Electric Service Reliability in Pennsylvania

2017

Pennsylvania Public Utility Commission

PENNSYLVANIA ELECTRIC RELIABILITY REPORT 2017

July 2018

Published by:

Pennsylvania Public Utility Commission

Commonwealth Keystone Building

400 North St

Harrisburg, PA 17105-3265

www.puc.pa.gov

Technical Utility Services

Paul T. Diskin, Director

Prepared by:

David M. Washko, Reliability Engineer

Table of Contents

Executive Summary

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

The benchmarks and standards established by the Commission are based on 4 reliability performance metrics adopted by the Institute of Electrical and Electronic Engineers Inc. (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 push the metrics above the benchmark.[4] In recognition of these unforeseen circumstances, the PUC set the performance standard as the minimum level of EDC reliability performance. Reliability performance standards not in compliance may require an EDC to undergo additional scrutiny and may include a Corrective Action Plan or a credible analysis that would justify no corrective action was needed.

As mandated, EDCs report metrics[5] using both a rolling 12-month average and a rolling 3-year average. Tables 1A, 1B, and 1C, below, provide a brief visual comparison summary of the EDCs' 12-month average performance for 2017, 2016, and 2015. More detailed analysis can be found in Section 4, *EDC Reliability Performance Data*.

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).

---

[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.
[6] Docket No. L-00040167.

Table 1A

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.

Table 1B

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.

Table 1C

2015 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	105	107	103	130	103	105	107	103
	SAIDI	126	60	69	78	71	182	60	69	78	71
	SAIFI	1.17	0.58	0.66	0.73	0.69	1.40	0.58	0.66	0.73	0.69
PECO	CAIDI	112	92	90	86	84	134	92	90	86	84
	SAIDI	138	73	69	63	61	198	73	69	63	61
	SAIFI	1.23	0.80	0.76	0.73	0.72	1.48	0.80	0.76	0.73	0.72
PPL	CAIDI	145	142	**155**	124	118	174	142	155	124	118
	SAIDI	142	114	122	86	84	205	114	122	86	84
	SAIFI	0.98	0.80	0.79	0.69	0.72	1.18	0.80	0.79	0.69	0.72
Met-Ed (FirstEnergy)	CAIDI	117	**122**	**126**	**128**	113	140	122	126	128	113
	SAIDI	135	133	**158**	**158**	**136**	194	133	158	158	136
	SAIFI	1.15	1.09	**1.25**	**1.23**	**1.19**	1.38	1.09	1.25	1.23	1.19
Penelec (FirstEnergy)	CAIDI	117	**123**	**131**	**123**	**140**	141	123	131	123	140
	SAIDI	148	**185**	**190**	**168**	**191**	213	185	190	168	191
	SAIFI	1.26	**1.50**	**1.45**	**1.37**	**1.36**	1.52	1.50	1.45	1.37	1.36
Penn Power (FirstEnergy)	CAIDI	101	**104**	**109**	95	100	121	104	109	95	100
	SAIDI	113	103	**114**	112	**114**	162	103	114	112	114
	SAIFI	1.12	0.99	1.05	**1.18**	**1.14**	1.34	0.99	1.05	1.18	1.14
West Penn (FirstEnergy)	CAIDI	170	135	148	149	154	204	135	148	149	154
	SAIDI	179	138	168	175	179	257	138	168	175	179
	SAIFI	1.05	1.02	**1.13**	**1.17**	**1.17**	1.26	1.02	1.13	1.17	1.17
Small EDCs											
Citizens'	CAIDI	105	87	73	78	91	141	87	73	78	91
	SAIDI	21	17	17	20	18	38	17	17	20	18
	SAIFI	0.20	0.20	**0.23**	**0.25**	0.19	0.27	0.20	0.23	0.25	0.19
Pike County	CAIDI	174	104	**199**	**197**	**205**	235	104	199	197	205
	SAIDI	106	**119**	93	77	78	194	119	93	77	78
	SAIFI	0.61	**1.15**	0.47	0.39	0.38	0.82	**1.15**	0.47	0.39	0.38
UGI	CAIDI	169	153	122	113	103	228	153	122	113	103
	SAIDI	140	59	52	47	41	256	59	52	47	41
	SAIFI	0.83	0.38	0.43	0.41	0.40	1.12	0.38	0.43	0.41	0.40
Wellsboro	CAIDI	124	75	82	72	76	167	75	82	72	76
	SAIDI	153	54	80	82	81	278	54	80	82	81
	SAIFI	1.23	0.72	0.97	1.14	1.06	1.66	0.72	0.97	1.14	1.06

[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.

Section 1 – Introduction

Purpose

The report discusses the reliability performance of EDCs operating under the Commission's jurisdiction, specifically focusing on the reliability of the electric distribution system.[7]

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).[8] 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 benchmarks and standards 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 benchmark performance in order to prepare for times when unforeseen circumstances push the metrics above the benchmark. 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 percent from the reliability index benchmark, as compared with the 20 percent or 35 percent deviations allowed by the 12-month performance standard.

The Commission set the performance standard as the minimum level of EDC reliability performance. Reliability Performance Standards that are not 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. Performance Standards that are not achieved during an assessment period will be followed up by the Commission to ensure there is not a systemic breakdown. The inability of an EDC to achieve consistent compliance may result in an Order directing specific corrective actions.[9] 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.[10]

[7] 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.
[8] For more information on CAIDI and SAIFI, see Section 2.
[9] 52 Pa. Code § 57.197(a).
[10] 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 4 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.[11]

Additional information and data EDCs report:

- Average number of customers served.
- Number of sustained customer interruption minutes.
- Number of customers affected by service interruptions.
- Breakdown and analysis of outage causes such as equipment failure, animal contact and contact with trees.[12]
- Reliability performance on the 5 percent of worst performing circuits and a corrective action plan to increase the reliability of these circuits.

[11] 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.

[12] This information is collected and trended by EDCs to reduce customer outages and improve system reliability.

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:[13]

- An interruption of electric service resulting from conditions beyond the control of the EDC which affects at least 10 percent of the customers in the EDC's service territory during the course of the event for a duration of 5 minutes or greater; or
- An unscheduled interruption of electric service resulting from an action taken by an EDC to maintain the adequacy and security of the electrical system.

Outage data relating to major events are to be excluded from the calculation of reliability metrics. Prior to excluding major event outage 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 performance **benchmark** represents the statistical average of the EDC's annual, system-wide, reliability performance index values for the 5 years from 1994-98. The benchmark serves as a reference point limit to ensure an EDC's reliability performance is considered acceptable. As noted in Section 1, above, the EDCs' reliability metrics should be at or below benchmark scores, absent other uncontrollable factors such as worse-than-expected weather.

The performance **standard** is a numerical value representing an EDC's performance upper control limit established for each reliability index. 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 occasionally exceed a benchmark limit. However, exceeding the standard limit may be an indication of reliability issues and will require further scrutiny by Commission staff.

The performance rolling **12-month average** is 120 percent of the benchmark for the large EDCs and 135 percent for the small EDCs.[14] 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 percent of the benchmark for all EDCs. This performance standard was set at 10 percent 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

[13] *See* 52 Pa. Code § 57.192.

[14] 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.

standard at the end of each calendar year. The rolling 3-year standard analysis contained in this report uses 2015, 2016 and 2017 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 percent 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 **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.[15] In addition, Commission staff may initiate an investigation to determine whether an EDC is providing reliable service.[16]

Benchmarks and standards for EDC reliability performance and actual reliability metrics for 2017 are located in Appendix A.

[15] *See* 52 Pa. Code § 57.195(g).
[16] *See* 52 Pa. Code § 57.197(a).

Inspection and Maintenance

EDCs are required to have a plan for periodic inspection and maintenance of poles, overhead conductors and cables, wires, transformers, switching devices, protective devices, regulators, capacitors, substations, and other facilities critical to maintaining an acceptable level of reliability.[17] The time intervals for such inspections are detailed in Table 2, 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 2017 (effective January 2019 through December 2020) for FirstEnergy (Met-Ed, Penelec, Penn Power and West Penn Power) and UGI.

- Filed in October 2016 (effective January 2018 through December 2019) for Duquesne Light, PECO, PPL, Citizens', Pike County and Wellsboro.

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 B describes the exemptions that were requested by the EDCs and provides a summary of the explained justification for said exemptions.[18]

Table 2 - 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**

[17] *See* 52 Pa. Code § 57.198.
[18] *See* 52 Pa. Code § 57.198(c).

Section 3 – 2017 Outage Response Review

Overview

Table 3, below, presents a breakdown of the 50 reportable outage events summarized chronologically for 2017. All Pennsylvania EDCs had at least 1 PUC Reportable Outage Event (ROE) in 2017[19] with the exception of Citizens', Pike, and UGI. 2017 was the highest number of reportable events since data has been collected beginning in 1993; and there were 30 more reportable events in 2017 as compared to 2016.

Table 3a, below, details the number of reportable events from 2008 to 2017.

Table 3b, below, details the number of customers affected by reportable events from 2008 to 2017. In 2017, a total of 1,309,960 customers were affected by reportable outage events, mainly storms, as compared to 779,512 customers in 2016, and 619,474 customers in 2015. 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 3c, below, details the number of reportable events by EDC from 2008 to 2017. In 2017, as well as cumulatively; PPL, West Penn, and Penelec had the most reportable events. Overall in 2017, West Penn and Met-Ed had more reportable events than they had any years previously.

[19] Service outages reports are required under 52 Pa. Code § 67.1. 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 days after the last customer is restored. The reporting threshold for service outages is 5 percent of total customers or 2,500 customers, whichever is less, for six or more consecutive hours.

Table 3 – 2017 Reportable Outage Events Summary

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

Table 3a – Reportable Events 2008-2017

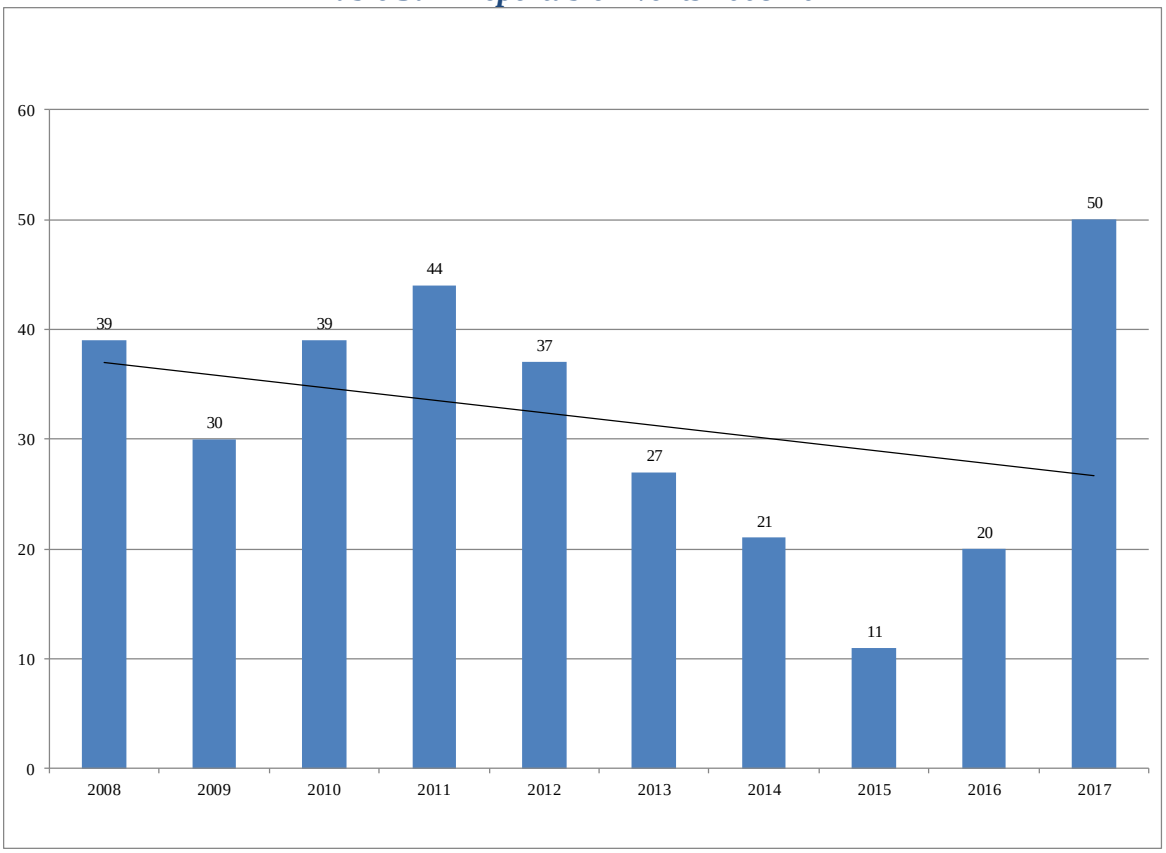


Table 3b – Total Customers affected by Reportable Events 2008-2017

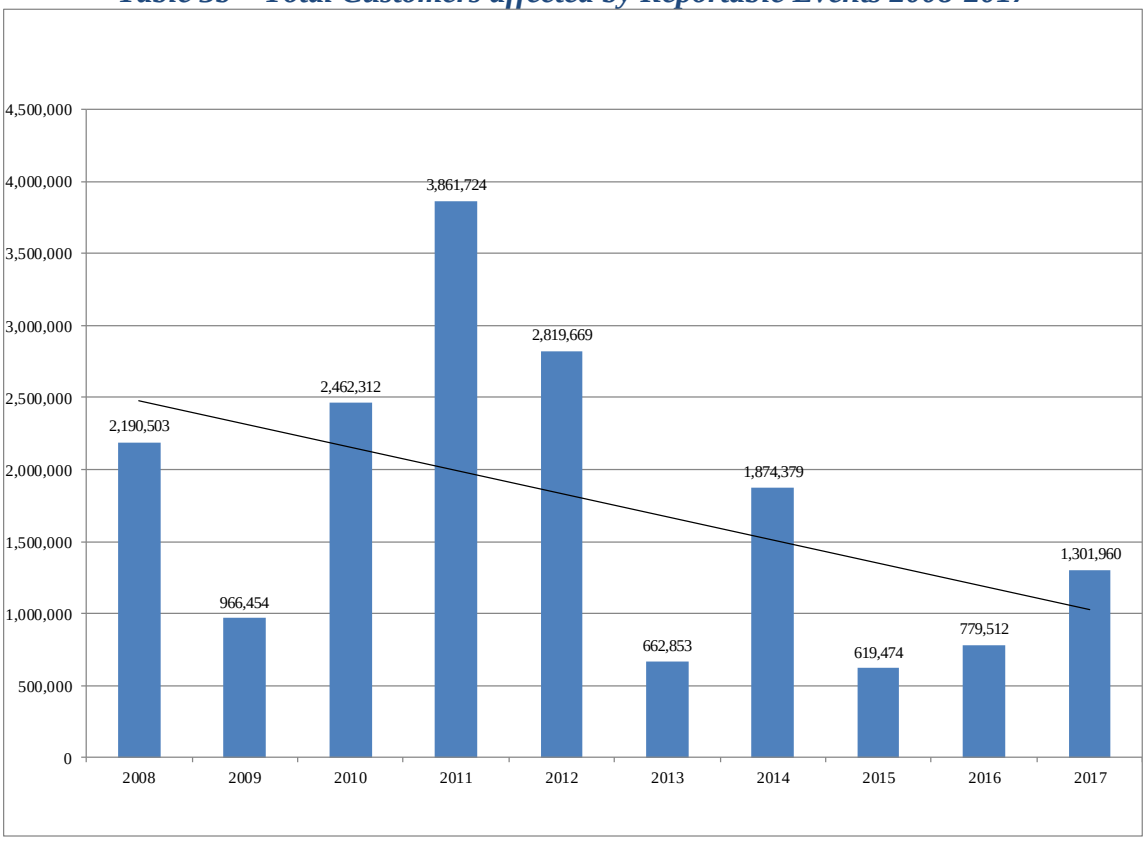
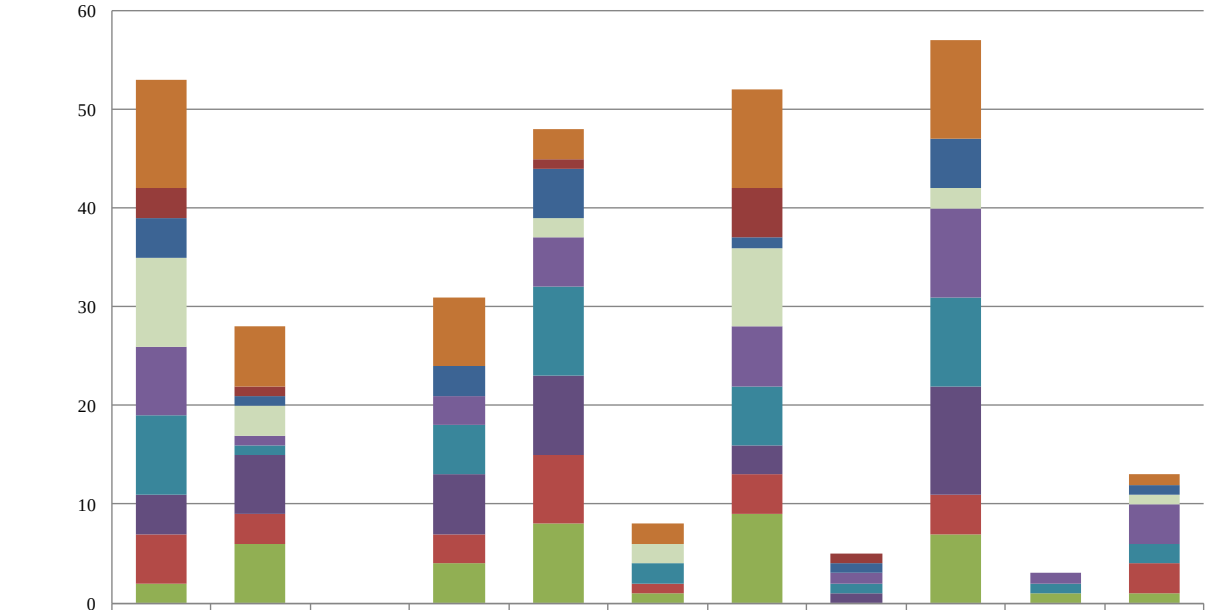


Table 3c –Reportable Events by EDC 2008-2017



	West Penn	Duquesne Light	Citizens Electric	Met Ed	PECO	Penn Power	Penelec	Pike County (O&R)	PPL	UGI Electric	Wellsboro
Total 2017	11	6	0	7	3	2	10	0	10	0	1
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
Total 2010	4	6		6	8	0	3	1	11	0	0
Total 2009	5	3		3	7	1	4		4		3
Total 2008	2	6		4	8	1	9		7	1	1

Major Event Exclusion Requests

Section 2, above, defined Major Events. In 2017, EDCs filed 13 Major Event Exclusion requests for power outages as compared to 11 in 2016. All 13 requests were approved. In 2017, 163,403 customers were affected by major events as compared to 21,060 customers in 2016. A brief description of each major event is provided in Table 4 below:

Table 4 – 2017 Major Exclusion Events

EDC	Date	Customers Affected	Cause
West Penn	6/23/2017	1,665	Flood waters
Penn Power	11/5/2017	19,298	Thunder Storm and wind
Citizens	9/30/2017	6,995	Wind
Penelec	7/23/2017	1,111	Flood waters
West Penn	7/28/2017	3,748	Flood waters
Pike	2/13/2017	786	Snow and wind
Penelec	5/1/2017	95,607	Rain and high winds
Citizens	7/3/2017	1,411	Squirrel
Citizens	7/4/2017	1,411	Squirrel
West Penn	5/1/2017	7,458	Thunderstorms and high winds
Citizens	5/27/2017	1,015	Squirrel
Wellsboro	5/6/2017	6,341	Substation bus insulator failure
Penn Power	3/8/2017	16,557	Snow and wind

Review of Long-Duration Outage Event(s)

There were no long duration outage events in 2017.[20]

[20] Long-duration outage events may include, but are not limited to, Major Service Outage events as outlined in 52 Pa. Code § 69.192(b)(1). Examples include ice storms, heavy snows, hurricanes, and tropical storms, among others. The PUC also considers events such as severe thunderstorms that cause long-duration outages (over 48 hours) for a significant number of customers as long-duration outage events.

Section 4 –EDC Reliability Performance Data

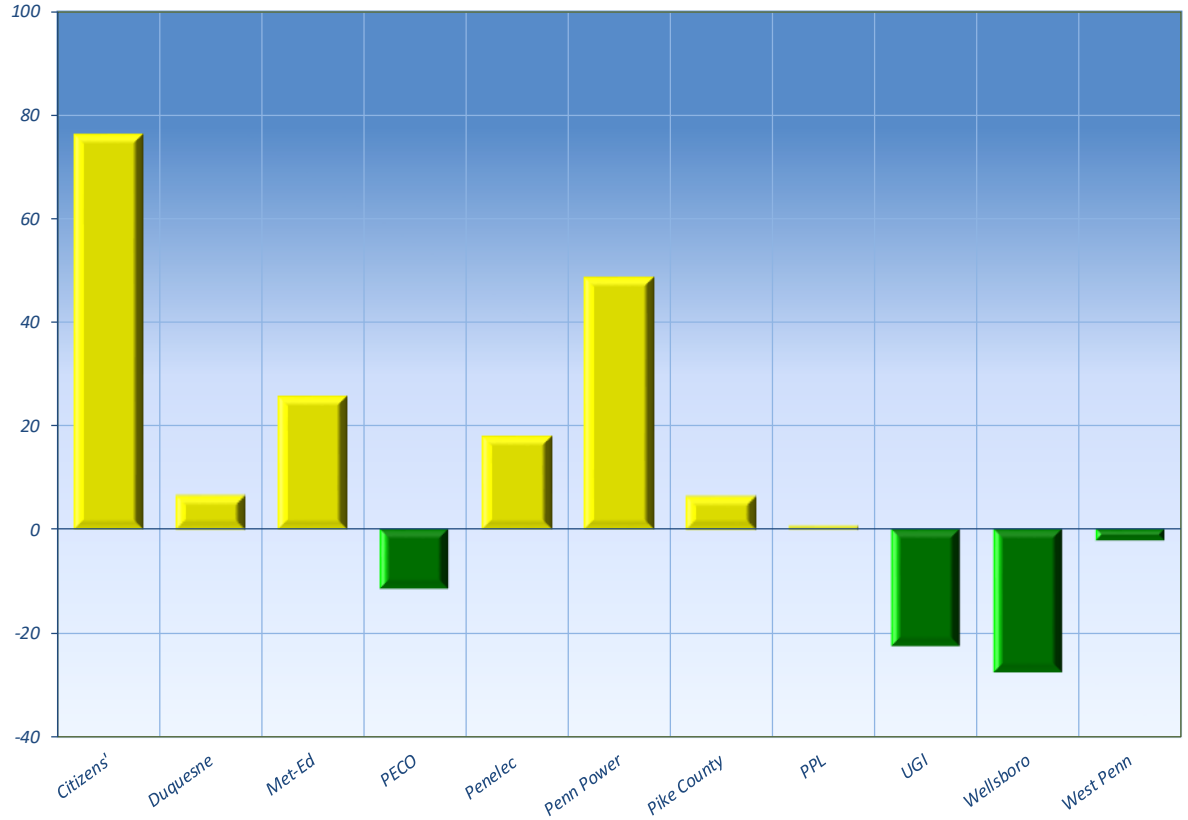
Statewide Summary

Rolling 12-month Benchmark Performance Compliance

The 2017 end of year reliability data for 12-month performance compliance submitted by the 11 EDCs indicates:

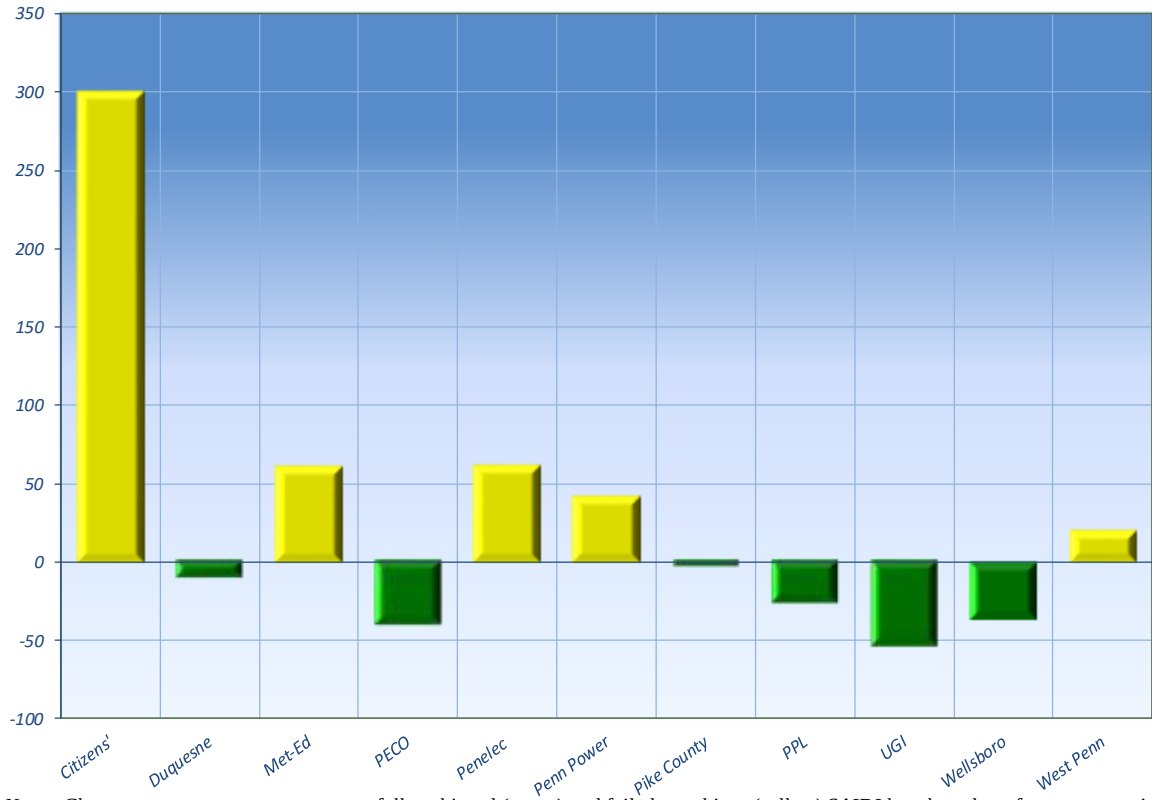
- 4 EDCs achieved the CAIDI benchmark, while 7 EDCs failed to achieve the CAIDI benchmark (Figure 1).
- 6 EDCs achieved the SAIDI benchmark, while 5 EDCs failed to achieve the SAIDI benchmark (Figure 2).
- 7 EDCs achieved the SAIFI benchmark, while 4 EDCs failed to achieve the SAIFI benchmark (Figure 3).

