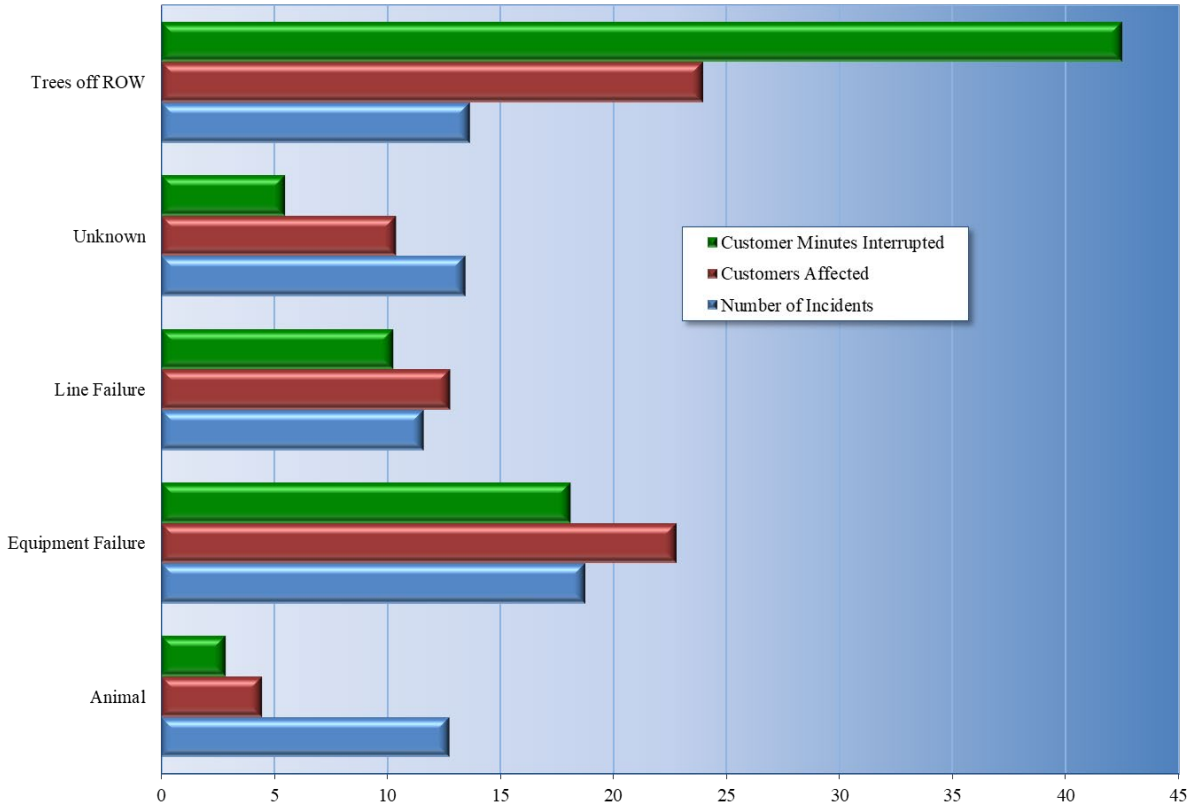
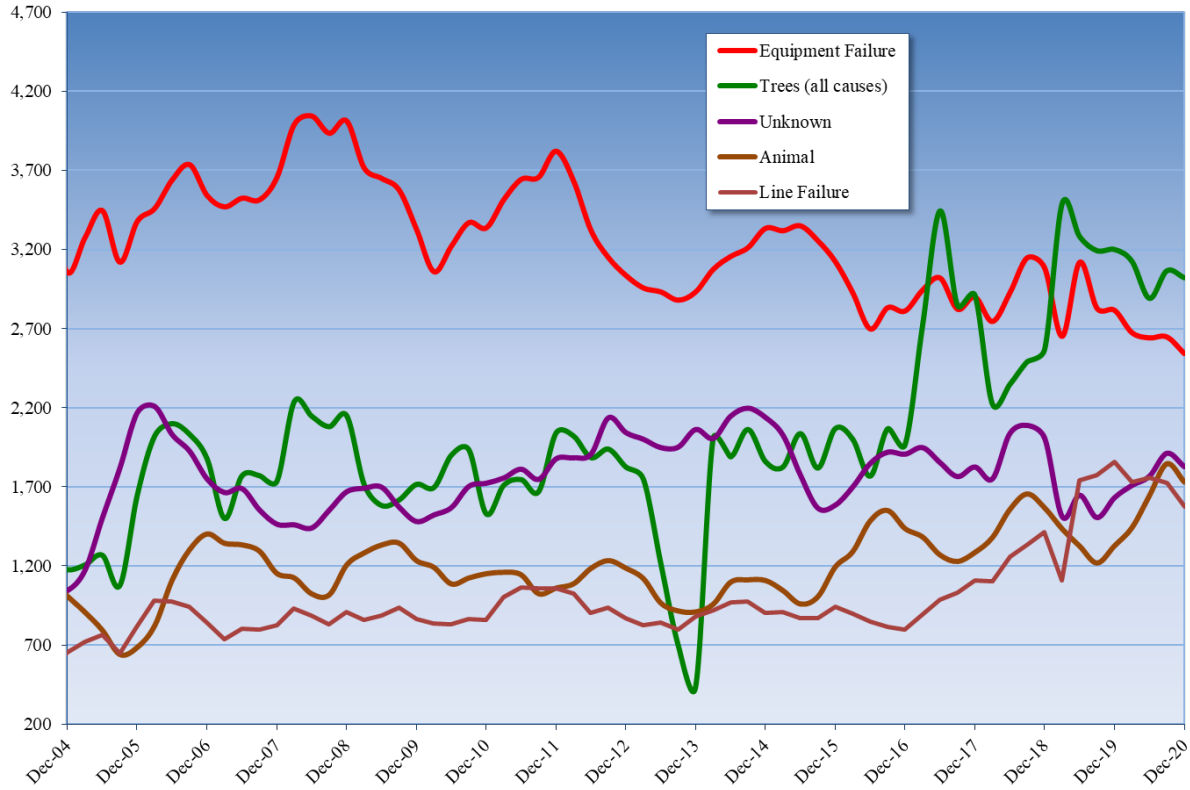


Figure 23 Penelec Outage Tracking (number of incidents)



Pennsylvania Power Company

Pennsylvania Power Company (Penn Power) has a service territory of about 1,100 square miles that serves approximately 165,230 customers.

In 2020, Penn Power experienced 159,907 customer interruptions and 29.6 million customer-minutes interrupted as compared to: 226,745 customer interruptions and 29.2 million customer-minutes interrupted in 2019; 180,247 customer interruptions and 113.1 million customer-minutes interrupted in 2018; 173,036 customer interruptions and 26 million customer-minutes interrupted in 2017; and 176,968 customer interruptions and 24.9 million customer-minutes interrupted in 2016.

Penn Power experienced no Major Events in 2020.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 129 minutes in 2019 to 185 minutes in 2020; failed to achieve benchmark by 83%.

3-year average: Increased from 139 minutes in 2019 to 151 minutes in 2020; failed to achieve standard by 36%.

SAIDI

Rolling 12-month: Increased from 178 minutes in 2019 to 179 minutes in 2020; failed to achieve benchmark by 58%.

3-year average: Increased from 163 minutes in 2019 to 170 minutes in 2020; failed to achieve standard by 25%.

SAIFI

Rolling 12-month: Decreased from 1.38 outages in 2019 to 0.97 outages in 2020; achieved benchmark by 13%.

3-year average: Decreased from 1.18 outages in 2019 to 1.15 outages in 2020; achieved standard by 7%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 24 and 25. Beginning in 2004, Penn Power's CAIDI performance trend has been inconsistent and frequently outside of acceptable tolerances. Penn Power's annual rolling 12-month CAIDI has been exceeding the "red" standard performance upper-control-limit-line for the past four years. More management attention is required to address the inconsistent CAIDI performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Penn Power's SAIFI performance for 2020 was greatly improved and below the benchmark upper-control-limit-line. More management attention is needed to ensure consistent SAIFI performance to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 26 shows the top reported 2019 outage-cause categories, as a percentage, for the following 3 distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Animals and Trees off ROW were the top cause of outages, customers affected, and customer-minutes interrupted. Over 60% of customer-minutes interrupted were caused by trees

Figure 27 shows historical trend of the top 4 main outage causes. Trees and Animal are the two most frequent causes of power outages for Penn Power. This is unique as almost all other EDCs have equipment failure and trees are the two most frequent outage-causes.

General Reliability

In 2016, Penn Power started to execute its LTIIP. This plan included expenditures and programs designed to accelerate repairment, improvement or replacement of aging infrastructure in order to adequately maintain and improve the efficiency, safety, adequacy, and reliability of the distribution system. On Jan. 18, 2019, Penn Power filed a Petition for Approval of Modification of its LTIIP in order to increase overall spending in the 2019 program year. The Petition was approved, as filed, through an Order entered on May 23, 2019.[42] On Aug. 30, 2019, Penn Power, along with

[42] *See Petition of Pennsylvania Power Company for Approval of Modification of its Long-Term Infrastructure Improvement Plan*, at Docket No. P-2015-2508931.

the other FirstEnergy Companies (Met-Ed, Penelec, and West Penn) filed petitions for second LTIIPs for the years 2020 through 2024. The petitions were approved through an Order entered on Jan. 16, 2020.[43]

The PUC has also been performing extra monitoring of Penn Power's work management system and Reliability Improvement Plan (RIP) beginning in 2015 as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[44] Penn Power's second LTIIP is designed to continue the reliability improvement efforts from the 2015 RIP.

Penn Power notes while its rolling 12-month CAIDI is above standard, improvement was seen in its rolling 12-month SAIFI, which is below benchmark. Penn Power believes the benefits of LTIIP work are coming to fruition and improvement is taking place.

Penn Power notes that it employs various programs to strengthen the durability and flexibility of the electric system. Penn Power notes that it utilizes core programs to support cost-effective and reliable service. These programs include, but are not limited to:

- Inspection and Maintenance (I&M) – Penn Power notes that its I&M Practices are designed to assist the FirstEnergy Companies in determining the need for, and prioritization of, the repair or replacement of distribution system components and facilities.

- Vegetation Management

    - Routine cycle tree trimming removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes off right-of-way priority trees.

    - 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.

    - FirstEnergy has a program to proactively remove ash trees off ROW was implemented in response to damage caused by the Emerald Ash Borer.

    - 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.

[43] *See Petition of Pennsylvania Power Company for Approval of its Long-Term Infrastructure Improvement Plan* at Docket No. P-2019-3012614.
[44] Final Order entered Nov 5, 2015, at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

- Customers Experiencing Multiple Interruptions (CEMI) – FirstEnergy's CEMI program is aimed to reduce frequent or repeated outages for affected clusters of customers or frequently operated devices.

- Load Forecasting and Distribution Planning – FirstEnergy's load forecasting application is used to estimate future substation and circuit loading based upon historical load data. 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 – FirstEnergy's 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 FirstEnergy companies first began to execute their respective LTIIP programs in 2016. In 2020, the Companies filed the Cost Effectiveness report at the completion of its first LTIIP. FirstEnergy's second LTIIPs span the period 2020 through 2024 and are focused on two areas: asset health and outage exposure. Asset health focuses on maintaining the system in a state of good repair while outage exposure focuses on minimizing the impact of customer outages.

- Minimizing Outage Impact – FirstEnergy notes that its companies incorporate 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 – all FirstEnergy companies perform an annual storm exercise. FirstEnergy notes 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.

- Smart Meters – the FirstEnergy Companies have completed mass deployment of smart meters to customers across Pennsylvania. 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 Companies to ping the meter to determine if a customer's service has been restored.

- Incident Command System (ICS) – the FirstEnergy Companies are 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, the Companies' incident response ability is improved, and reliability is enhanced by utilizing a common system for incident response personnel (both intrastate and interstate).

Conclusion

Trees and Animal are the top two outage causes that substantially negatively affect electrical reliability to Penn Power customers. Trees and animal outage causes contributed to over 63% of the total lost customer-minutes.

Beginning in 2004, Penn Power's CAIDI and SAIFI benchmark performance has been inconsistent. Penn Power through its RIP and LTIIP will need to address the inconsistent CAIDI and SAIFI performance and sustain the trend line below the "green" benchmark performance upper-control-limit-line. The Commission expects to see continuing improvement in reliability for the FirstEnergy Companies in 2021.

Figure 24 Penn Power CAIDI (minutes)

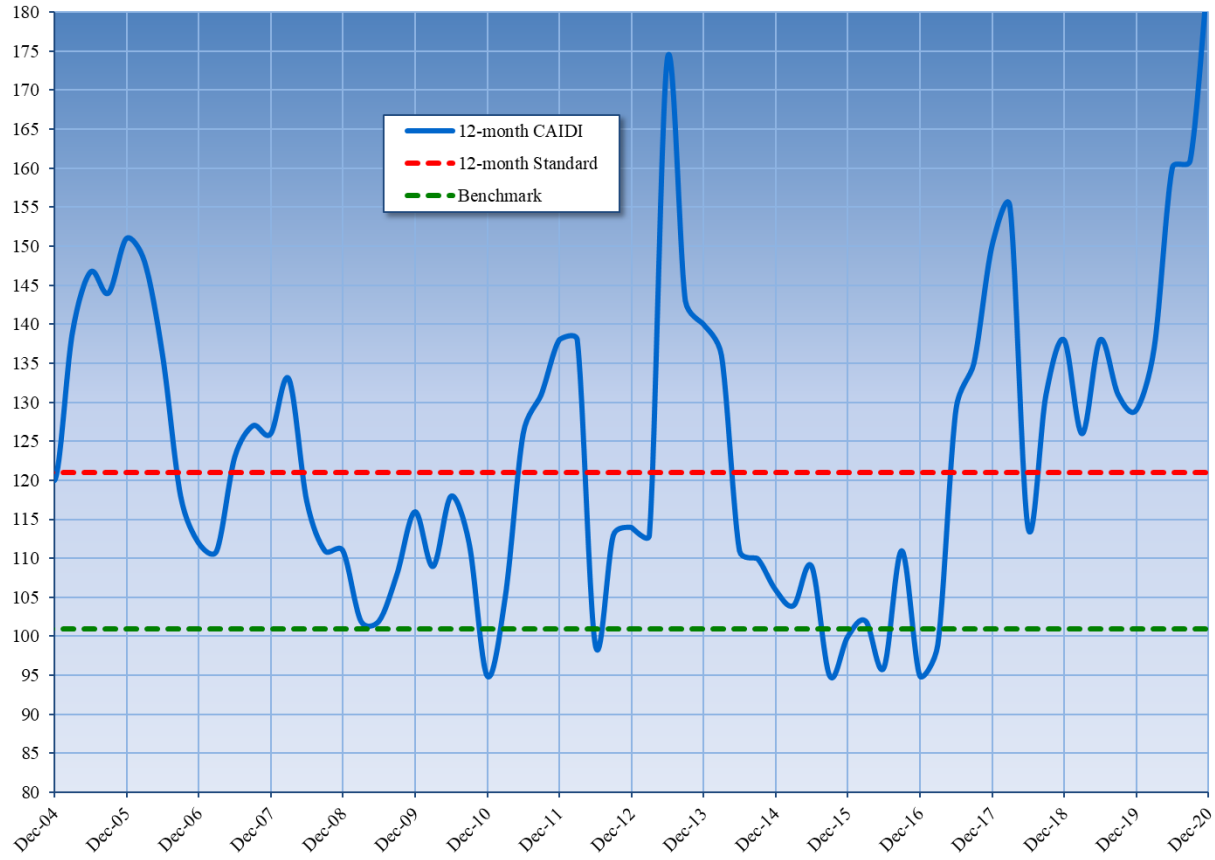


Figure 25 Penn Power SAIFI (interruptions per customer)

