PENNSYLVANIA PUC
PUBLIC UTILITY COMMISSION

Electric Service Reliability in Pennsylvania

2016

Pennsylvania Public Utility Commission

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Executive Summary

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

The benchmarks and standards established by the Commission are based on four reliability performance metrics adopted by the Institute of Electrical and 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 and 1B, below, provide a brief summary of the EDCs' performance for the rolling 12-month period ending Dec. 31, 2016 and also provides 2015 data for comparison. 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 3.
[6] Docket No. L-00040167.

Table 1A

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	82	130	92	70	71	82
	SAIDI	126	76	55	64	70	182	76	55	64	70
	SAIFI	1.17	0.83	0.79	0.90	0.85	1.40	0.83	0.79	0.90	0.85
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 1B

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	95	130	103	105	107	95
	SAIDI	126	60	69	78	71	182	60	69	78	71
	SAIFI	1.17	0.58	0.66	0.73	0.75	1.40	0.58	0.66	0.73	0.75
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
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	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.

[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.

Section 2 –Reliability Performance Measures

Reliability Performance Metrics

The Commission's benchmarks and standards are based on 4 reliability performance metrics that have been adopted by the IEEE. The EDCs report metrics on a system-wide basis, rather than on a regional operating area basis. EDCs report the four reliability metrics on both a rolling 12-month average and a 3-year calendar year average:

1. **CAIDI** (Customer Average Interruption Duration Index): Measures average power restoration time (by minutes) for every customer who lost power during reporting period.
2. **SAIDI** (System Average Interruption Duration Index): Measures average outage duration time (by minutes) for every customer served during reporting period.
3. **SAIFI** (System Average Interruption Frequency Index): Measures average frequency of power interruptions for every customer served during reporting period.
4. **MAIFI** (Momentary Average Interruption Frequency Index): Measures average frequency of momentary (less than 5 minutes) interruptions for every customer served during reporting period.

*Note: EDCs are required to report **MAIFI** data provided the equipment capability is available to obtain relevant data.*

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.[9]
- Reliability performance on a 5 percent of worst performing circuits and a corrective action plan to increase the reliability of these circuits.

Major Events

In order to analyze and set measurable goals for electric service reliability performance, outage data is separated into either normal or abnormal periods. Only outages during normal event periods are used in calculating the reliability metrics. The term "major event" is used to identify an abnormal event, such as a major storm, and is defined as either of the following:[10]

- 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

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

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

Outage data relating to major events are to be excluded from the calculation of reliability metrics. Prior to excluding major event 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 five 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.[11] A greater degree of short-term latitude 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 standard at the end of each calendar year. The rolling 3-year standard analysis contained in this report uses 2014, 2015 and 2016 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

[11] 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.

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, 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.[12] In addition, Commission staff may initiate an investigation to determine whether an EDC is providing reliable service.[13]

Benchmarks and standards for EDC reliability performance and average reliability Metrics for 2016 are listed in Appendix A.

Inspection and Maintenance

EDCs are required to have a plan for periodic inspection and maintenance of poles, overhead conductors and cables, wires, transformers, switching devices, protective devices, regulators, capacitors, substations, and other facilities critical to maintaining an acceptable level of reliability.[14] 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 2015 (effective January 2017 through December 2018) 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

[12] *See* 52 Pa. Code § 57.195(g).
[13] *See* 52 Pa. Code § 57.197(a).
[14] *See* 52 Pa. Code § 57.198.

the exemptions that were requested by the EDCs and provides a summary of the explained justification for said exemptions.[15]

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**

Section 3 – 2016 Outage Response Review

Overview

All Pennsylvania EDCs had at least 1 PUC Reportable Outage Event (ROE) in 2016 with the exception of Citizens', UGI, Penn Power, and Wellsboro.[16] In 2016, a total of 787,102 customers were affected by weather-related ROE's as compared to the total of 619,474 customers in 2015. Table 3, below, shows a breakdown of PUC reportable outage events in 2016.

[15] *See* 52 Pa. Code § 57.198(c).

[16] 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 6 or more consecutive hours.

Table 3 – 2016 Reportable Outage Events

EDC	Date	Customers Affected	Cause
PECO	2/24/2016	72,118	Rain and high winds
Met-Ed	2/24/2016	52,175	Rain and high winds
PPL	2/24/2016	28,191	Rain and high winds
Penelec	4/2/2016	24,168	Rain and high winds
PECO	4/2/2016	89,051	Rain and high winds
PPL	4/2/2016	59,284	Rain and high winds
Met-Ed	4/2/2016	41,292	Rain and high winds
PECO	6/8/2016	96,373	Rain and high winds
West Penn	6/16/2016	26,417	Thunder storm and wind
PECO	7/18/2016	30,920	Rain and high winds
Penelec	7/25/2016	25,122	Rain and high winds
PPL	7/25/2016	27,843	Rain and high winds
PECO	7/25/2016	72,983	Rain and high winds
Duquesne	8/16/2016	23,590	Rain and high winds
West Penn	8/16/2016	20,897	Rain and high winds
West Penn	8/28/2016	13,707	Rain and high winds
PPL	11/19/2016	25,401	Snow and high winds
West Penn	10/20/2016	22,038	Rain and high winds
Duquesne	12/17/2016	12,500	Freezing rain and high winds
West Penn	12/17/2016	20,532	Freezing rain and high winds

Major Event Exclusion Requests

In 2016, EDCs filed 11 Major Exclusion requests for power outages and all 11 requests were approved. A brief description of each major event is provided in Table 4 below:

Table 4 – 2016 Major Exclusion Events

EDC	Date	Customers Affected	Cause
Pike County	2/16/2016	1,795	Mylar balloons caught in power line
Pike County	2/24/2016	1,067	Rain and high winds
Citizens	3/30/2016	1,409	Three phase polymer insulator failed
Wellsboro	4/3/2016	2,015	Rain and high winds
Wellsboro	8/8/2016	897	Bear in conductors
Pike County	8/13/2016	627	Rain and high winds
Pike County	9/19/2016	2,518	Motor vehicle hit utility pole
Penelec	11/2/2016	1,794	Flash Flood near Ralston
Citizens	11/8/2016	1,008	homeowner cut down tree into line
Citizens	11/19/2016	1,833	Rain and high winds
Wellsboro	12/26/2016	6,097	Transmission line failure

Review of Long-Duration Outage Event(s)

There were no long duration outage events in 2016.[17]

Section 4 –EDC Reliability Performance Data

Statewide Summary

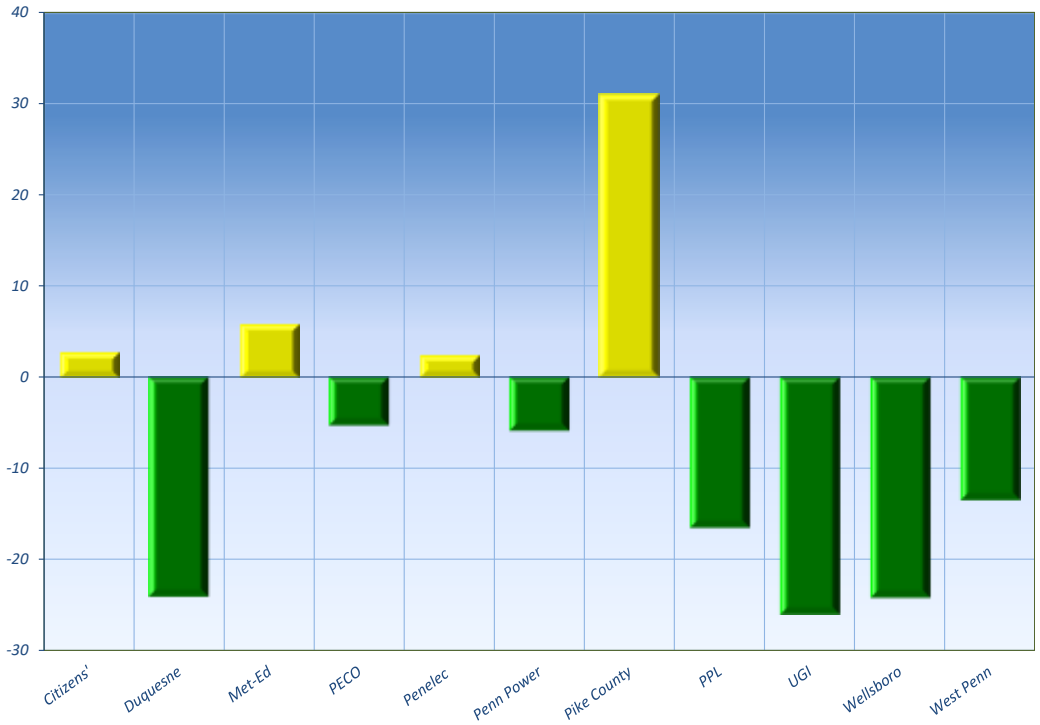
Rolling 12-month Benchmark Performance Compliance