Figure 1 – 2017 CAIDI Comparison (percent above or below benchmark)



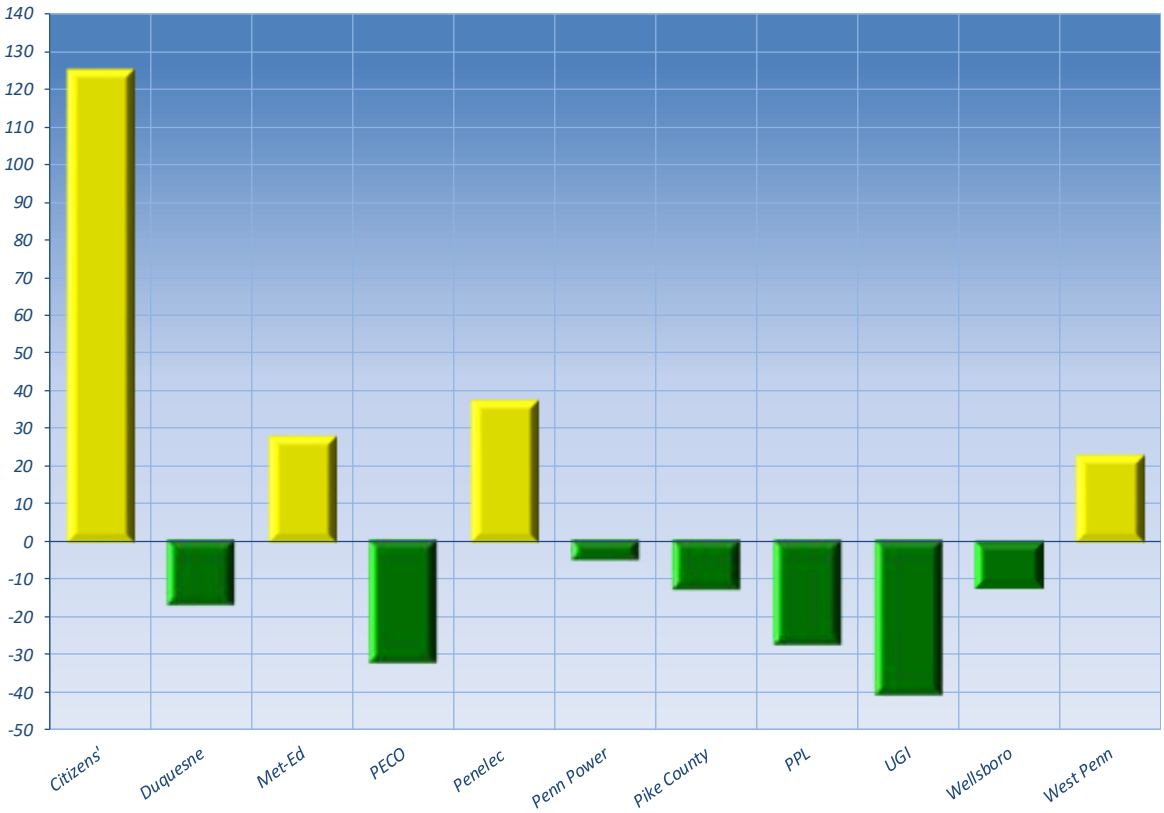
Note: Chart represents percentage successfully achieved (green) and failed to achieve (yellow) CAIDI benchmark performance metric.

FIGURE 2 – 2017 SAIDI Comparison (percent above or below benchmark)



Note: Chart represents percentage successfully achieved (green) and failed to achieve (yellow) SAIDI benchmark performance metric.

FIGURE 3 – 2017 SAIFI Comparison (percent above or below benchmark)



Note: Chart represents percentage successfully achieved (green) and failed to achieve (yellow) SAIFI benchmark performance metric.

Rolling 3-year Average (2015-2017) Performance Compliance

Appendix A provides the 2017 results for the 12-month average and 3-year average reliability performance metrics for individual EDCs.

4 EDCs (Citizens, Penelec, Penn Power and Pike County) failed to meet the rolling 3-year CAIDI performance standard.

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

3 EDCs (Citizens, Met-Ed, and Penelec) 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 has a service territory of about 817 square miles with a well-developed distribution system serving about 590,000 customers.

In 2017, Duquesne experienced 7.1 million kilovolt-amps (kVA) interruptions and 813 million kVA-minutes of interruption compared to 5 million kilovolt-amps (kVA) interruptions and 497 million kVA-minutes of interruption in 2016, and 5 million kilovolt-amps (kVA) interruptions and 510 million kVA-minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 100 minutes in 2016 to 115 minutes in 2017; achieved benchmark by 12 percent.

3-year average: Increased from 102 minutes in 2016 to 106 minutes in 2017; achieved standard by 11 percent.

SAIDI

Rolling 12-month: Increased from 69 minutes in 2016 to 112 minutes in 2017; achieved benchmark by 11 percent.

3-year average: Increased from 68 minutes in 2016 to 84 minutes in 2017; achieved standard by 45 percent.

SAIFI

Rolling 12-month: Increased from 0.69 outages in 2016 to 0.98 outages in 2017; achieved benchmark by 16.2 percent.

3-year average: Increased from 0.67 outages in 2016 to 0.79 outages in 2017; achieved standard by 39 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 4 and Figure 5. Duquesne has sustained below benchmark performance for CAIDI during the last 4 quarters and sustained benchmark for SAIFI during the entire year of 2017.

Figure 6 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 7 shows historical trend of the top 3 main outage causes. The most frequent outage causes were trees/storms and equipment failure. Trees were the top cause of outages and customer minutes interrupted. About 50 percent of outages are caused by trees, which includes: trees falling; trees in contact with distribution system; and tree damage during storms.

Duquesne continues to improve its reliability management work programs and storm hardening activities. Duquesne rolled out an enhanced rights-of-way vegetation management maintenance program which is designed to reduce outages and to continue targeting off right-of-way danger trees. As of May 2018, Duquesne has 104 circuits as compared to 98 circuits in 2017 that utilize pulse-recloser fault protection and sectionalizing. This type of recloser reduces the stress on the circuit components during a fault event, thereby reducing component damage and outage restoration times.

Duquesne completed various capacity upgrades in 2017 that upgraded lines, transformers, and substation infrastructure. Duquesne participates in the Spare Transformer Equipment program managed by the Edison Electric Institute. The company is also committed to the installation of an outage management system (OMS) that in the future will provide customers with more accurate restoration information and improve storm restoration execution. Duquesne utilizes Infrared Inspection on 20 percent of distribution circuits each year.

Duquesne has been a consistent Benchmark performer during the last 11 quarters in all categories. However, during the last 3 12-month rolling quarters of 2017, CAIDI scores have increased slightly above benchmark. Based on past performance this appears, at this time, to be a short-term issue due to increased stormy weather.[21] However, TUS will continue to monitor this for any trends.

[21] *See* Section 3.

Figure 4 Duquesne CAIDI (minutes)

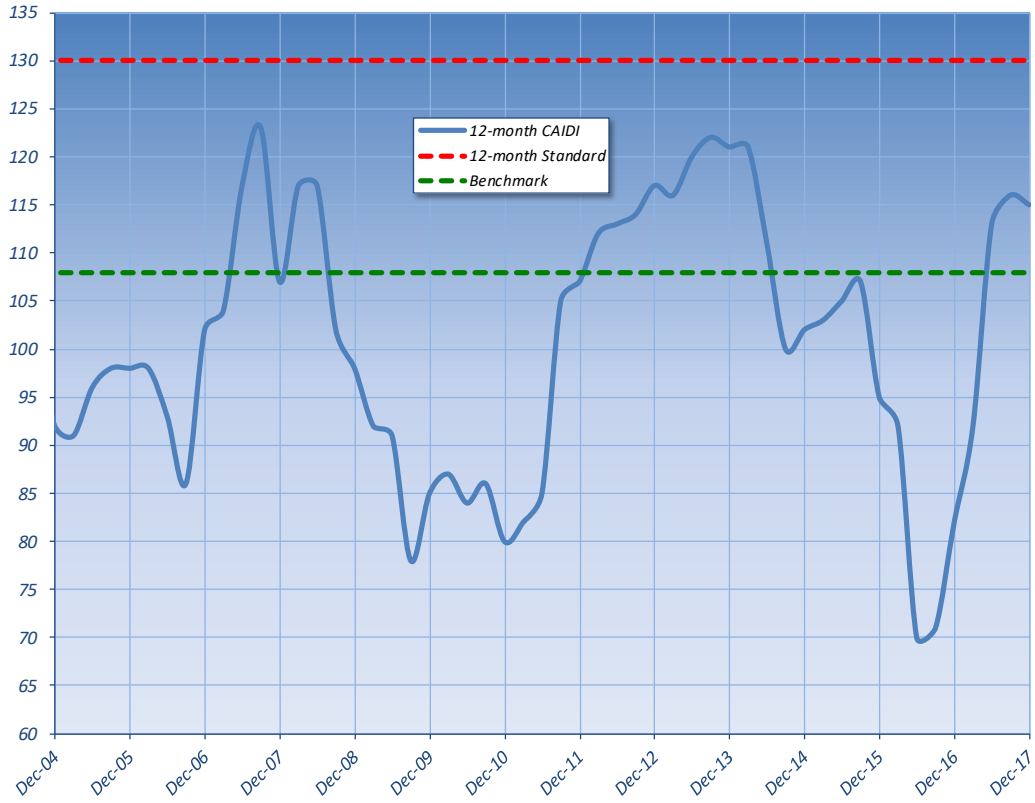


Figure 5 Duquesne SAIFI (Interruptions Per Customer)

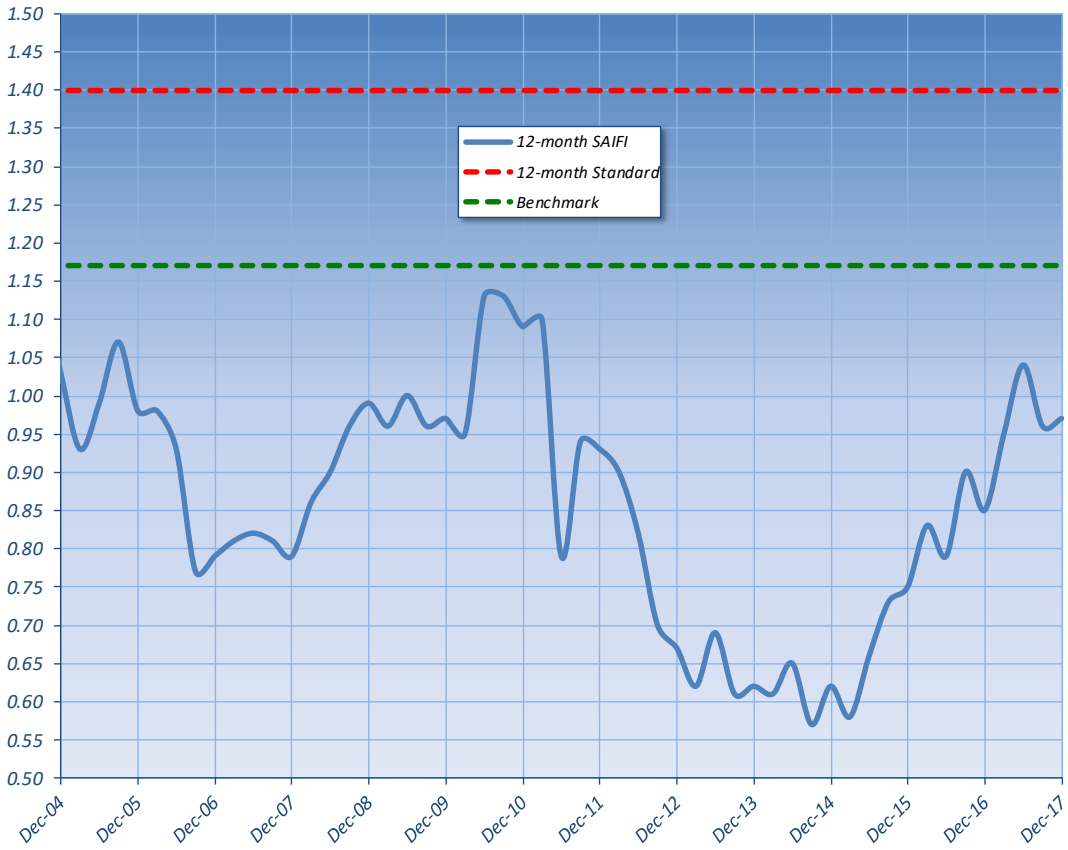


Figure 6 Duquesne Outage Causes (percent of total outages)

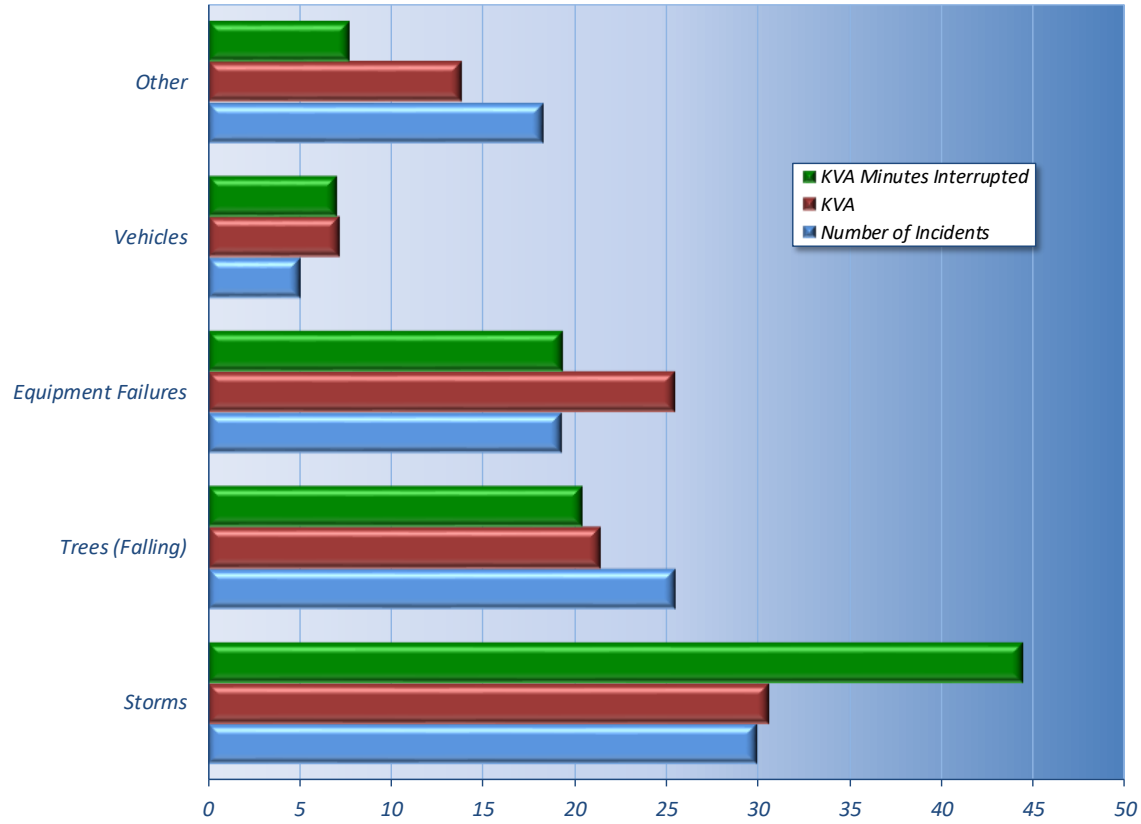
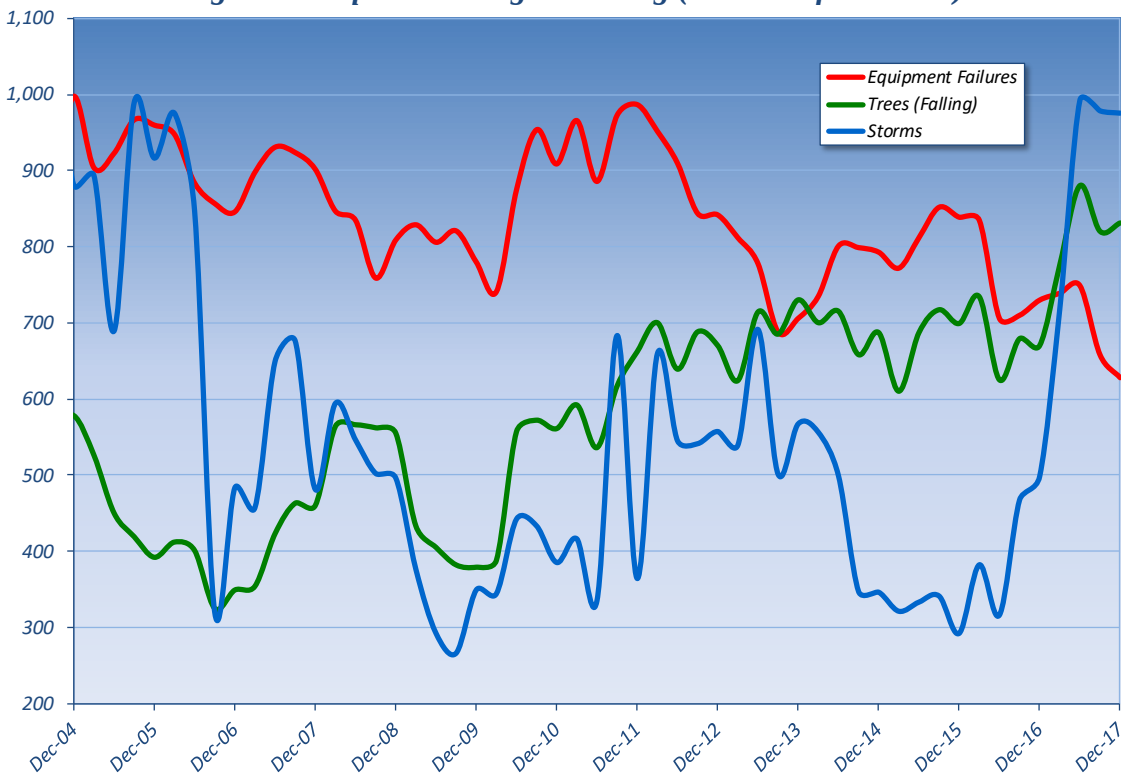


Figure 7 Duquesne Outage Tracking (number of incidents)



PECO Energy Company

PECO has a service territory of about 2,100 square miles that serves a well-developed distribution system serving about 1.7 million customers.

In 2017, PECO experienced 1.35 million customer interruptions and 134.0 million minutes of interruptions as compared to 1.62 million customer interruptions and 171.6 million minutes of interruption in 2016, and 1.23 million customer interruptions and 103.3 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 106 minutes in 2016 to 99 minutes in 2017; achieved benchmark by 12 percent.

3-year average: Increased from 95 minutes in 2016 to 96 minutes in 2017; achieved standard by 22 percent.

SAIDI

Rolling 12-month: Decreased from 106 minutes in 2016 to 82 minutes in 2017; achieved benchmark by 41 percent.

3-year average: Remained unchanged at 83 minutes in 2017; achieved standard by 50 percent.

SAIFI

Rolling 12-month: Decreased from 1.00 outages in 2016 to 0.83 outages in 2017; achieved benchmark by 32 percent.

3-year average: Decreased from 0.86 outages in 2016 to 0.85 outages in 2017; achieved standard by 37 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 8 and Figure 9. PECO has consistently sustained benchmark performance in every reliability category for the past 5 years.

Figure 10 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 11 shows the historical trend of the top 3 main outage causes. The most frequent outage cause is equipment failure, which is about 38 percent of outage causes, followed by tree related outages at about 30 percent.

In 2017, PECO continued storm hardening activities through infrastructure improvements and enhanced vegetation management. PECO installed more than 45 miles of tree-resistant wire in areas impacted by high incidences of vegetation-related outages and removed more than 3,000 hazardous trees in 2017 to enhance system performance and reduce service interruptions.

PECO's Long-Term Infrastructure Improvement Plan (LTIIP), or "System 2020" plan, was approved by the Commission on Oct 22, 2015.[22] Under the System 2020 Plan, PECO will spend an additional $274 million through 2020 on system resiliency and storm hardening system

[22] Order entered on Oct 22, 2015, at Docket No. P-2015-2471423.

improvements. These investments are in 3 key areas: storm hardening and resiliency measures; accelerated cable replacements; and the acceleration of a plan to retire building substations and to upgrade the distribution facilities supplied by those substations. Accelerated spending in the replacement of aging infrastructure should overtime, reduce the number of outages caused by equipment failure.

PECO has been a consistent Benchmark performer during the last 12 quarters in all categories.

Figure 8 PECO CAIDI (minutes)

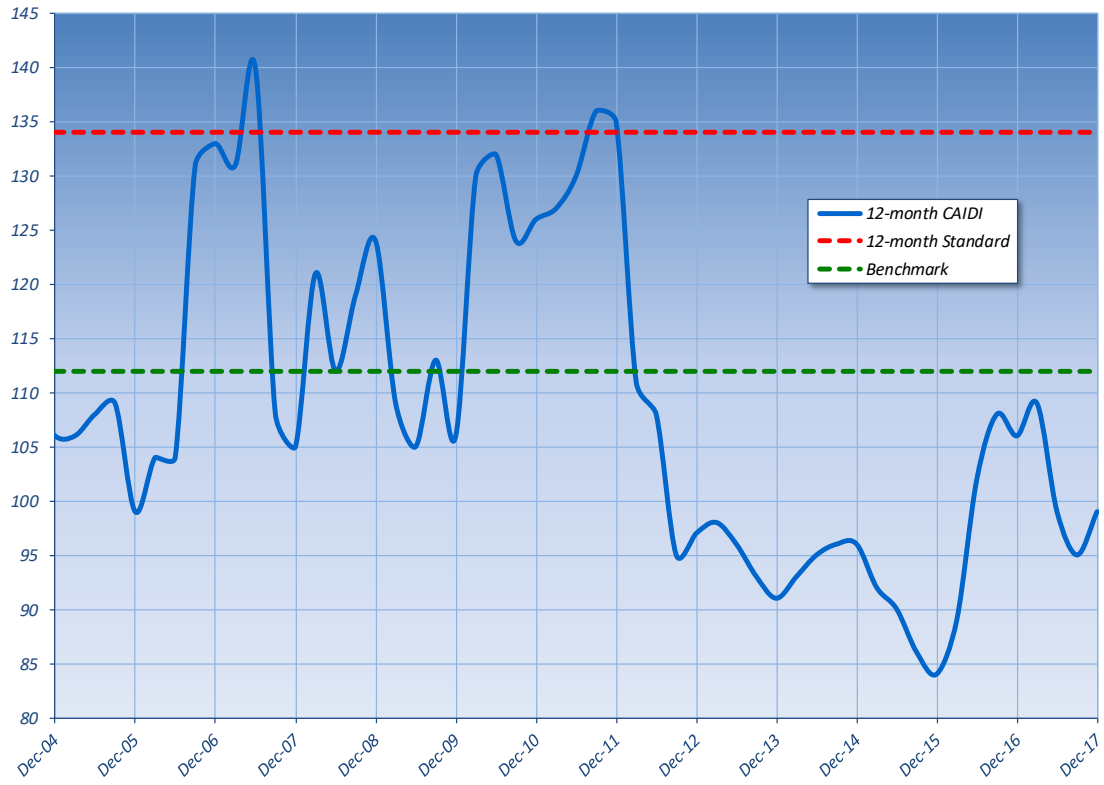


Figure 9 PECO SAIFI (interruptions per customer)

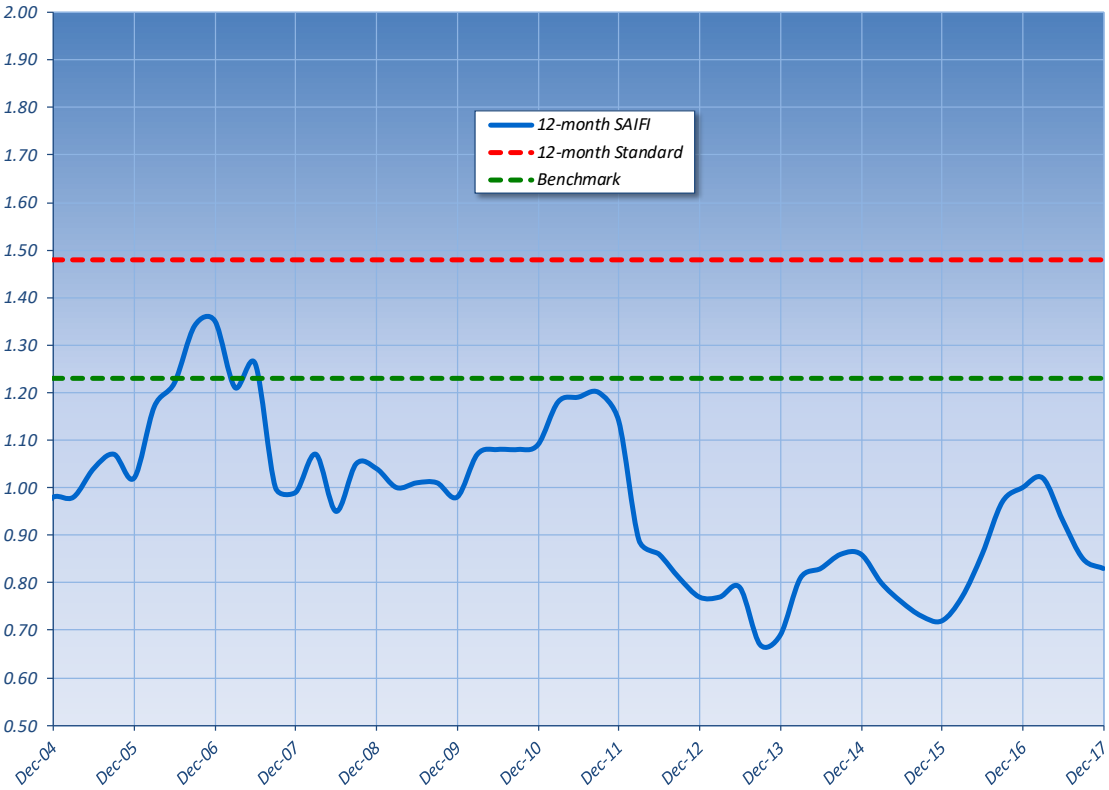


Figure 10 PECO Outage Causes (percent of total outages)

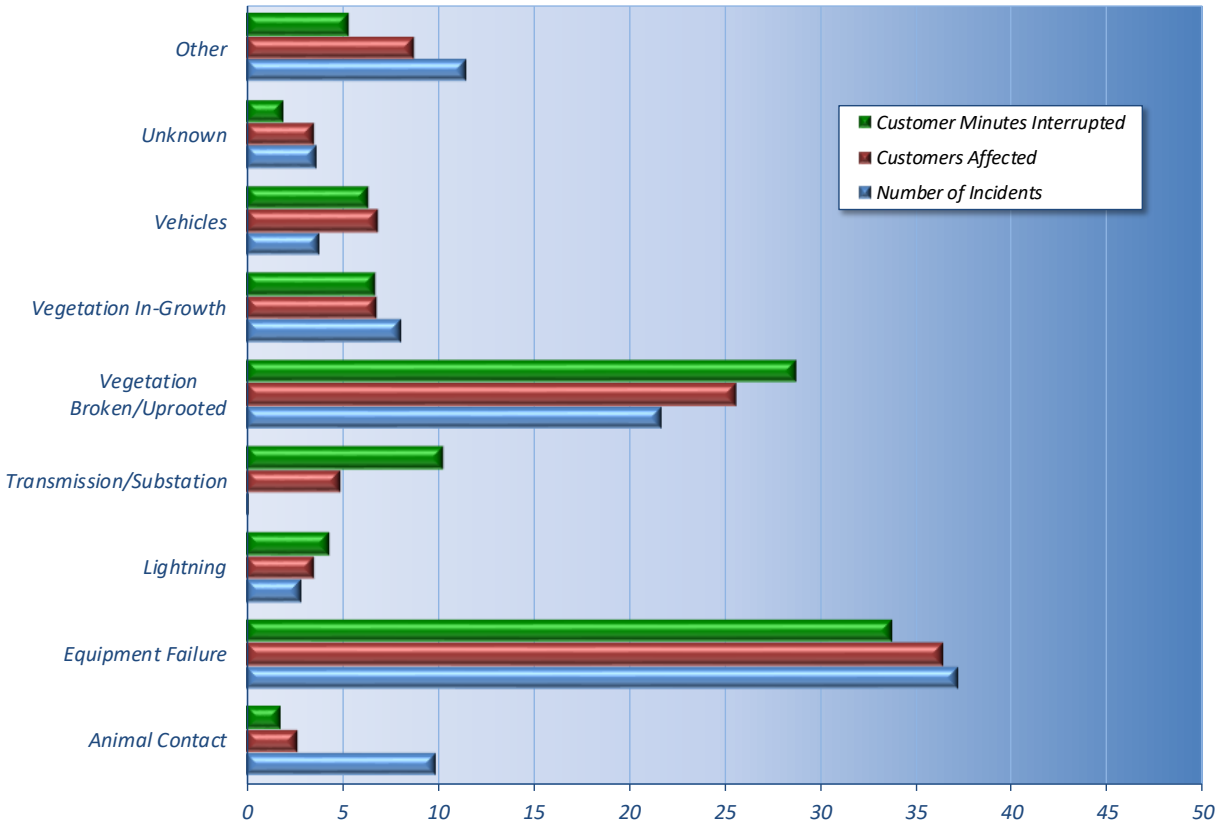
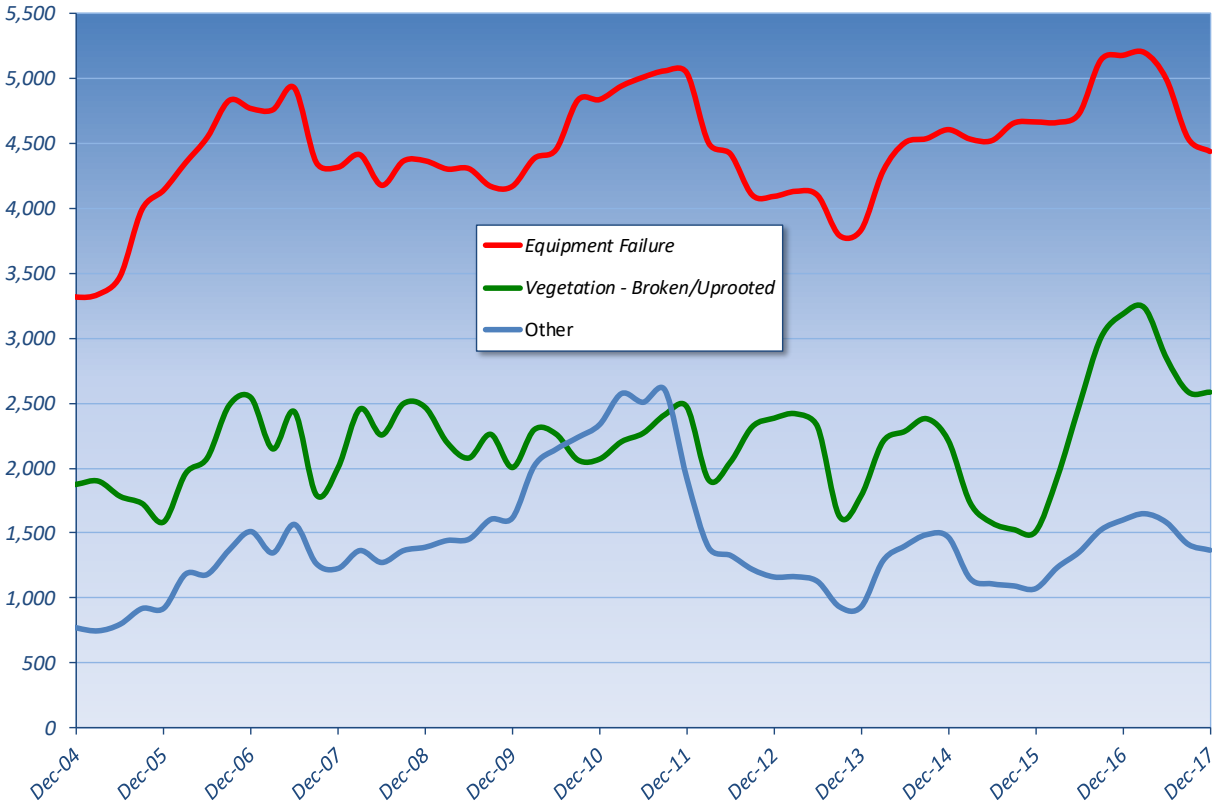


Figure 11 PECO Outage Tracking (number of incidents)



PPL Electric Utilities Corporation

PPL has a service territory of about 10,000 square miles and serves 1.4 million customers.