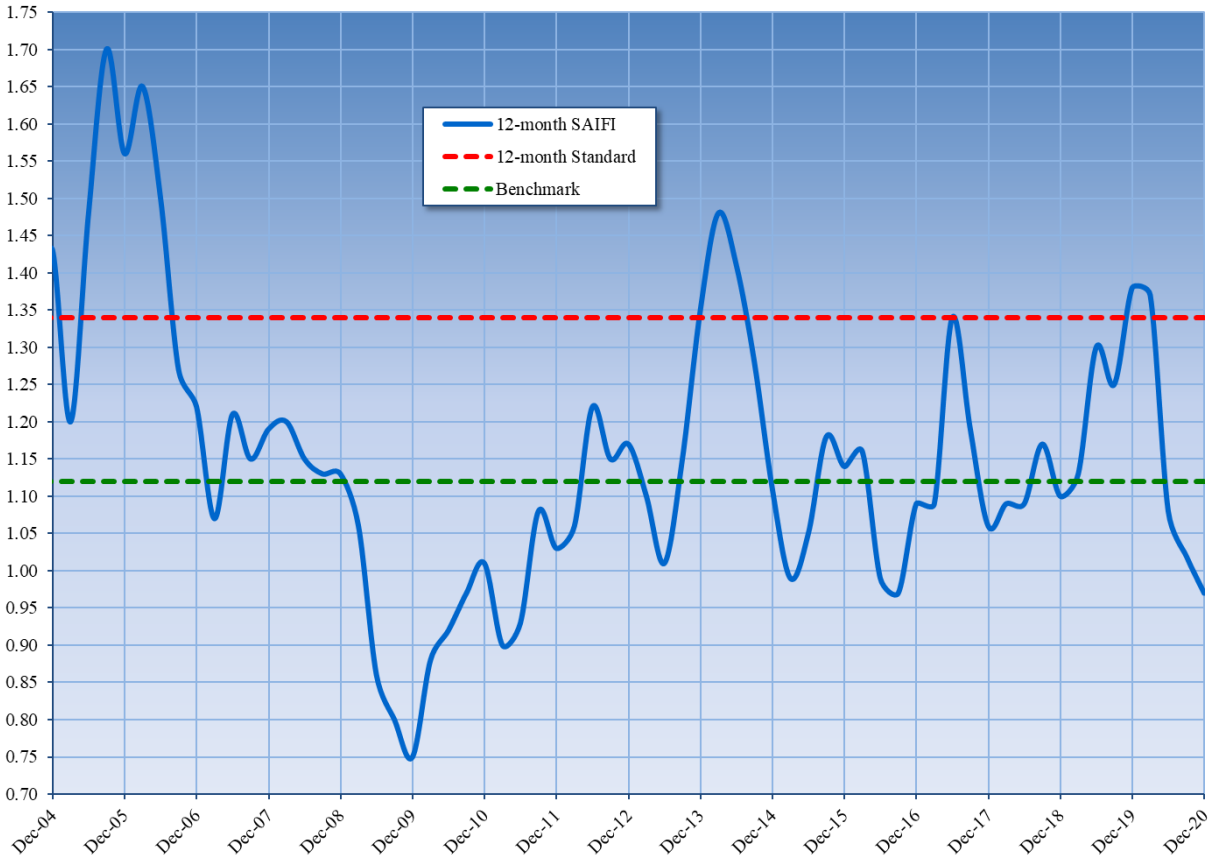


Figure 26 Penn Power Outage Causes (percent of total outages)

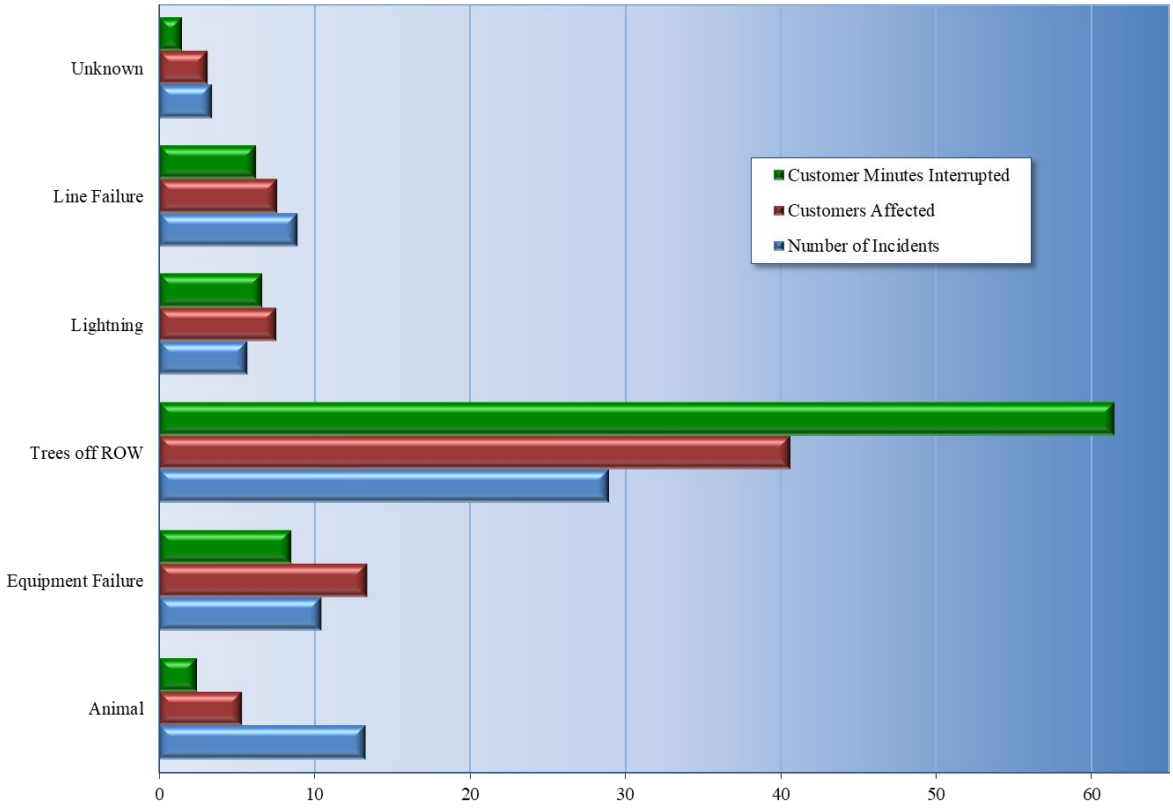
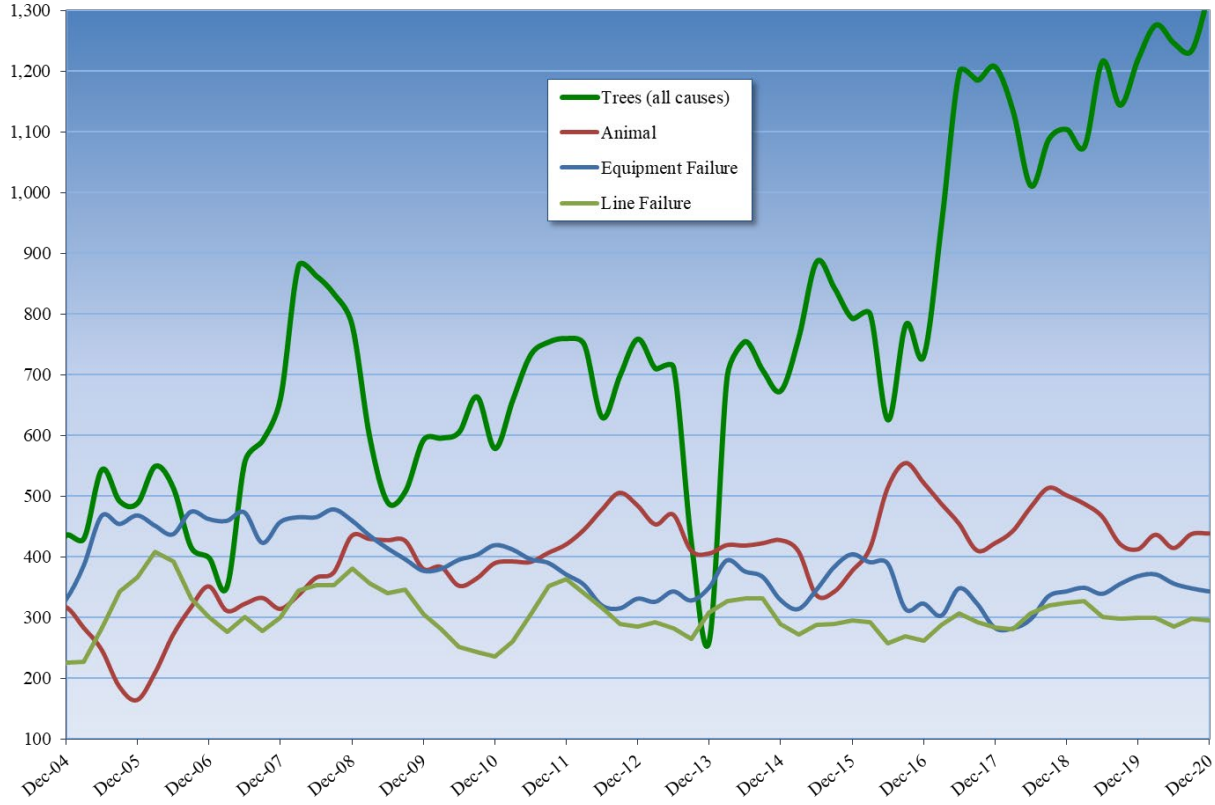


Figure 27 Penn Power Outage Tracking (number of incidents)



West Penn Power Company

West Penn Power Company (West Penn) has a service territory of about 10,400 square miles and serves about 721,000 customers.

In 2020, West Penn experienced 806,924 customer interruptions and 173.9 million customer-minutes interrupted as compared to: 851,338 customer interruptions and 140.3 million customer-minutes interrupted in 2019; 844,298 customer interruptions and 136.3 million customer-minutes interrupted in 2018; 919,673 customer interruptions and 152.7 million customer-minutes interrupted in 2017; and 772,206 customer interruptions and 113.1 million customer-minutes interrupted in 2016.

West Penn experienced no Major Events in 2020.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 165 minutes in 2019 to 216 minutes in 2020; failed to achieve benchmark by 27%.

3-year average: Increased from 167 minutes in 2019 to 184 minutes in 2020; achieved standard by 2%.

SAIDI

Rolling 12-month: Increased from 196 minutes in 2019to 241 minutes in 2020; failed to achieve benchmark by 35%.

3-year average: Increased from 206 minutes in 2019 to 215 minutes in 2020; achieved standard by 1%.

SAIFI

Rolling 12-month: Decreased from 1.19 outages in 2019 to 1.12 outages in 2020; failed to achieve benchmark by 7%.

3-year average: Decreased from 1.23 outages in 2019 to 1.18 outages in 2020; failed to achieve standard by 1%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 28 and 29. West Penn's CAIDI performance trend has historically been erratic. However, from 2014 through part of 2019 CAIDI has been positively below the "green" benchmark performance upper-control-limit-line. In 2020, West Penn's rolling 12-month CAIDI was significantly above the benchmark upper-control-limit-line and 10 minutes above the standard. West Penn management attention is required to return West Penn to the positive CAIDI trend it has previously exhibited.

Beginning in 2004, West Penn's SAIFI performance trend has been erratic. From 2017 through 2020, West Penn's SAIFI performance has been improving. West Penn needs to ensure management attention to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 30 shows the top reported 2019 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Equipment Failure (including line failure) and off ROW trees were the top cause of outages, customers affected, and customer-minutes interrupted. About 56% of customer interrupted minutes are caused by trees and 28% are caused by equipment failures.

Figure 31 shows historical trend of the top three main outage causes. Equipment Failure and Trees are the two most frequent outage-causes that are significantly negatively affecting West Penn's distribution system reliability and resilience, as well as most every EDC in Pennsylvania.

General Reliability

In 2016, West Penn started to execute its LTIIP. This plan included expenditures and programs designed to accelerate repairment, improvement or replacement of aging infrastructure in order to adequately maintain and improve the efficiency, safety, adequacy, and reliability of the distribution system. On Jan. 18, 2019, West Penn filed a Petition for Approval of Modification of its Long-Term Infrastructure Improvement Plan in order to increase overall spending in the 2019 program

year. The Petition was approved, as filed, through and Order entered on May 23, 2019.[45] On Aug. 30, 2019, West Penn, along with the other FirstEnergy Companies (Met-Ed, Penelec, and Penn Power) filed petitions for second LTIIPs for the years 2020 through 2024. The petitions were approved through an Order entered on Jan. 16, 2020.[46]

The PUC has also been performing extra monitoring of West Penn's work management system and Reliability Improvement Plan (RIP) beginning in 2015 as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[47] West Penn's second LTIIP is designed to continue the reliability improvement efforts from the 2015 RIP. The Commission expects to see continuing improvement in reliability for the FirstEnergy Companies in 2021.

West Penn notes while SAIFI and CAIDI are not at benchmark, improvement was seen in its rolling 12-month SAIFI measure from 2019. West Penn believes the benefits of LTIIP work are coming to fruition and improvement is taking place.

West Penn notes that it employs various programs to strengthen the durability and flexibility of the electric system. West Penn notes that it utilizes core programs to support cost-effective and reliable service. These programs include, but are not limited to:

- Inspection and Maintenance (I&M) – West Penn notes that its I&M Practices are designed to assist the FirstEnergy Companies in determining the need for, and prioritization of, the repair or replacement of distribution system components and facilities.

- Vegetation Management

    - Routine cycle tree trimming removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes off right-of-way priority trees.

    - 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.

    - FirstEnergy has a program to proactively remove ash trees off ROW was implemented in response to damage caused by the Emerald Ash Borer.

    - 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

[45] *See Petition of West Penn Power Company for Approval of Modification of its Long-Term Infrastructure Improvement Plan*, at Docket No. P-2015-2508948.
[46] *See Petition of West Penn Power Company for Approval of its Long-Term Infrastructure Improvement Plan* at Docket No. P-2019-3012617.
[47] Final Order entered Nov 5, 2015, at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

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) – FirstEnergy's CEMI program is aimed to reduce frequent or repeated outages for affected clusters of customers or frequently operated devices.

- Load Forecasting and Distribution Planning – FirstEnergy's load forecasting application is used to estimate future substation and circuit loading based upon historical load data. 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 – FirstEnergy's 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 FirstEnergy companies first began to execute their respective LTIIP programs in 2016. In 2020, the Companies filed the Cost Effectiveness report at the completion of its first LTIIP. FirstEnergy's second LTIIPs span the period 2020 through 2024 and are focused on two areas: asset health and outage exposure. Asset health focuses on maintaining the system in a state of good repair while outage exposure focuses on minimizing the impact of customer outages.

- Minimizing Outage Impact – FirstEnergy notes that its companies incorporate 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 – all FirstEnergy companies perform an annual storm exercise. FirstEnergy notes 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.

- Smart Meters – the FirstEnergy Companies have completed mass deployment of smart meters to customers across Pennsylvania. 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 Companies to ping the meter to determine if a customer's service has been restored.

- Incident Command System (ICS) – the FirstEnergy Companies are 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, the Companies' incident response ability is improved, and reliability is enhanced by utilizing a common system for incident response personnel (both intrastate and interstate).

Conclusion

Off ROW Trees and Equipment Failure are the top two outage causes that substantially negatively affect electrical reliability to West Penn customers. In 2020, these outage causes contributed to over 72% of the total lost customer-minutes.

West Penn had been a consistent CAIDI benchmark performer since 2014. The Commission hopes this is a one-year anomaly and West Penn can return to benchmark CAIDI performance. West Penn's SAIFI performance continues to need more management attention to sustain the trend line below the "green" benchmark performance upper-control-limit-line. The Commission expects to see continuing improvement in reliability for the FirstEnergy Companies in 2021.

Figure 28 West Penn CAIDI (minutes)

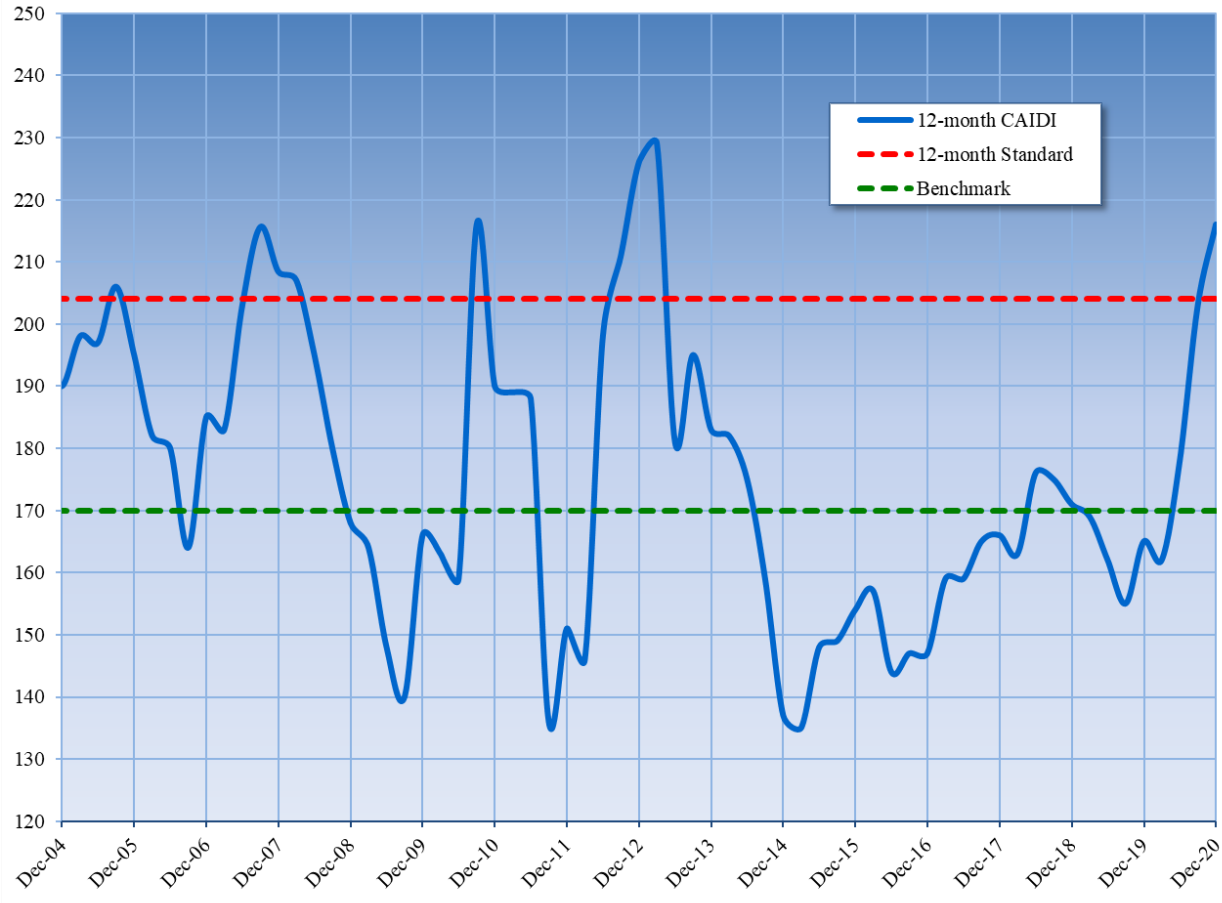


Figure 29 West Penn SAIFI (interruptions per customer)