The 2016 end of year reliability data for 12-month performance compliance submitted by the 11 EDCs indicates:

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

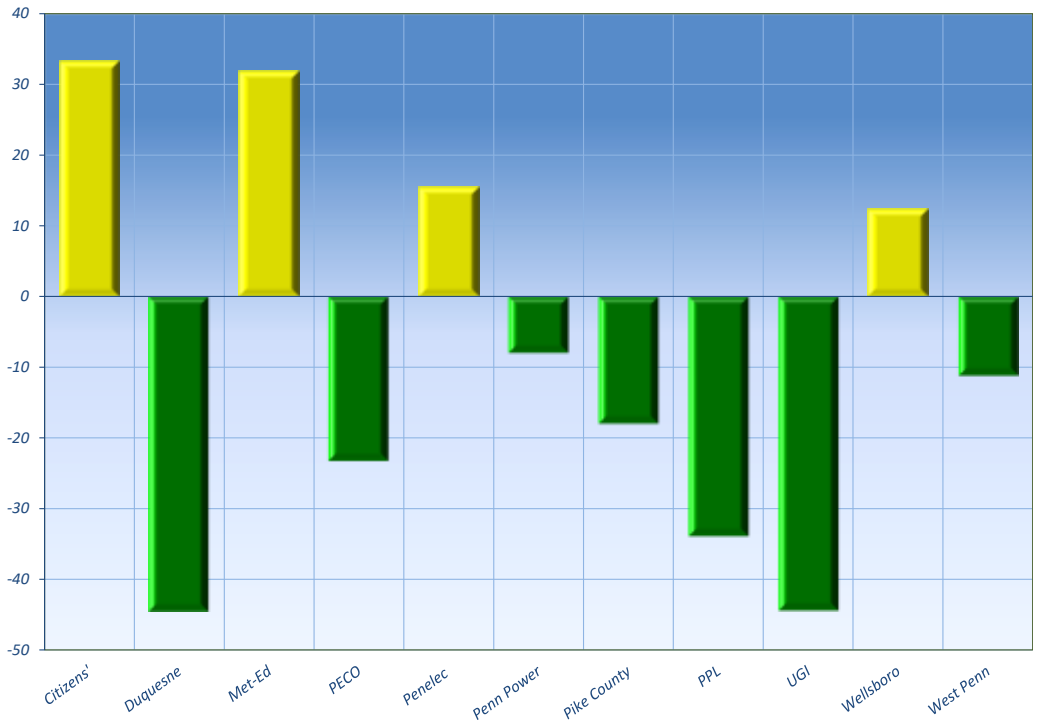
[17] Long-duration outage events may include, but are not limited to, Major Service Outage events as outlined in 52 Pa. Code § 69.192(b)(1). Examples include ice storms, heavy snows, hurricanes, and tropical storms, among others. The PUC also considers events such as severe thunderstorms that cause long-duration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

Figure 1 – 2016 CAIDI Comparison (percent above or below benchmark)



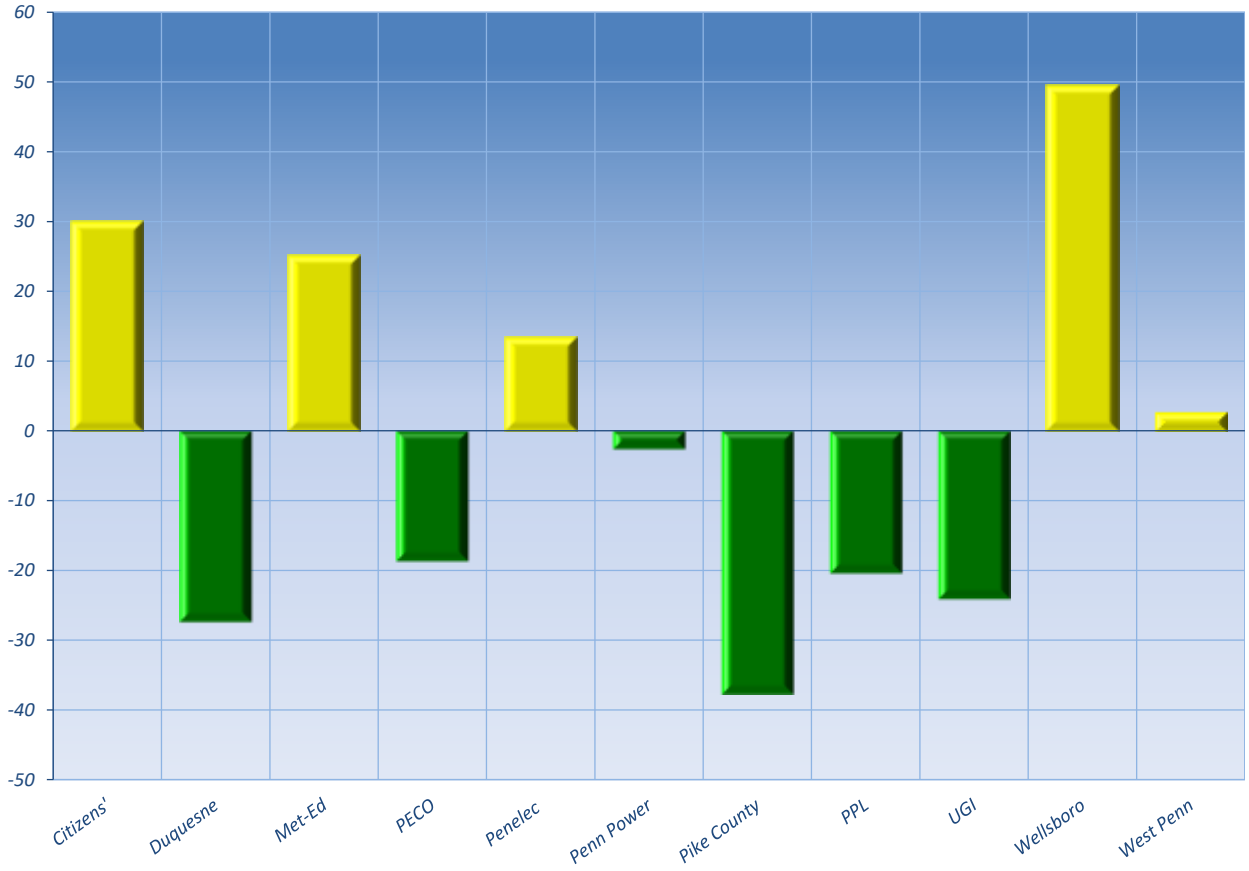
Note: The green bar shows the percentage successfully achieved CAIDI benchmark performance metric. The yellow bar shows the percentage failed to achieve CAIDI benchmark. Actual data is shown in Appendix A.