In 2017, PPL experienced 1 million customer interruptions and 147.2 million minutes of interruptions as compared to 1.1 million customer interruptions and 132.9 million minutes of interruption in 2016, and 1 million customer interruptions and 118.5 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 121 minutes in 2016 to 146 minutes in 2017; and was above benchmark by 1 percent.

3-year average: Decreased from 140 minutes in 2015 to 128 minutes in 2017; achieved standard by 20 percent.

SAIDI

Rolling 12-month: Increased from 94 minutes in 2016 to 104 minutes in 2017; and achieved benchmark by 27 percent.

3-year average: Decreased from 114 minutes in 2016 to 94 minutes in 2017; achieved standard by 45 percent.

SAIFI

Rolling 12-month: Decreased from 0.78 outages in 2016 to 0.71 outages in 2017; achieved benchmark by 28 percent.

3-year average: Decreased from 0.81 outages in 2016 to 0.74 outages in 2017; achieved benchmark by 32 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 12 and Figure 13. The recent trend is that outages are less frequent, and the duration is slightly increasing. Figure 14 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 15 shows a historical trend of the top 3 main outage causes. The most frequent outage causes were trees at 63 percent, followed by equipment failure at 22 percent.

PPL's vegetation management program utilizes industry best practices and seeks to improve the reliability of the electric transmission and distribution systems by preventing outages from vegetation located on easements and rights-of-way (ROW) and minimizing outages from vegetation located adjacent to ROW. Trees are generally the most common cause of storm-related power outages, and PPL recognizes that vegetation management is critical to keeping the system reliable.

In 2013, PPL launched more comprehensive tree trimming on multi-phase circuits and accelerated its efforts to identify and remove trees outside of the ROW that have the potential to cause outages. These efforts, combined with several years of more comprehensive tree trimming on higher voltage lines, resulted in a reduction in the number of tree-related outages. These reliability gains are currently being somewhat offset by the Emerald Ash Borer (EAB) infestation in Pennsylvania. PPL plans to continue this initiative in 2018.

PPL also has a Hazard Tree Program, where trees that are at risk of causing damage to PPL power lines are identified and addressed. With the EAB infestation, PPL is taking measures to remove all ash danger trees on the company's transmission lines. For the distribution system, dead or declining ash trees are targeted as part of the "Hazard Tree" program during cycle maintenance. These preventive measures have been established for both transmission and distribution circuits.

The overall intent of PPL's storm hardening initiatives is to reduce pole breaks and damage due to vegetation, which can lead to extended repair time. PPL will continue implementing several initiatives to improve system resiliency in 2018. These initiatives include changes to engineering instructions and construction specifications to enhance the reliability of the distribution system during storms. For example, fiberglass crossarms are now used whenever possible. These crossarms are higher in strength, and resist damage from corrosion and contamination. PPL is also using steel poles at highway and railroad crossings to harden these critical locations. Larger poles are now used in locations where heavier equipment is installed, and remote service kits are installed to improve restoration times for residential customers in rural areas.

PPL continues to invest in its smart grid initiative. A pilot program conducted in Dauphin and Cumberland counties saw a 35 to 50 percent reduction in customer minutes interrupted as compared to non-automated circuits in the same geographic area. Another project conducted in the Pocono region saw outage durations reduced by an average of 30 percent.

PPL has several noteworthy reliability improvement activities. For example, PPL pioneered a momentary outage task force and program to investigate and mitigate the causes of multiple momentary outages in 2016. This program is reducing momentary outages for customers and should also reduce permanent outages which may have eventually been caused by the conditions that were causing the momentary outages. Projects under this program include replacing deteriorated/defective equipment, hot spot tree trimming, protection evaluation, and animal guarding.

PPL also has a program to address customers experiencing multiple interruptions (CEMI). Under this program all customers have their interruption count monitored on a rolling 12-month basis and appropriate remediation strategies are developed.

PPL Electric experienced 26 storm events in 2017, as compared to an average of 14 during the benchmark period of 1994-1998. A PPL record-tying 10 storms in 2017 were PUC-reportable, while 16 were not reportable but required the opening of 1 or more area emergency centers to manage restoration efforts.

In 2017, PPL was considered a benchmark performer in all quarters with the exception of being over CAIDI by 1 minute in the fourth quarter. PPL continues to proactively improve grid resiliency, reliability, sustainability, and storm hardening.

Figure 12 PPL CAIDI (minutes)

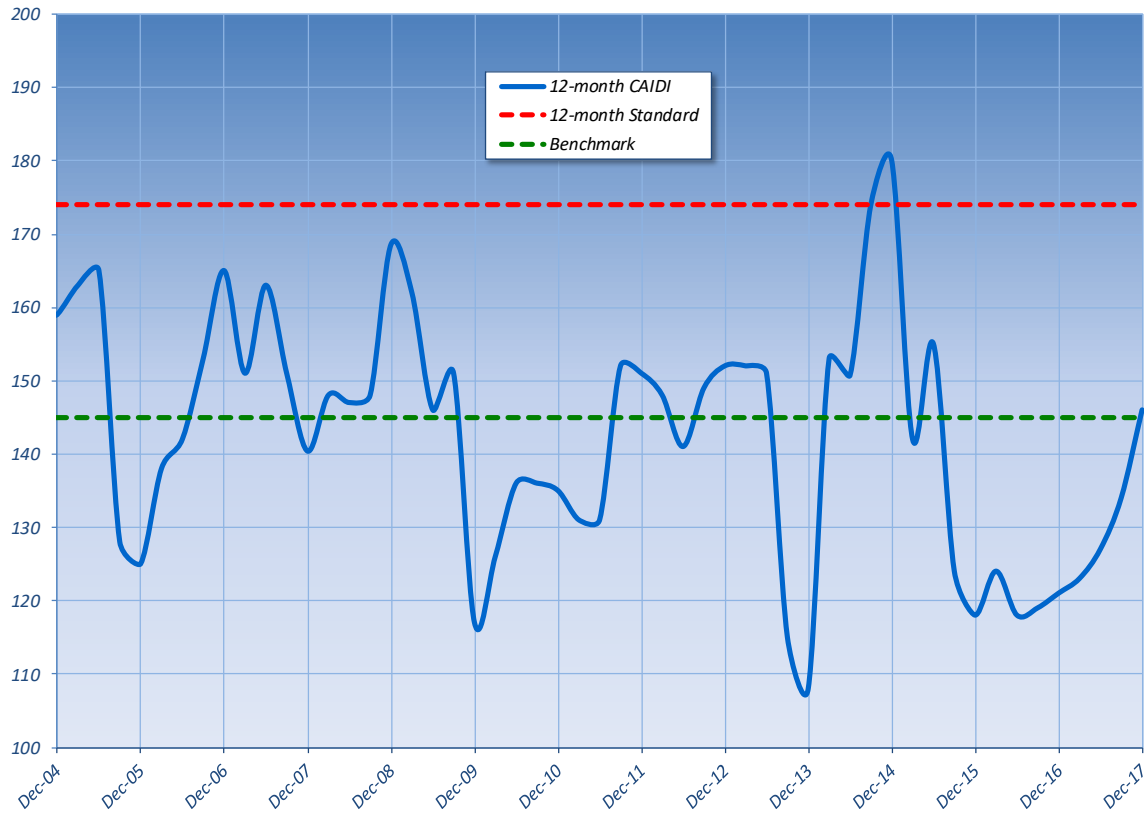


Figure 13 PPL SAIFI (interruptions per customer)

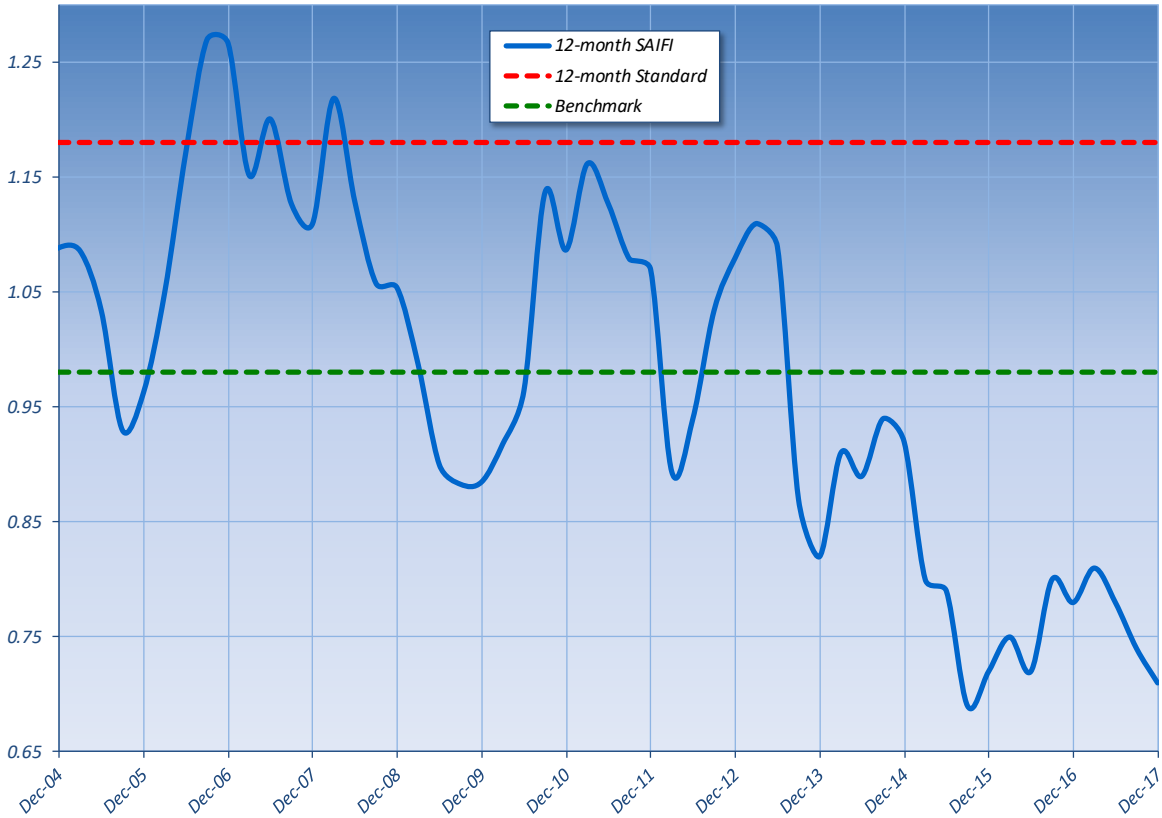


Figure 14 PPL Outage Causes (percent of total outages)

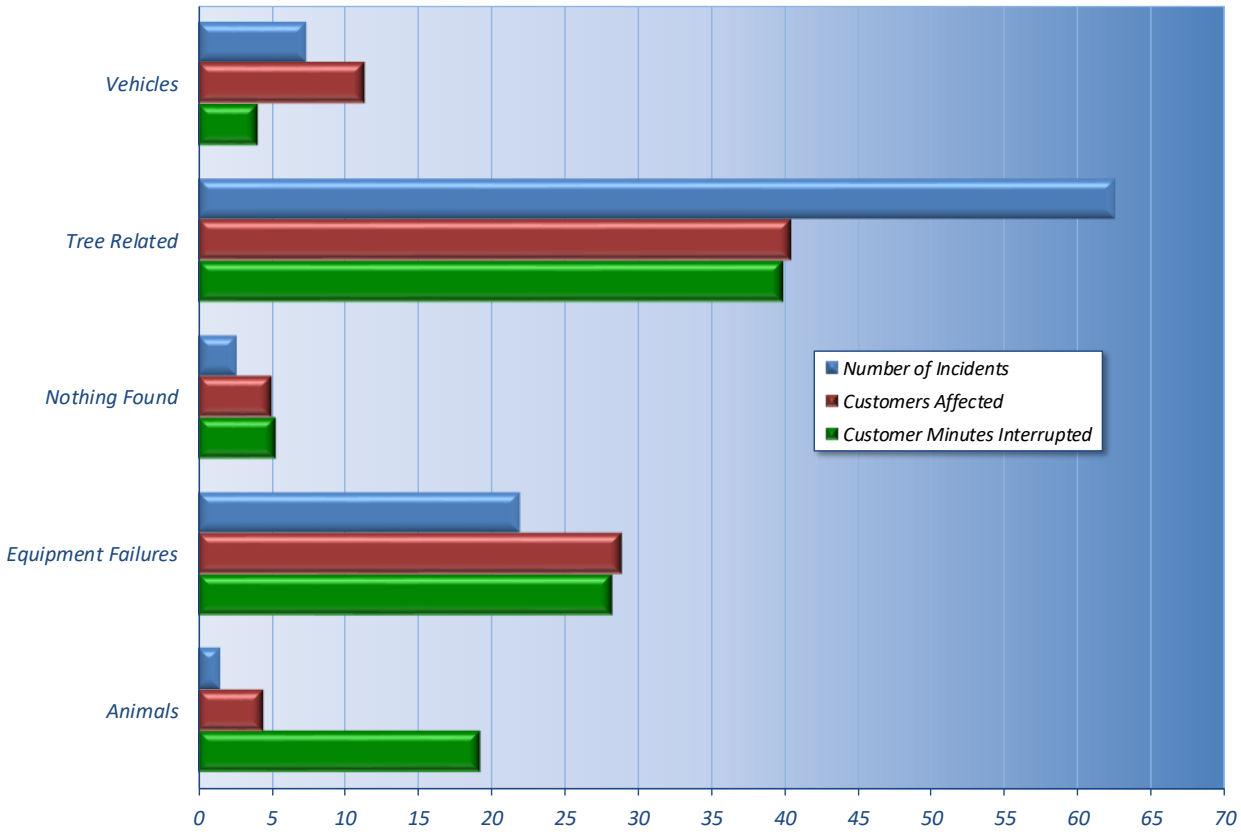
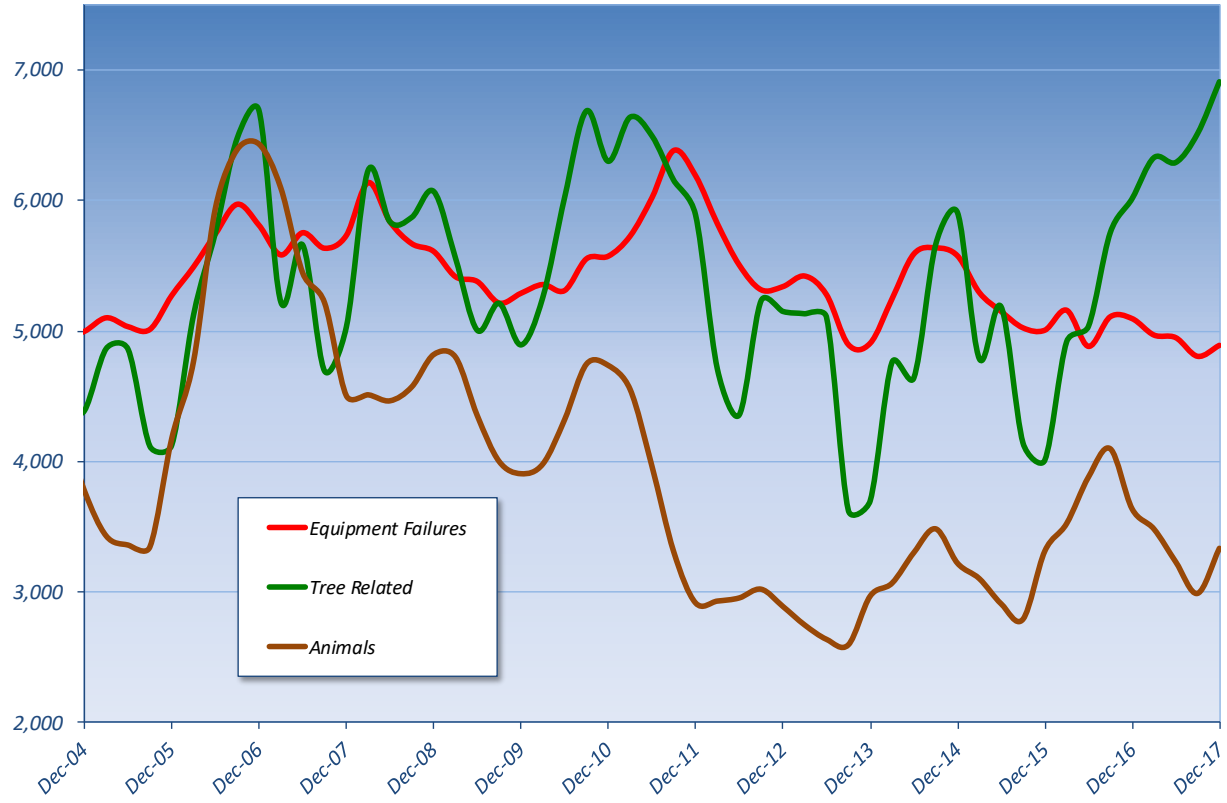


Figure 15 PPL Outage Tracking (number of incidents)



Metropolitan Edison Company

Met-Ed has a service territory of about 3,300 square miles that serves about 554,500 customers.

In 2017, Met-Ed experienced 827,461 customer interruptions and 121.9 million minutes of interruptions as compared to 804,947 customer interruptions and 99.6 million minutes in 2016, and 662,492 customer interruptions and 75.2 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 124 minutes in 2016 to 147 minutes in 2017; failed to achieve benchmark by 26 percent.

3-year average: Increased slightly from 122 minutes in 2016 to 128 minutes in 2017; achieved standard by 1 percent.

SAIDI

Rolling 12-month: Increased from 178 minutes in 2016 to 217 minutes in 2017; failed to achieve benchmark by 61 percent.

3-year average: Increased from 152 minutes in 2016 to 177 minutes in 2017; failed to achieved standard by 9 percent.

SAIFI

Rolling 12-month: Increased from 1.44 outages in 2016 to 1.47 outages in 2017; failed to achieve benchmark by 28 percent.

3-year average: Increased from 1.25 outages in 2016 to 1.37 outages in 2017; failed to achieve standard by 8 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 16 and Figure 17. In 2017, Met-Ed's CAIDI and SAIDI scores have trended negatively higher in the third and fourth quarters, and are now additionally over the upper control standard. Ideally, EDCs should be at or below benchmark performance so that increased storm activity will temporarily bump them above benchmark. During the past 5 years, Met-Ed has struggled to sustain consistently positive benchmark scores.

Figure 18 shows the distribution of causes of service outages that occurred during 2017 as a percentage of total outages. Figure 19 shows the top main outage causes, which shows off right-of-way trees and equipment failure as the most frequent cause of power outages and customer minutes interrupted. However, if all the subcategories of tree outages (not shown) are combined, the total outages caused by trees increases to 31 percent and equipment failure is second at 23 percent. Trees affect substantially more customers and cause the most customer minutes interrupted.

The PUC has been performing extra monitoring of Met-Ed's work management system and Reliability Improvement Plan (RIP) as a result of a Commission Motion regarding FirstEnergy's

Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[23]

Met-Ed's Long-Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[24] Met-Ed's LTIIP was designed to help improve storm hardening, system resiliency, and reliability. As of the release date of this report, TUS is currently reviewing the efficacy of all the FirstEnergy Company LTIIPs as part of the required mid-term review of LTIIPs.[25]

Met-Ed Reliability Initiatives

In 2017, Met-Ed performed 2,895 miles of cycle-based tree trimming, including the removal of 7,083 priority trees. Met-Ed plans to trim approximately 2,940 miles in 2018. Met-Ed also performs enhanced tree trimming that removes healthy limbs overhanging primary conductors. Met-Ed conducted a study in 2017 to determine the areas that should receive enhanced trimming. The study identified the number of trees overhanging conductors, the number of declining Ash trees and the number of imminent threat trees. Met-Ed also performed enhanced trimming on 300 miles in 2017 and plans to perform trimming on an additional 559 miles in 2018. Met-Ed also implemented a program in 2018 to remove Ash trees that have been deemed a threat by the Emerald Ash Borer.

To reduce the scope of outages, fuses and other protective devices are being installed on circuits selected based on overall performance as well as protection needs. Met-Ed installed 433 fuses in 2017 and plans to install 550 fuses in 2018.

Circuit ties and loops continue to be built between radial sections of circuits. When ties and loops are available, circuits can be switched during outages to enable faster service restoration. Met-Ed installed 4 circuit ties and loops in 2017 and plans to install 2 circuit ties and loops in 2018.

To strengthen its electrical system, Met-Ed targets upgrading of circuits having a high rate of equipment and line failure and animal-caused outages. Equipment that may be replaced includes crossarms, capacitors and circuits. Met-Ed has 7 circuits targeted for rehabilitation in 2018.

Met-Ed is also replacing existing gang operated air brake switches, disconnect switches and hydraulically-operated circuit reclosers with supervisory control and data acquisition (SCADA) controlled switches that allow for remote operation to restore service to customers when an outage occurs. Remote switching eliminates the need to dispatch crews to manually operate the switches, resulting in fewer customers affected and reduced outage duration. Met-Ed installed 28 SCADA devices in 2017, and 114 are planned to be installed in 2018.

Met-Ed is replacing porcelain cutouts with more robust polymer cutouts to reduce the number of recloser and circuit breaker lockouts and other equipment damage. Met-Ed replaced porcelain cutouts on 5 circuits in 2017 and will target an additional 5 circuits in 2018.

Met-Ed is replacing bare concentric neutral cable as part of its underground distribution residential cable replacement program. This type of cable was manufactured without an insulating jacket,

[23] Final Order entered Nov 5, 2015 at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.
[24] Order entered Feb 11, 2016 at Docket No. P-2015-2508942.
[25] *See* Docket No. M-2018-3000943, and 52 Pa. Code § 121.7.

causing the concentric neutral wire to corrode and fail prematurely. Met-Ed replaced approximately 20,022 feet of cable in 2017 and plans to replace approximately 16,000 feet of cable in 2018.

Continued Monitoring

Met-Ed's reliability performance failed to achieve benchmark performance, as well as exceeded the upper control limit standard in the last quarter of 2017. It appears Met-Ed's performance continues to be leaning more negatively. Met-Ed's LTIIP and RIP activities could help in reducing Met-Ed's equipment failures, however trees continue to be the primary issue causing outages that affect the most customers and customer minutes interrupted. It also appears recent severe storms and associated damaging effects of trees have increased significantly and that is negatively impacting the distribution system. If more frequent, severe storms are considered the new norm, a more aggressive approach to tree trimming will be necessary to reduce tree outages in the future. TUS will consider these and other factors in its review of Met-Ed's LTIIP.