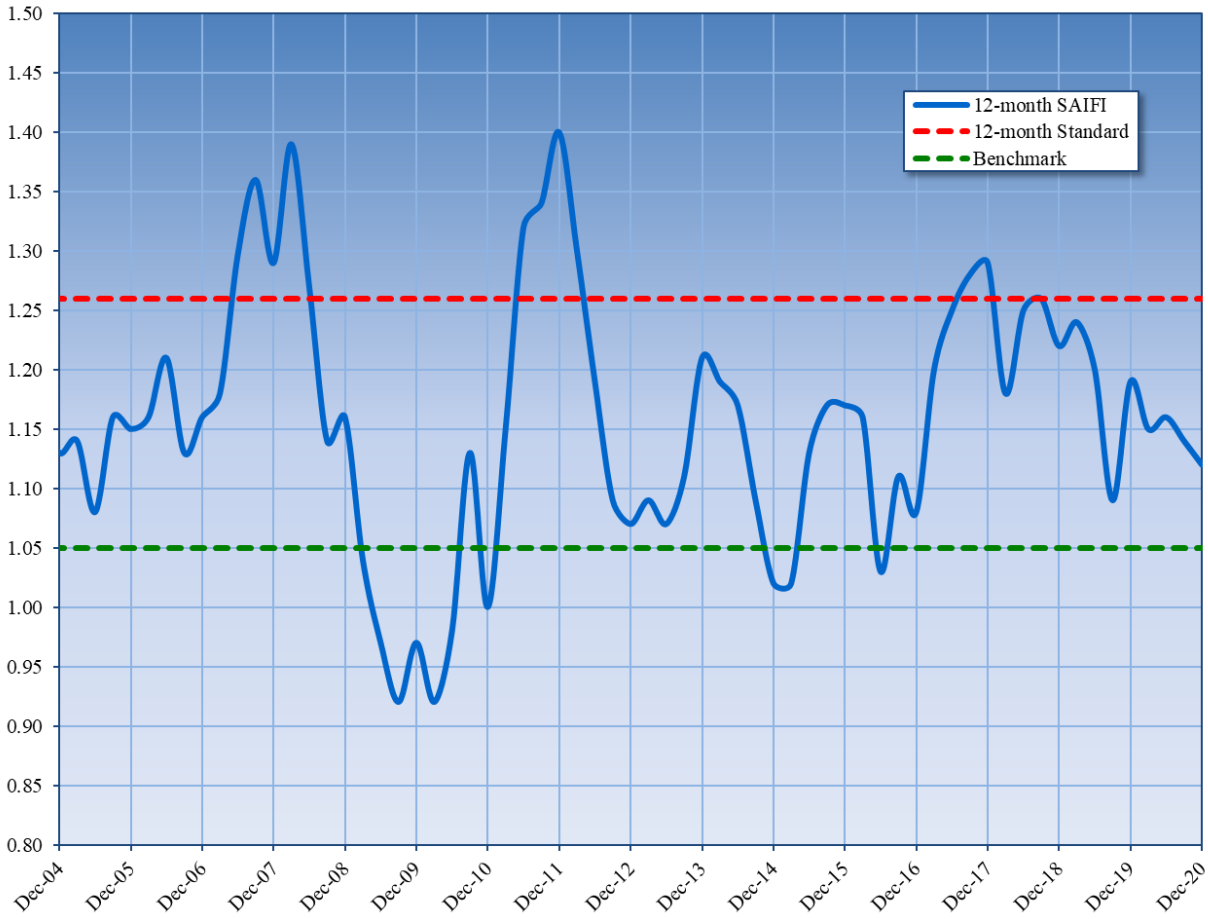


Figure 30 West Penn Outage Causes (percent of total outages)

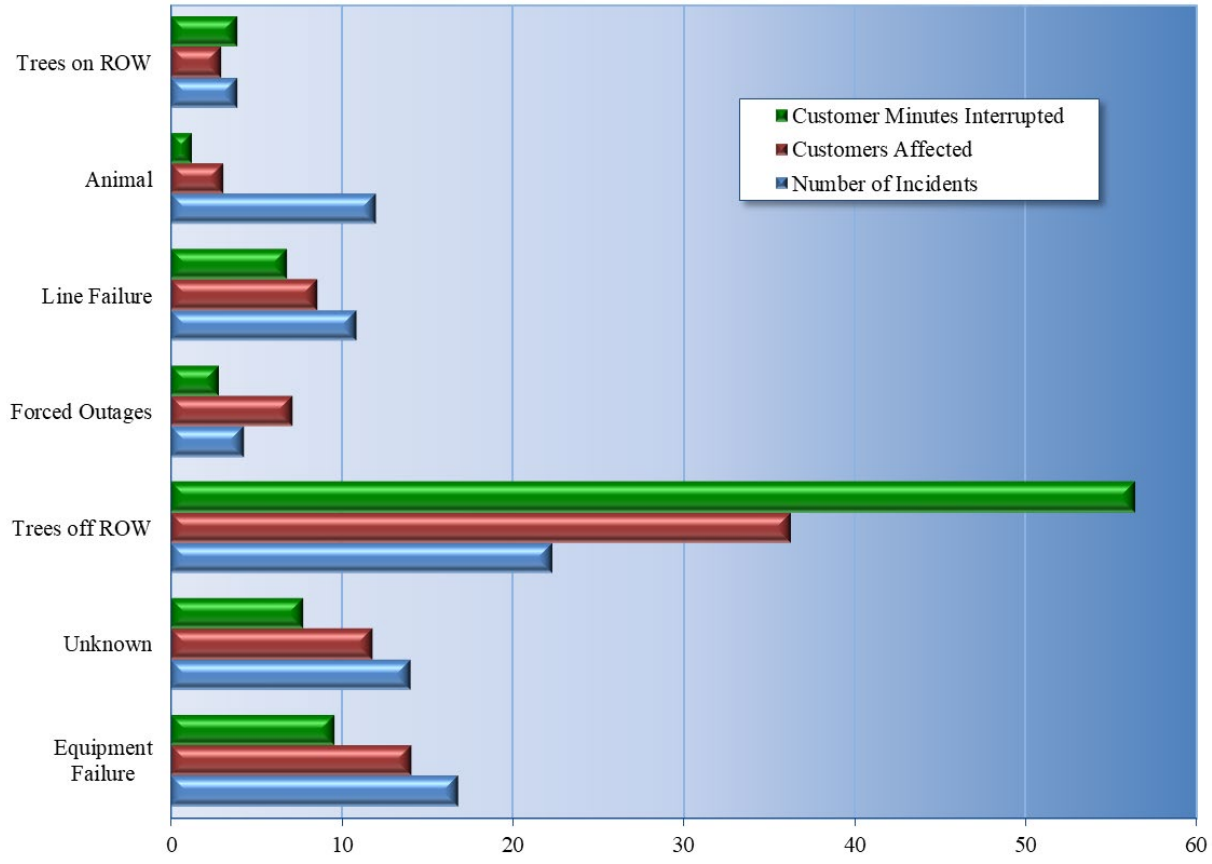
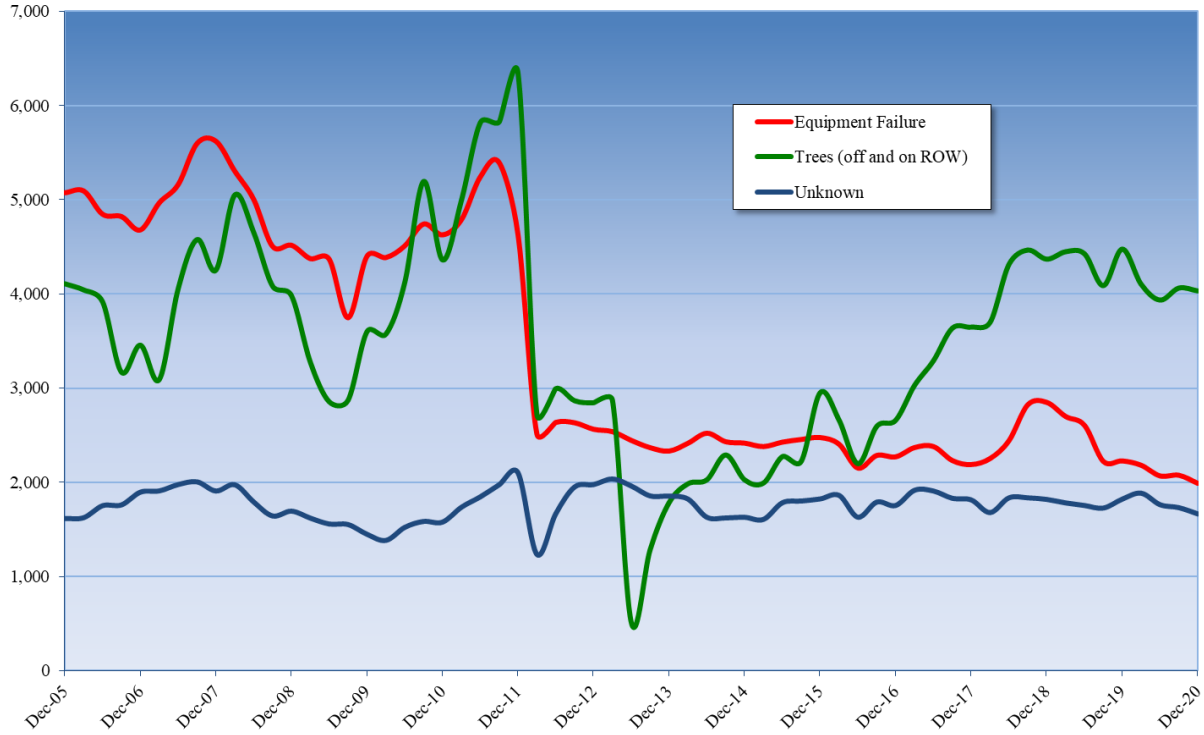


Figure 31 West Penn Outage Tracking (number of incidents)



Citizens' Electric Company

Citizens' Electric Company (Citizens') has an operating service area of about 41 square miles with about 7,045 customers. The electric system consists of one distribution substation and nine distribution feeder lines.

In 2020, Citizens' experienced 561 customer interruptions and 48,645 customer-minutes interrupted as compared to: 1,982 customer interruptions and 154,257 customer-minutes interrupted in 2019; 1,449 customer interruptions and 109,478 customer-minutes interrupted in 2018, 3,180 customer interruptions and 588,067 customer-minutes interrupted in 2017, and 1,787 customer interruptions and 192,235 customer-minutes interrupted in 2016.

Citizens' experienced five Major Events in 2020 on the dates listed below with a total of 8,200 customer interruptions not included in the total above.

- January 21
- July 8
- August 27
- September 30

- November 15

CAIDI/SAIDI/SAIFI Evaluation[48]

CAIDI

Rolling 12-month: Increased from 77 minutes in 2019 to 87 minutes in 2020; achieved benchmark by 17%.

3-year average: Decreased from 113 minutes in 2019 to 80 minutes in 2020; achieved standard by 30%.

SAIDI

Rolling 12-month: Decreased from 22 minutes in 2019 to 7 minutes in 2020; achieved benchmark by 67%.

3-year average: Decreased from 41 minutes in 2019 to 15 minutes in 2020; achieved standard by 41%.

SAIFI

Rolling 12-month: Decreased from 0.28 outages in 2019 to 0.08 outages in 2020; achieved benchmark by 60%.

3-year average: Decreased from 0.31 outages in 2019 to 0.19 outages in 2020; achieved standard by 14%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 32 and 33. Beginning in 2004, Citizens' CAIDI performance has been overall positive for most years. 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 ensure consistent CAIDI performance is now sustained below the "green" benchmark performance upper-control-limit-line.

Beginning in 2004, Citizens' SAIFI performance has been inconsistent. From the 4th quarter 2014 through the 4th quarter 2019, 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. More management attention is needed to ensure consistent SAIFI performance is sustained below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 34 shows the reported 2019 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted; Customers Affected; and Number of Incidents. Off ROW trees, Other and Animals were the top causes of customer-minutes

[48] Smaller CAIDI, SAIFI, and SAIDI benchmark values are typical for companies with fewer customers. While Citizens' did not achieve benchmark for SAIFI and SAIDI in 2019, its SAIFI and SAIDI values for 2019 are still lower than that of all other EDCs.

interrupted, and number of customers affected. Equipment and off ROW trees caused the most number of incidents.

Figure 35 shows the historical trend of the top three main outage causes. Off ROW trees and Equipment are the two most frequent outage-causes that are significantly negatively affecting Citizens' distribution system reliability and resilience, as well as almost every EDC in Pennsylvania.

General Reliability

Citizens' notes that its customers enjoyed one of the best reliability years in 2020. Citizens' notes that it experienced ten-year lows for its rolling 12-month SAIDI and SAIFI, as well as 12-month rolling CAIDI significantly below benchmark levels. This marks the third year of an overall positive trend in reliability.

Citizens' notes that it is continuing its commitment to a responsible vegetation management program as evidenced by being recognized for 18 consecutive years as a "Tree Line USA" utility by the National Arbor Day Foundation. Citizens' notes that this award recognizes utilities for their use of nationally approved trimming techniques and vegetation management procedures. Part of Citizens' Tree Line effort is its annual educational session hosted in cooperation with the Penn State Extension. Citizens' state that this event provides education not only for Company employees, but also the company's current vegetation management contractor, and local municipal road and public works crews. Topics covered include directional pruning techniques, 'Right Tree in the Right Place' planning, and updates on current and expected threats to Pennsylvania forests.

Citizens' notes that trees were again the most impactful cause of outages in 2020 and off ROW trees in particular. Citizens' states that it continues to emphasize hazard tree identification and removal with employees, tree contractors and customers. Citizens' also notes that it began to increase its efforts during 2020 to replace porcelain cutouts to address the increasing trend in equipment failures and that it will continue to sustain the increased replacement efforts into 2021.

Citizens' notes that it continues to evaluate, compare and improve its practices through participation in a variety of industry peer groups, including the Pennsylvania Rural Electric Association, the Energy Association of Pennsylvania, the National Rural Electric Cooperative Association, and the International Association of Arboriculture.

Conclusion

Citizens' had the best CAIDI, SAIFI, and SAIDI performance of any Pennsylvania EDC in 2020, which is commendable. Citizens' should continue to refine its processes and methods and improve on this excellent performance.

It should also be noted that Major Events had a significant negative impact on Citizens' customers that is not reflected in CAIDI and SAIFI performance metrics.