Figure 2 – 2016 SAIDI Comparison (percent above or below benchmark)



Note: The green bar shows the percentage successfully achieved SAIDI benchmark performance metric. The yellow bar shows the percentage failed to achieve SAIDI benchmark. Actual data is shown in Appendix A.

FIGURE 3 – 2016 SAIFI Comparison (percent above or below benchmark)



Note: The green bar shows the percentage successfully achieved SAIFI benchmark performance metric. The yellow bar shows the percentage failed to achieve SAIFI benchmark. Actual data is shown in Appendix A.

Rolling 3-year Average (2014-2016) Performance Compliance

Appendix A provides the actual 2016 12- month average and 3-year average reliability performance metrics for individual EDCs.

All EDCs achieved and sustained the rolling 3-year CAIDI performance standard.

Two EDCs (Penelec and Pike County) failed to meet the rolling 3-year SAIFI performance standard by 0.06 and 0.29 outages respectively.

Two EDCs (Penelec and Pike County) failed to meet the rolling 3-year SAIDI performance standard by 3 minutes and 1 minute respectively.

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 current 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.

Citizens' Electric Company

Citizens' has an operating service area of about 41 square miles with about 6,963 customers. The electric system consists of one distribution substation and nine distribution feeder lines. In 2016, Citizens' experienced 1,787 customer interruptions and 192,235 minutes of interruption, compared to 2015 when customers experienced 1,333 interruptions and 121,876 minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 91 minutes in 2015 to 108 minutes in 2016; failed to achieve benchmark by 3 percent.

3-year average: Increased from 87 minutes in 2015 to 96 minutes in 2016; achieved standard by 17 percent.

SAIDI

Rolling 12-month: Increased from 18 minutes in 2015 to 28 minutes in 2016; failed to achieve benchmark by 33 percent.

3-year average: Decreased from 24 minutes in 2015 to 21 minutes in 2016; achieved standard by 16 percent.

SAIFI

Rolling 12-month: Increased from 0.19 outages in 2015 to 0.26 outages in 2016; failed to achieve benchmark by 30 percent.

3-year average: Decreased from 0.28 outages in 2015 to 0.21 outages in 2016; achieved standard by 3 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 performance. 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 4 and Figure 5. As displayed, Citizens' CAIDI and SAIFI were below or close to standard during 2016.

Figure 6 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 7 shows the historical trend of the top 3 main outage causes. The most frequent outage causes were equipment, animals, and off right-of-way trees.

Since 2012, Citizens' has increased its vegetation management budget by an annual average of 46 percent each year and continues to identify and resolve off right-of-way danger trees. The Emerald Ash Borer beetle has continued to impact the service territory and the company will continue to commit extra resources to this tree hazard in 2017.

Citizens' storm hardening initiatives include: on a large part of continuing its program to reduce the impact of off right-of-way danger trees; identifying and replacing failure-prone equipment such as vintage arrestors and porcelain cutouts; improving the accuracy of Smart Grid outage locations aided by the 100 percent smart meter installation; and continuing line crew usage of mobile wireless tablet based work system that was enhanced in 2016. Another module upgrade was added to the tablets in 2017 to help provide real-time status of work activities.

Citizens' is currently proactively planning to gradually increase staffing and train operations staff starting in 2016 due to the expectation that over 80 percent of their employees are eligible to retire in the next 10 years. One person retired in 2016 and 1 person was hired.

Each year Citizens' performs infrared thermography inspections of all 3-phase primary overhead line sections and all single-phase overhead line sections are done on a three-year inspection cycle.

In the last year, Citizens' failed to achieve benchmark performance in every category by small margins and improvement is expected in 2017.

Figure 4 Citizens' CAIDI (minutes)

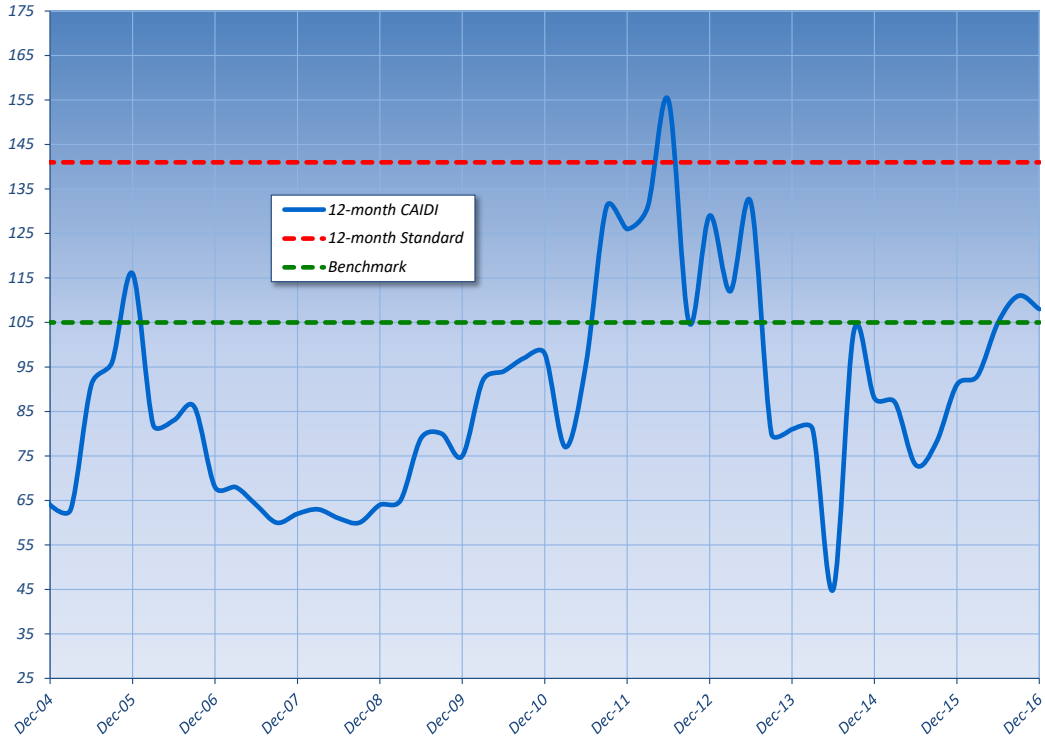


Figure 5 Citizens' SAIFI (interruptions per customer)

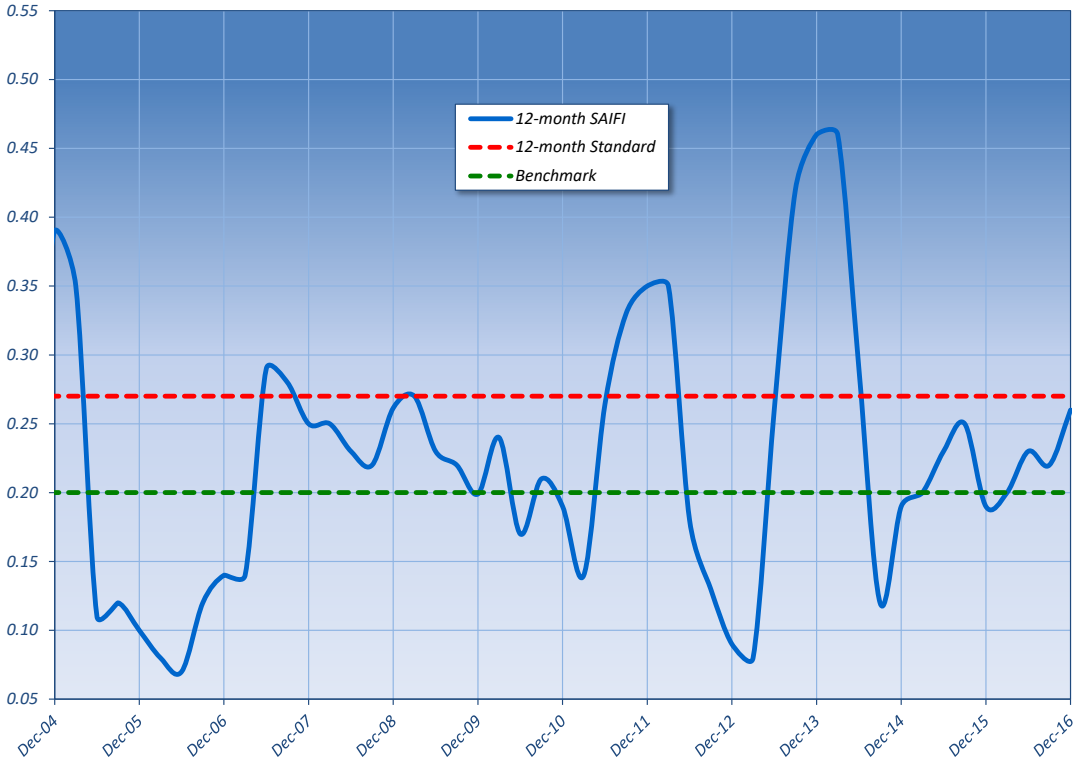


Figure 6 Citizens' Outage Causes (percent of total outages)