Figure 16 Met-Ed CAIDI (minutes)

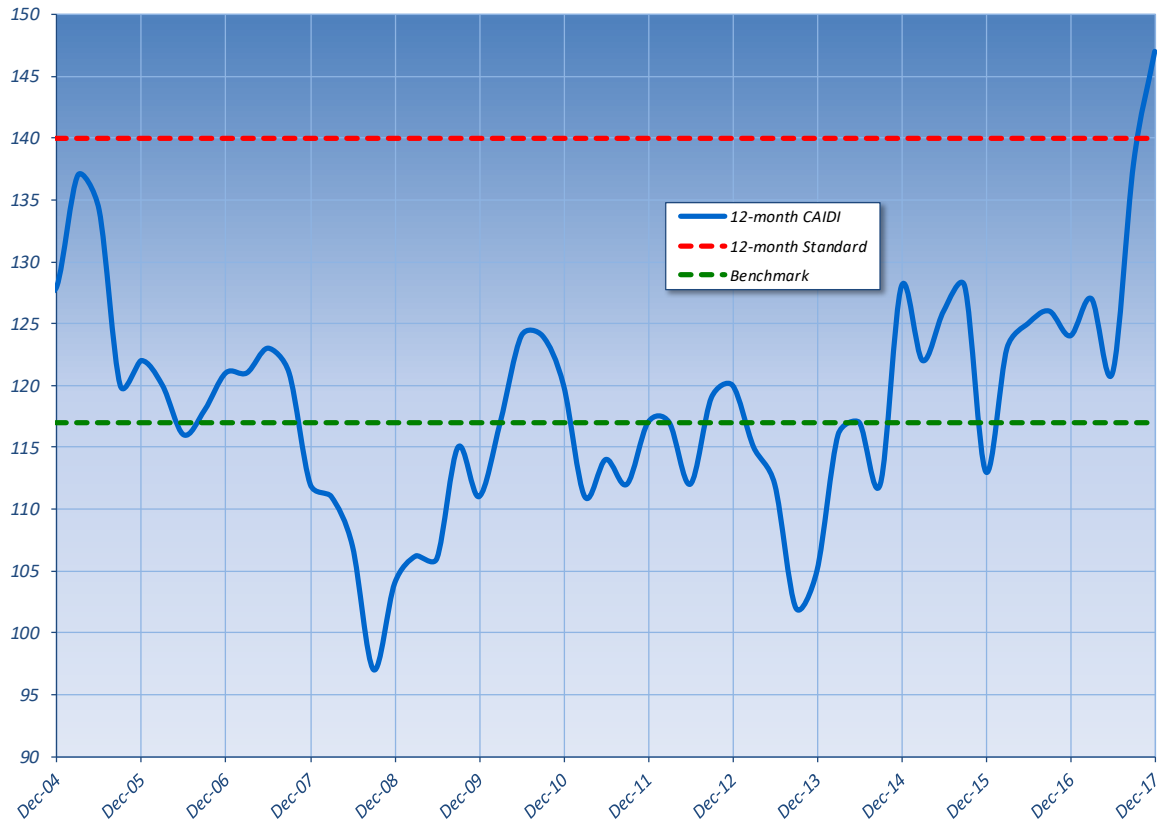


Figure 17 Met-Ed SAIFI (interruptions per customer)

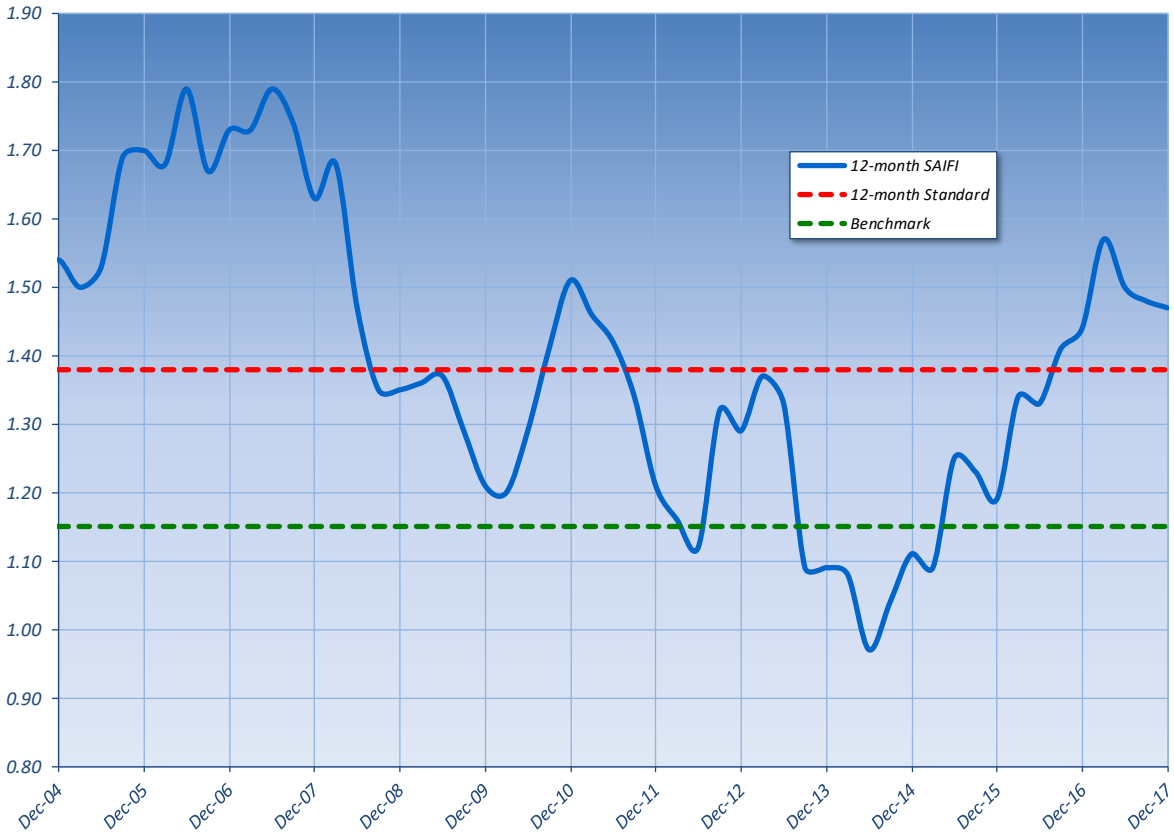


Figure 18 Met-Ed Outage Causes (percent of total outages)

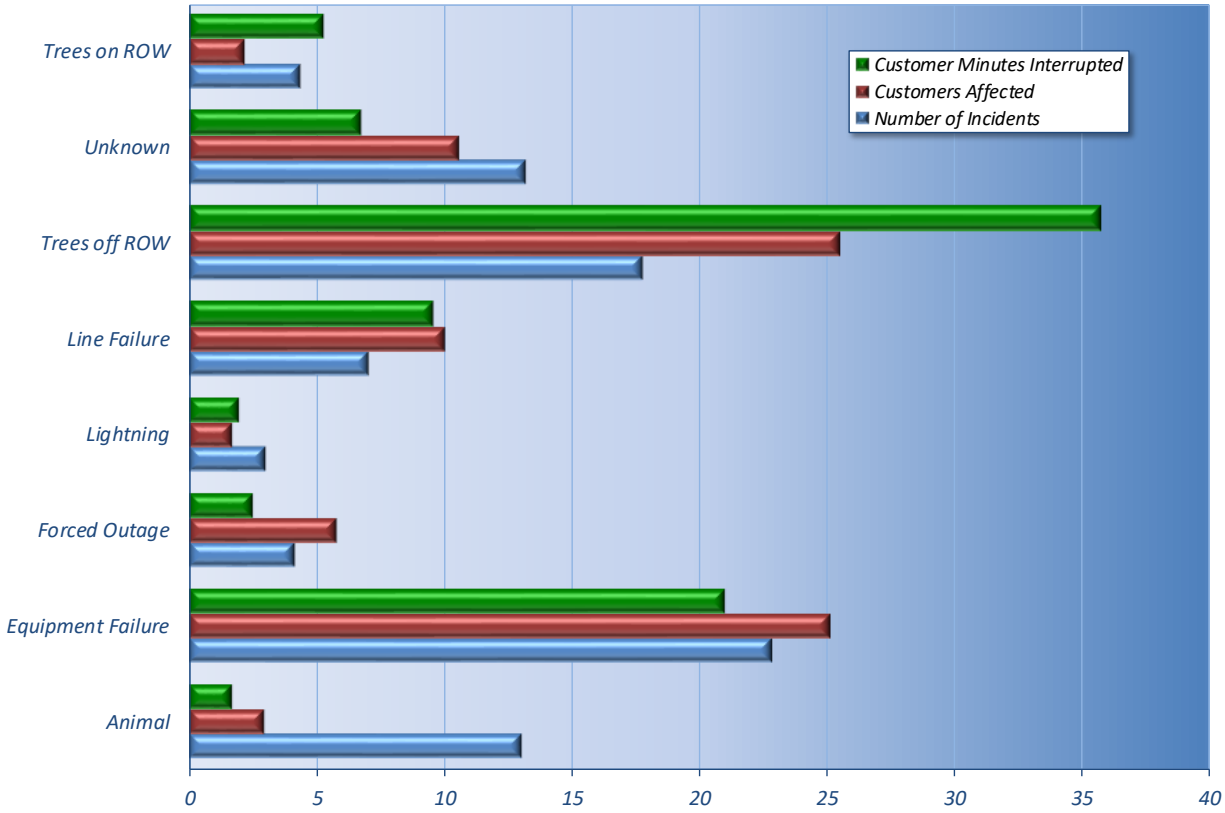
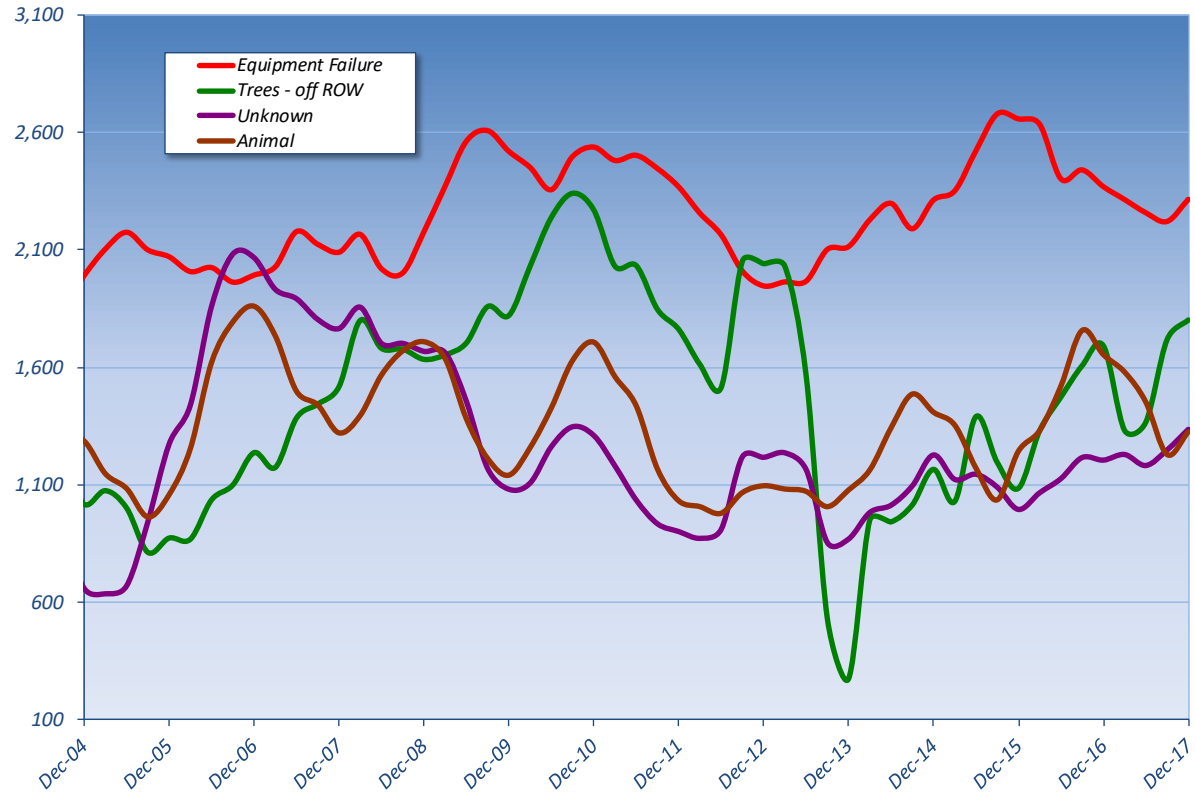


Figure 19 Met-Ed Outage Tracking (number of incidents)



Pennsylvania Electric Company

Penelec has a service territory of about 17,600 square miles serving 582,000 customers.

In 2017, Penelec experienced 1.0 million customer interruptions and 138.5 million minutes of interruptions as compared to 833,315 customer interruptions and 99.6 million minutes in 2016, and 792,673 customer interruptions and 111.2 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 120 minutes in 2016 to 138 minutes in 2017; and failed to achieve benchmark by 18 percent.

3-year average: Increased from 126 minutes in 2016 to 133 minutes in 2017; failed to achieved standard by 3 percent.

SAIDI

Rolling 12-month: Increased from 171 minutes in 2016 to 239 minutes in 2017; failed to achieve benchmark by 62 percent

3-year average: Increased from 182 minutes in 2016 to 200 minutes in 2017; failed to achieve standard by 12 percent.

SAIFI

Rolling 12-month: Increased from 1.43 outages in 2016 to 1.73 outages in 2017; failed to achieve benchmark by 37 percent.

3-year average: Increased from 1.45 outages in 2016 to 1.51 outages in 2017; failed to achieve standard by 8 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 20 and Figure 21. The CAIDI trend is improving toward benchmark and the SAIFI trend is slightly trending negatively away from benchmark. Figure 22 shows trees and equipment failures are both significant causes of outages and customer interruption minutes. Figure 23 shows a historical trend of the top main outage causes.

In 2015, 2016, and continuing into 2017, the Commission's Reliability and Emergency Preparedness Section of the Bureau of TUS began increased monitoring and assessment of Penelec's reliability performance due to Penelec's poor reliability performance. TUS required Penelec to initiate a Corrective Action Plan (CAP), or reliability improvement plan (RIP). A 3-year plan was developed and is currently being executed by Penelec to attain benchmark performance by 2018. In 2015, the Commission also required extra monitoring of Penelec's reliability quality system and RIP as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[26]

[26] Final Order entered Nov 5, 2015, at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

Penelec's Long-Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[27] The LTIIP was designed to help improve storm hardening, system resiliency, and reliability. As of the release date of this report, TUS is currently reviewing the efficacy of all the FirstEnergy Company LTIIPs as part of the required mid-term review of LTIIPs.[28]

Penelec Reliability Initiatives

To reduce tree related outages in 2017, Penelec performed on cycle-based tree trimming, which removes selected incompatible trees within the clearing zone corridor, removes certain defective limbs that are overhanging primary conductors, controls selected incompatible brush, and removes off right-of-way priority trees. Penelec performed tree trimming on 3,792 miles, including the removal of 131,290 priority trees, in 2017 and plans to trim approximately 3,636 miles in 2018.

A study was conducted by Penelec Engineering in 2017 that determined 23 of Penelec's circuits, or 8 percent of the total mileage, accounted for 24 percent of the total outages over the past 5 years. Because of this study, Penelec reduced the trimming cycle for 6 circuits to every 3 years, and every 4 years for an additional 17 circuits. Beginning in 2018, Penelec will concentrate its efforts on those circuits by accelerating the trimming of approximately 665 miles. Penelec removed approximately 44,000 Ash trees in 2017 that were deemed a threat due to the Emerald Ash Borer Beatle.

Penelec also proactively replaced porcelain cutouts with a more robust version constructed from polymer, which is likely to reduce the number of recloser and circuit breaker lockouts and other equipment damage. Penelec replaced porcelain cutouts on 80 circuits in 2017 and plans to replace cutouts on an additional 57 circuits by the end of 2018.

Penelec targeted circuit rehabilitation on circuits having a high rate of equipment and line failure and animal-caused outages. Types of equipment that may be replaced includes: crossarms; capacitors; insulators; lightning arresters; and connectors. Penelec completed the rehabilitation of 12 circuits in 2017 and plans to complete rehabilitation on an additional 21 circuits in 2018.

Supervisory control and data acquisition (SCADA) controlled devices were installed at locations on both the distribution and 34.5 kV systems. These devices allow for remote operation to restore service to customers when an outage occurs. Remote switching eliminates the need to dispatch crews to manually operate the switches. The result is fewer customers affected and reduced outage durations. Penelec installed 21 SCADA controlled switches in 2017, and Penelec plans to install an additional 25 switches in 2018. Penelec, based on full circuit coordination studies, also implemented fuse protection coordination and recommendations on 6 circuits in 2017 and plans to address an additional 5 circuits in 2018.

Penelec is also replacing brown porcelain cap and pin style insulators that are prone to failure, as well as switch insulators and arresters. Penelec replaced 15 insulators in 2017 and plans to replace an additional 30 insulators in 2018.

Penelec continues to build circuit ties and loops between radial sections of circuits. When ties and loops are available, circuits can be switched during outages to enable faster service restoration.

[27] Order entered Feb 11, 2016 at Docket No. P-2015-2508936.
[28] *See* Docket No. M-2018-3000943, and 52 Pa. Code § 121.7.

Penelec installed 1 circuit tie and loop in 2017 and plans to install at least 1 additional tie and loop in 2018.

Advanced protective devices such as electronically controlled reclosers and switches with modernized communication are being installed to allow for additional protection coordination. Penelec installed 2 advanced protective devices in 2017, and 18 are planned for installation in 2018.

Penelec has identified a brand of circuit breaker that fails to operate properly causing unreliable breaker operations during line outages. As a result, these select circuit breakers at 34.5 kV substations are being replaced. Penelec replaced 16 breakers in 2017 and plans to replace at least 40 breakers in 2018.

Penelec is performing reliability improvements on clusters of customers that experience frequent or repeated outages. The customer service improvement program is designed to reduce the frequency of outages at the customer level and is often initiated from customer complaints. In addition to enhancing system performance, the program is a means to reduce the frequency of outages at the customer level that might not otherwise be addressed when targeting overall system metrics. Penelec completed 31 projects in 2017, and 30 projects are planned for 2018.

Continued Monitoring

Penelec's reliability performance failed to achieve benchmark performance, as well as exceeded the upper control limit standard for SAIDI and SAIFI in the last 2 quarters of 2017. Penelec's performance continues to be leaning more negatively. Penelec's LTIIP and RIP activities could help in reducing Penelec's equipment failures. However, trees continue to be the primary issue causing outages that affect the most customers and customer minutes interrupted. It also appears severe storms and the associated damaging effects of trees have increased significantly, which is negatively impacting the distribution system. If more frequent, severe storms are considered the new norm, then a more aggressive approach to tree trimming will be necessary to reduce tree outages in the future. TUS will consider these and other factors in its review of Penelec's LTIIP.

Figure 20 Penelec CAIDI (minutes)

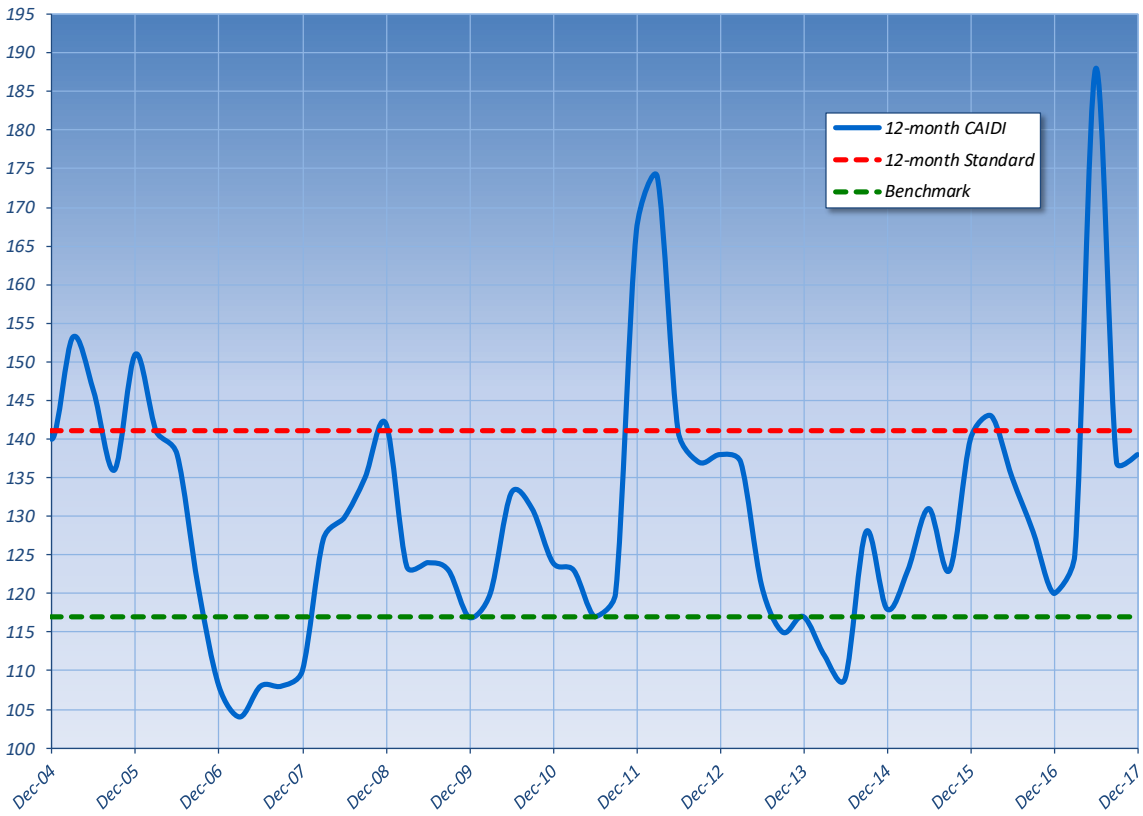


Figure 21 Penelec SAIFI (interruptions per customer)

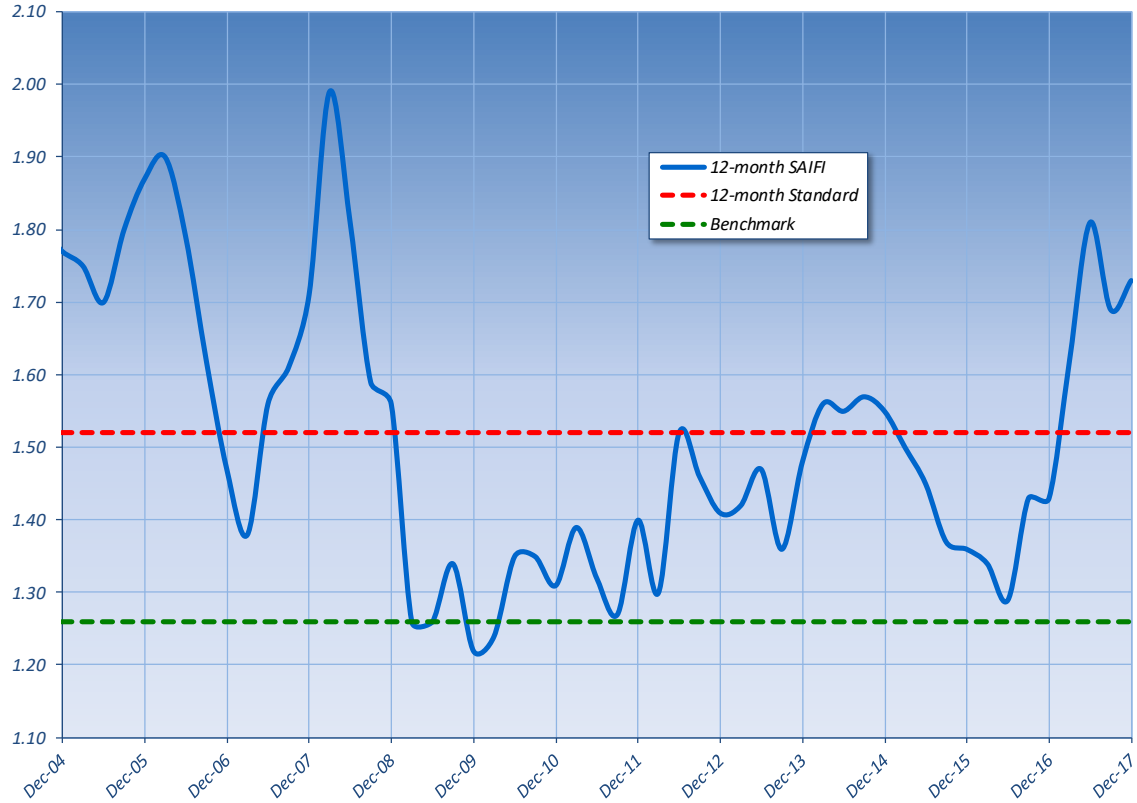


Figure 22 Penelec Outage Causes (percent of total outages)

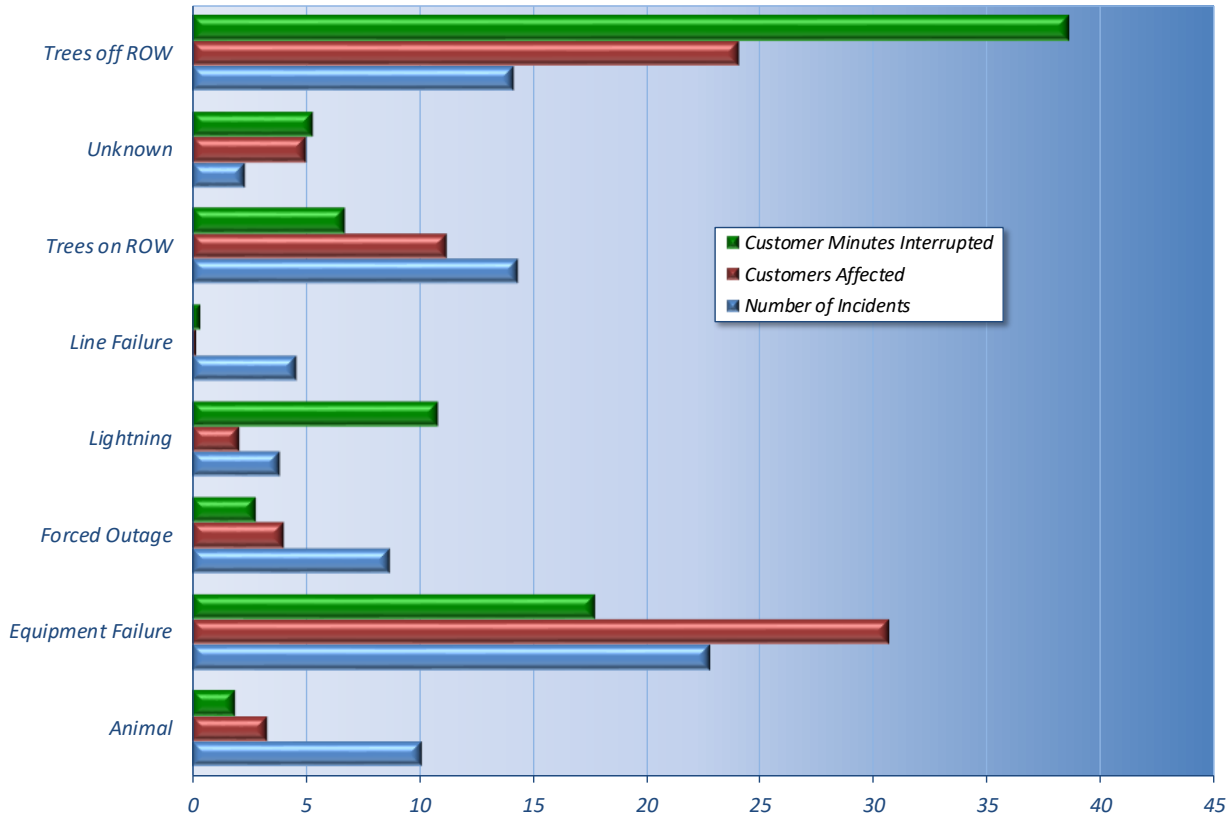
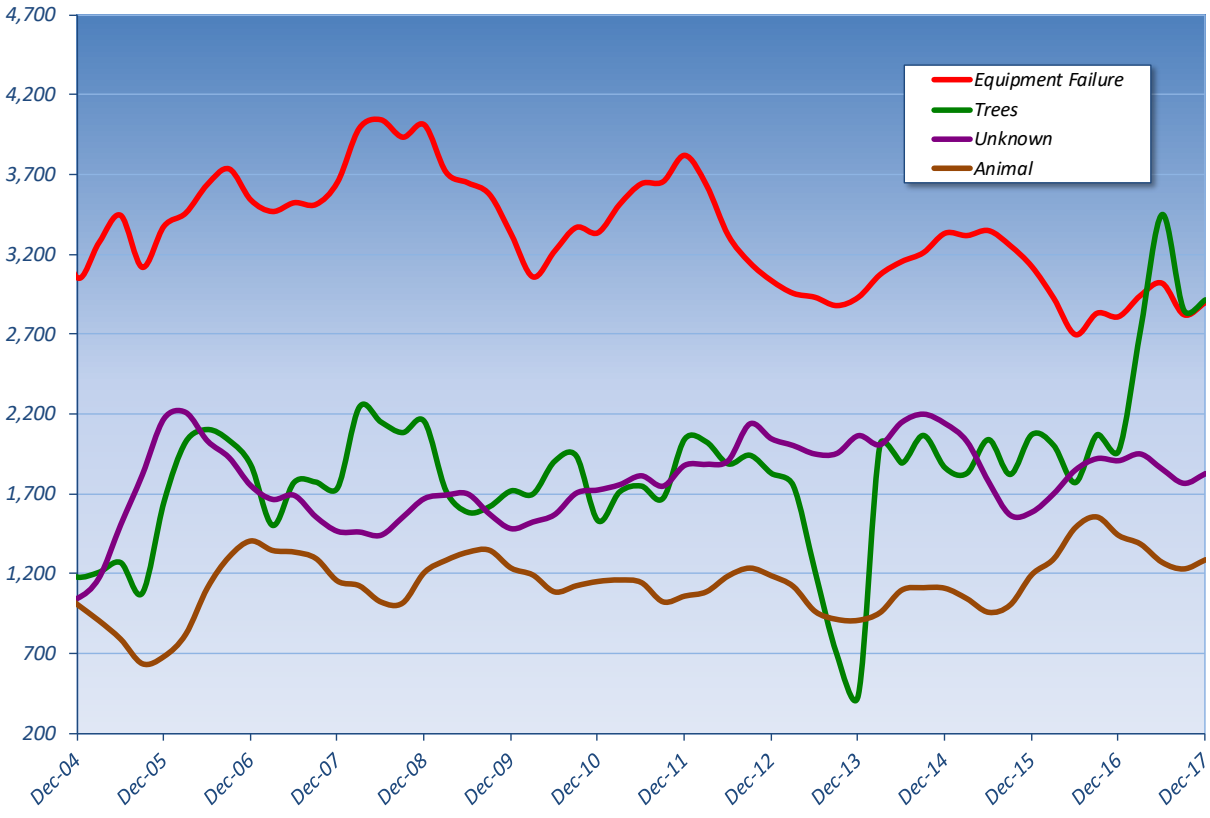


Figure 23 Penelec Outage Tracking (number of incidents)



Pennsylvania Power Company

Penn Power has a service territory of about 1,100 square miles that serves primarily 159,500 customers.