Figure 32 Citizens' CAIDI (minutes)

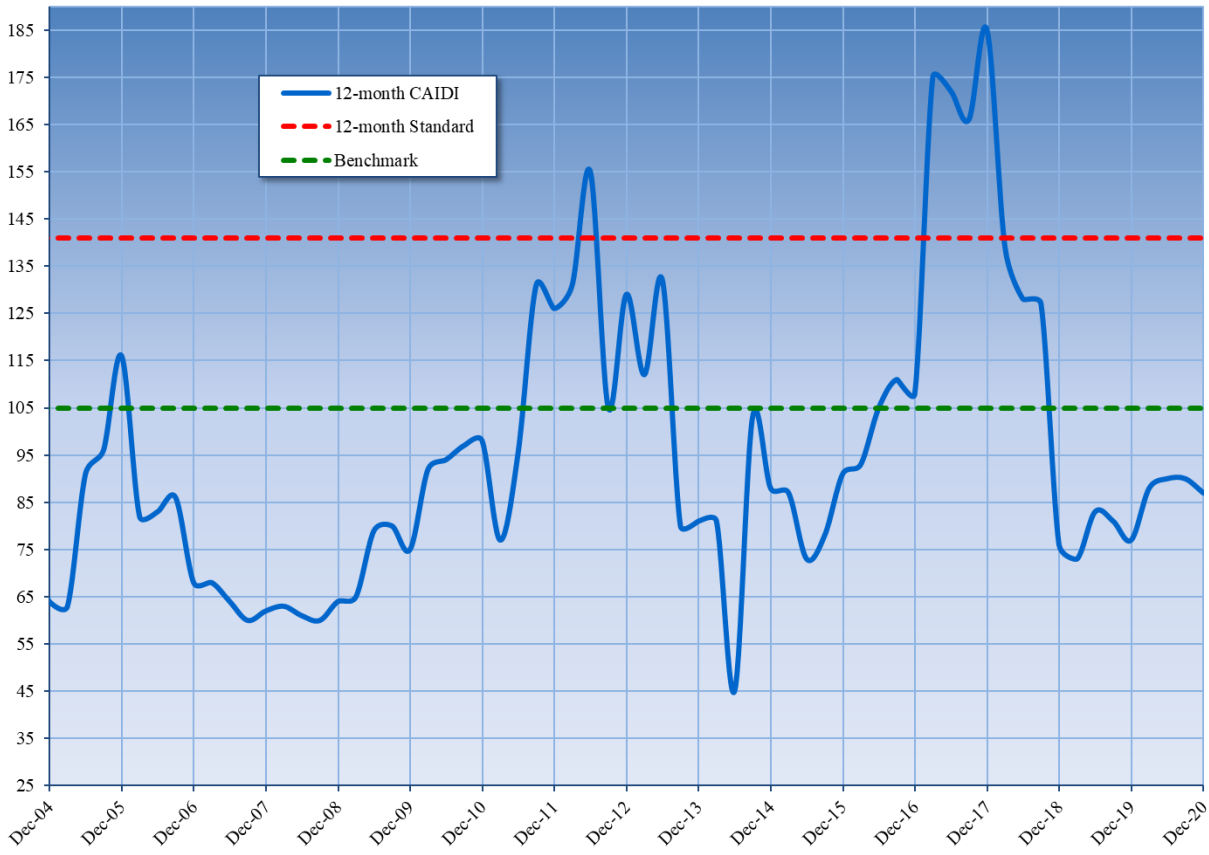


Figure 33 Citizens' SAIFI (interruptions per customer)

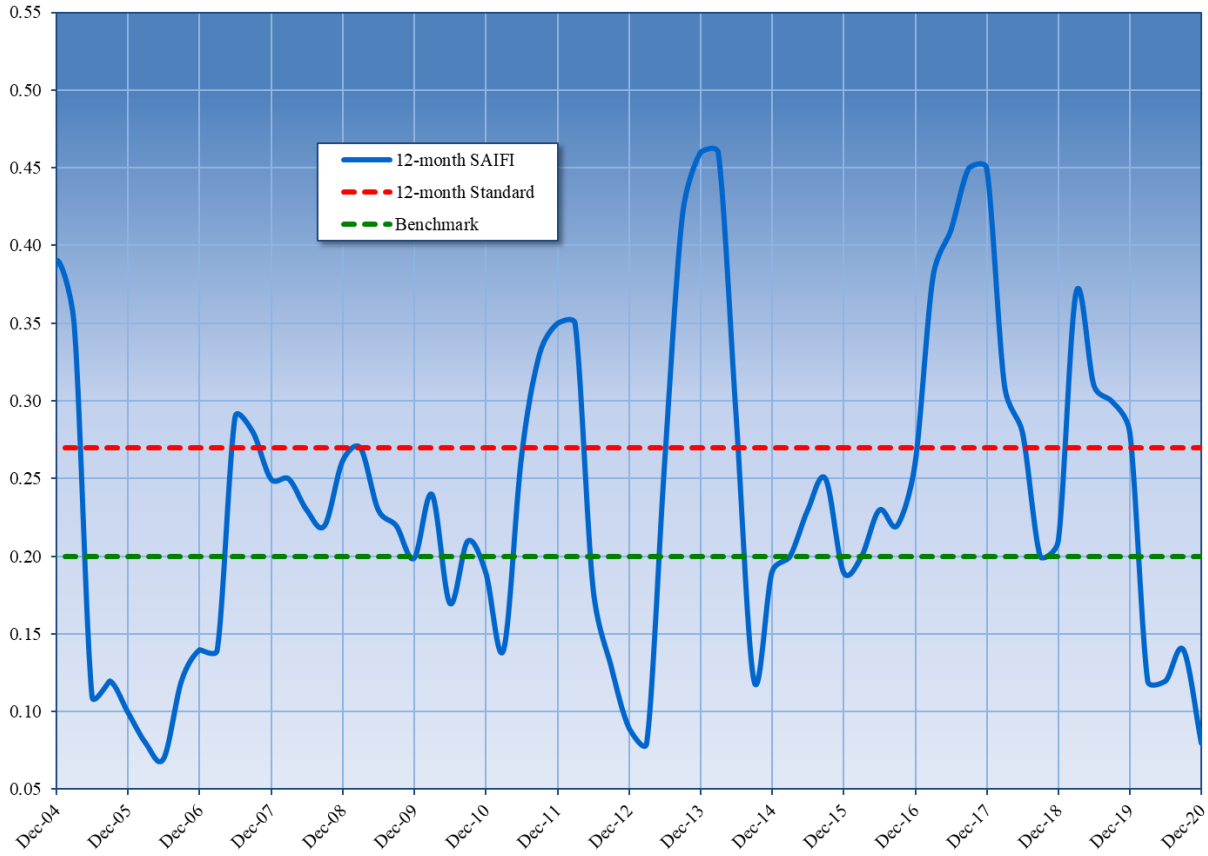


Figure 34 Citizens' Outage Causes (percent of total outages)

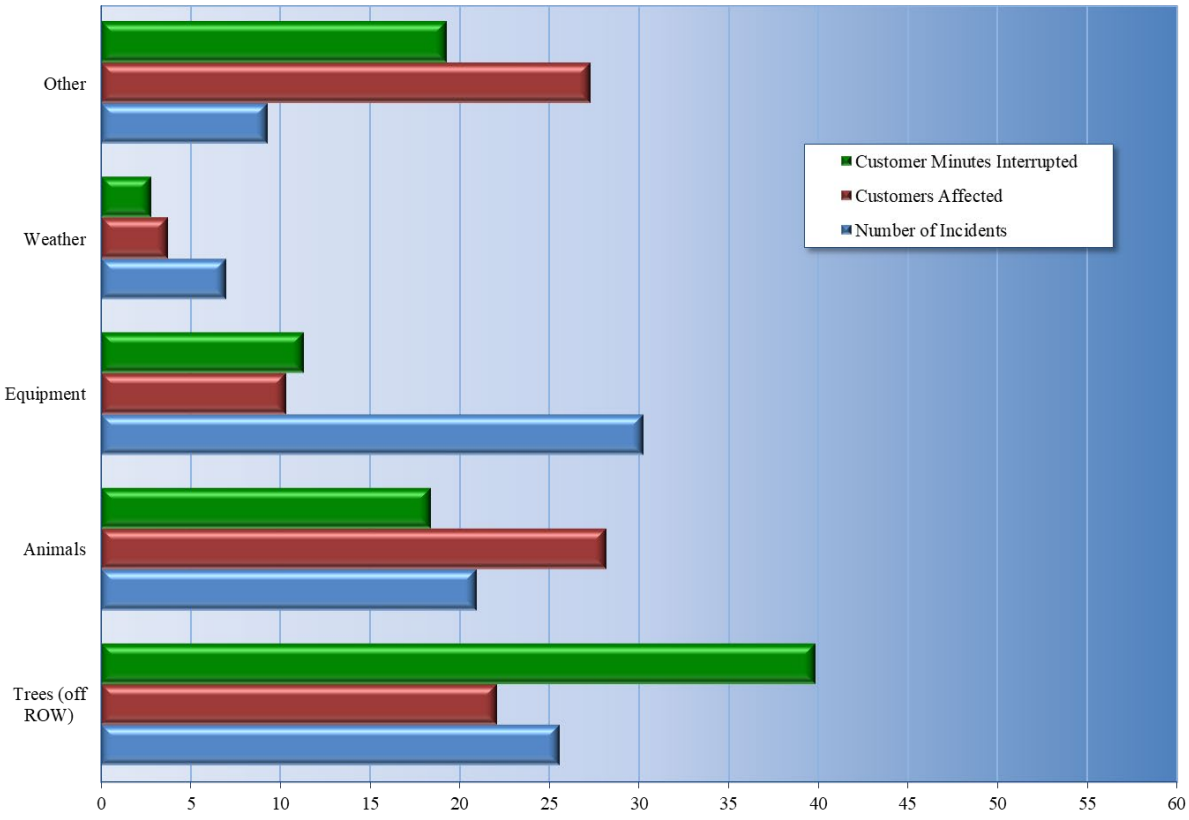
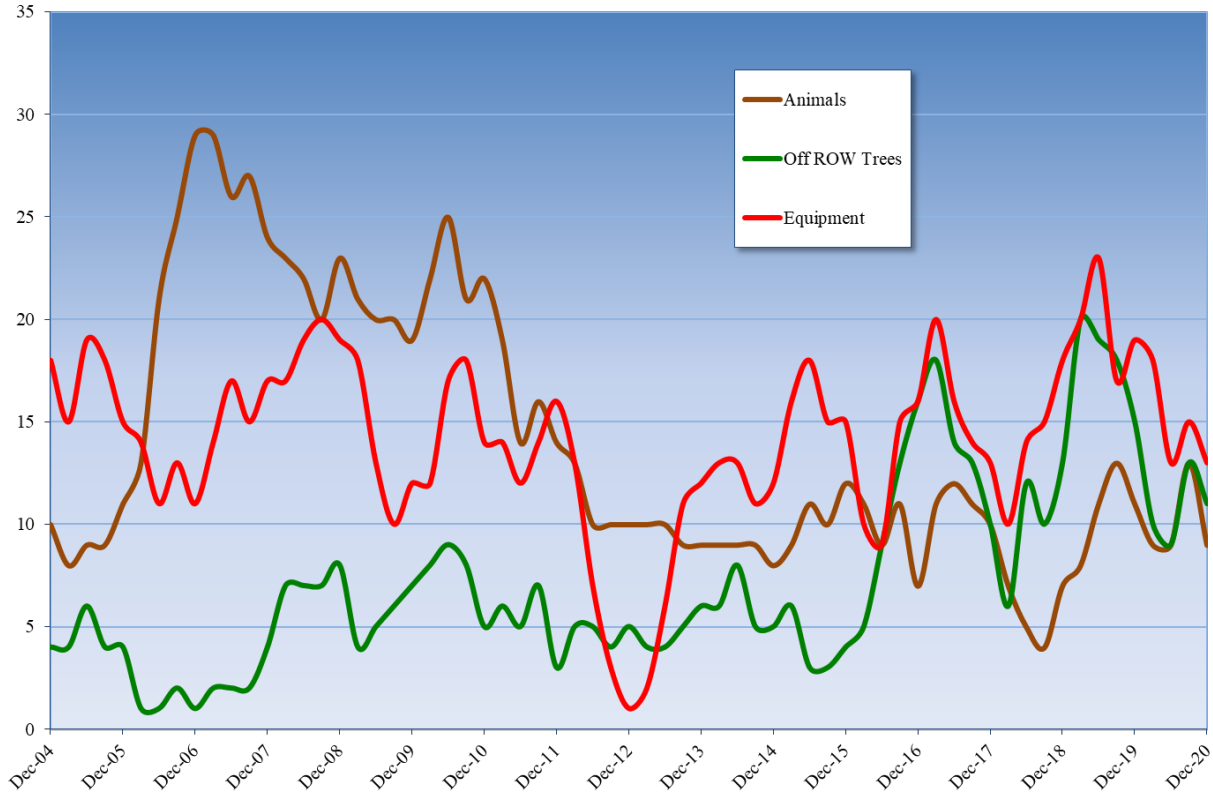


Figure 35 Citizens' Outage Tracking (number of incidents)



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 5,227 customers. Pike is primarily fed from two 34.5 kV feeders supplied from New York substations, and the eastern portion of Pike service territory is fed by two 13.2 kV feeders from the Matamoras Substation.

In 2020, Pike experienced 2,356 customer interruptions and 432,428 customer-minutes interrupted as compared to: 1,870 customer interruptions and 331,335 customer-minutes interrupted in 2019; 4,057 customer interruptions and 872,312 customer-minutes interrupted in 2018; 4,648 customer interruptions and 475,003 customer-minutes interrupted in 2017; and 1,735 customer interruptions and 394,826 customer-minutes interrupted in 2016.

Pike experienced five Major Events on the dates listed below with a total of 9,317 customer interruptions not included in the total above.

- March 16
- May 29
- August 4

- November 23
- December 25

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 177 minutes in 2019 to 184 minutes in 2020; failed to achieve benchmark by 6%.

3-year average: Remained unchanged at 199 minutes in 2020; failed to achieve standard by 4%.

SAIDI

Rolling 12-month: Increased from 69 minutes in 2019 to 83 minutes in 2020; achieved benchmark by 22%.

3-year average: Decreased from 124 minutes in 2019 to 117 minutes in 2020; achieved standard by 9%.

SAIFI

Rolling 12-month: Increased from 0.39 outages in 2019 to 0.45 outages in 2020; achieved benchmark by 26%.

3-year average: Decreased from 0.59 outages in 2019 to 0.56 outages in 2020; achieved standard by 16%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 36 and 37. From 2004 through 2019, Pike's CAIDI performance has been erratic and frequently above the "green" benchmark performance upper-control-limit-line. However, Pike's CAIDI performance has improved the past 2 years. More management attention is needed to ensure consistent CAIDI performance is sustained below the "green" benchmark performance upper-control-limit-line.

Pike's SAIFI performance trend has been overall positive the past two years and below the "green" benchmark performance upper-control-limit-line. More management attention is needed to ensure consistent SAIFI performance is sustained below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 38 shows the top reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Tree Contact and Other were the top cause of customer-minutes interrupted and customers affected, while Tree Contact and Equipment Failures created the most number of incidents. Approximately 51% of outages and 73% of customer-minutes interrupted are caused by Tree Contact.

Figure 39 shows the historical trend of the top 3 main outage causes. Tree Contact and Equipment Failure are the two most frequent outage-causes that are significantly negatively affecting Pike's distribution system reliability and resilience, as well as most every EDC in Pennsylvania.

General Reliability

Pike notes that it is focused on reducing the impact from danger trees and that in prior years, it has been effective in removing danger trees. Pike will remove danger trees within ROW areas when identified. Those danger trees that exist outside of the ROW areas can only be removed with customer or municipal authorization. Pike notes that it works with the County Commissioners' office, the Boroughs of Matamoras and Milford, the Townships of Westfall and Milford, and the Milford Shade Tree Commission to address danger trees that represent a hazard to the Company's electrical system located within and outside of right-of-way areas.

Pike states that it has also focused its reliability efforts on pole inspections and defective pole replacements. Pike accelerated its pole inspection and the defective pole replacements in 2017 and 2018, resulting in the Company completing the first twelve-year cycle and replacing over 100 poles and pole top apertures. Pike notes that in 2019 it inspected over 1,000 poles, and in a return to normal annual frequency, 425 poles in 2020 with 30 pole replacements. Pike notes that the emphasis on replacement of defective poles was to focus on the "main-line" of the two 34.5 kV circuits from the Delaware River into Milford Borough and Township and laterals. Pike notes that the second stage of priority is to replace defective poles along with the attached equipment, such as transformers, regulators and reclosers.

Pike notes that its improving reliability indices and reduction in total interruptions, customers affected and customer minutes are a reflection of the effectiveness of its reliability programs such as: the combination of the hot spot tree trimming and select hazardous tree removals; the accelerated pad-mount transformer/underground cable end inspection; and the accelerated pole inspection and replacement programs. Pike expects that the programs will continue to produce positive results.

Conclusion

In 2019 and 2020, Pike has improved both CAIDI and SAIFI performance. However, more management attention is needed in the future to sustain the trend line below the "green" benchmark performance upper-control-limit-line.