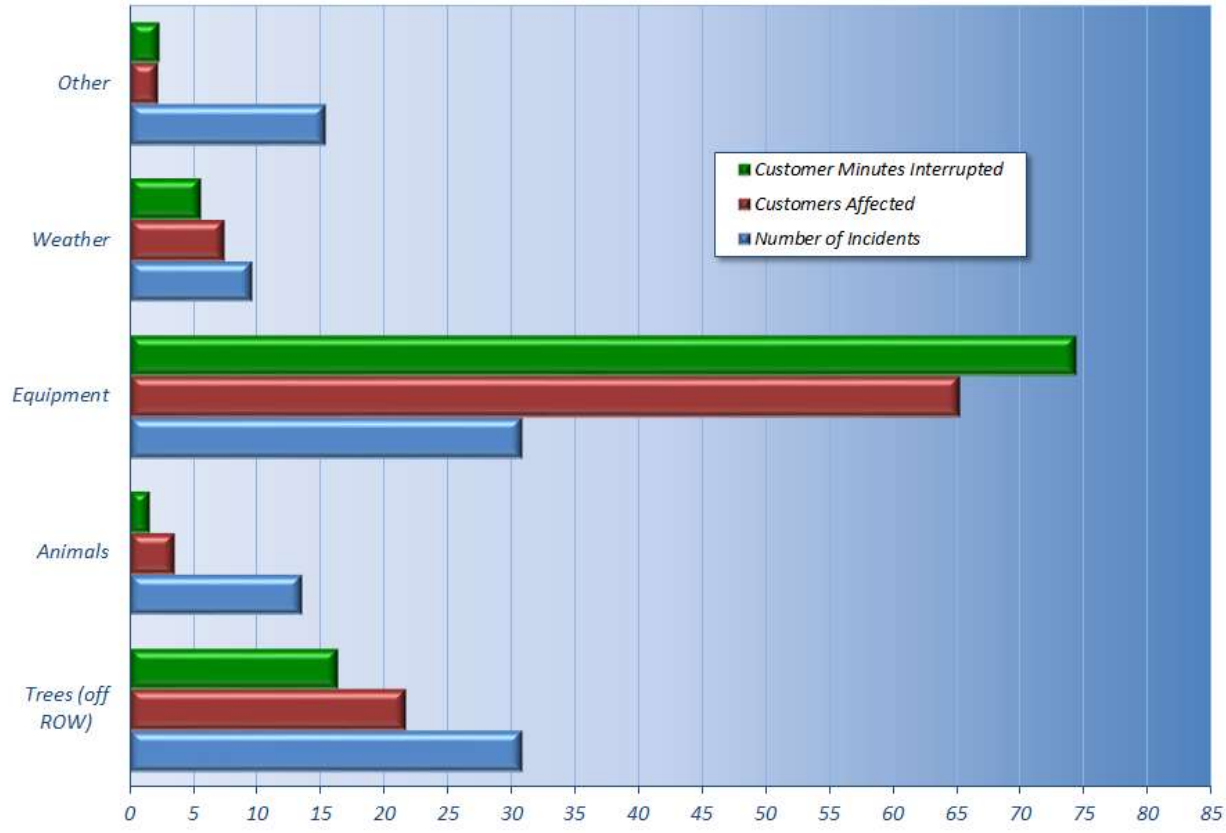
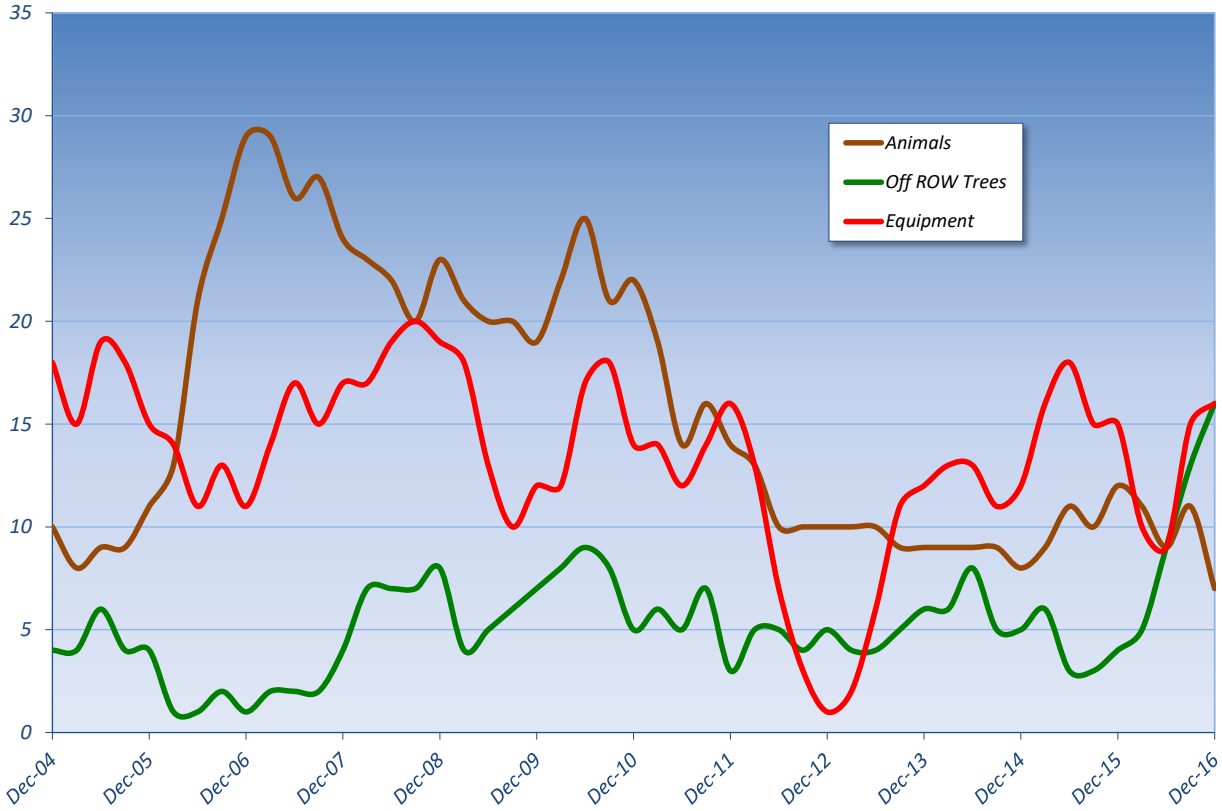


Figure 7 Citizens' Outage Tracking (number of incidents)



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 2016, Duquesne experienced 6.2 million kilovolt-amps (kVA) interruptions and 505 million kVA-minutes of interruption, compared to 2015, when customers experienced 5.4 million kilovolt-amps (kVA) interruptions and 514 million kVA-minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 95 minutes in 2015 to 82 minutes in 2016; achieved benchmark by 24 percent.