In 2017, Penn Power experienced 173,036 customer interruptions and 26.0 million minutes of interruptions as compared to 176,968 customer interruptions and 16.8 million minutes in 2016, and 181,479 customer interruptions and 18.2 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 95 minutes in 2016 to 150 minutes in 2017; and failed to achieved benchmark by 49 percent.

3-year average: Increased from 100 minutes in 2016 to 115 minutes in 2017; and failed to achieved standard by 4 percent.

SAIDI

Rolling 12-month: Increased from 104 minutes in 2016 to 160 minutes in 2017; and failed to achieved benchmark by 42 percent.

3-year average: Increased from 112 minutes in 2016 to 126 minutes in 2017; and achieved standard by 7 percent.

SAIFI

Rolling 12-month: Decreased from 1.09 outages in 2016 to 1.06 outages in 2017; and achieved benchmark by 5 percent.

3-year average: Decreased from 1.11 outages in 2016 to 1.10 outages in 2017; and achieved standard by 11 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 24 and Figure 25. Figure 26 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Trees off right-of-way are the most significant cause of customer minutes interrupted and number of customers affected by an outage in 2017. However, if you combine all the subcategories of tree-related outages, not shown, tree-related issues represent 35 percent of all Penn Power outages. Figure 27 shows the historical trend of the top 3 main outage causes. The most frequent outage cause was trees.

In 2015, the Commission also required extra monitoring of Penn Power's reliability quality system and RIP as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit.[29]

Penn Power's Long-Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[30] The LTIIP was designed to help improve storm hardening, system resiliency, and

[29] Final Order entered Nov 5, 2015 at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

[30] Order entered Feb 11, 2016 at Docket No. P-2015-2508936.

reliability. As of the release date of this report, TUS is currently reviewing the efficacy of all the FirstEnergy Company LTIIPs as part of the required mid-term review of LTIIPs.[31]

Penn Power Reliability Initiatives

To reduce tree related outages, Penn Power performs cycle-based tree trimming that: 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. Penn Power performed cycle-based tree trimming on 1,187 miles, including the removal of approximately 25,000 priority trees, in 2017. Penn Power plans to trim approximately 1,149 miles in 2018. Penn Power also performs enhanced trimming which removes healthy limbs overhanging primary conductors. The Company has changed its approach on enhanced trimming to focus on trimming all zones of the top 5 worst performing circuits, where outages were primarily caused by trees. Penn Power will target the aggressive removal of off right-of-way trees on 418 miles of circuits in 2018.

Penn Power improved line sectionalizing capability on 6 circuits in 2017 and plans to improve 6 to 10 circuits in 2018.

Penn Power is replacing smaller, aging overhead conductors to improve energy efficiency, increase capacity and improve operational flexibility. Penn Power replaced overhead conductors along 4.3 miles in 2017 and plans to replace conductors along approximately 10 miles in 2018.

Additional supervisory control and data acquisition (SCADA) devices are being installed where circuit conditions and system performance warrant. Remote SCADA controlled devices allow for remote operation to restore service to customers when an outage occurs. Remote switching eliminates the need to dispatch crews to manually operate the switches. The result is fewer customers affected and reduced outage durations. Penn Power installed 14 SCADA switches in 2017 and plans to install an additional 28 switches in 2018.

Penn Power continues to build circuit ties and loops between radial sections of circuits. When ties and loops are available, circuits can be switched during outages to enable faster restoration. In addition, Penn Power continues to add new substations which provide a new source to serve customers and additional capacity. Penn Power created 10 circuit ties, loops and new sources in 2017 and has plans to create an additional 15 circuit ties, loops or new sources by the end of 2018.

Bare concentric neutral cable is being replaced as part of Penn Power's underground residential distribution cable replacement program. This type of cable was manufactured without an insulating jacket, causing the concentric neutral wire to corrode and fail prematurely. Penn Power replaced approximately 25,021 feet of cable in 2017 and plans to replace approximately 23,000 feet of cable in 2018.

Substation circuit breakers, station transformers and other substation equipment, such as insulators, switches, buses, arresters and conductors that are obsolete or in poor condition are being replaced with new equipment. Proactively replacing older equipment increases substation reliability and reduces the occurrence of equipment failure. Penn Power replaced 33 pieces of equipment in 2017 and plans to replace 24 pieces in 2018.

[31] *See* Docket No. M-2018-3000943, and 52 Pa. Code § 121.7.

Continued Monitoring

Penn Power's reliability performance failed to achieve benchmark performance for CAIDI and SAIDI during the last 3 quarters, as well as exceeded the upper control limit standard for CAIDI in the last 3 quarters of 2017. It appears Penn Power's performance continues to be leaning more negatively. Penn Power's LTIIP and RIP activities could help in reducing its animal-caused outages. However, trees continue to be the primary issue causing outages that affect the most customers and customer minutes interrupted. Additionally, it appears recent severe storms and the associated damaging effects of trees have increased significantly, which is negatively impacting the distribution system. If more frequent, severe storms are considered the new norm, then a more aggressive approach to tree trimming will be necessary to reduce tree outages in the future. TUS will consider these and other factors in its review of Penn Power's LTIIP.

Figure 24 Penn Power CAIDI (minutes)

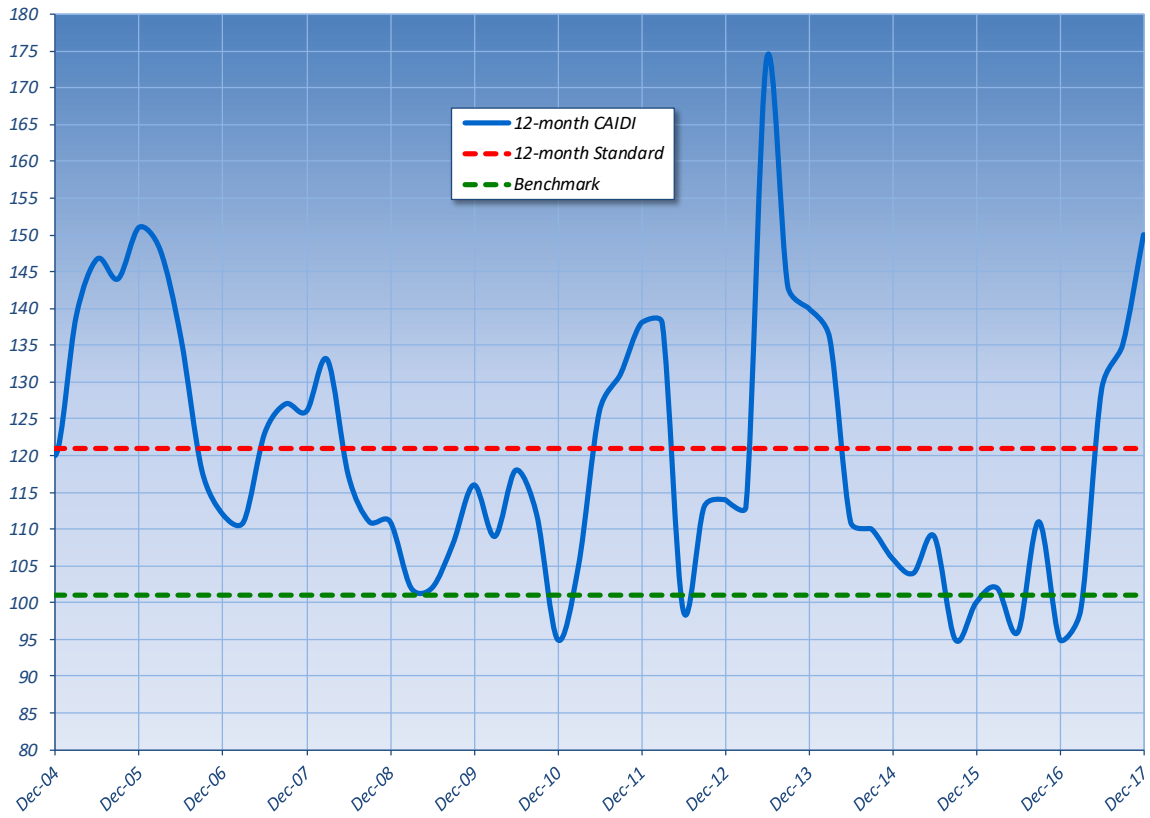


Figure 25 Penn Power SAIFI (interruptions per customer)

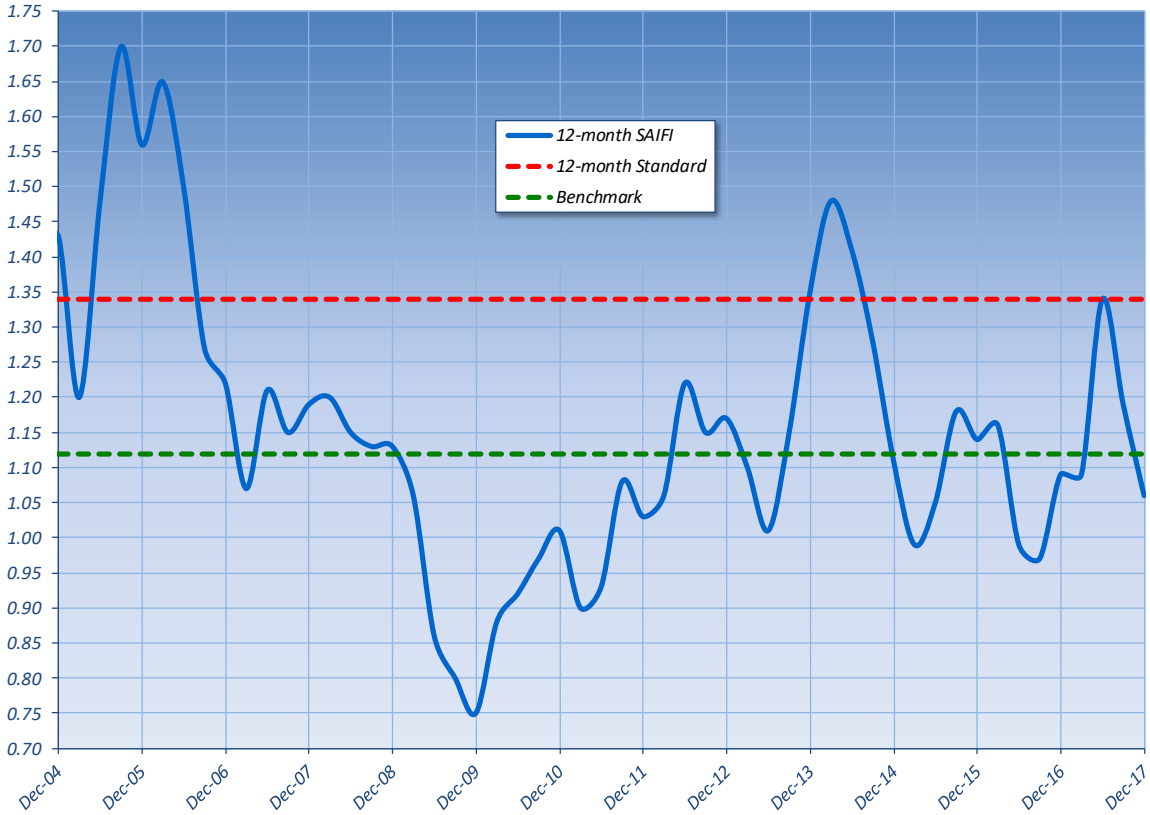


Figure 26 Penn Power Outage Causes (percent of total outages)

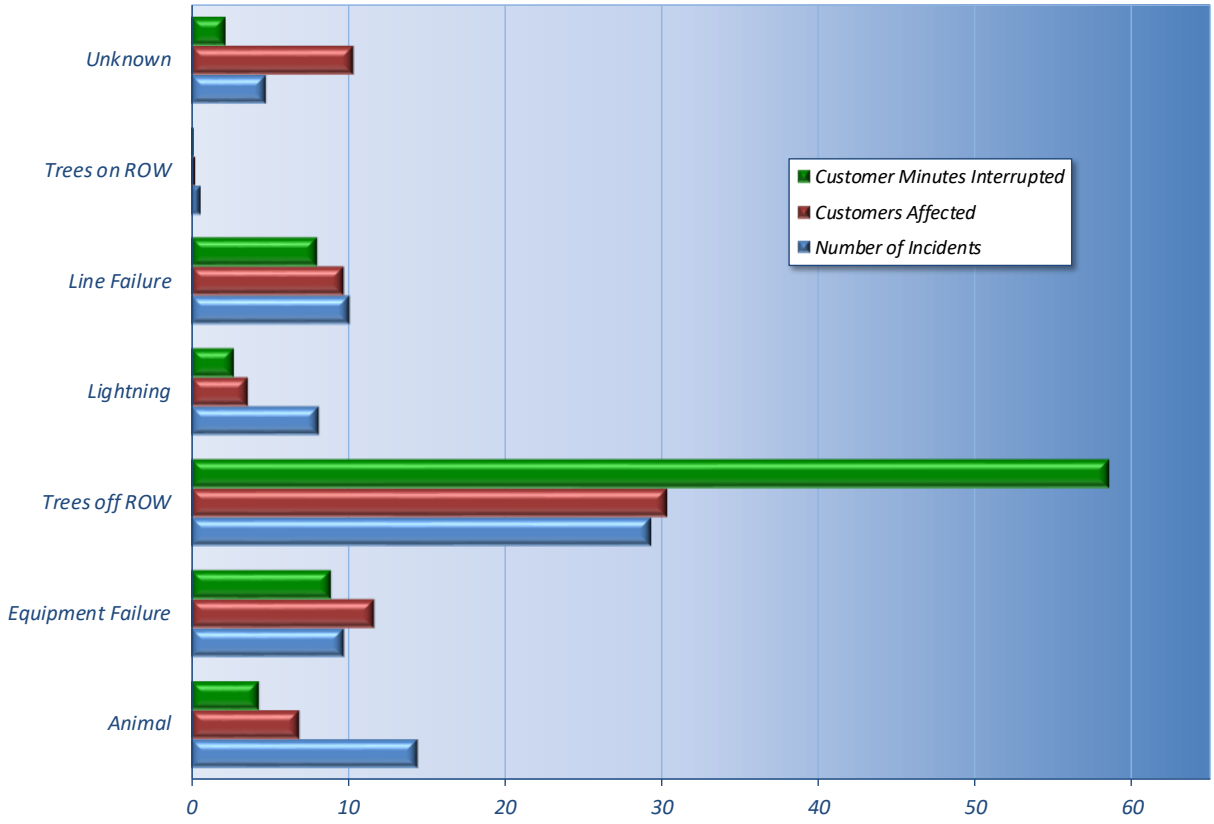
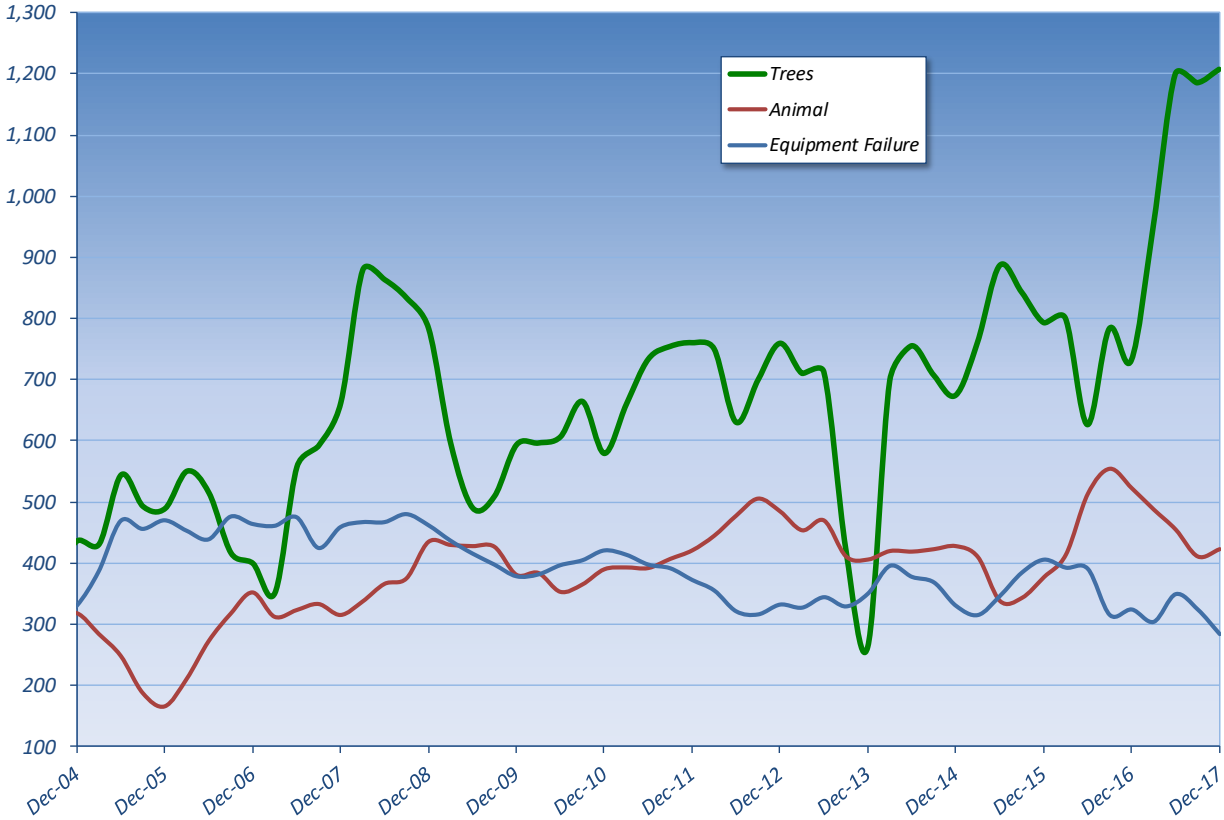


Figure 27 Penn Power Outage Tracking (number of incidents)



West Penn Power Company

West Penn has a service territory of about 10,400 square miles and serves about 710,000 customers.

In 2017, West Penn experienced 919,673 customer interruptions and 152.7 million minutes of interruptions as compared to 772,206 customer interruptions and 113.1 million minutes in 2016, and 827,613 customer interruptions and 127.3 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 147 minutes in 2016 to 166 minutes in 2017; and achieved benchmark by 2 percent.

3-year average: Increased from 146 minutes in 2016 to 156 minutes in 2017; and achieved standard by 17 percent.

SAIDI

Rolling 12-month: Increased from 159 minutes in 2016 to 214 minutes in 2017; and failed to achieved benchmark by 20 percent.

3-year average: Increased from 159 minutes in 2016 to 184 minutes in 2017; and failed to achieved standard by 2 percent.

SAIFI

Rolling 12-month: Increased from 1.17 outages in 2016 to 1.29 outages in 2017; and failed to achieve benchmark by 23 percent.

3-year average: Increased from 1.09 outages in 2016 to 1.18 outages in 2017; and failed to achieved standard by 6 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 28 and Figure 29. Figure 30 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 31 shows the historical trend of the main outage causes. The top 2 known causes were trees and equipment failure.

West Penn's Long-Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[32] West Penn's LTIIP is designed to help improve storm hardening, system resiliency, and reliability. The PUC has also been performing extra monitoring of West Penn's reliability quality system and Reliability Improvement Plan (RIP) as a result of a Commission Motion regarding FirstEnergy's Implementation Plan to the findings of the Commission's Focused Management and Operations Audit[33]

As of the release date of this report, TUS is currently reviewing the efficacy of all the FirstEnergy Company LTIIPs as part of the required mid-term review of LTIIPs.[34]

[32] Order entered on Feb 11, 2016, at Docket No. P-2015-2508948.

[33] Final Order entered Nov 5, 2015 at Docket Nos. D-2013-2365991, D-2013-2365992, D-2013-2365993, and D-2013-2365994.

[34] *See* Docket No. M-2018-3000943, and 52 Pa. Code § 121.7.

West Penn Reliability Initiatives

To reduce tree related outages, West Penn performs cycle-based tree trimming that: 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. West Penn performed tree trimming on 4,667 miles, including the removal of approximately 112,000 priority trees, in 2017 and plans to trim approximately 4,584 miles in 2018. West Penn also performed enhanced trimming, which removes healthy limbs overhanging primary conductors. West Penn performed enhanced trimming on 350 miles in 2017 and plans to perform enhanced trimming on approximately 233 miles in 2018. In addition, West Penn continues the proactive removal of Ash trees that have been deemed a threat by the Emerald Ash Borer, and in 2017 approximately 44,819 Ash trees were removed.

West Penn is installing new fused cutouts on unprotected line sections to minimize outage frequency and duration and ensure the adequate protection of circuits. West Penn installed fuses on 60 circuits in 2017 and plans to install fuses on at least 100 circuits in 2018.

West Penn performs targeted circuit rehabilitation in zones 1 and 2, focusing on circuits having a high rate of equipment and line failure and animal-caused outages. Equipment that may be replaced includes crossarms, capacitors, insulators, lightning arresters and cutouts. Forty-four circuits were rehabilitated in 2017. West Penn plans to rehabilitate at least 35 circuits in 2018.

Select worst performing circuits have been targeted for enhanced circuit rehabilitation, which can include hardware rehabilitation, coordination review, installation of additional protective devices as well as reclosers. 8 worst performing circuits received enhanced rehabilitation in 2017 and West Penn plans to target an additional 6 to 8 worst performing circuits in 2018.

West Penn installed new electronic reclosers with supervisory control and data acquisition (SCADA) at targeted substations as part of the enhanced overcurrent protection program. Adding SCADA control to electronic reclosers in select substations with existing SCADA capabilities limits the number of customers affected, provides additional monitoring, and allows for remote switching to restore customers at the circuit level more quickly. West Penn replaced a total of 28 breakers with electronic reclosers in 2017 and plans to install 20 to 30 electronic reclosers in 2018.

West Penn is replacing aging electro-mechanical relay controls and switches, and automated subtransmission switching locations are being replaced with newer technology. The installation of SCADA controlled reclosers and switches and automatic switch modernization will provide enhanced sectionalizing for larger blocks of customers at the substation level. The SCADA controlled switches are designed to allow for remote switching to restore large blocks of customers more quickly. West Penn installed 72 automatic reclosers or switches at its substations in 2017 and plans to install at least 50 reclosers or switches in 2018.

West Penn is replacing substation exit cables that were manufactured without an insulating jacket that can cause the concentric neutral wire to corrode and fail prematurely. By replacing these exit cables, West Penn will reduce the interruptions to a circuit associated with the cable as well as the long interruption times associated with the replacement. West Penn replaced exit cables at 13 substations in 2017 and exit cables at 10 substations are targeted to be replaced in 2018.

West Penn is replacing bare concentric neutral cable as part of its underground residential distribution cable replacement program. This type of cable was manufactured without an insulating jacket, causing the concentric neutral wire to corrode and fail prematurely. West Penn replaced 8,392 feet of cable in 2017 and plans to replace approximately 7,920 feet of cable in 2018.

West Penn is replacing substation circuit breakers, station transformers and other substation equipment, such as insulators, switches, buses, arresters and conductors that are obsolete or in poor condition, with new equipment. Proactively replacing older equipment increases substation reliability and reduces the occurrence of equipment failure. West Penn replaced 69 pieces of equipment in 2017 and plans to replace at least 86 pieces in 2018.

West Penn is implementing improvement projects focusing on clusters of customers experiencing multiple interruptions of line protection devices. This program should enhance system performance as well as reduce the frequency of outages at the customer level that might not be addressed when targeting overall system metrics. West Penn completed 21 projects in 2017, and West Penn plans to complete at least 40 projects in 2018.

Continued Monitoring

West Penn's reliability performance failed to achieve benchmark performance for SAIFI and SAIDI during the last 4 quarters, as well as exceeded the upper control limit standard for SAIFI in the last 2 quarters of 2017. West Penn's performance continues to be leaning more negatively. West Penn's LTIIP and RIP activities could help in reducing its equipment failures. However, trees continue to be the primary issue causing outages that affect the most customers and customer minutes interrupted. Additionally, it appears recent severe storms and associated damaging effects of trees have increased significantly, which is negatively impacting the distribution system. If more frequent, severe storms are considered the new norm, then a more aggressive approach to tree trimming will be necessary to reduce tree outages in the future. TUS will consider these and other factors in its review of Penn Power's LTIIP.