Figure 36 Pike County CAIDI (minutes)

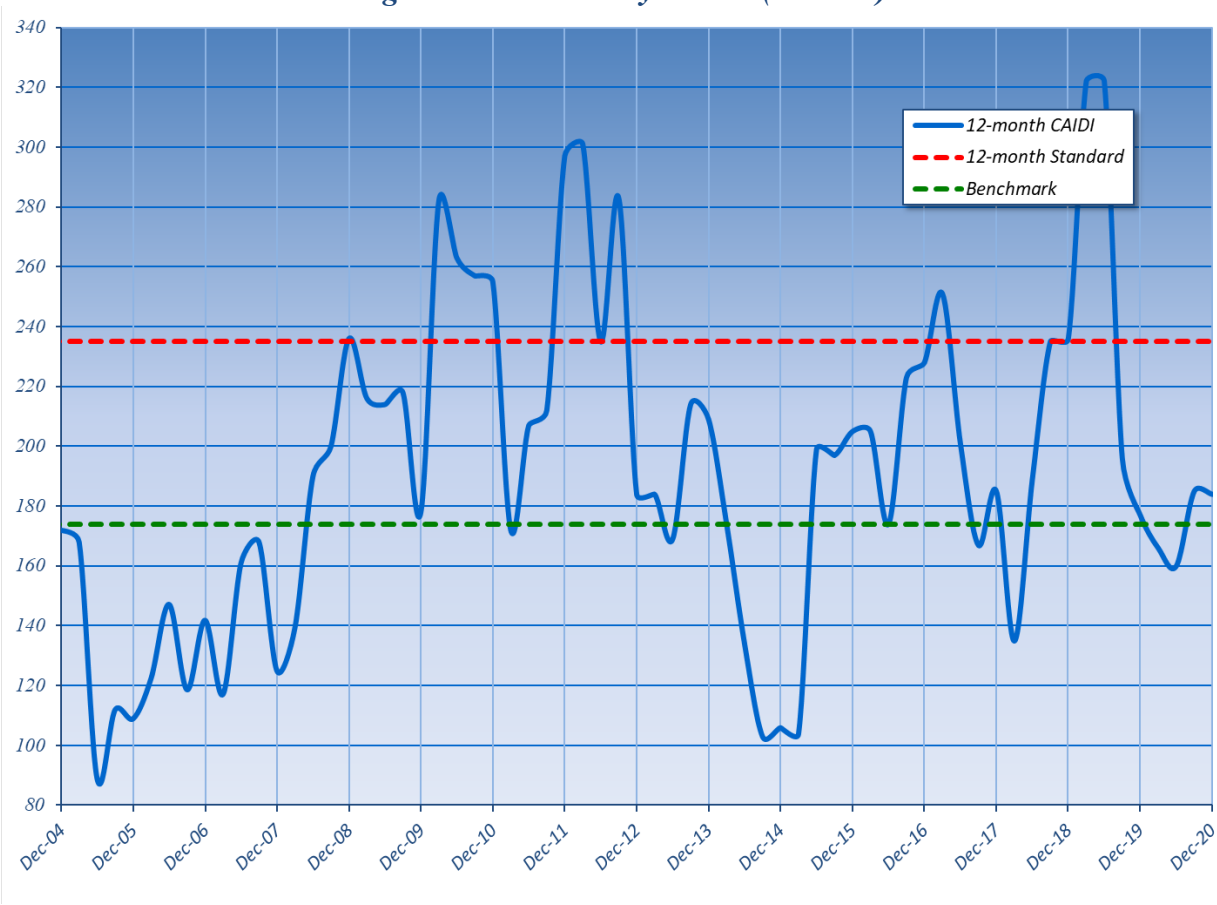


Figure 37 Pike County SAIFI (interruptions per customer)

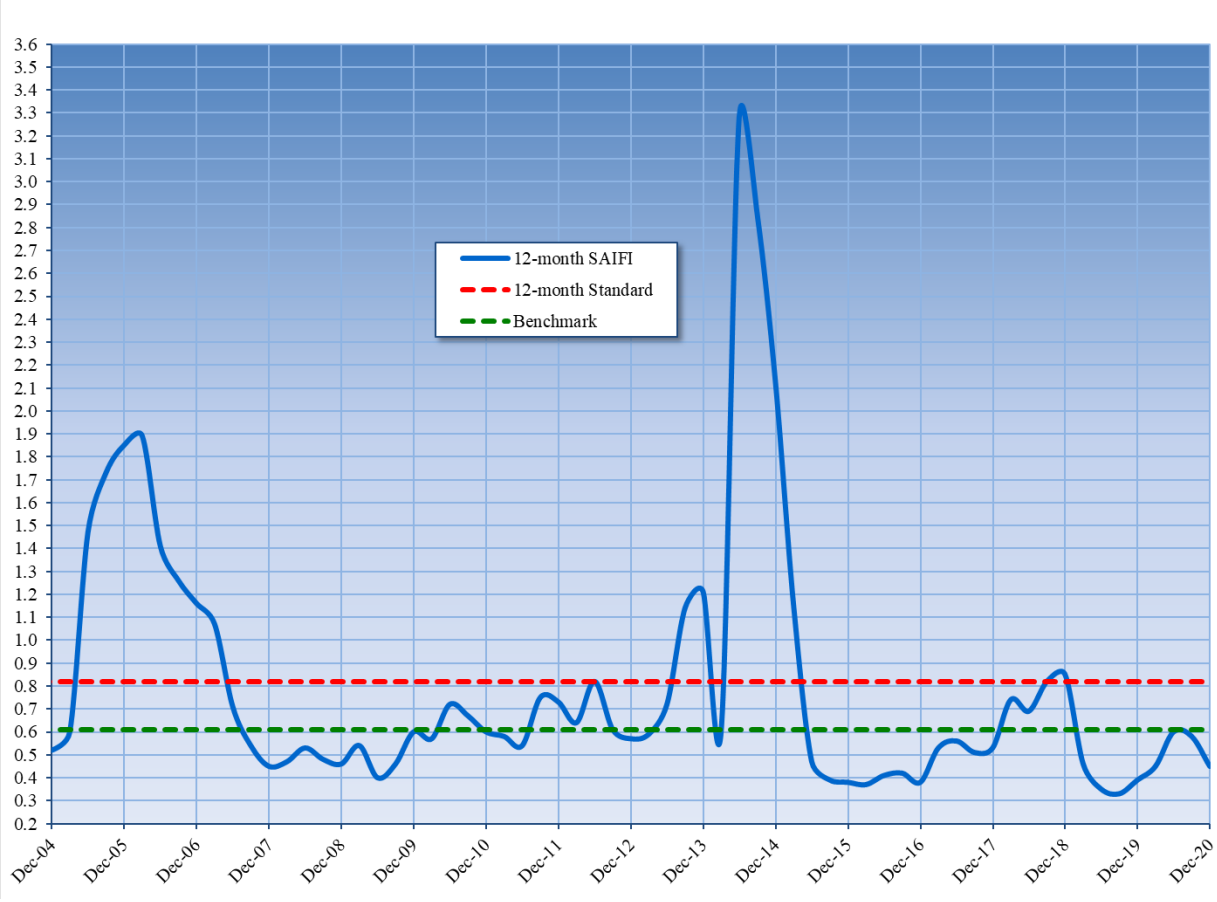


Figure 38 Pike County Outage Causes (percent of total outages)

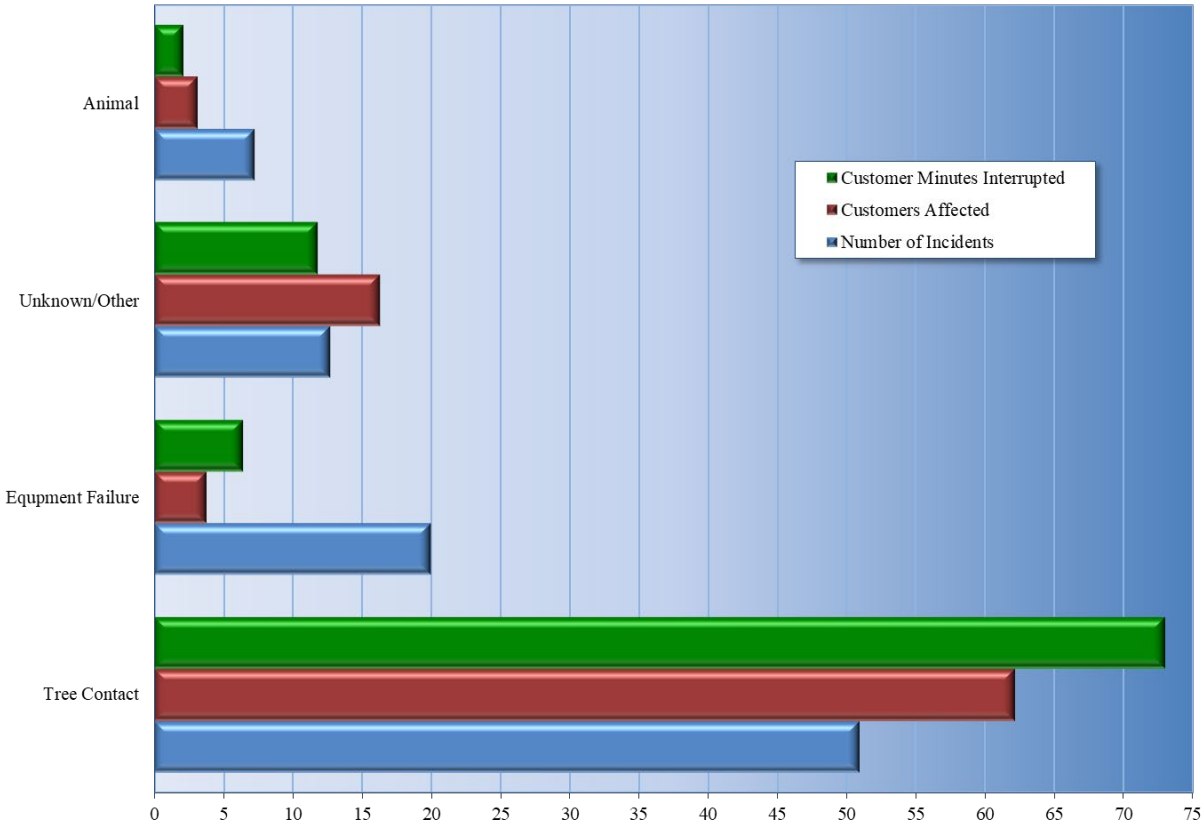
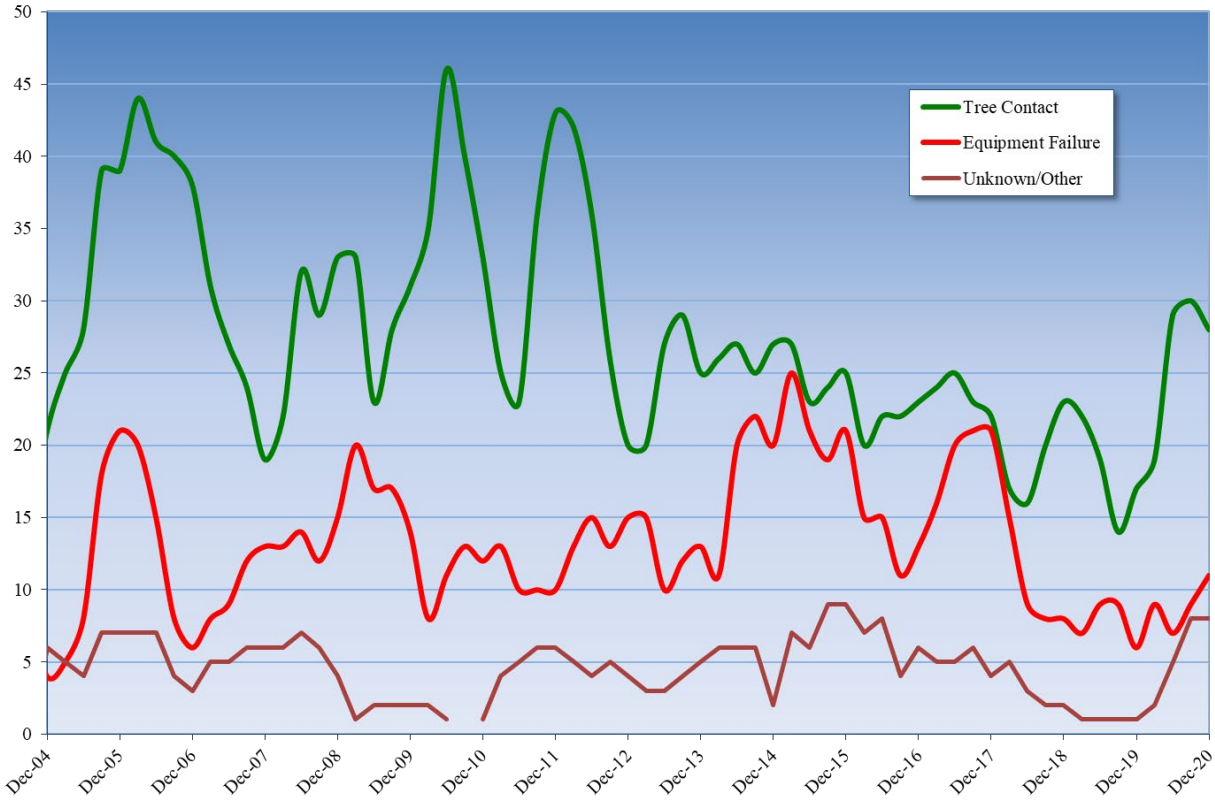


Figure 39 Pike County Outage Tracking (number of incidents)



UGI Utilities Inc.

UGI has a service territory of about 410 square miles and serves about 61,200 customers.

In 2020, UGI experienced 25,110 customer interruptions and 4.1 million customer-minutes interrupted as compared to: 59,946 customer interruptions and 11.3 million customer-minutes interrupted in 2019; 31,305 customer interruptions and 4.1 million customer-minutes interrupted in 2018; 31,395 customer interruptions and 4.1 million customer-minutes interrupted in 2017; and 38,909 customer interruptions and 4.9 million customer-minutes interrupted in 2016.

UGI experienced one Major Event in 2020 on November 23, with 10,665 customer interruptions not included in the total above.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 188 minutes in 2019 to 163 minutes in 2020; achieved benchmark by 4%.

3-year average: Increased from 166 minutes in 2019 to 176 minutes in 2020; achieved standard by 5%.

SAIDI

Rolling 12-month: Decreased from 182 minutes in 2019 to 66 minutes in 2020; achieved benchmark by 53%.

3-year average: Increased from 153 minutes in 2019 to 154 minutes in 2020; achieved standard by 10%.

SAIFI

Rolling 12-month: Decreased from 0.96 outages in 2019 to 0.40 outages in 2020; achieved benchmark by 52%.

3-year average: Decreased from 0.88 outages in 2019 to 0.85 outages in 2020; achieved standard by 7%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 40 and 41. UGI failed to attain benchmark performance in 2018 and 2019, as shown on the chart to be above the "green" benchmark performance upper-control-limit-line. However, UGI did achieve better than benchmark performance in 2020. More management attention is needed to ensure CAIDI performance is again being sustained below the "green" benchmark performance upper-control-limit-line.

UGI's SAIFI performance in 2018 and 2019 was inconsistent, as shown on the chart to be above the "green" benchmark performance upper-control-limit-line. However, prior to 2018, UGI was a consistent SAIFI benchmark performer and UGI in 2020 tied with 2015 for its best annual SAIFI performance. More management attention is needed to ensure SAIFI performance is again being sustained below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 42 shows the reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Trees and Equipment Failure were the top cause of outages, and Trees was the cause of the most customer-minutes interrupted. Over 67% of outages were caused by Trees and Equipment Failure.

Figure 43 shows historical trend of the top three main outage causes. Trees and Equipment Failure are the 2 most frequent outage-causes that are significantly negatively affecting UGI's distribution system reliability and resilience, as well as almost every EDC in Pennsylvania.

General Reliability

UGI notes that it has an outage management system (OMS) in place which allows it to gather information on system interruptions. The information accumulated in this system is analyzed to identify equipment failure trends and outage clusters. This information is also used to identify weaknesses in the system and decide how to allocate resources for maintenance and/or system upgrades. UGI notes that it is currently upgrading its OMS to gain additional functionality and efficiency, with completion expected by September 2022.

UGI also states that it continues to expand its distribution supervisory control and data acquisition (DSCADA) into operations to allow further visibility and awareness into the distribution system. UGI notes that the DSCADA acquires and historizes distribution data and allows the control of distribution devices from UGI's operations center.

UGI notes that the largest contributors to outage incidents on its system and primary target for improvement projects are tree-related outages and equipment failures. UGI states that customers served in some of the more remote and isolated areas of its system have been impacted most significantly by multiple and extended outages. To address these areas, UGI is targeting increased vegetation management and tree removal as well as line relocations and construction of remote tie-lines where appropriate. UGI states that it has increased its vegetation management budget and added tree-trimming resources to supplement regular trim cycles as outlined in its maintenance plan.

To reduce outages caused by equipment failures, UGI has undertaken an accelerated focus on infrastructure replacement, such as underground cable and wood pole replacement. UGI has increased initiatives to reduce outages caused by components susceptible to failure on the distribution system, such as porcelain insulators and cut-outs which have been targeted for replacement. UGI notes that these programs will address significant long-term reliability factors. Considering these programs and others documented in the UGI LTIIP, UGI fully expects to improve overall system reliability and, to some extent, smooth out historical weather-related variability.

In addition to the physical infrastructure upgrades, UGI notes that it has identified opportunities to reduce the duration and impact of outages using technology-based solutions and additional circuit sectionalizing. UGI continues preparing the distribution network to accommodate a future system that can self-heal and will isolate faulted line sections and restore the undamaged portions. UGI notes that remote control capability is being integrated into existing transmission motor operated air-breaks to allow expedited sectionalizing and recovery of the system following disturbances.

Conclusion

Trees and Equipment Failure are the top two outage causes that negatively affect electrical reliability to UGI customers. In 2020, Trees and Equipment Failure outage causes contributed to over 67 % of the total lost customer-minutes.

UGI has significantly improved its CAIDI and SAIFI performance in 2020. However, management focus should be on sustaining the trend line below the "green" benchmark performance upper-control-limit-line.