3-year average: Decreased from 106 minutes in 2015 to 93 minutes in 2016; achieved standard by 22 percent.

SAIDI

Rolling 12-month: Decreased from 71 minutes in 2015 to 70 minutes in 2016; achieved benchmark by 44 percent.

3-year average: Decreased from 70 minutes in 2015 to 68 minutes in 2016; achieved standard by 56 percent.

SAIFI

Rolling 12-month: Increased from 0.75 outages in 2015 to 0.85 outages in 2016; achieved benchmark by 27 percent.

3-year average: Increased from 0.66 outages in 2015 to 0.74 outages in 2016; achieved standard by 43 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 8 and Figure 9. Duquesne has sustained below benchmark performance during the entire year of 2016 for all benchmark performance categories.

Figure 10 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 11 shows historical trend of the top 3 main outage causes. The most frequent outage causes were equipment failure, trees, and 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 2017, Duquesne has 98 circuits versus 89 circuits in 2016 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 2016 that upgraded lines, transformers, and substation infrastructure. Duquesne continues to evaluate installed Fault Current Indicators (FCI) on sections of underground line to help identify fault locations more quickly thereby reducing outage restoration times. Duquesne also became a participant in the Spare Transformer

Equipment program managed by Edison Electric Institute. The company is committed to the installation of an Outage management system (OMS), which will provide customers with more accurate restoration information and improve storm restoration execution.

Duquesne does infrared thermography inspections on a 5 year cycle on distribution circuits each year. Duquesne uses a two person crew that typically can do inspection from inside a vehicle and if lines are inaccessible by a vehicle, inspections would be performed by walking down the circuit.

Duquesne is a consistent Benchmark performer and has achieved benchmark performance in every category for the past ten, 12-month rolling quarters. Benchmark performance scores are expected to continue in 2017.

Figure 8 Duquesne CAIDI (minutes)

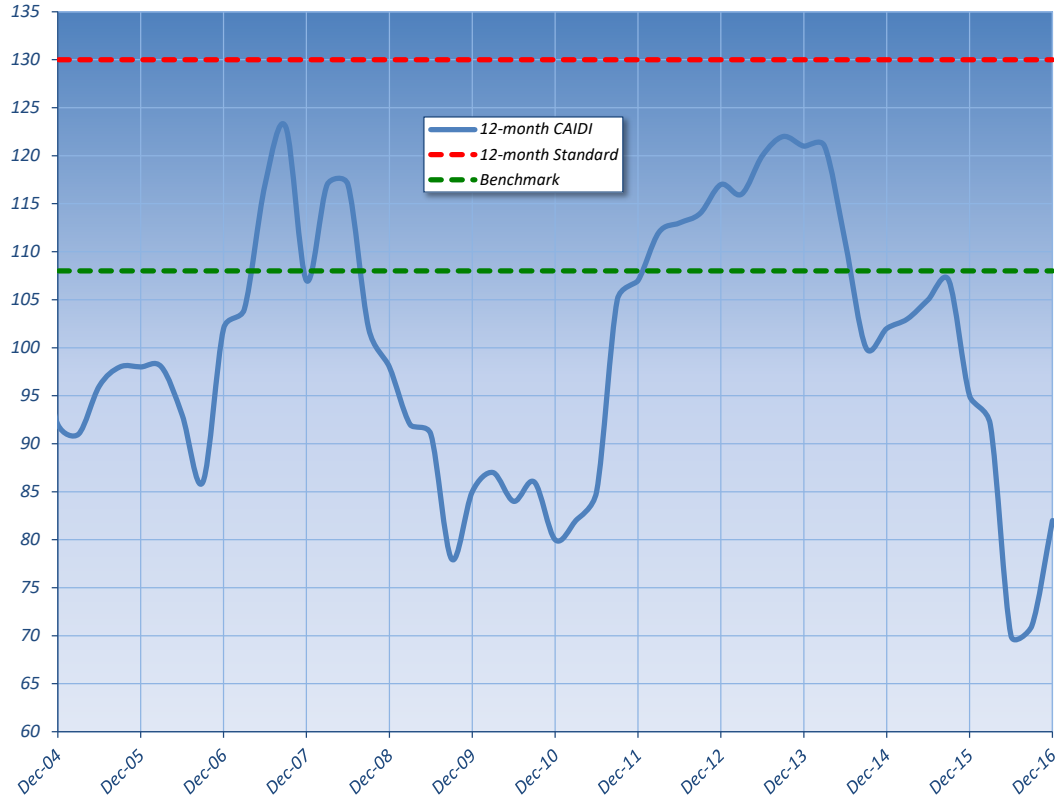


Figure 9 Duquesne SAIFI (interruptions per customer)

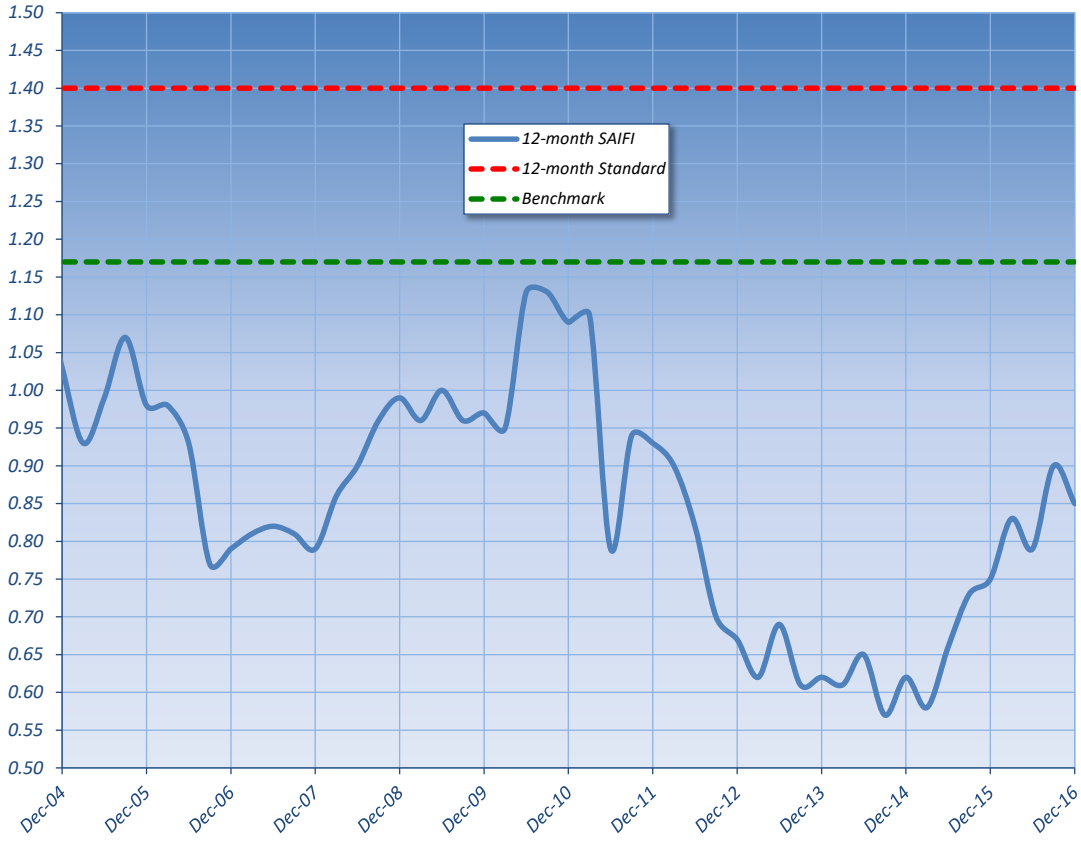


Figure 10 Duquesne Outage Causes (percent of total outages)