Figure 28 West Penn CAIDI (minutes)

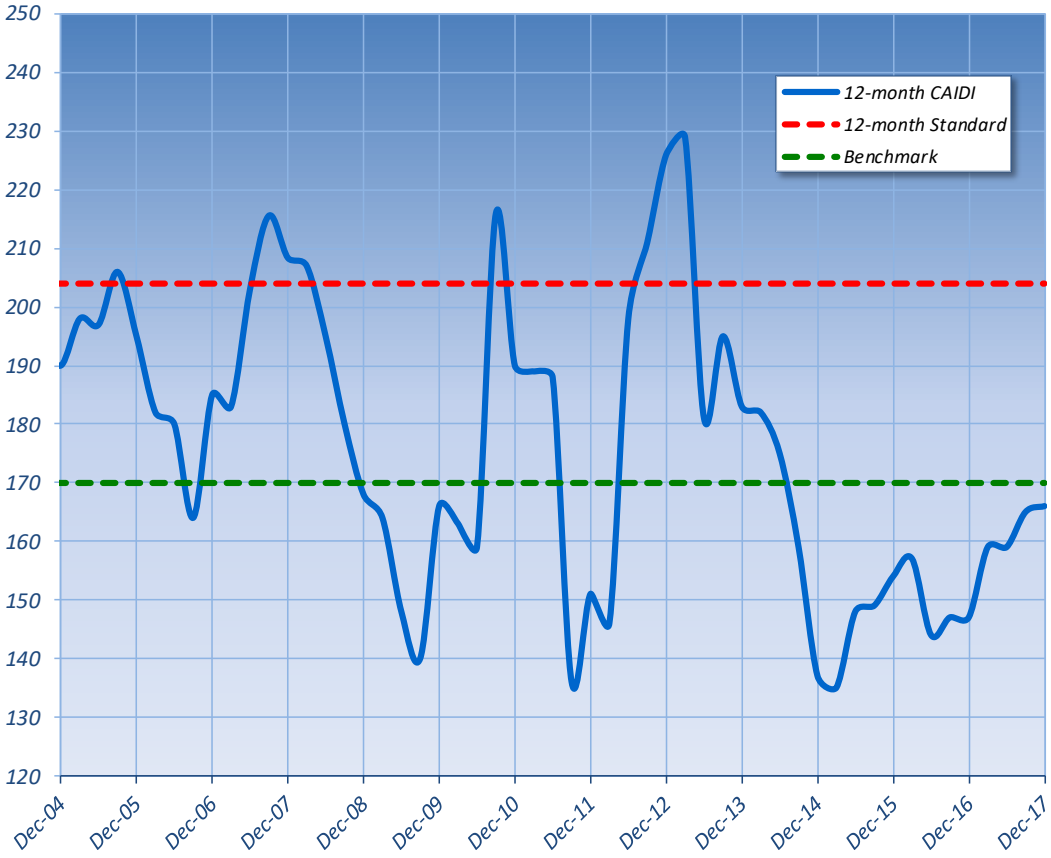


Figure 29 West Penn SAIFI (interruptions per customer)

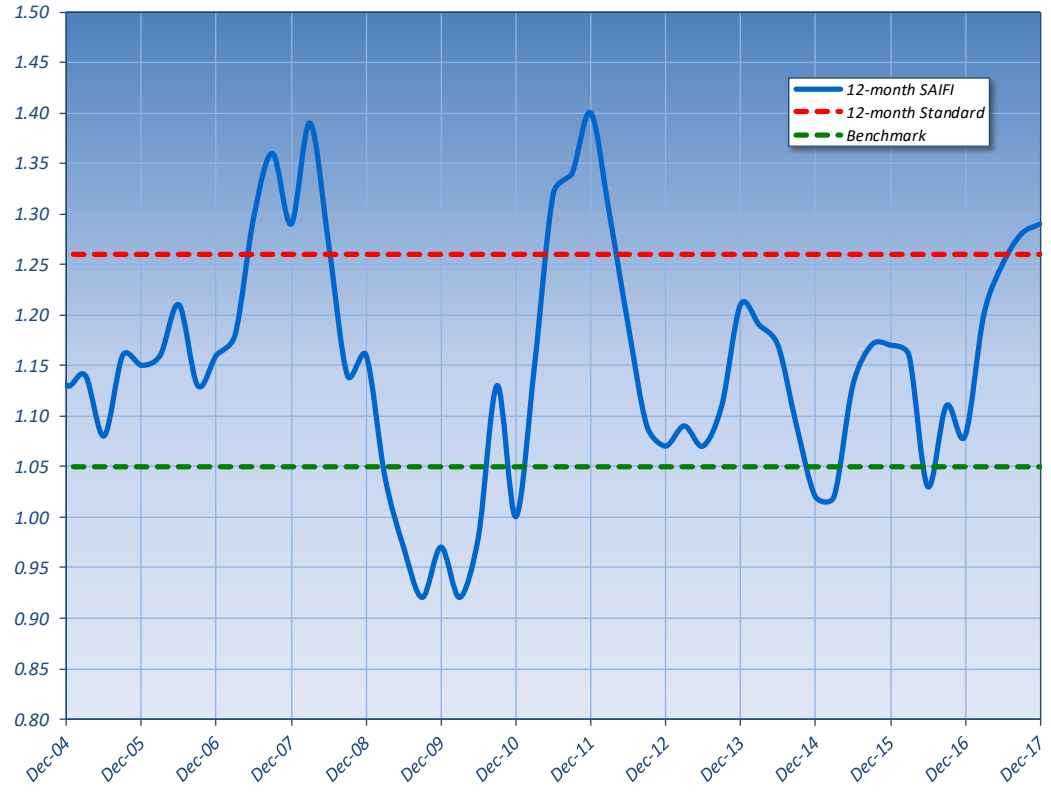


Figure 30 West Penn Outage Causes (percent of total outages)

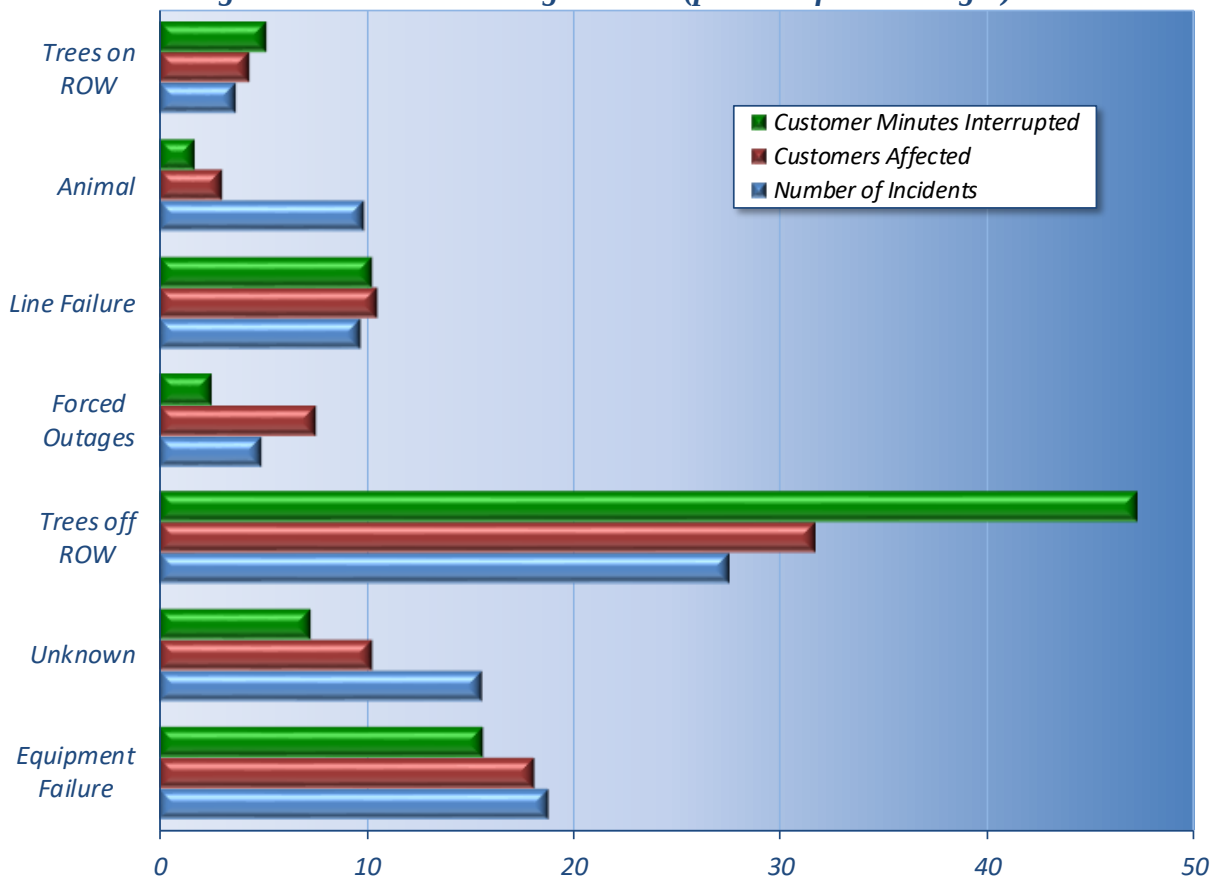
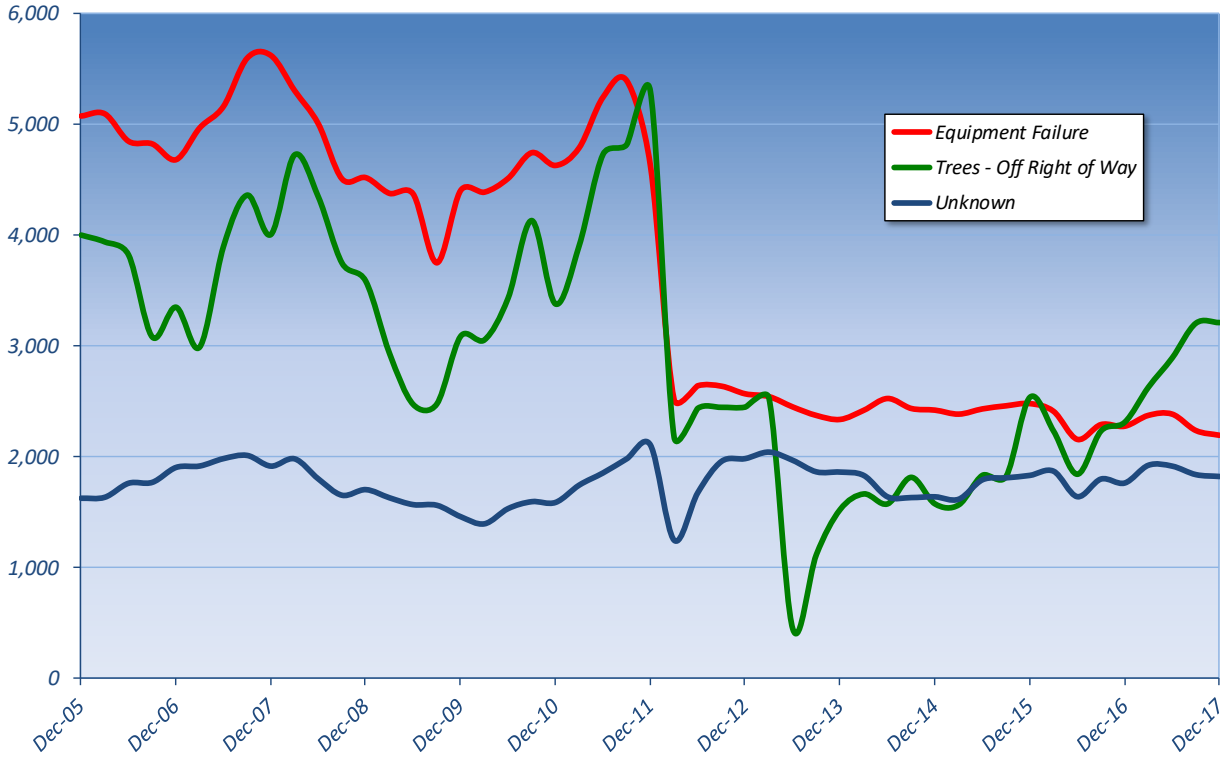


Figure 31 West Penn Outage Tracking (number of incidents)



Citizens' Electric Company

Citizens' has an operating service area of about 41 square miles with about 6,963 customers. The electric system consists of 1 distribution substation and 9 distribution feeder lines.

In 2017, Citizens' experienced 3,180 customer interruptions and 588,067 minutes of interruptions as compared to 1,787 customer interruptions and 192,235 minutes in 2016, and 1,333 customer interruptions and 121,876 minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 108 minutes in 2016 to 185 minutes in 2017; failed to achieve benchmark by 76 percent.

3-year average: Increased from 96 minutes in 2016 to 128 minutes in 2017; failed to achieved standard by 11 percent.

SAIDI

Rolling 12-month: Increased from 28 minutes in 2016 to 84 minutes in 2017; failed to achieve benchmark by 300 percent.

3-year average: Increased from 21 minutes in 2016 to 43 minutes in 2017; failed to achieved standard by 16 percent.

SAIFI

Rolling 12-month: Increased from 0.26 outages in 2016 to 0.45 outages in 2017; achieved benchmark by 125 percent.

3-year average: Increased from 0.21 outages in 2016 to 0.30 outages in 2017; failed to achieved standard by 36 percent.

Note: Smaller SAIFI values are typical for companies with fewer customers. Smaller systems tend to experience more variability in service outage data, which is captured in the development of historical. This data can only be used with the historical performance of Citizens' to access reliability performance and actual values are not valid for comparisons among other EDCs.

Historical 12-month CAIDI and SAIFI trends are shown in Figure 32 and Figure 33. As displayed, Citizens' CAIDI and SAIFI spiked above benchmark during 2017. Severe weather outages caused trees to fall into distribution system facilities.

Figure 34 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 35 shows the historical trend of the top 3 main outage causes. The most frequent outage cause was tree outages at about 38 percent, which impacted about 80 percent of the customers experiencing outages. Tree outages consist of both weather and off right-of-way tree outages.

Since 2012, Citizens' has been investing increasing resources to identify and remove off right-of-way hazard trees. A primary focus has been the continuing impact from the Emerald Ash Borer. As this invasive beetle moved through the territory, a significant number of deteriorating Ash trees became apparent. Citizens' has again committed additional resources to identify, prioritize and

remove significant threats to reliability from hazard trees during 2018. Citizens' vegetation coordinator, line crews, and trimming contractors have all been trained to continue identifying and resolving off right-of-way priority trees where possible.

During 2017, a positive trend began to emerge. Citizens' began seeing a decrease in the number of outages caused by off right-of-way trees. Through continued focus on these trees, Citizens' believes this downward trend will continue.

Citizens' storm hardening initiatives include efforts to identify and replace specific equipment it has identified as failure-prone. This includes certain vintages of overhead arrestors and porcelain cutouts. To improve longevity and reliability, all new cutouts being installed utilize polymer-based insulators rather than porcelain. To maximize protection for the coming storm season, inspection of important arrestor locations such as switch points has been performed. Citizens' is replacing arrestors found to be problematic.

.

In addition to the above steps, Citizens' has completed line design changes at several locations to make certain circuit sections less vulnerable to weather-induced tree outages. These changes include moving sections of line from difficult-to-access wooded areas to roadsides and altering some pole-top configurations to push conductors farther from trees that might encroach the right-of-way during strong winds.

Citizens' recently began a project to replace all remaining first-generation smart meters within 5 years. There are approximately 4,700 of these meters still in service. Replacing these meters will provide many benefits, including faster, more-reliable communications. This will help operations staff more quickly assess outages, dispatch repair crews, verify restorations, monitor voltage quality and identify areas of load growth.

In 2017, Citizens' failed to achieve benchmark performance in every category. However, Citizens' SAIDI and SAIFI results for 2017 are still considered some of the best in Pennsylvania, even though they have exceeded their individual metrics for benchmark and standard requirements that are the most conservative relative to other Pennsylvania EDCs. TUS will continue to monitor to ensure Citizens' performance improves.

Figure 32 Citizens' CAIDI (minutes)

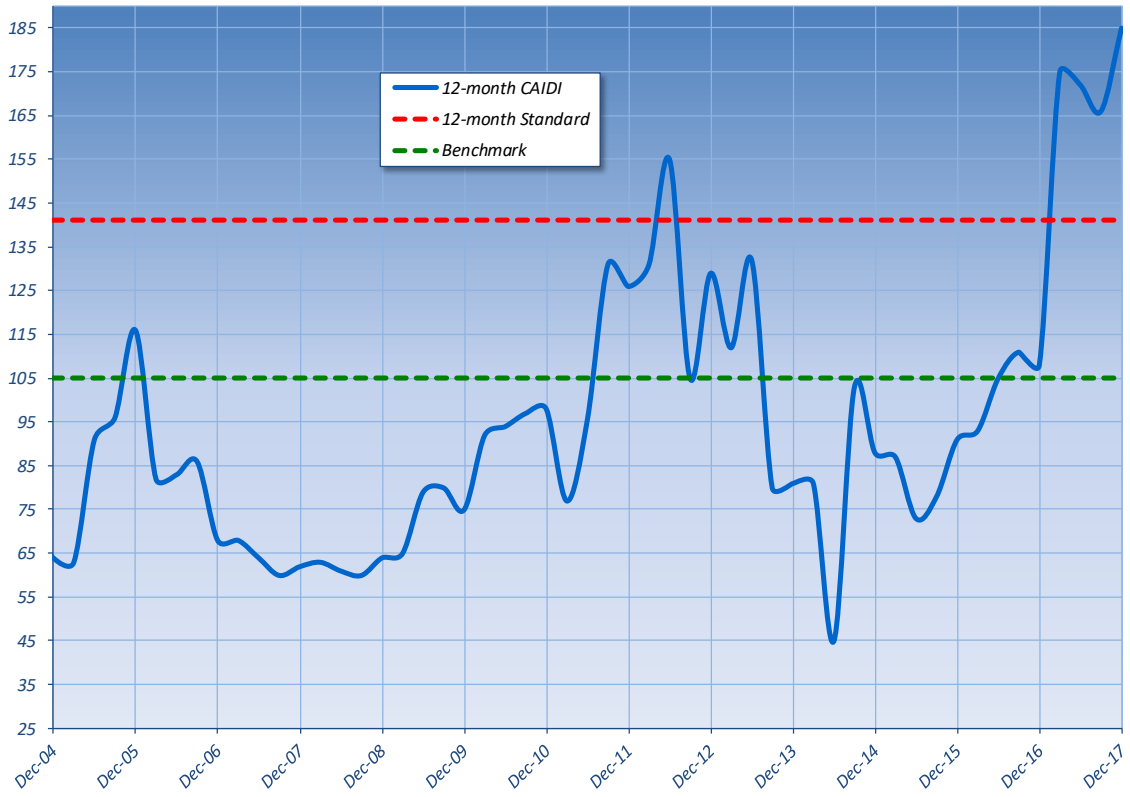


Figure 333 Citizens' SAIFI (interruptions per customer)

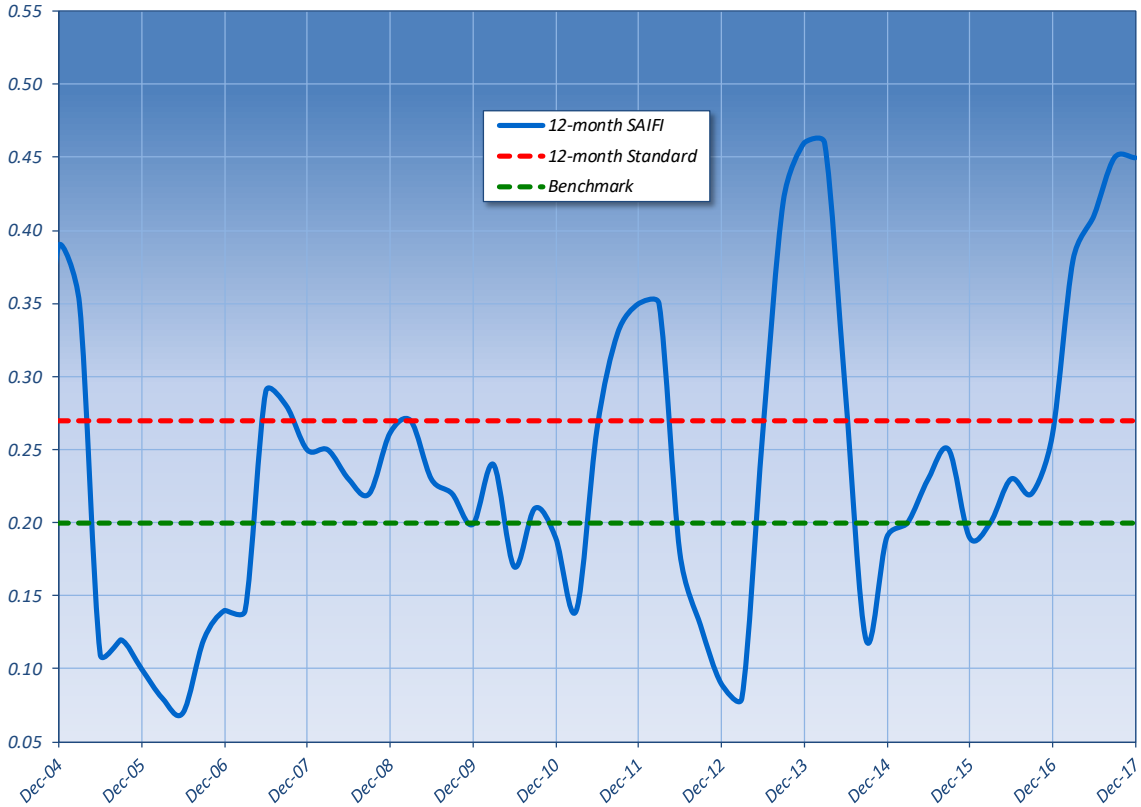


Figure 34 Citizens' Outage Causes (percent of total outages)

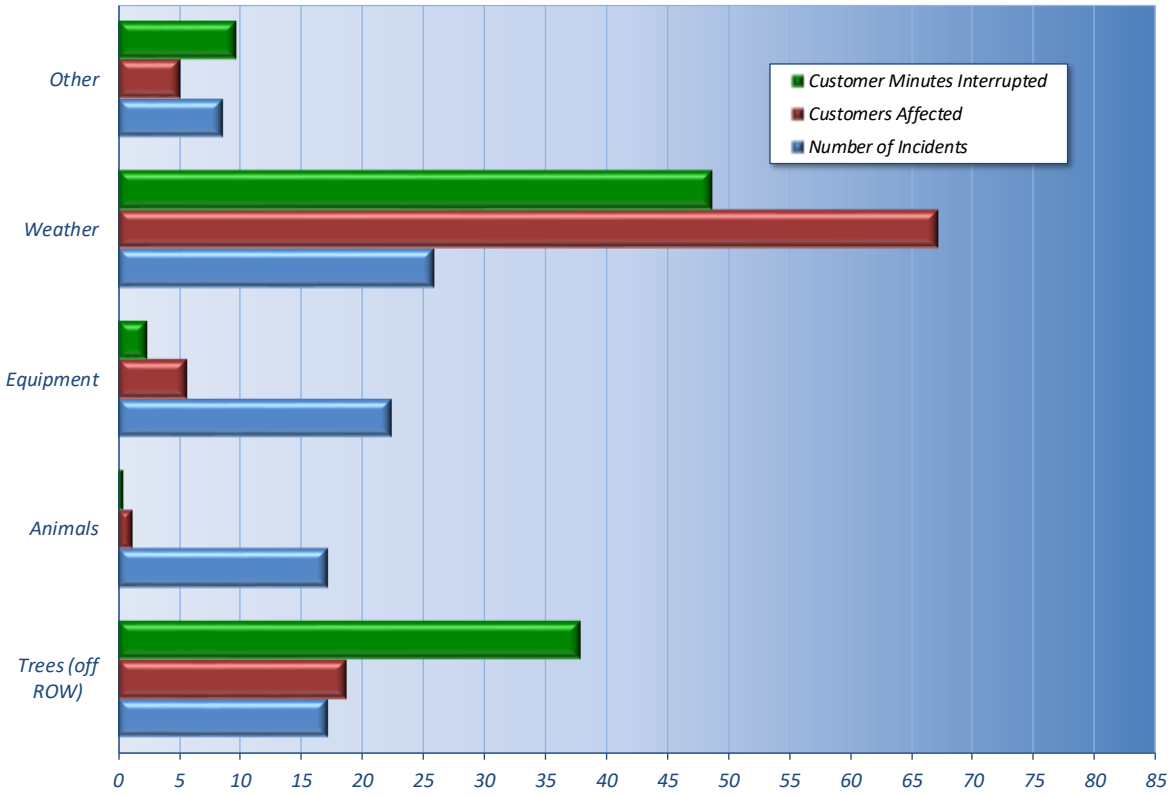
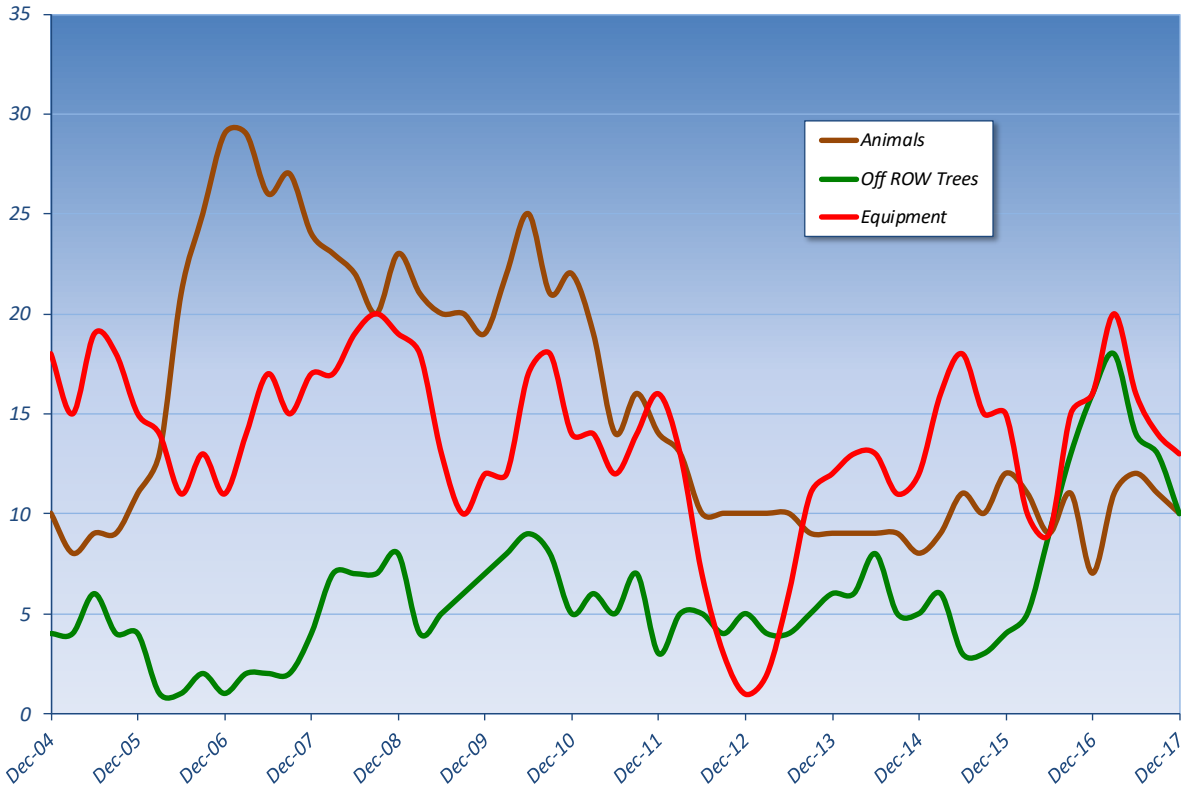


Figure 35 Citizens' Outage Tracking (number of incidents)



Pike County Light & Power Company

Pike has a relatively small operating service area with about 4,429 customers in 44 square miles. Pike County is primarily fed from 2 34.5-kilovolt (kV) feeders supplied from New York substations and the eastern portion of Pike County service territory is fed by 2 13.2 kV feeders from Matamoras Substation.

In 2017, Pike experienced 4,648 customer interruptions and 475,003 minutes of interruptions as compared to 1,735 customer interruptions and 394,826 minutes in 2016, and 1,821 interruptions and 367,000 minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 228 minutes in 2016 to 185 minutes in 2017; and failed to achieve benchmark by 6 percent.

3-year average: Increased from 180 minutes in 2016 to 206 minutes in 2017; and failed to achieved standard by 7 percent.

SAIDI

Rolling 12-month: Increased from 87 minutes in 2016 to 102 minutes in 2017; achieved benchmark by 4 percent.

3-year average: Decreased from 130 minutes in 2016 to 89 minutes in 2017; achieved standard by 31 percent.

SAIFI

Rolling 12-month: Increased from 0.38 outages in 2016 to 0.53 outages in 2017; achieved benchmark by 13 percent.

3-year average: Decreased from 0.96 outages in 2016 to 0.43 outages in 2017; achieved standard by 36 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 36 and Figure 37. Pike's CAIDI score is slightly negative above benchmark. However, Pike's SAIDI and SAIFI scores are positively below benchmark. Figure 38 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 39 shows the historical trend of the top 2 main outage causes. The most frequent outage causes were trees and equipment failure. About 37 percent of Pike's outages are caused by trees, which impact 56 percent of the customers experiencing outages.