Figure 40 UGI CAIDI (minutes)

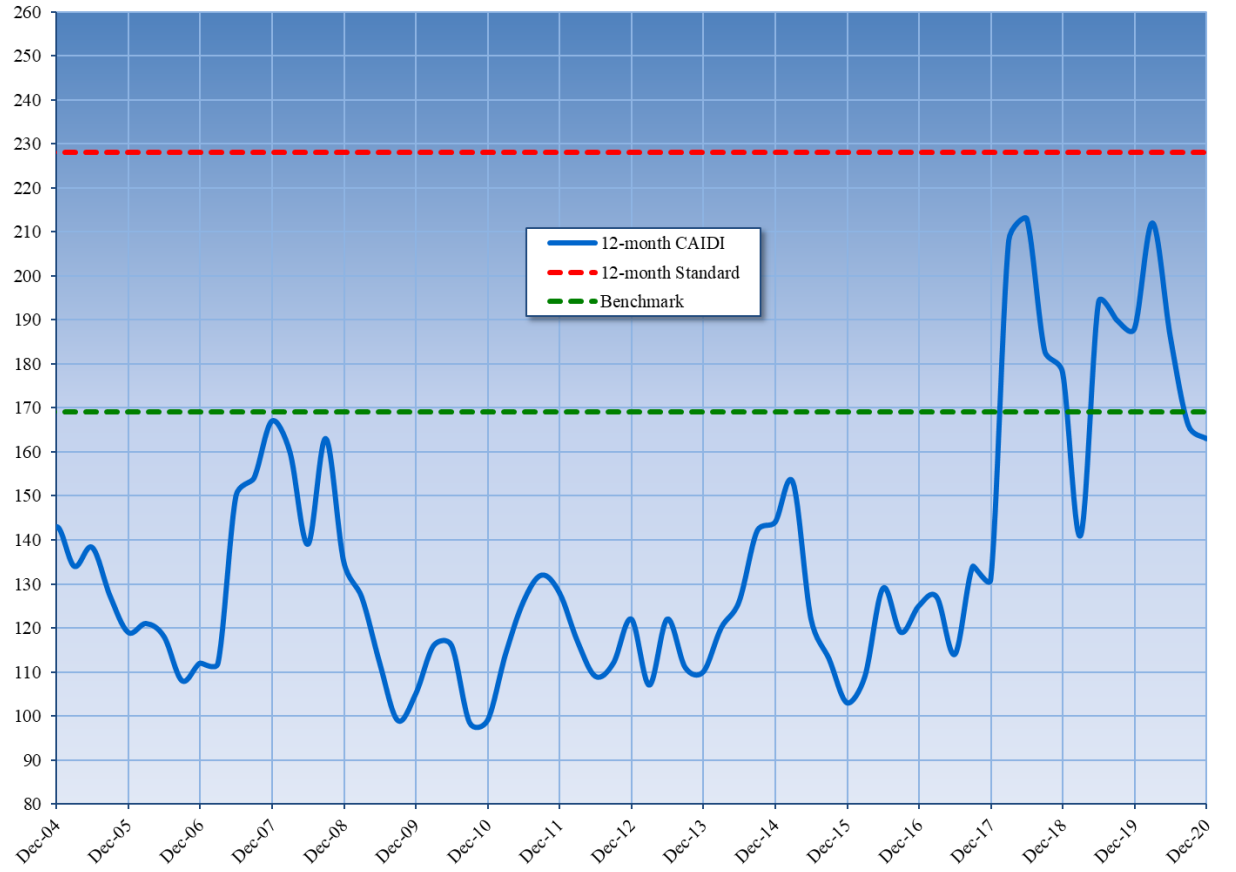


Figure 41 UGI SAIFI (interruptions per customer)

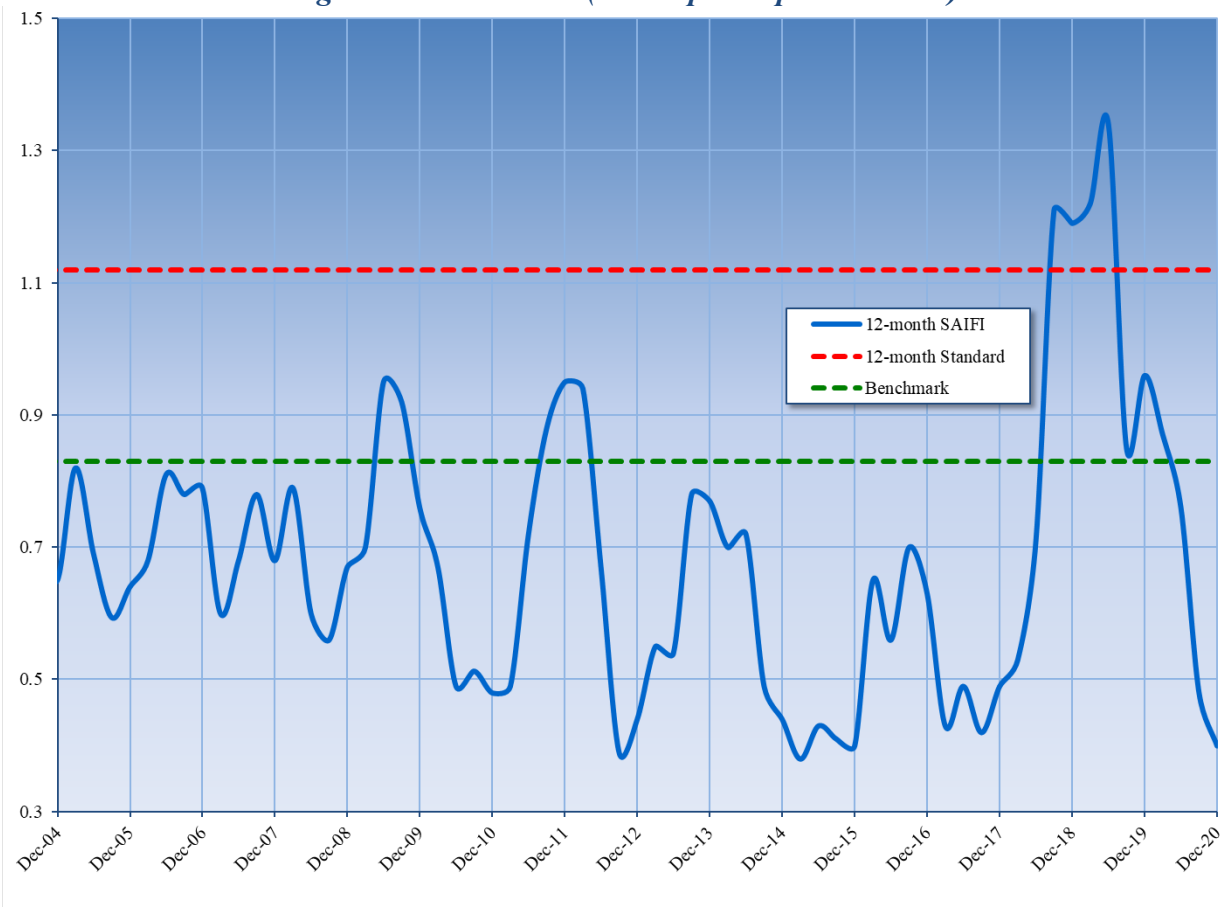


Figure 42 UGI Outage Causes (percent of total outages)

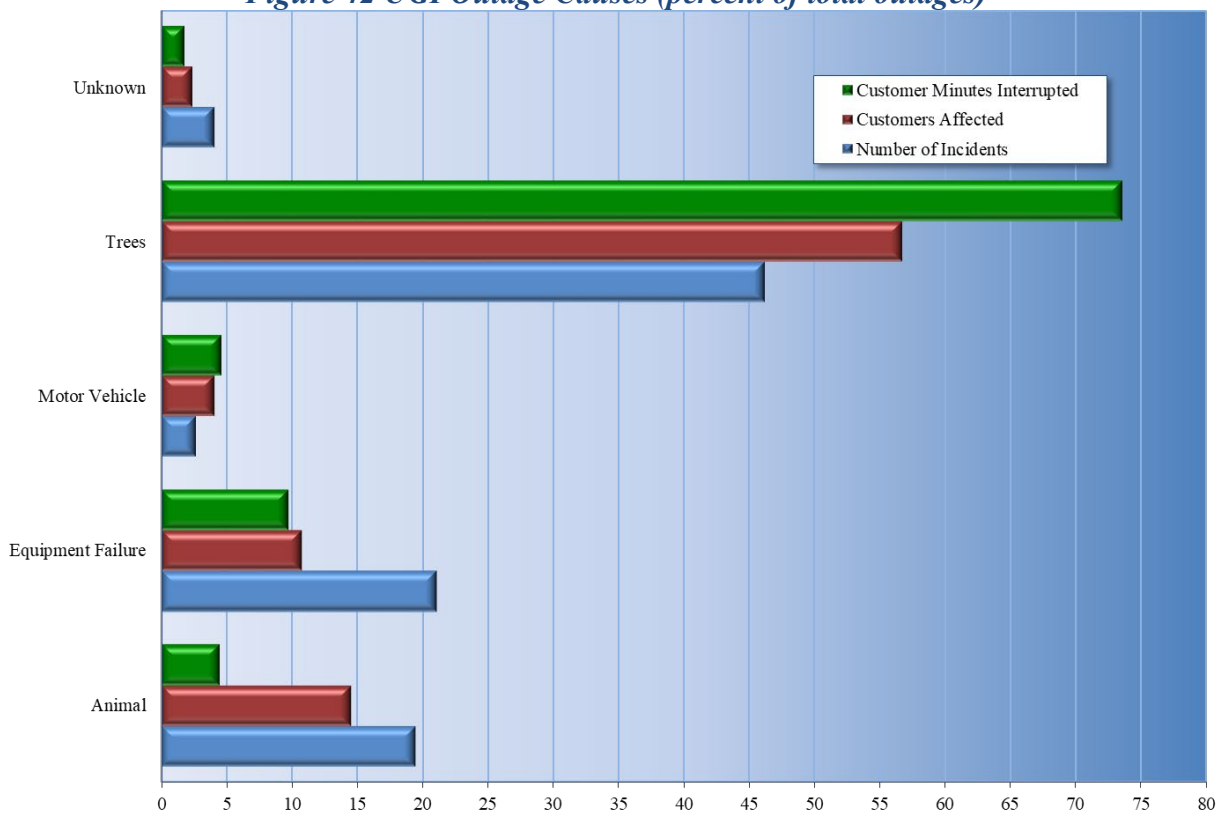
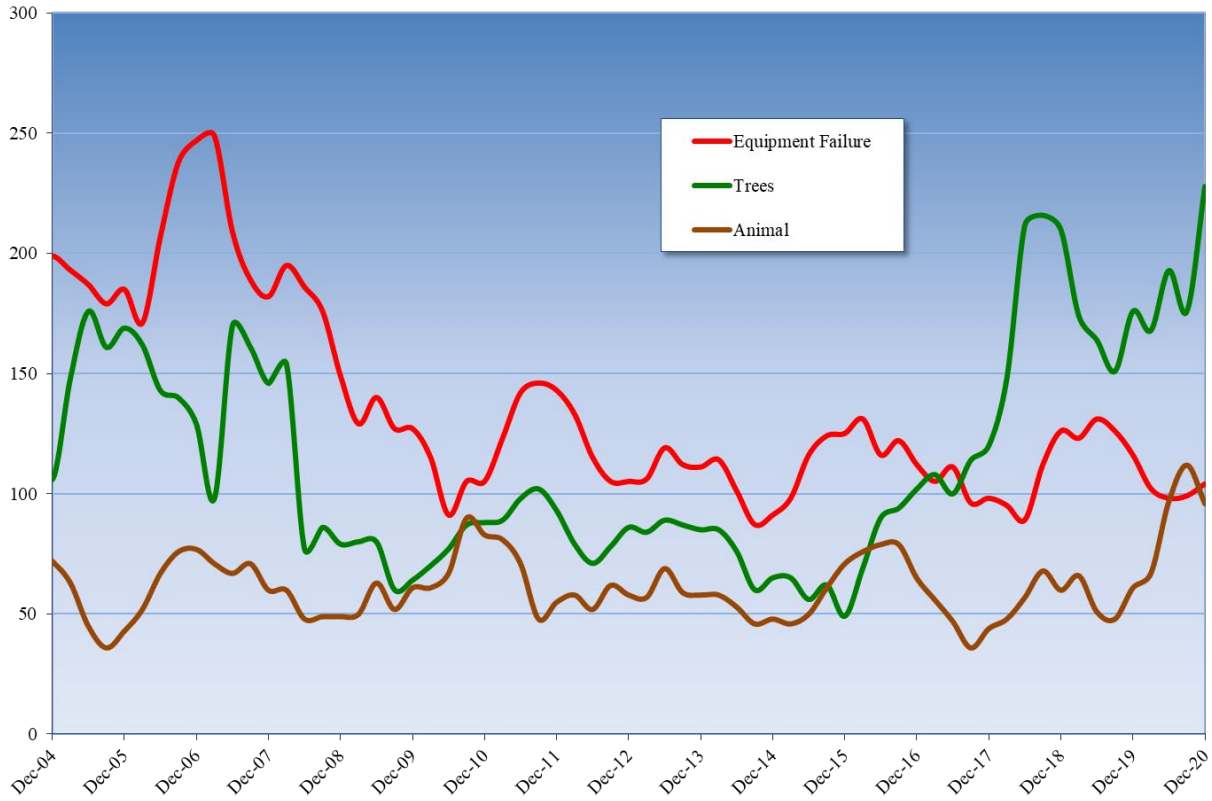


Figure 43 UGI Outage Tracking (number of incidents)



Wellsboro Electric Company

Wellsboro Electric Company (Wellsboro) has a service territory of about 178 square miles and serves about 6,392 customers.

In 2020, Wellsboro experienced 7,543 customer interruptions and 0.7 million customer-minutes interrupted as compared to: 4,815 customer interruptions and 0.7 million customer-minutes interrupted in 2019; 8,565 customer interruptions and 1.1 million customer-minutes interrupted in 2018; 6,816 customer interruptions and 0.3 million customer-minutes interrupted in 2017; and 10,138 customer interruptions and 1.1 million customer-minutes interrupted in 2016.

Wellsboro experienced 12 Major Events in 2020 on the dates listed below with a total of 29,964 customer interruptions not included in the total above.

- April 14
- May 9
- May 23
- June 18
- June 27

- July 30
- August 4
- August 8
- August 19
- August 23
- October 15
- October 21

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 105 minutes in 2019 to 97 minutes in 2020; achieved benchmark by 22%

3-year average: Increased from 109 minutes in 2019 to 111 minutes in 2020; achieved standard by 18%.

SAIDI

Rolling 12-month: Increased from 81 minutes in 2019 to 114 minutes in 2020; achieved benchmark by 26%.

3-year average: Increased from 119 minutes in 2019 to 124 minutes in 2020; achieved standard by 33%.

SAIFI

Rolling 12-month: Increased from 0.77 outages in 2019 to 1.17 outages in 2020; achieved benchmark by 5%.

3-year average: Increased from 1.07 outages in 2019 to 1.10 outages in 2020; achieved standard by 19%.

CAIDI and SAIFI Performance

Historical 12-month CAIDI and SAIFI benchmark reliability performance trends are shown in Figures 44 and 45. Wellsboro's 2020 CAIDI performance is currently in control as shown on the chart to be below the "green" benchmark performance upper-control-limit-line and is a marked improvement from its worst CAIDI year in 2018. Prior to 2018, Wellsboro was a consistent CAIDI benchmark performer. Management attention is needed to ensure CAIDI performance is sustained below the "green" benchmark performance upper-control-limit-line.

Wellsboro's 2020 SAIFI performance is below the "green" benchmark performance upper-control-limit-line and considered under control. Management attention is needed to ensure consistent SAIFI performance is sustained below the "green" benchmark performance upper-control-limit-line.

Outage Causes

Figure 46 shows the reported 2020 outage-cause categories, as a percentage, for the following three distinct performance metrics: Customer-minutes Interrupted, Customers Affected, and Number of Incidents. Trees (combined off and on ROW) and Equipment Failure were the top cause of customer-minutes interrupted. About 85% of the customer minutes interrupted are caused by trees and equipment failure.

Figure 47 shows the historical trend of the top three main outage causes. Trees (all causes) and Equipment Failure are the two most frequent outage-causes. Tree outages and equipment failures are significantly negatively affecting Wellsboro's distribution system reliability and resilience, as well as almost every EDC in Pennsylvania.

General Reliability

Wellsboro experienced several Major Events in 2020. Wellsboro notes that these were due to severe weather events as well as its electric supplier feed from Penelec. Wellsboro notes that the supplier issue was due mainly to Penelec upgrading a transmission line and Wellsboro being served by a backup 34.5 kV circuit.

Wellsboro notes that to address tree-related reliability issues, it has undertaken a program to shorten its tree trimming cycle to five years. Wellsboro notes it will continue to trim 70 miles of circuit per year to maintain this pace and that it also identified some hot spot trimming opportunities in its downtown Wellsboro 3-phase system. Wellsboro also notes that it continues its danger tree program on both on and off ROW areas.

Wellsboro also identified that it has started to install new reclosers in order to be able to isolate outages to smaller customer counts. Wellsboro notes that it targeted its Charleston circuit in 2020, but that it plans to install additional reclosers and upgrade other equipment on other circuits in 2021 with an expected completion in 2022.

Conclusion

Wellsboro achieved benchmark performance for all three reliability metrics: CAIDI, SAIFI and SAIDI. However, Wellsboro also experienced 12 Major Events in 2020 and the impacts of those events were excluded from those reliability metric calculations. As noted above, several of those events were due to a loss of the main feed, but it appears that those issues will subside in 2021 with the completion of Penelec's upgrade work. It is also expected that, for smaller EDCs, a year in which there are several severe storms may result in a higher number of excludable events because of the relatively small customer interruption number to reach Major Event level (10% or more of total customers interrupted for five or more minutes). However, 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 Wellsboro's CAIDI and SAIFI performance below the "green" benchmark performance upper-control-limit-line.