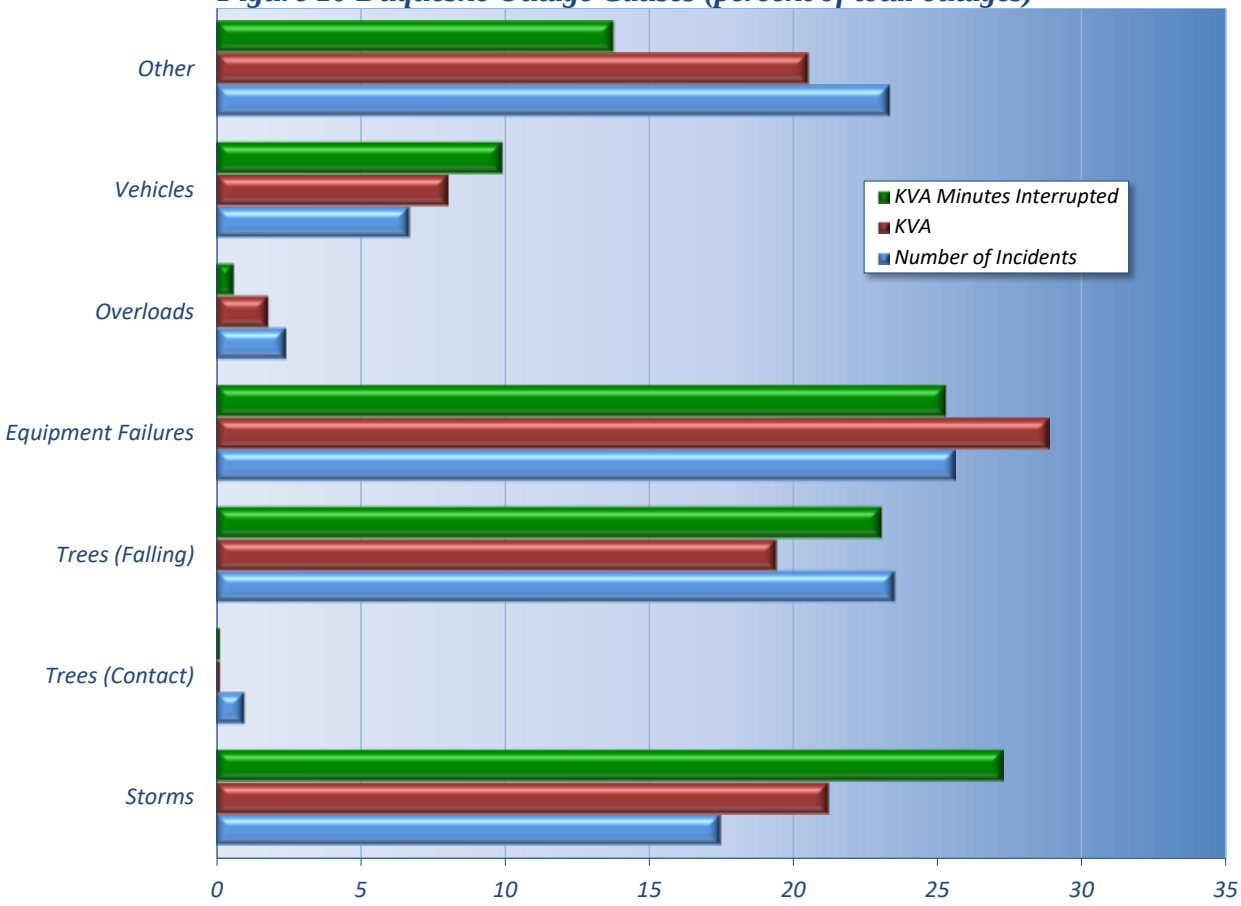
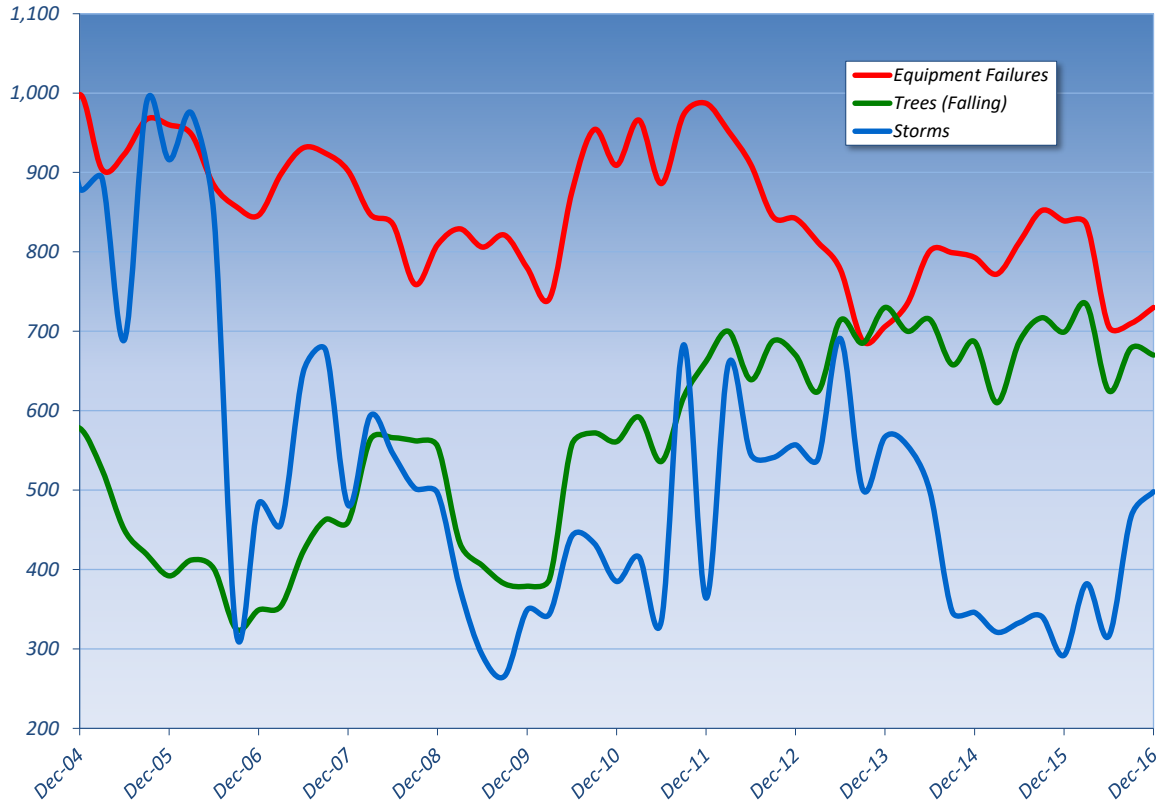


Figure 11 Duquesne Outage Tracking (number of incidents)



Metropolitan Edison Company

Met-Ed has a service territory of about 3,300 square miles that serves about 554,500 customers. In 2016, Met-Ed experienced 804,947 customer interruptions and 99.6 million minutes of interruption, compared to 2015, when customers experienced 662,492 customer interruptions and 75.2 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 113 minutes in 2015 to 124 minutes in 2016; failed to achieve benchmark by 6 percent.

3-year average: Increased slightly from 115 minutes in 2015 to 122 minutes in 2016; achieved standard by 6 percent.

SAIDI

Rolling 12-month: Increased from 136 minutes in 2015 to 178 minutes in 2016; failed to achieve benchmark by 32 percent.

3-year average: Increased from 131 minutes in 2015 to 152 minutes in 2016; achieved standard by 7 percent.

SAIFI

Rolling 12-month: Increased from 1.19 outages in 2015 to 1.44 outages in 2016; failed to achieve benchmark by 25 percent.

3-year average: Increased from 1.13 outages in 2015 to 1.25 outages in 2016; achieve standard by 2 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 12 and Figure 13. The past year trend shows a slight increase in restoration times and outages frequency. In 2016, Met-Ed trended consistently above benchmark during the year.

Figure 14 shows the distribution of causes of service outages that occurred during 2016 as a percentage of total outages. Figure 14 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.