Pike continued the usage of smart fault indicators (SFI). These devices allow for automatic and remote notification of any power disturbances in coverage zones, such as transient and permanent faults. SFIs significantly reduce outage response time by directly identifying faulted zones, thereby directly reducing circuit patrol times and customer outage durations.

Pole top reclosers and substation devices currently monitored and controlled by Orange and Rockland Utilities' (ORU) SCADA system is in progress of being converted to Pike's SCADA monitoring and control system.

Pike's SAIFI and SAIDI performance has been a benchmark performer the last 2 quarters of 2017 and CAIDI performance is close to becoming benchmark.

Figure 36 Pike County CAIDI (minutes)

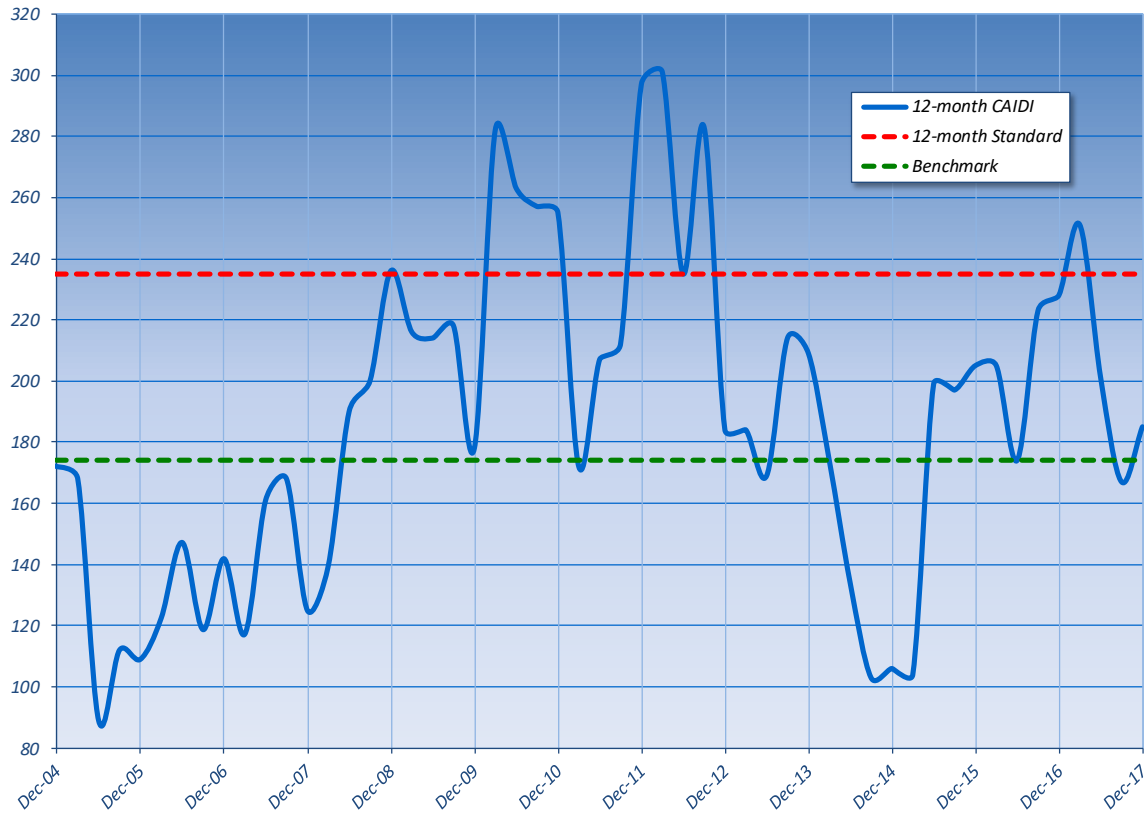


Figure 37 Pike County SAIFI (interruptions per customer)

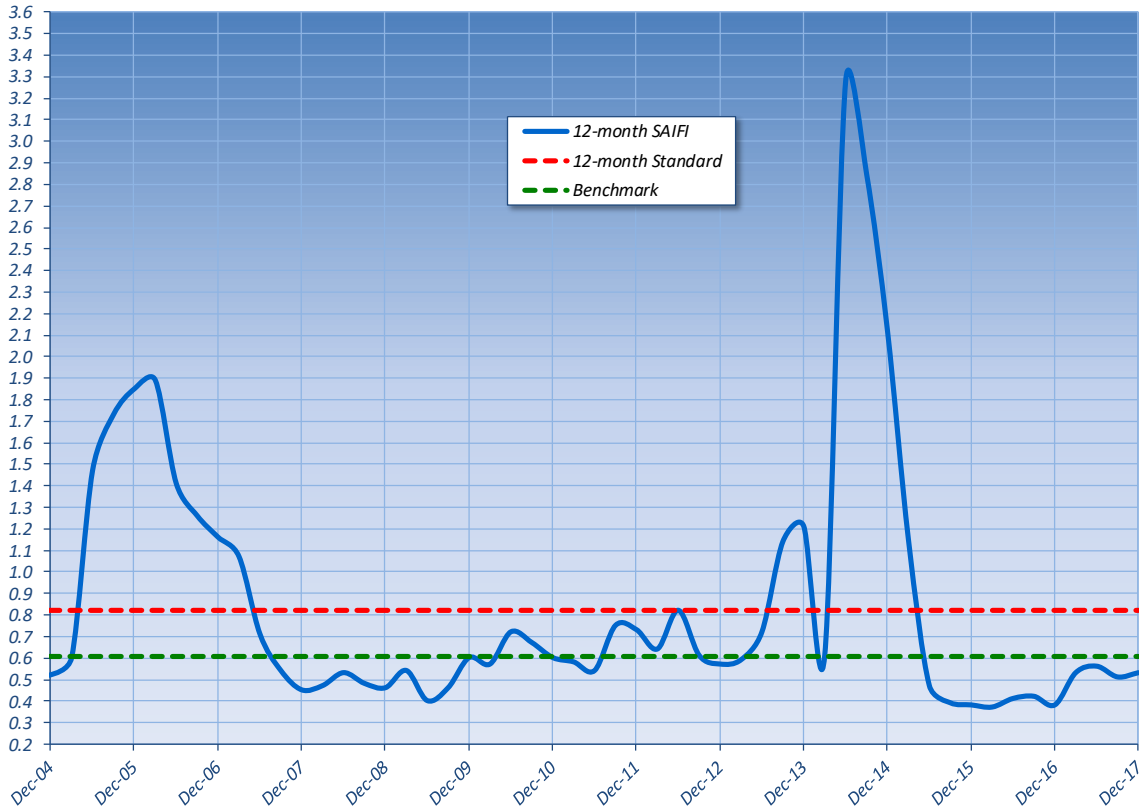


Figure 38 Pike County Outage Causes (percent of total outages)

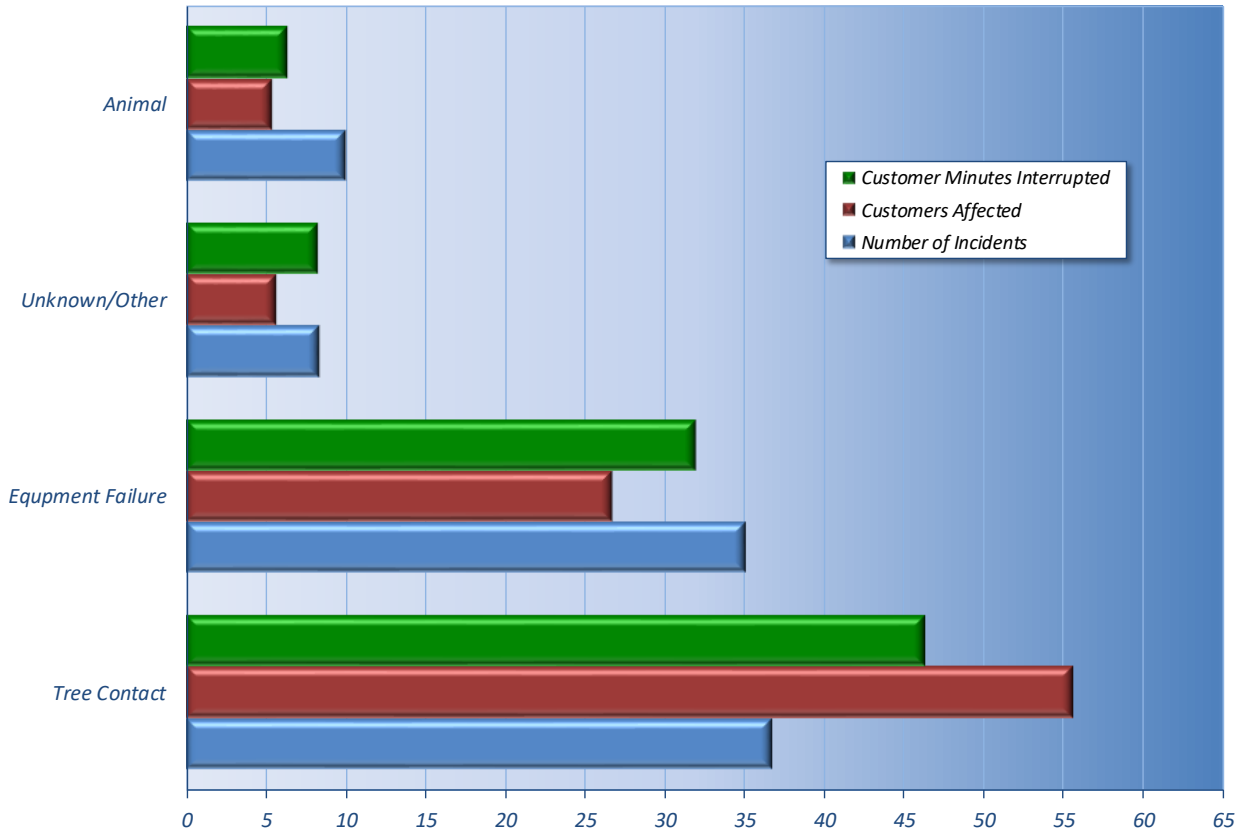
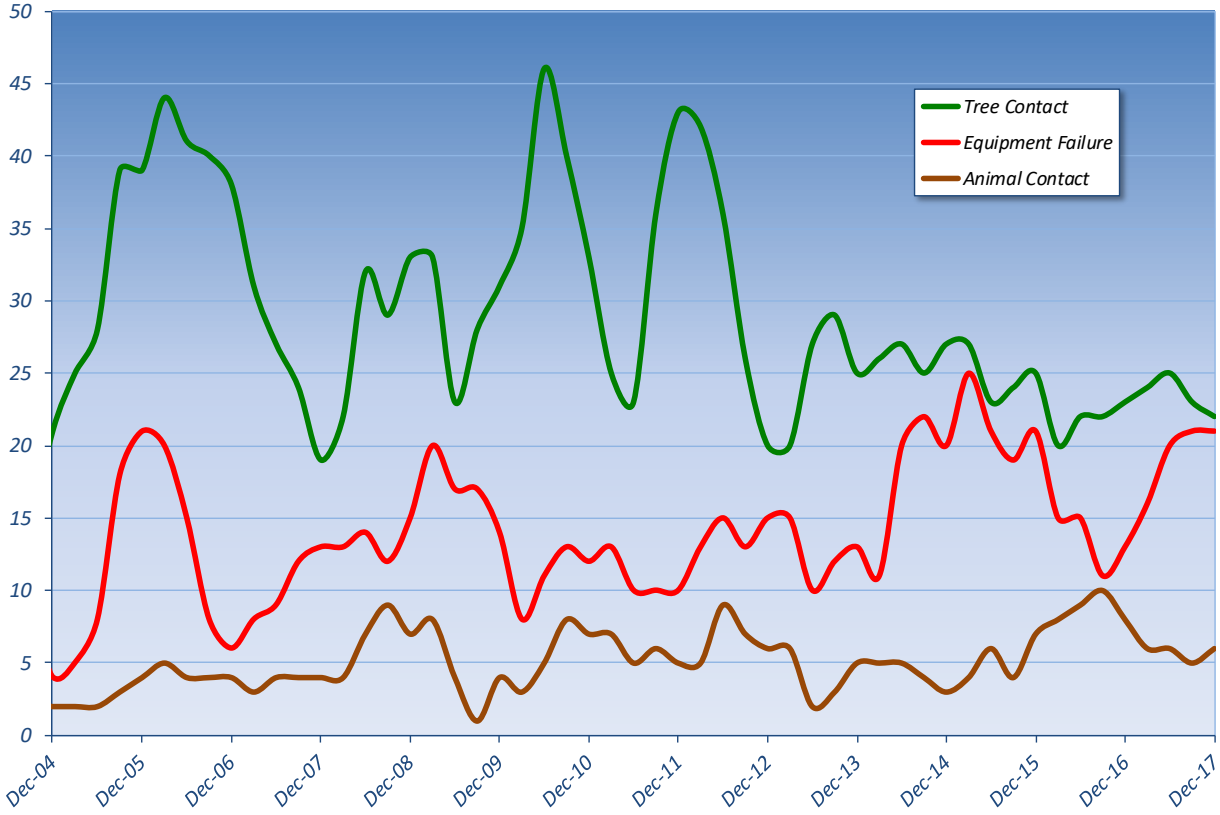


Figure 39 Pike County Outage Tracking (number of incidents)



UGI Utilities Inc.

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

In 2017, UGI experienced 31,395 customer interruptions and 4.1 million minutes of interruptions as compared to 38,909 customer interruptions and 4.85 million minutes in 2016, and 24,122 customer interruptions and 2.48 million minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 125 minutes in 2016 to 131 minutes in 2017; achieved benchmark by 23 percent.

3-year average: Decreased from 124 minutes in 2016 to 120 minutes in 2017; achieved standard by 36 percent.

SAIDI

Rolling 12-month: Decreased from 78 minutes in 2016 to 64 minutes in 2017; achieved benchmark by 54 percent.

3-year average: Remained the same from 61 minutes in 2016 to 61 minutes in 2017; achieved standard by 64 percent.

SAIFI

Rolling 12-month: Decreased from 0.63 outages in 2016 to 0.49 outages in 2017; achieved benchmark by 41 percent.

3-year average: Increased from 0.49 outages in 2016 to 0.51 outages in 2017; achieved standard by 44 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 40 and Figure 41. Figure 42 shows the distribution of outage causes that occurred during 2017 as a percentage of total outages. Figure 43 shows the historical trend of main outage causes. The most frequent outage causes were trees/weather at 42 percent and equipment failure at 28 percent.

UGI initiated a Distribution Automation Pilot Project in 2015 and based on its success, a 5-year project plan was developed to extend remote monitoring and control via wireless communication links to 3-phase reclosers on select feeders through-out the system. To date, communication to 22 existing devices has been completed and another 10 are planned to be completed in 2017. Additionally, 13 new 3-phase reclosers with communication are planned to be installed in 2017. Remote management of these devices, by UGI System Operators, will significantly reduce switching times to sectionalize and/or restore customers impacted by outages.

To bolster UGI's existing Danger Tree Mitigation Program, UGI added additional vegetation clearance resources in 2017 to address the expected vegetation issue caused by the Emerald Ash Borers devastation. The Danger Tree Mitigation Program identifies and addresses mainly off right-of-way trees that pose a threat to transmission and distribution facilities. These new resources will specifically target the removal of ash trees both on and off right-of-way. In addition, UGI continues the practice of "ground to sky" trimming on multi-phase circuits and on single phase lines where appropriate.

UGI's Line Segmentation Program focuses on identifying locations to install fuses, disconnects, and other devices to limit the number customers affected when line damage occurs and enable field personnel to restore service to customers on unaffected line segments through switching before repairs are made. To date, UGI has completed patrols of 79 percent of its overhead distribution feeders identifying over 190 locations for new devices with installation completed at 146, or 77 percent, of these locations. In 2017, UGI will complete patrols of an additional 5 distribution circuits and plans to install 18 new sectionalizing devices.

UGI's Primary Line Relocation Program moves distribution lines from troublesome off-road locations to road-side rights-of-way. Relocating the lines to road side enables quicker patrolling as well as making repairs quicker and safer because mechanized aerial equipment can be used as opposed to climbing the poles to do repair work. UGI completed 4 projects in 2016 and plans to complete 2 in 2017.

UGI is considered a benchmark performer. In the last 20 quarters, UGI has achieved benchmark performance in every category and this positive performance is expected to continue in 2018.

Figure 40 UGI CAIDI (minutes)

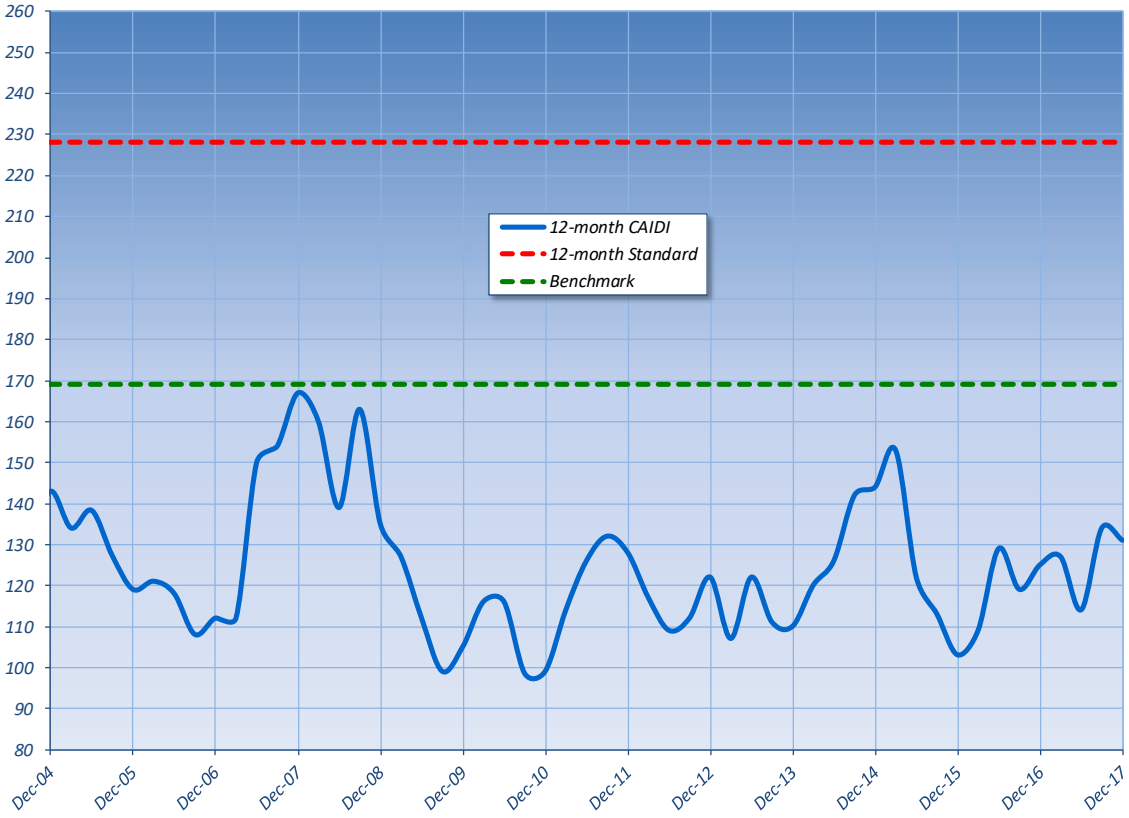


Figure 41 UGI SAIFI (interruptions per customer)

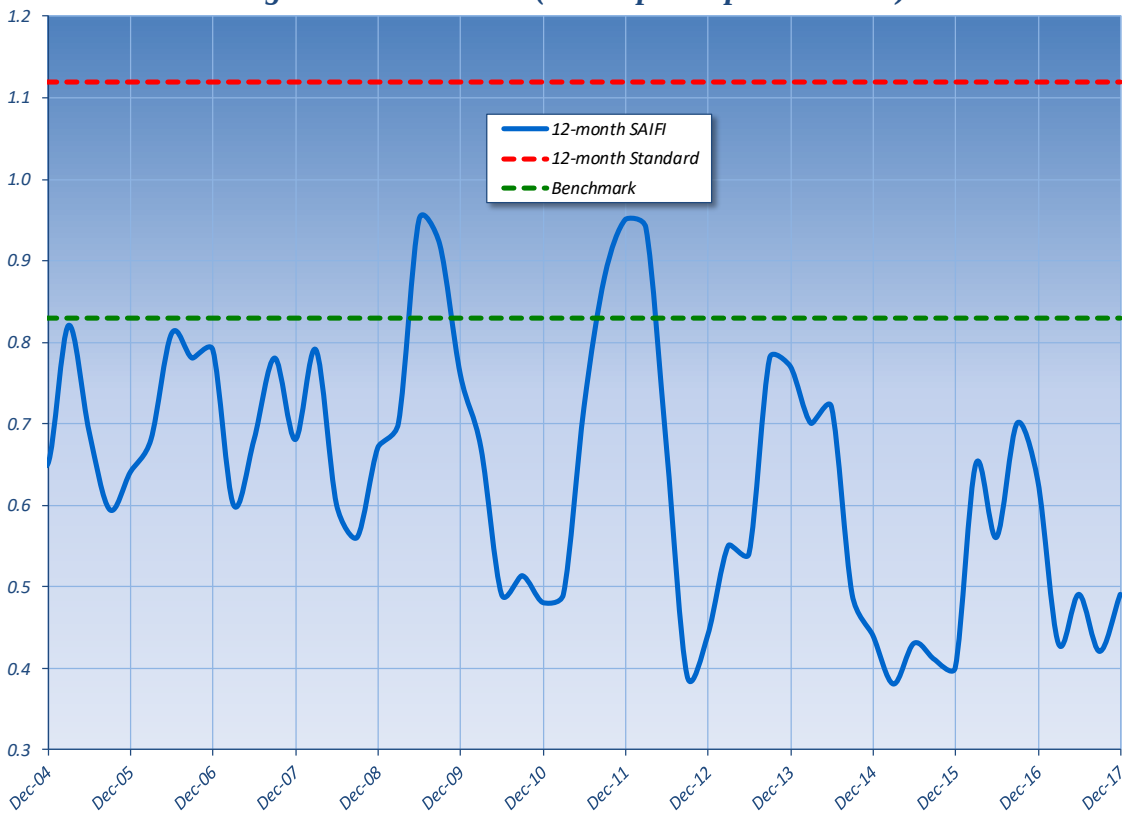


Figure 42 UGI Outage Causes (percent of total outages)

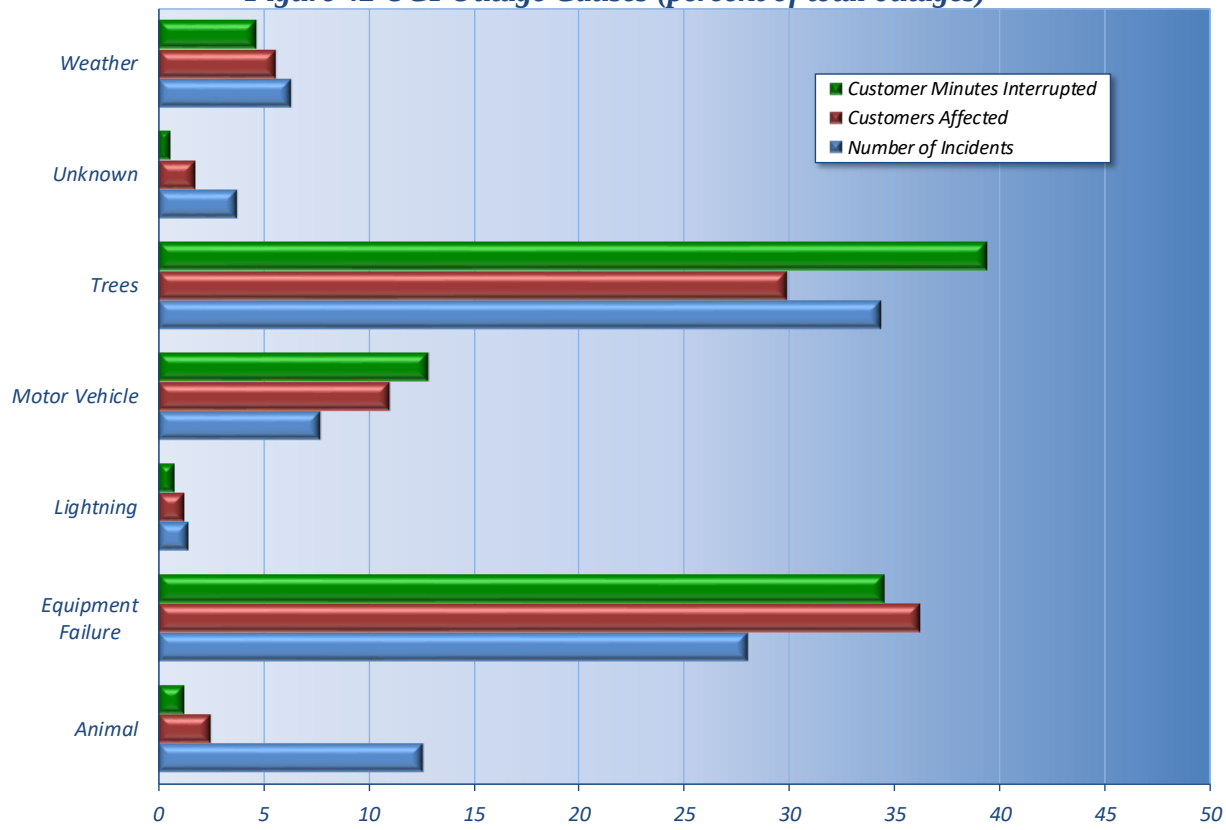
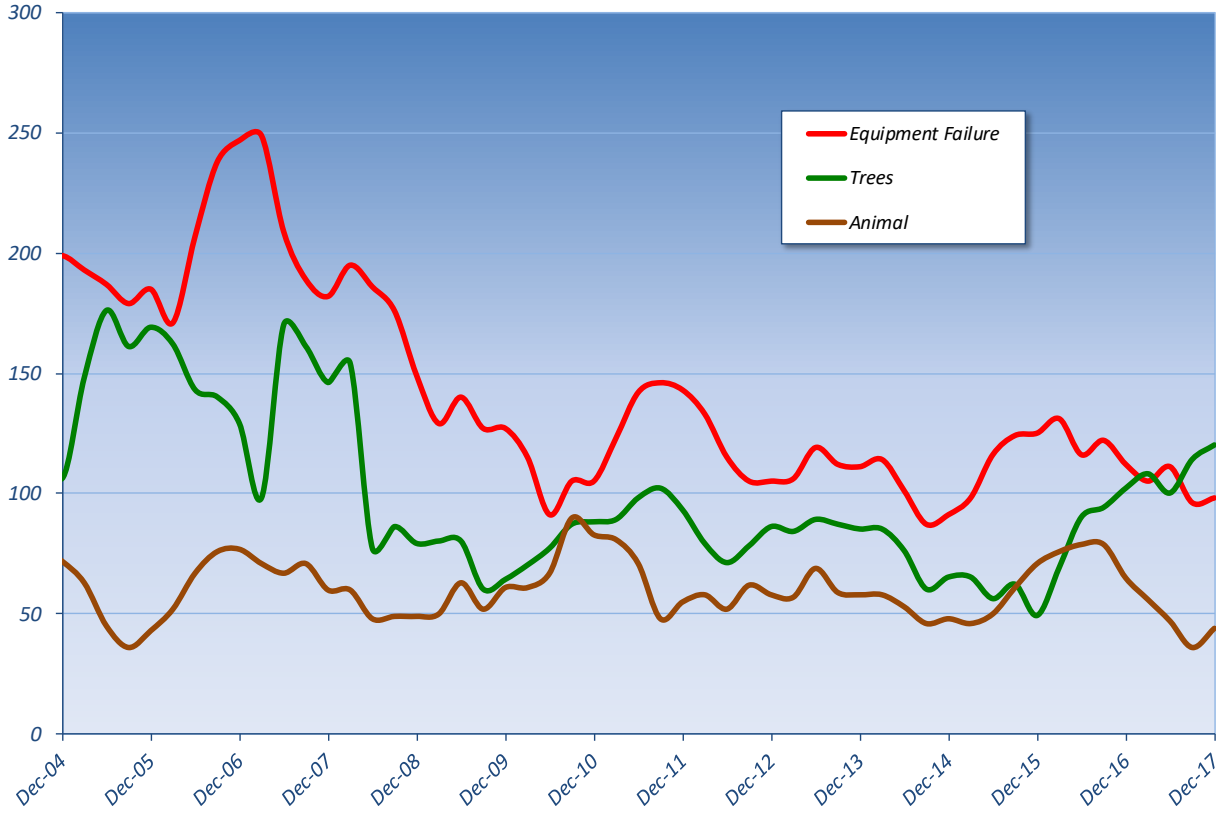


Figure 43 UGI Outage Tracking (number of incidents)



Wellsboro Electric Company

Wellsboro has a service territory of about 178 square miles and serves about 6,272 customers.