Figure 44 Wellsboro CAIDI (minutes)

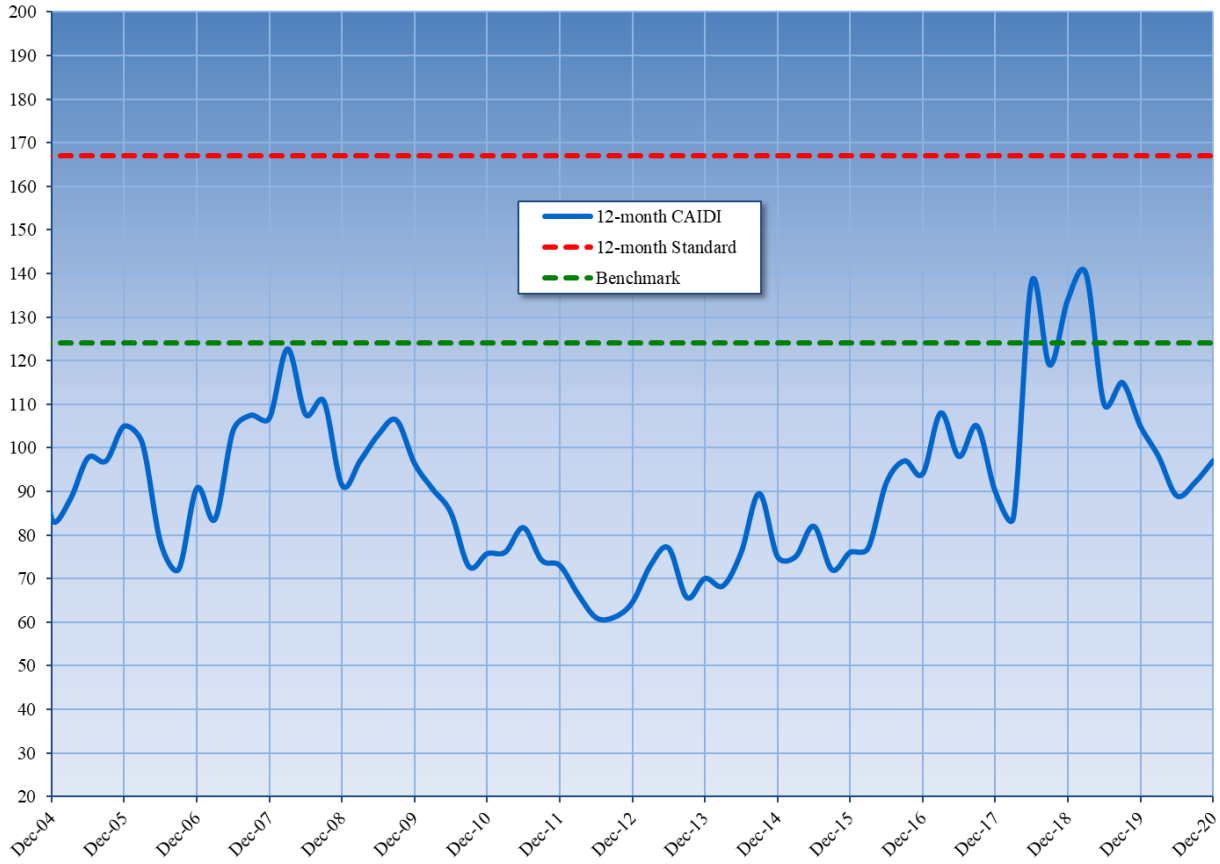


Figure 45 Wellsboro SAIFI (interruptions per customer)

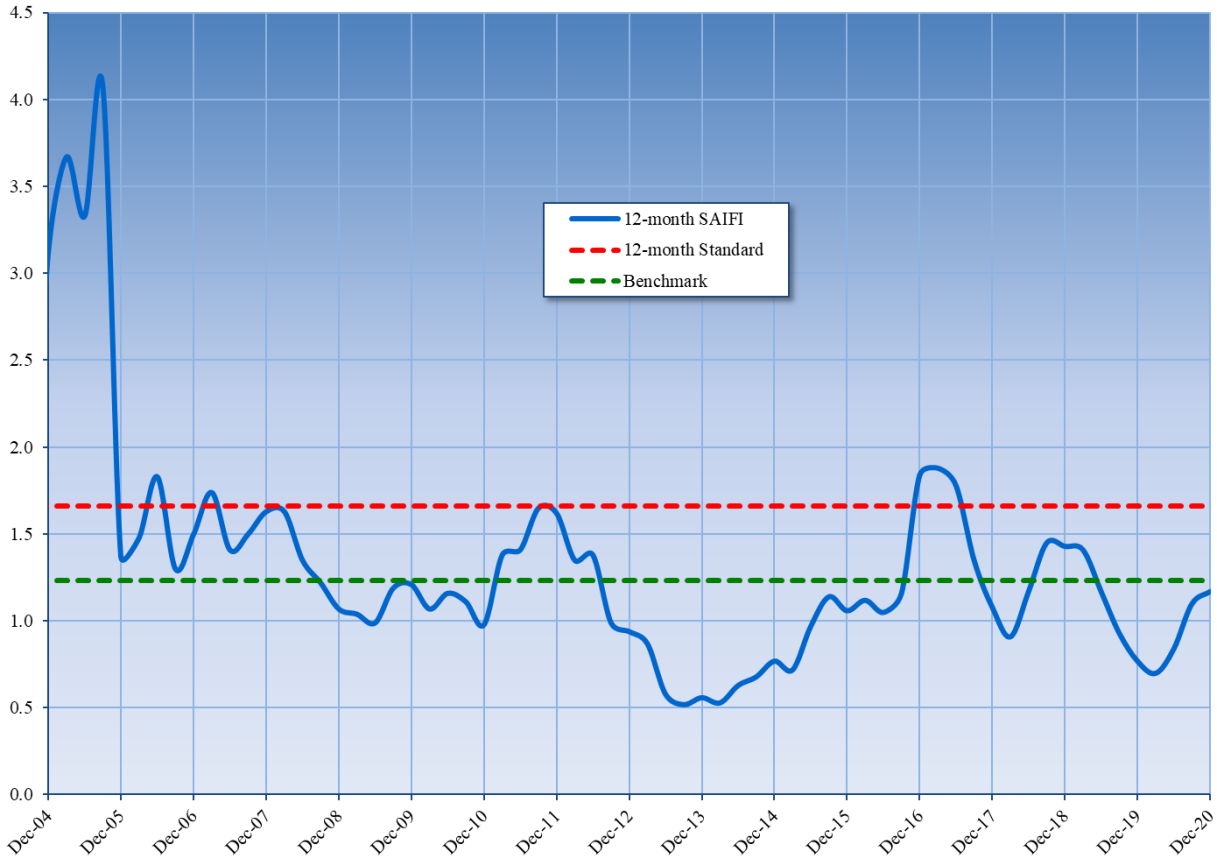


Figure 46 Wellsboro Outage Causes (percent of total outages)

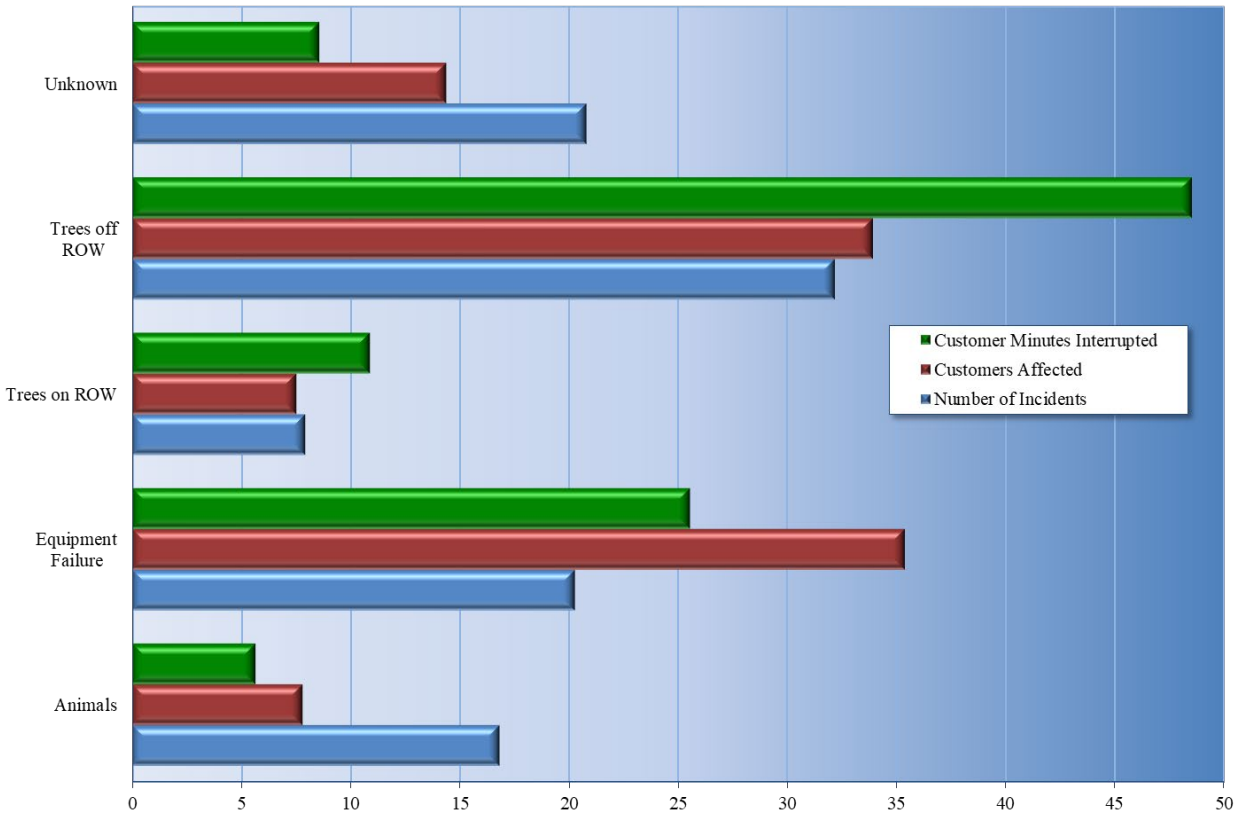
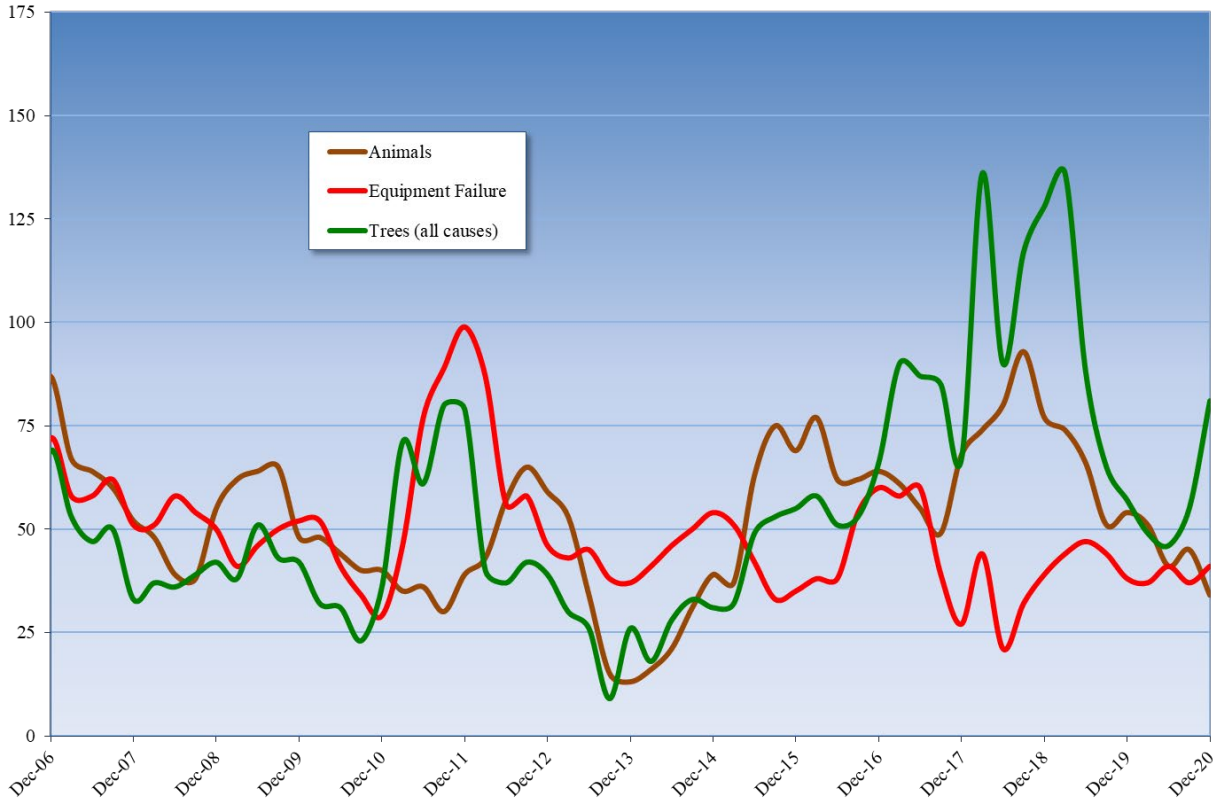


Figure 47 Wellsboro Outage Tracking (number of incidents)



Section 5 – Conclusion

As has been the case the past four years, severe weather in Pennsylvania was challenging to both electrical reliability and resilience in 2020. However, improvement was seen in reducing the number of customer outages experienced in 2020 as compared to 2019. As seen in Appendix B, eight of the 11 EDCS achieved benchmark for SAIFI in 2020, as compared to only five in 2019. Also in 2020, 10 of the 11 EDCs performed better than the rolling 12-month performance standard for SAIFI, as compared to 7 in 2019. For all EDCs except Duquesne, approximately 5.4 million customer outages were experienced in 2020 as compared to 6 million in 2019. Duquesne calculates customer outages as kVA disrupted, rather than individual customers, but Duquesne also saw a reduction from 7.3 million kVA disrupted in 2019 to 6.4 million kVA disrupted in 2020.

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. CAIDI is an important measure as it relates to average duration of a service outage, and EDCs will be expected to improve worsening CAIDI, but reducing service outages from occurring in the first place is crucial to improving reliability performance.

The EDCs continue to accelerate infrastructure improvement and to work on improving reliability and resilience through their Long-Term Infrastructure Improvement Plans (LTIIPs). There are now nine of the 11 EDCs that 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, as also mentioned in the Executive Summary, there are several other areas of concern ripe for further discussion with the EDCs and other key stakeholders. TUS looks forward to the discussion in the Reliability Collaborative. TUS also notes that it expects to see continuing improvements in reliability as EDCs execute their LTIIPs.

Appendix A – Electric Reliability Metrics

12-Month Average Electric Reliability Indices for 2020

Customer Average Interruption Duration Index (CAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-20	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	87	105	141	-17.1	-38.3
Duquesne Light	132	108	130	22.2	1.5
Met-Ed (FE)	150	117	140	28.2	7.1
PECO	135	112	134	20.5	0.7
Penelec (FE)	136	117	141	16.2	-3.5
Penn Power (FE)	185	101	121	83.2	52.9
Pike County	184	174	235	5.7	-21.7
PPL	137	145	174	-5.5	-21.3
UGI	163	169	228	-3.6	-28.5
Wellsboro	97	124	167	-21.8	-41.9
West Penn (FE)	216	170	204	27.1	5.9
System Average Interruption Frequency Index (SAIFI)- outages/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-20	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	0.08	0.20	0.27	-60.0	-70.4
Duquesne Light	0.84	1.17	1.40	-28.2	-40.0
Met-Ed (FE)	1.27	1.15	1.38	10.4	-8.0
PECO	0.90	1.23	1.48	-26.8	-39.2
Penelec (FE)	1.58	1.26	1.52	25.4	3.9
Penn Power (FE)	0.97	1.12	1.34	-13.4	-27.6
Pike County	0.45	0.61	0.82	-26.2	-45.1
PPL	0.84	0.98	1.18	-14.3	-28.8
UGI	0.40	0.83	1.12	-51.8	-64.3
Wellsboro	1.17	1.23	1.66	-4.9	-29.5
West Penn (FE)	1.12	1.05	1.26	6.7	-11.1
System Average Interruption Duration Index (SAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-20	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	7	21	38	-66.7	-81.6
Duquesne Light	111	126	182	-11.9	-39.0
Met-Ed (FE)	190	135	194	40.7	-2.1
PECO	122	138	198	-11.6	-38.4
Penelec (FE)	214	148	213	44.6	0.5
Penn Power (FE)	179	113	162	58.4	10.5
Pike County	83	106	194	-21.7	-57.2
PPL	116	142	205	-18.3	-43.4
UGI	66	140	256	-52.9	-74.2
Wellsboro	114	153	278	-25.5	-59.0
West Penn (FE)	241	179	257	34.6	-6.2