Figure 15 shows a trend of outages causes; and equipment failure has been the most frequent cause of outages and the recent trend has been decreasing.

Met-Ed's Long Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[18] Met-Ed's LTIIP was designed to help improve storm hardening, system resiliency, and reliability. In 2016, Met-Ed continued aggressive storm hardening activities and various tree trimming activities. However, in 2017 Met-Ed plans on trimming an additional 303 miles on 16 circuits. In 2016, Met-Ed added 70 supervisory control and data acquisition-enabled (SCADA) switches and 28 are planned in 2017.

[18] Order entered Feb 11, 2016 at Docket No. P-2015-2508942.

In 2016 Met-Ed installed 1 circuit and loop on a radial circuit. In 2017, Met-Ed plans to install 3 circuit ties and 1 circuit loop. In 2016, Met-Ed conducted a targeted circuit rehabilitation to help strengthen the electrical system. One circuit was upgraded and 11 circuits are planned in 2017. Met-Ed also installed 1,181 fuses in 2016 and plans to install 432 fuses in 2017. Met-Ed has also been proactively replacing porcelain cutouts with polymer cutouts. In 2016, Met-Ed replaced 533 porcelain cutouts on 6 circuits and will target an additional 5 circuits in 2017. In 2016 Met-Ed performed targeted replacement of underground residential distribution (URD) cables with un-insulated concentric neutral wires, which are prone to failure. In 2016, approximately 3,900 feet were replaced and in 2017 there are plans to replace 12,500 feet.

Met-Ed, along with the other FirstEnergy companies, performs infrared thermography on an as-needed basis. Examples of when the thermography may be used include, but are not limited to, identifying hot spots on a distribution circuit with heavy load, or reviewing a circuit when recent outages were related to overheated connecters, fuses or switches. Areas where the Companies may use thermography include worst performing circuits or circuit rehabilitation.

The PUC has also 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.[19]

Met-Ed reliability performance failed to achieve benchmark performance in 2016 and has actually been trending slightly more negatively. Met-Ed LTIIP and RIP activities should begin to improve performance in 2017 and TUS will continue to monitor Met-Ed progress in implementing these programs.

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

Figure 12 Met-Ed CAIDI (minutes)

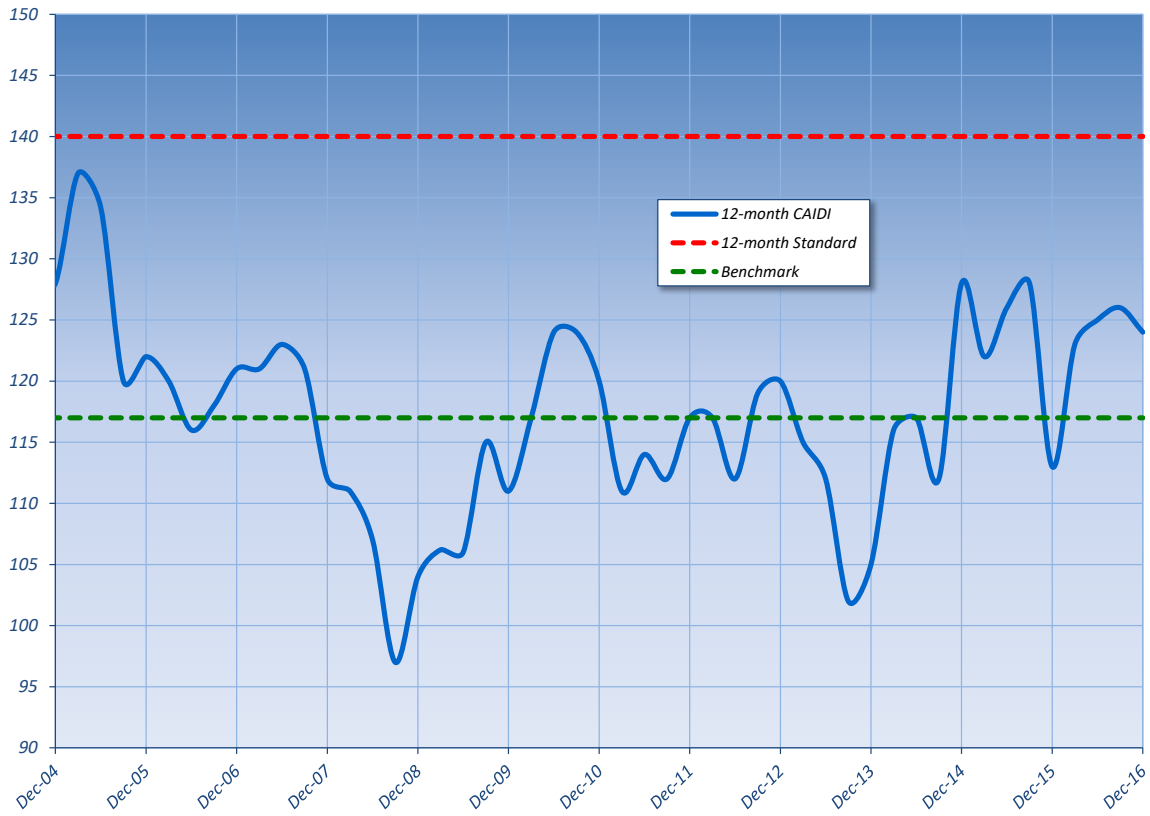


Figure 13 Met-Ed SAIFI (interruptions per customer)

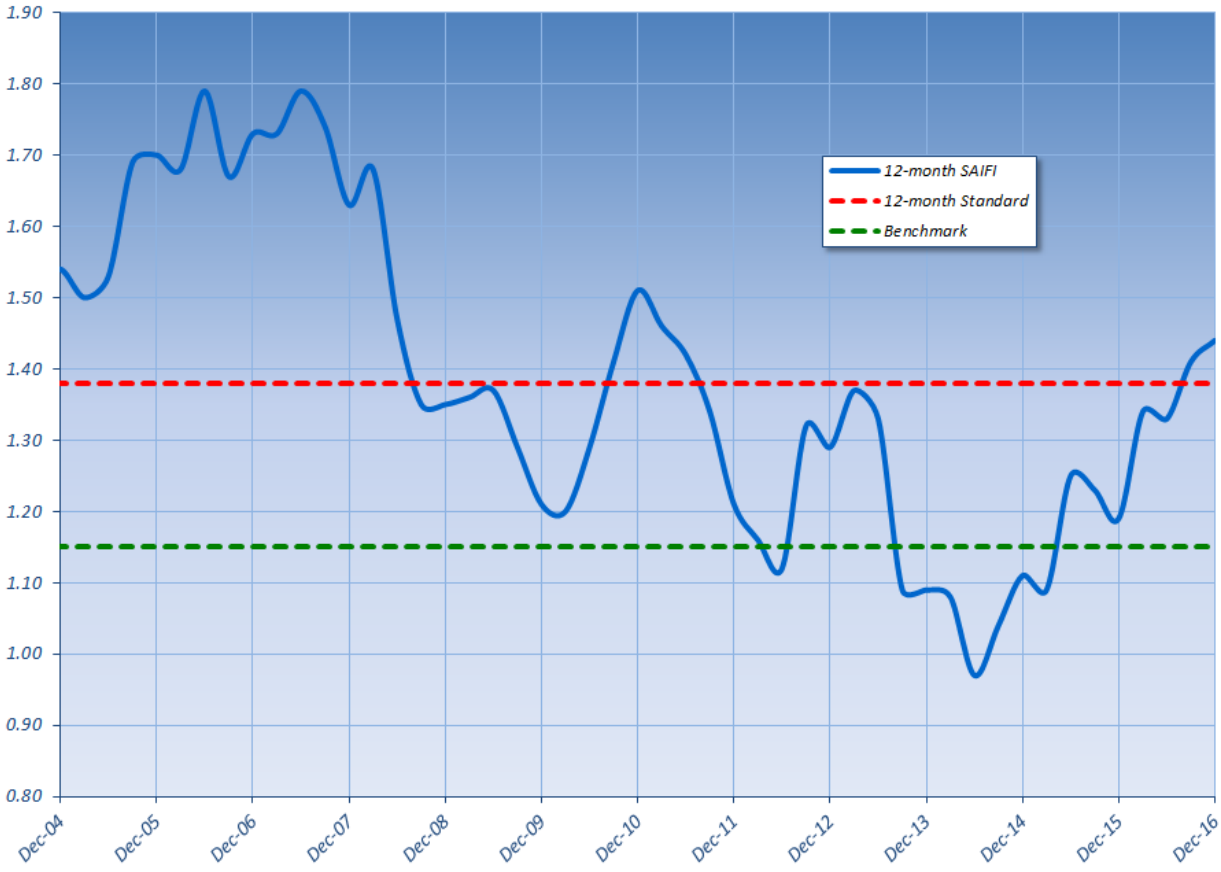


Figure 14 Met-Ed Outage Causes (percent of total outages)