In 2017, Wellsboro experienced 6,816 customer interruptions and 297,801 minutes of interruptions as compared to 10,138 customer interruptions and 1.1 million minutes in 2016, and 5,209 customer interruptions and 496,803 minutes of interruption in 2015.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 94 minutes in 2016 to 90 minutes in 2017; achieved benchmark by 27 percent.

3-year average: Increased from 82 minutes in 2016 to 87 minutes in 2017 and achieved standard by 36 percent.

SAIDI

Rolling 12-month: Decreased from 172 minutes in 2016 to 97 minutes in 2017; achieved benchmark by 37 percent.

3-year average: Increased from 103 minutes in 2016 to 117 minutes in 2017; achieved standard by 37 percent.

SAIFI

Rolling 12-month: Decreased from 1.84 outages in 2016 to 1.08 outages in 2017; achieved benchmark by 12 percent.

3-year average: Increased from 1.22 outages in 2016 to 1.33 outages in 2017 and achieved standard by 2 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 44 and Figure 45. Figure 46 shows the distribution of outage causes as a percentage of total outages. Figure 47 shows the historical trend of main outage causes. The most frequent outage causes were animals at 34 percent and trees at 34 percent. Wellsboro continues to install animal guarding. However, animal outages affect significantly less customers and customer minutes interrupted than tree outages. Tree outages affected 60 percent of the customers and were the cause of 43 percent of the customer minutes interrupted.

Wellsboro is continuing its programs to maintain electric reliability. Wellsboro has installed smart meters that cover approximately 97 percent of meters and plans to continue enhancing its Outage Management System

In 2017, Wellsboro performed a detailed Vegetation Management Inspection on 4 distribution circuits. The inspection looked for danger trees that could cause a problem to the distribution system and to determine the trimming cycle for all other vegetation. Wellsboro performed a complete trimming and removal of danger trees on 60 miles of the Middlebury feeder distribution system. Infrared imaging is conducted bi-annually on all major distribution system equipment. Also, Wellsboro now inspects substations monthly for hot spots with an infrared camera.

Wellsboro achieved benchmark performance in all categories during the last 2 quarters of 2017 and is currently considered a benchmark performer.

Figure 44 Wellsboro CAIDI (minutes)

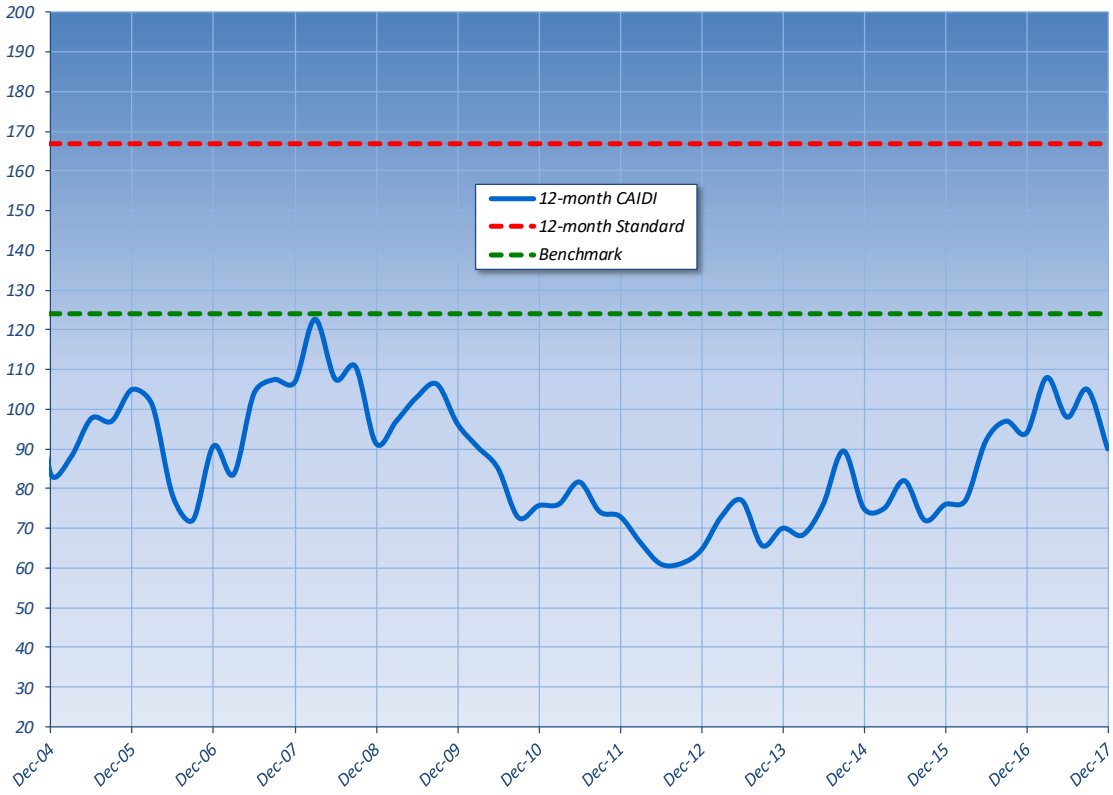


Figure 45 Wellsboro SAIFI (interruptions per customer)

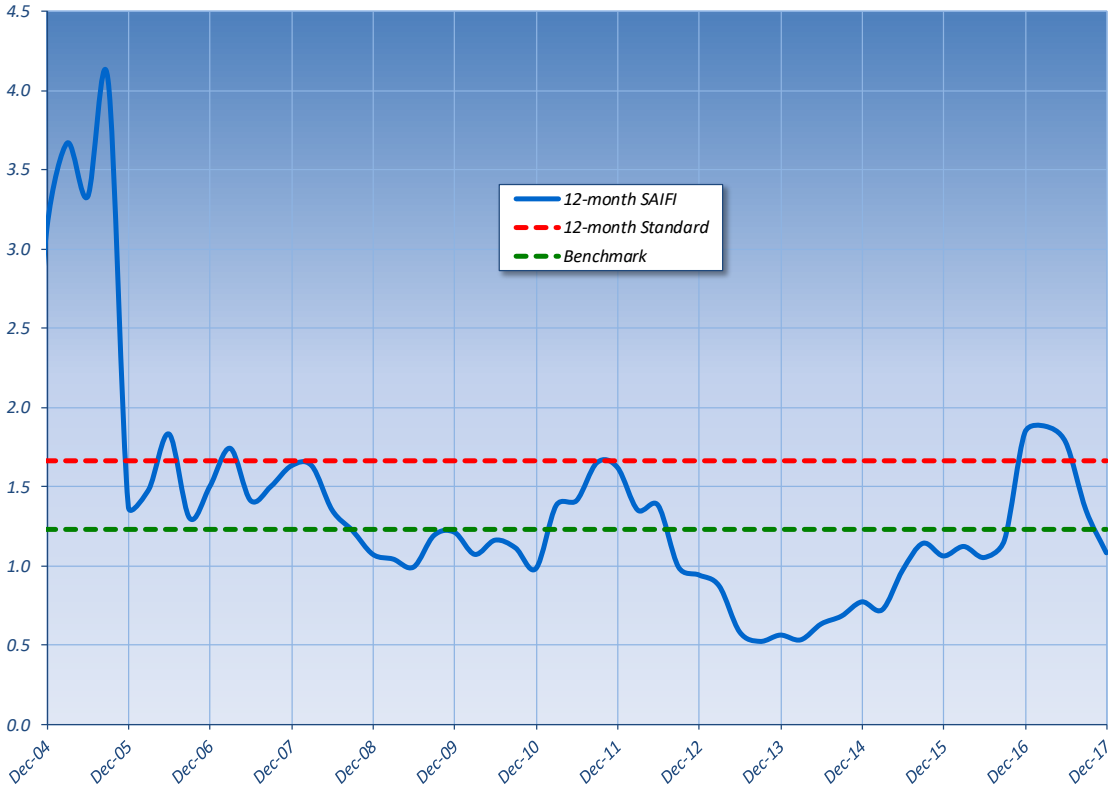


Figure 46 Wellsboro Outage Causes (percent of total outages)

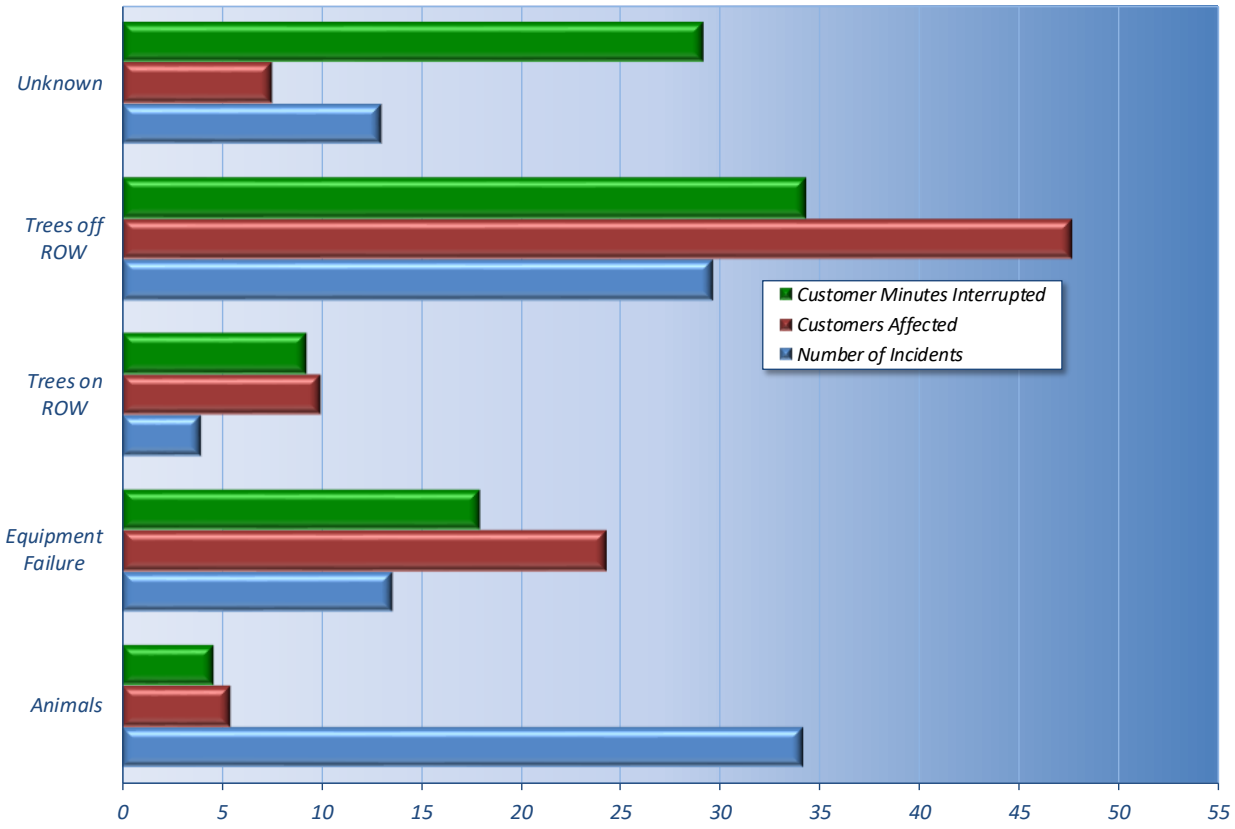
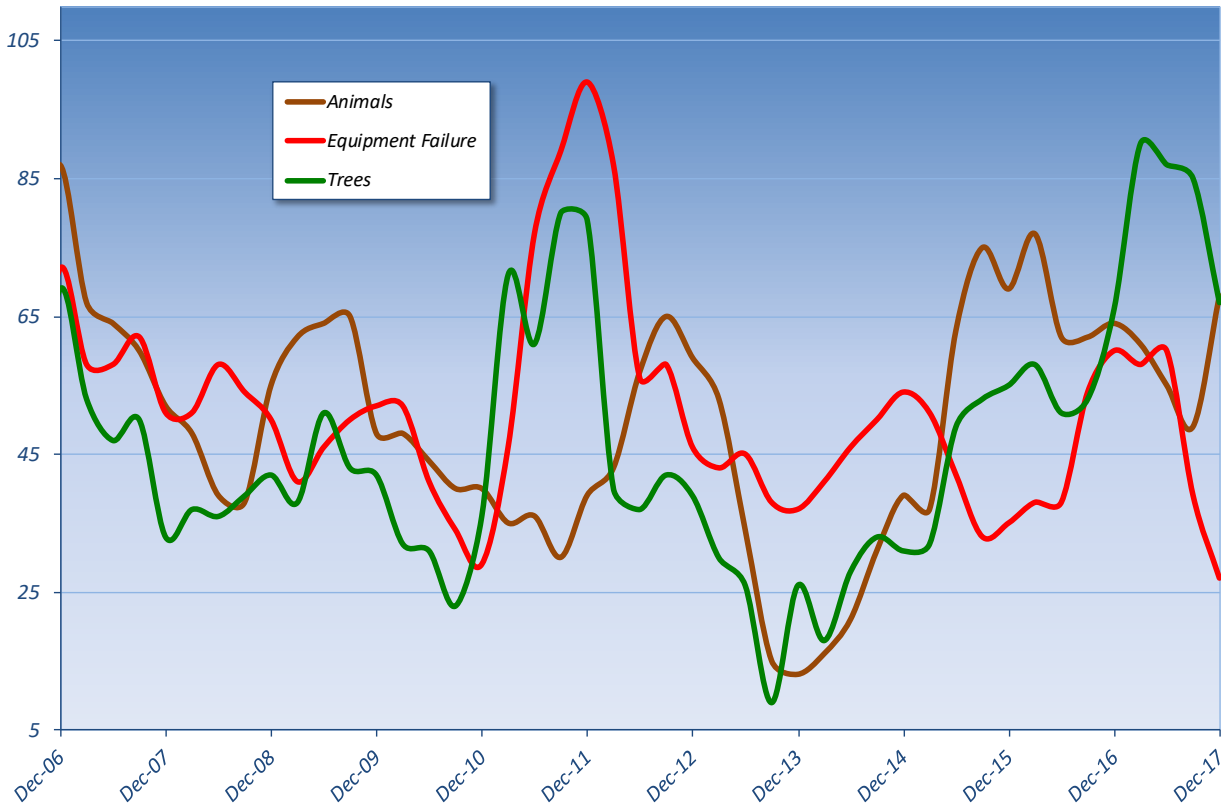


Figure 47 Wellsboro Outage Tracking (number of incidents)



Section 5– Conclusion

The Electricity Generation Customer Choice and Competition Act of 1996 mandates that the Commission ensure that levels of reliability that existed prior to the restructuring of the electric utility industry continue in the new competitive markets. In response, the PUC adopted reporting requirements designed to ensure the continuing safety, adequacy and reliability of the generation, transmission, and distribution of electricity in the Commonwealth. The Commission also established reliability benchmarks and standards with which to measure the performance of each EDC, and standards for the inspection and maintenance of electric distribution facilities.

As of the date of this report, 8 EDCs have approved Long-Term Infrastructure Improvement Plans (LTIIPs).[35] EDCs are utilizing the LTIIPs to proactively accelerate replacement of degraded distribution system components and improve the resiliency of their distribution systems through storm hardening initiatives. There has also been an increase in tree trimming activity beyond historic levels for many EDCs, in addition to the LTIIP initiatives. It is expected that this should also reduce damage to the electric system during storms and contribute to a general overall reduction in the number of outages in Pennsylvania.

Tree Issues

In general, as noted in the 2014, 2015, and 2016 PUC Pennsylvania Electric Reliability reports, every utility is challenged with danger trees outside its right-of-way boundaries. Trees are a direct challenge to the resiliency and storm hardening of the distribution system during weather events. Pennsylvania EDCs continue aggressive vegetation management programs. However, EDCs recognize that removal of off-right-of-way trees is a very slow and challenging process that requires extensive resources and support from landowners before an off-right-of-way tree can be trimmed or removed.

In 2017, tree-related outages in Pennsylvania caused approximately 400 million customer minutes of interruption to over 2 million customers. Total outages in 2017 were over 800 million customer minutes affecting over 5.5 million customers. Tree-related outages cause approximately 50 percent of the total customer minutes interrupted in Pennsylvania.

In 2017, there were a record of 50 reportable outage events as compared to 20 events in 2016.[36] Increased storm activity typically increases tree-related outages. Falling trees and limbs are a significant threat to electric reliability and cause significant interruptions to the distribution system. Additionally, during a severe weather event, trees falling on roadways cause highway road closures and significant restoration delays because utility crews need to safely clear roadway debris before work can be done to restore service.

It appears EDCs will continue to be challenged by tree-related outages, especially those outside of the right-of-way. EDCs are limited in what can be done outside of existing rights-of-way as in most cases they have to seek permission from land owners to be able to address trees outside the right-of-way. Trees may grow very tall outside of the right-of-way and be a threat to distribution systems, especially during storms. EDCs may need to reach out to external resources and

[35] The 8 EDCs with approved LTIIPs are Met-Ed, PECO, Penelec, Penn Power, PPL, West Penn, Duquesne Light, and UGI.

[36] *See* Section 3, above.

stakeholders that can complement their challenge on vegetation management, especially when severe storm activity increases. There are many tree-related initiatives that can be executed in parallel that will, overtime, make reliability gains, especially during severe weather events that seemed to have spiked in 2017. Below are some recommendations for EDCs and other stakeholders that could help increase the reliability and resilience of the electric distribution system through focused leadership initiative:

- Consider a call for legislative relief that will grant utility companies the authority to remove or trim danger trees that are off their existing right-of-way. Such relief could be the ability to establish a wider right-of-way or allow utilities the authority to trim or remove trees that can potentially fall onto power conductors.
- Local authorities and counties could work with EDCs to be more proactive identifying and removing danger trees that are diseased or leaning that can fall onto roadway.
- EDCs and stakeholders could develop a partnership on a long-term program to ensure only the "right tree in the right place" can be planted within 60 feet of primary electrical conductors.
- Stakeholders could work together on removing dense/mature tree growth entangled in communication lines.[37]
- Landowners should be more proactive in removing diseased or leaning trees near roadways.
- EDCs that belong to the North American Transmission Forum (NATF)[38] should consider utilizing and adopting principles of excellence (POE) and other quality management tools NATF offers in assessing, continually improving, and ensuring their vegetation management programs are effective, and providing value-added-services at a fair and reasonable cost.

Best Practices

PUC TUS staff began a reliability improvement initiative in 2016 through a dialogue with the EDCs to encourage the EDCs to voluntarily establish a partnership or collaborative with the NATF to begin adopting and utilizing elements of the NATF performance improvement/operational excellence program that have been successfully implemented in transmission programs. TUS suggested to the EDCs to consider applying these NATF program tools to make performance operational gains in distribution reliability, resilience, and security. The NATF program was established by transmission operators and owners after the August 2003 Northeast blackout.[39] NATF collaborated with the Institute of Nuclear Operations (INPO), which has over 35 years of experience in applying operational performance program techniques, to improve operational excellence to sustain reliability and security of the bulk electrical system.[40]

TUS considers this an excellent opportunity to achieve sustainable reliability and security improvements in all areas of distribution system operations, especially as the future distribution system evolves and incorporates elements such as smart grid controls, microgrids, and distributed energy resources.[41] These elements will require a significant effort to seamlessly operate reliably

[37] Per the current edition of the National Electric Safety Code, communication facility owners are not required to trim vegetation away from communication facilities.
[38] https://www.natf.net/about/about-the-natf.
[39] https://en.wikipedia.org/wiki/Northeast_blackout_of_2003#Long-term_effects.
[40] https://www.natf.net/docs/natf/documents/organization-and-programs.pdf.
[41] For example, community and/or customer-owned solar and wind power generation.

with the bulk electrical system. TUS notes that this important initiative could enhance the reliability and security of Pennsylvania's distribution system in a way that cannot be achieved by Commission rules alone. TUS recommends that EDCs that already belong to NATF, which includes 99 percent of jurisdictional Pennsylvania customers, consider voluntarily extending the NATF program into the Pennsylvania electrical distribution system operations programs. TUS believes at this time that an organic and proactive approach by EDCs through an already existing framework as a basis would best serve the customers of Pennsylvania.

Final Observation

In general, overall reliability performance of most EDCs regressed in 2017. Reliability and resilience of the electrical distribution system to meet established benchmark performance standards appears to be challenged in years where there is increased severe storm activity. It appears that if more frequent, severe weather patterns become the new norm, the Pennsylvania electrical distribution systems will have difficulty in meeting the established performance criterion.

As of the fourth quarter of 2017, the following companies have failed to achieve benchmark performance in at least one 12-month rolling performance metric: Duquesne Light, PPL, Met-Ed, Penelec, Penn Power, West Penn, Citizens', and Pike County. Also as of the fourth quarter of 2017, the following companies have failed to achieve standard performance in at least one performance metric: Met-Ed, Penelec, Penn Power, West Penn, and Citizens'.

Appendix A – Electric Reliability Metrics

12-Month Average Electric Reliability Indices for 2017

Customer Average Interruption Duration Index (CAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-17	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	185	105	141	76.2	31.2
Duquesne Light	115	108	130	6.5	-11.5
Met-Ed (FE)	147	117	140	25.6	5.0
PECO	99	112	134	-11.6	-26.1
Penelec (FE)	138	117	141	17.9	-2.1
Penn Power (FE)	150	101	121	48.5	24.0
Pike County	185	174	235	6.3	-21.3
PPL	146	145	174	0.7	-16.1
UGI	131	169	228	-22.5	-42.5
Wellsboro	90	124	167	-27.4	-46.1
West Penn (FE)	166	170	204	-2.4	-18.6
System Average Interruption Frequency Index (SAIFI)- outages/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-17	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	0.45	0.20	0.27	125.0	66.7
Duquesne Light	0.98	1.17	1.40	-16.2	-30.0
Met-Ed (FE)	1.47	1.15	1.38	27.8	6.5
PECO	0.83	1.23	1.48	-32.5	-43.9
Penelec (FE)	1.73	1.26	1.52	37.3	13.8
Penn Power (FE)	1.06	1.12	1.34	-5.4	-20.9
Pike County	0.53	0.61	0.82	-13.1	-35.4
PPL	0.71	0.98	1.18	-27.6	-39.8
UGI	0.49	0.83	1.12	-41.0	-56.3
Wellsboro	1.08	1.23	1.66	-12.2	-34.9
West Penn (FE)	1.29	1.05	1.26	22.9	2.4
System Average Interruption Duration Index (SAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-17	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	84	21	38	300.0	121.1
Duquesne Light	112	126	182	-11.1	-38.5
Met-Ed (FE)	217	135	194	60.7	11.9
PECO	82	138	198	-40.6	-58.6
Penelec (FE)	239	148	213	61.5	12.2
Penn Power (FE)	160	113	162	41.6	-1.2
Pike County	102	106	194	-3.8	-47.4
PPL	104	142	205	-26.8	-49.3
UGI	64	140	256	-54.3	-75.0
Wellsboro	97	153	278	-36.6	-65.1
West Penn (FE)	214	179	257	19.6	-16.7

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

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

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

Three-Year Average Electric Reliability Indices for 2015-2017

Customer Average Interruption Duration Index (CAIDI)-min/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2015*	*2016*	*2017*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	*91*	*108*	*185*	*128*	*115*	*11.3*
Duquesne Light	*103*	*100*	*115*	*106*	*119*	*-10.9*
Met-Ed (FE)	*113*	*124*	*147*	*128*	*129*	*-0.8*
PECO	*84*	*106*	*99*	*96*	*123*	*-21.7*
Penelec (FE)	*140*	*120*	*138*	*133*	*129*	*2.8*
Penn Power (FE)	*100*	*95*	*150*	*115*	*111*	*3.6*
Pike County	*205*	*228*	*185*	*206*	*192*	*7.3*
PPL	*118*	*121*	*146*	*128*	*160*	*-19.8*
UGI	*103*	*125*	*131*	*120*	*186*	*-35.7*
Wellsboro	*76*	*94*	*90*	*87*	*136*	*-36.3*
West Penn (FE)	*154*	*147*	*166*	*156*	*187*	*-16.8*
System Average Interruption Frequency Index (SAIFI)-outages/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2015*	*2016*	*2017*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	*0.19*	*0.26*	*0.45*	*0.30*	*0.22*	*36.4*
Duquesne Light	*0.69*	*0.69*	*0.98*	*0.79*	*1.29*	*-39.0*
Met-Ed (FE)	*1.19*	*1.44*	*1.47*	*1.37*	*1.27*	*7.6*
PECO	*0.72*	*1.00*	*0.83*	*0.85*	*1.35*	*-37.0*
Penelec (FE)	*1.36*	*1.43*	*1.73*	*1.51*	*1.39*	*8.4*
Penn Power (FE)	*1.14*	*1.09*	*1.06*	*1.10*	*1.23*	*-10.8*
Pike County	*0.38*	*0.38*	*0.53*	*0.43*	*0.67*	*-35.8*
PPL	*0.72*	*0.78*	*0.71*	*0.74*	*1.08*	*-31.8*
UGI	*0.40*	*0.63*	*0.49*	*0.51*	*0.91*	*-44.3*
Wellsboro	*1.06*	*1.84*	*1.08*	*1.33*	*1.35*	*-1.7*
West Penn (FE)	*1.17*	*1.08*	*1.29*	*1.18*	*1.16*	*1.7*
System Average Interruption Duration Index (SAIDI)-min/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2015*	*2016*	*2017*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	*18*	*28*	*84*	*43*	*25*	*73.3*
Duquesne Light	*71*	*69*	*112*	*84*	*153*	*-45.1*
Met-Ed (FE)	*136*	*178*	*217*	*177*	*163*	*8.6*
PECO	*61*	*106*	*82*	*83*	*167*	*-50.3*
Penelec (FE)	*191*	*171*	*239*	*200*	*179*	*11.9*
Penn Power (FE)	*114*	*104*	*160*	*126*	*136*	*-7.4*
Pike County	*78*	*87*	*102*	*89*	*129*	*-31.0*
PPL	*84*	*94*	*104*	*94*	*172*	*-45.3*
UGI	*41*	*78*	*64*	*61*	*170*	*-64.1*
Wellsboro	*81*	*172*	*97*	*117*	*185*	*-36.9*
West Penn (FE)	*179*	*159*	*214*	*184*	*217*	*-15.2*

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

Appendix B – Modifications to Inspection and Maintenance Intervals

Modifications to Inspection and Maintenance (I&M) Intervals (Group 1) Submitted October 2017, effective January 1, 2019- December 31, 2020

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.

Modifications to Inspection and Maintenance Intervals (Group 2) Submitted October 2016, effective January 1, 2018- December 31, 2019

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
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 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

Pennsylvania Public Utility Commission