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

Three-Year Average Electric Reliability Indices for 2018-2020

Customer Average Interruption Duration Index (CAIDI)-min/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2018	2019	2020	Average	Standard	Below (-) Standard
Citizens'	76	77	87	80	115	-30.4
Duquesne Light	106	106	132	115	119	-3.6
Met-Ed (FE)	130	164	150	148	129	14.7
PECO	110	189	135	145	123	17.6
Penelec (FE)	114	147	136	132	129	2.6
Penn Power (FE)	138	129	185	151	111	35.7
Pike County	236	177	184	199	192	3.6
PPL	168	176	137	160	160	0.2
UGI	178	188	163	176	186	-5.2
Wellsboro	131	105	97	111	136	-18.4
West Penn (FE)	171	165	216	184	187	-1.6
System Average Interruption Frequency Index (SAIFI)-outages/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2018	2019	2020	Average	Standard	Below (-) Standard
Citizens'	0.21	0.28	0.08	0.19	0.22	-13.6
Duquesne Light	0.84	1.01	0.84	0.90	1.29	-30.5
Met-Ed (FE)	1.27	1.54	1.27	1.36	1.27	7.1
PECO	0.97	1.08	0.90	0.98	1.35	-27.2
Penelec (FE)	1.71	1.72	1.58	1.67	1.39	20.1
Penn Power (FE)	1.10	1.38	0.97	1.15	1.23	-6.5
Pike County	0.85	0.39	0.45	0.56	0.67	-15.9
PPL	0.84	0.85	0.84	0.84	1.08	-21.9
UGI	1.19	0.96	0.40	0.85	0.91	-6.6
Wellsboro	1.36	0.77	1.17	1.10	1.35	-18.5
West Penn (FE)	1.22	1.19	1.12	1.18	1.16	1.4
System Average Interruption Duration Index (SAIDI)-min/yr/cust				3-Year	3-Year	% Above (+) or
EDC	2018	2019	2020	Average	Standard	Below (-) Standard
Citizens'	16	22	7	15	25	-40.7
Duquesne Light	89	106	111	102	153	-33.3
Met-Ed (FE)	165	253	190	203	163	24.3
PECO	106	205	122	144	167	-13.6
Penelec (FE)	195	252	214	220	179	23.1
Penn Power (FE)	152	178	179	170	136	24.8
Pike County	200	69	83	117	129	-9.0
PPL	141	150	116	136	172	-21.1
UGI	213	182	66	154	170	-9.6
Wellsboro	178	81	114	124	185	-32.8
West Penn (FE)	209	196	241	215	217	-0.8

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

Appendix B – Reliability Performance Scorecard Results 2016-2020

2020 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	103	106	126	132	130	103	106	126	132
	SAIDI	126	98	84	102	111	182	98	84	102	111
	SAIFI	1.17	0.95	0.79	0.81	0.84	1.40	0.95	0.79	0.81	0.84
PECO	CAIDI	112	190	182	171	135	134	190	182	171	135
	SAIDI	138	193	181	157	122	198	193	181	157	122
	SAIFI	1.23	1.01	0.99	0.92	0.90	1.48	1.01	0.99	0.92	0.90
PPL	CAIDI	145	167	136	145	137	174	167	136	145	137
	SAIDI	142	131	111	128	116	205	131	111	128	116
	SAIFI	0.98	0.79	0.82	0.88	0.84	1.18	0.79	0.82	0.88	0.84
Met-Ed (FirstEnergy)	CAIDI	117	146	144	145	150	140	146	144	145	150
	SAIDI	135	222	202	205	190	194	222	202	205	190
	SAIFI	1.15	1.52	1.41	1.42	1.27	1.38	1.52	1.41	1.42	1.27
Penelec (FirstEnergy)	CAIDI	117	148	143	146	136	141	148	143	146	136
	SAIDI	148	246	231	235	214	213	246	231	235	214
	SAIFI	1.26	1.66	1.62	1.60	1.58	1.52	1.66	1.62	1.60	1.58
Penn Power (FirstEnergy)	CAIDI	101	137	160	161	185	121	137	160	161	185
	SAIDI	113	187	173	164	179	162	187	173	164	179
	SAIFI	1.12	1.37	1.08	1.02	0.97	1.34	1.37	1.08	1.02	0.97
West Penn (FirstEnergy)	CAIDI	170	162	178	203	216	204	162	178	203	216
	SAIDI	179	187	206	231	241	257	187	206	231	241
	SAIFI	1.05	1.15	1.16	1.14	1.12	1.26	1.15	1.16	1.14	1.12
Small EDCs											
Citizens'	CAIDI	105	88	90	90	87	141	87.6	90.3	90	87
	SAIDI	21	11	11	13	7	38	10.7	11	12.5	7
	SAIFI	0.20	0.12	0.12	0.14	0.08	0.27	0.12	0.12	0.14	0.08
Pike County	CAIDI	174	166	160	185	184	235	166	160	185	184
	SAIDI	106	75	96	107	83	194	75	96	107	83
	SAIFI	0.61	0.45	0.60	0.58	0.45	0.82	0.45	0.60	0.58	0.45
UGI	CAIDI	169	212	186	166	163	228	212	186	166	163
	SAIDI	140	185	142	81	66	256	185	142	81	66
	SAIFI	0.83	0.87	0.76	0.48	0.40	1.12	0.87	0.76	0.48	0.40
Wellsboro	CAIDI	124	98	89	92	97	167	98	89	92	97
	SAIDI	153	68	75	101	114	278	68	75	101	114
	SAIFI	1.23	0.70	0.84	1.10	1.17	1.66	0.70	0.84	1.10	1.17

[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.

2019 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	106	109	100	106	130	106	109	100	106
	SAIDI	126	92	107	98	106	182	92	107	98	106
	SAIFI	1.17	0.87	0.99	0.98	1.01	1.40	0.87	0.99	0.98	1.01
PECO	CAIDI	112	112	138	149	189	134	112	138	149	189
	SAIDI	138	117	145	156	205	198	117	145	156	205
	SAIFI	1.23	1.05	1.05	1.05	1.08	1.48	1.05	1.05	1.05	1.08
PPL	CAIDI	145	177	152	155	176	174	177	152	155	176
	SAIDI	142	161	131	123	150	205	161	131	123	150
	SAIFI	0.98	0.91	0.86	0.79	0.85	1.18	0.91	0.86	0.79	0.85
Met-Ed (FirstEnergy)	CAIDI	117	145	150	151	164	140	145	150	151	164
	SAIDI	135	200	230	211	253	194	200	230	211	253
	SAIFI	1.15	1.37	1.54	1.40	1.54	1.38	1.37	1.54	1.40	1.54
Penelec (FirstEnergy)	CAIDI	117	115	122	136	147	141	115	122	136	147
	SAIDI	148	209	233	241	252	213	209	233	241	252
	SAIFI	1.26	1.82	1.91	1.77	1.72	1.52	1.82	1.91	1.77	1.72
Penn Power (FirstEnergy)	CAIDI	101	126	138	131	129	121	126	138	131	129
	SAIDI	113	143	179	163	178	162	143	179	163	178
	SAIFI	1.12	1.13	1.30	1.25	1.38	1.34	1.13	1.30	1.25	1.38
West Penn (FirstEnergy)	CAIDI	170	169	162	155	165	204	169	162	155	165
	SAIDI	179	209	195	169	196	257	209	195	169	196
	SAIFI	1.05	1.24	1.20	1.09	1.19	1.26	1.24	1.20	1.09	1.19
Small EDCs											
Citizens'	CAIDI	105	73.1	82.7	80.5	77	141	73.1	82.7	80.5	77
	SAIDI	21	26.9	25.3	24.3	21.5	38	26.9	25.3	24.3	21.5
	SAIFI	0.20	0.37	0.31	0.30	0.28	0.27	0.37	0.31	0.30	0.28
Pike County	CAIDI	174	322	322	196	177	235	322	322	196	177
	SAIDI	106	148	114	64	69	194	148	114	64	69
	SAIFI	0.61	0.46	0.35	0.33	0.39	0.82	0.46	0.35	0.33	0.39
UGI	CAIDI	169	141	149	190	188	228	141	149	190	188
	SAIDI	140	172	166	161	182	256	172	166	161	182
	SAIFI	0.83	1.22	1.11	0.85	0.96	1.12	1.22	1.11	0.85	0.96
Wellsboro	CAIDI	124	140	110	115	105	167	140	110	115	105
	SAIDI	153	197	128	107	81	278	197	128	107	81
	SAIFI	1.23	1.41	1.17	0.93	0.77	1.66	1.41	1.17	0.93	0.77

[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.

2018 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	114	103	116	106	130	114	103	116	106
	SAIDI	126	97	77	95	89	182	97	77	95	89
	SAIFI	1.17	0.85	0.75	0.82	0.84	1.40	0.85	0.75	0.82	0.84
PECO	CAIDI	112	98	96	106	110	134	98	96	106	110
	SAIDI	138	70	75	98	106	198	70	75	98	106
	SAIFI	1.23	0.72	0.78	0.93	0.97	1.48	0.72	0.78	0.93	0.97
PPL	CAIDI	145	137	185	173	168	174	137	185	173	168
	SAIDI	142	90	145	146	141	205	90	145	146	141
	SAIFI	0.98	0.65	0.78	0.85	0.84	1.18	0.65	0.78	0.85	0.84
Met-Ed (FirstEnergy)	CAIDI	117	144	147	139	130	140	144	147	139	130
	SAIDI	135	171	175	173	165	194	171	175	173	165
	SAIFI	1.15	1.19	1.19	1.25	1.27	1.38	1.19	1.19	1.25	1.27
Penelec (FirstEnergy)	CAIDI	117	132	127	116	114	141	132	127	116	114
	SAIDI	148	199	198	194	195	213	199	198	194	195
	SAIFI	1.26	1.51	1.56	1.67	1.71	1.52	1.51	1.56	1.67	1.71
Penn Power (FirstEnergy)	CAIDI	101	155	114	131	138	121	155	114	131	138
	SAIDI	113	170	124	154	152	162	170	124	154	152
	SAIFI	1.12	1.09	1.09	1.17	1.10	1.34	1.09	1.09	1.17	1.10
West Penn (FirstEnergy)	CAIDI	170	163	176	175	171	204	163	176	175	171
	SAIDI	179	191	219	219	209	257	191	219	219	209
	SAIFI	1.05	1.18	1.25	1.26	1.22	1.26	1.18	1.25	1.26	1.22
Small EDCs											
Citizens'	CAIDI	105	139	128	127	76	141	139	128	127	76
	SAIDI	21	43	36	26	16	38	43	36	26	16
	SAIFI	0.20	0.31	0.28	0.20	0.21	0.27	0.31	0.28	0.20	0.21
Pike County	CAIDI	174	135	189	235	236	235	135	189	235	236
	SAIDI	106	100	129	195	200	194	100	129	195	200
	SAIFI	0.61	0.74	0.69	0.82	0.85	0.82	0.74	0.69	0.82	0.85
UGI	CAIDI	169	208	213	183	178	228	208	213	183	178
	SAIDI	140	109	150	221	213	256	109	150	221	213
	SAIFI	0.83	0.53	0.71	1.21	1.19	1.12	0.53	0.71	1.21	1.19
Wellsboro	CAIDI	124	84	138	119	131	167	84	138	119	131
	SAIDI	153	76	162	172	178	278	76	162	172	178
	SAIFI	1.23	0.91	1.17	1.45	1.36	1.66	0.91	1.17	1.45	1.36

[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.

2017 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	92	113	116	115	130	92	113	116	115
	SAIDI	126	87	117	111	112	182	87	117	111	112
	SAIFI	1.17	0.95	1.04	0.96	0.98	1.40	0.95	1.04	0.96	0.98
PECO	CAIDI	112	109	99	95	99	134	109	99	95	99
	SAIDI	138	111	92	80	82	198	111	92	80	82
	SAIFI	1.23	1.02	0.93	0.85	0.83	1.48	1.02	0.93	0.85	0.83
PPL	CAIDI	145	123	127	134	146	174	123	127	134	146
	SAIDI	142	99	98	99	104	205	99	98	99	104
	SAIFI	0.98	0.81	0.78	0.74	0.71	1.18	0.81	0.78	0.74	0.71
Met-Ed (FirstEnergy)	CAIDI	117	127	121	138	147	140	127	121	138	147
	SAIDI	135	199	181	205	217	194	199	181	205	217
	SAIFI	1.15	1.57	1.50	1.48	1.47	1.38	1.57	1.50	1.48	1.47
Penelec (FirstEnergy)	CAIDI	117	125	188	137	138	141	125	188	137	138
	SAIDI	148	202	340	232	239	213	202	340	232	239
	SAIFI	1.26	1.62	1.81	1.69	1.73	1.52	1.62	1.81	1.69	1.73
Penn Power (FirstEnergy)	CAIDI	101	99	129	135	150	121	99	129	135	150
	SAIDI	113	108	173	161	160	162	108	173	161	160
	SAIFI	1.12	1.09	1.34	1.19	1.06	1.34	1.09	1.34	1.19	1.06
West Penn (FirstEnergy)	CAIDI	170	159	159	165	166	204	159	159	165	166
	SAIDI	179	191	198	211	214	257	191	198	211	214
	SAIFI	1.05	1.20	1.25	1.28	1.29	1.26	1.20	1.25	1.28	1.29
Small EDCs											
Citizens'	CAIDI	105	175	172	166	185	141	175	172	166	185
	SAIDI	21	67	70	74	84	38	67	70	74	84
	SAIFI	0.20	0.38	0.41	0.45	0.45	0.27	0.38	0.41	0.45	0.45
Pike County	CAIDI	174	251	201	167	185	235	251	201	167	185
	SAIDI	106	134	113	84	102	194	134	113	84	102
	SAIFI	0.61	0.53	0.56	0.51	0.53	0.82	0.53	0.56	0.51	0.53
UGI	CAIDI	169	127	114	134	131	228	127	114	134	131
	SAIDI	140	55	56	57	64	256	55	56	57	64
	SAIFI	0.83	0.43	0.49	0.42	0.49	1.12	0.43	0.49	0.42	0.49
Wellsboro	CAIDI	124	108	98	105	90	167	108	98	105	90
	SAIDI	153	203	175	143	97	278	203	175	143	97
	SAIFI	1.23	1.88	1.78	1.35	1.08	1.66	1.88	1.78	1.35	1.08

[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.

2016 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	92	70	71	100	130	92	70	71	100
	SAIDI	126	76	55	64	69	182	76	55	64	69
	SAIFI	1.17	0.83	0.79	0.90	0.69	1.40	0.83	0.79	0.90	0.69
PECO	CAIDI	112	89	102	108	106	134	89	102	108	106
	SAIDI	138	68	88	103	106	198	68	88	103	106
	SAIFI	1.23	0.77	0.86	0.97	1.00	1.48	0.77	0.86	0.97	1.00
PPL	CAIDI	145	124	118	119	121	174	124	118	119	121
	SAIDI	142	92	85	95	94	205	92	85	95	94
	SAIFI	0.98	0.75	0.72	0.80	0.78	1.18	0.75	0.72	0.80	0.78
Met-Ed (FirstEnergy)	CAIDI	117	123	125	126	124	140	123	125	126	124
	SAIDI	135	164	166	178	178	194	164	166	178	178
	SAIFI	1.15	1.34	1.33	1.41	1.44	1.38	1.34	1.33	1.41	1.44
Penelec (FirstEnergy)	CAIDI	117	143	135	128	120	141	143	135	128	120
	SAIDI	148	192	175	183	171	213	192	175	183	171
	SAIFI	1.26	1.34	1.29	1.43	1.43	1.52	1.34	1.29	1.43	1.43
Penn Power (FirstEnergy)	CAIDI	101	102	96	111	95	121	102	96	111	95
	SAIDI	113	118	95	107	104	162	118	95	107	104
	SAIFI	1.12	1.16	0.99	0.97	1.09	1.34	1.16	0.99	0.97	1.09
West Penn (FirstEnergy)	CAIDI	170	157	144	147	147	204	157	144	147	147
	SAIDI	179	183	148	163	159	257	183	148	163	159
	SAIFI	1.05	1.16	1.03	1.11	1.08	1.26	1.16	1.03	1.11	1.08
Small EDCs											
Citizens'	CAIDI	105	93	105	111	108	141	93	105	111	108
	SAIDI	21	19	25	24	28	38	19	25	24	28
	SAIFI	0.20	0.20	0.23	0.22	0.26	0.27	0.20	0.23	0.22	0.26
Pike County	CAIDI	174	205	174	223	228	235	205	174	223	228
	SAIDI	106	75	71	95	87	194	75	71	95	87
	SAIFI	0.61	0.37	0.41	0.42	0.38	0.82	0.37	0.41	0.42	0.38
UGI	CAIDI	169	109	129	119	125	228	109	129	119	125
	SAIDI	140	71	73	84	78	256	71	73	84	78
	SAIFI	0.83	0.65	0.56	0.70	0.63	1.12	0.65	0.56	0.70	0.63
Wellsboro	CAIDI	124	77	92	97	94	167	77	92	97	94
	SAIDI	153	86	96	113	172	278	86	96	113	172
	SAIFI	1.23	1.12	1.05	1.16	1.84	1.66	1.12	1.05	1.16	1.84

[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 – Modifications to Inspection and Maintenance Intervals

Modifications to Inspection and Maintenance Intervals (Group 2) Submitted October 2020, effective Jan. 1, 2022 – Dec. 31, 2023

Company	Exemption 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 below-ground 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

Modifications to Inspection and Maintenance (I&M) Intervals (Group 1) Submitted October 2019, effective Jan. 1, 2021 – Dec. 31, 2022

Company	Exemption Requested	Justification
FirstEnergy companies: 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.
FirstEnergy companies: Penelec, Penn Power, Met-Ed, and West Penn Power	Distribution overhead line inspections – 5 years rather than 1 to 2-year cycle	Approved previously in the Jan. 1, 2013-Dec. 31, 2014 I&M Plan.
FirstEnergy companies: Penelec, Penn Power, Met-Ed, and West Penn Power	Overhead transformer inspections – 5 years rather than 1 to 2-year cycle	Approved previously in the Jan. 1, 2013-Dec. 31, 2014 I&M Plan.

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