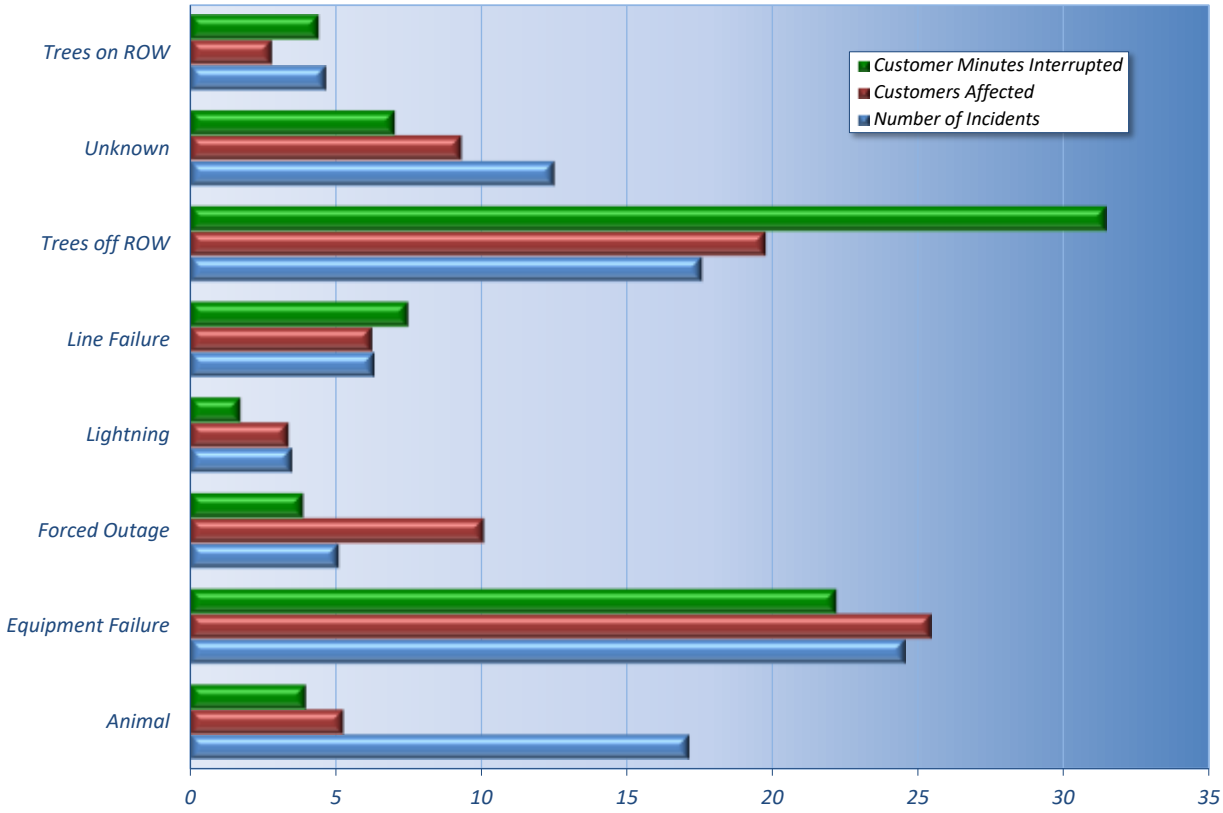
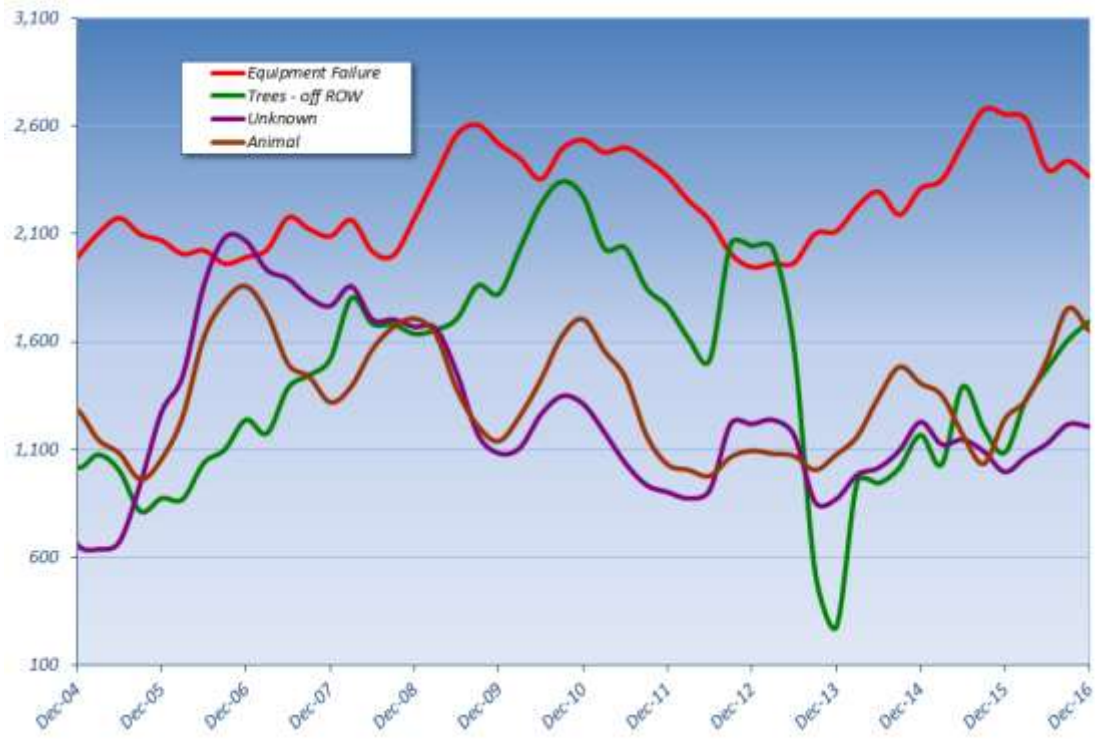


Figure 15 Met-Ed Outage Tracking (number of incidents)



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 2016, PECO experienced 1.62 million customer interruptions and 171.6 million minutes of interruption, compared to 2015, when customers experienced 1.23 million customer interruptions and 103.3 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 84 minutes in 2015 to 106 minutes in 2016; achieved benchmark by 5 percent.

3-year average: Remained the same from 95 minutes in 2015 to 95 minutes in 2016; achieved standard by 23 percent.

SAIDI

Rolling 12-month: Increased from 61 minutes in 2015 to 106 minutes in 2016; achieved benchmark by 23 percent.

3-year average: Increased from 69 minutes in 2015 to 83 minutes in 2016; achieved standard by 50 percent.

SAIFI

Rolling 12-month: Increased from 0.72 outages in 2015 to 1.00 outages in 2016; achieved benchmark by 19 percent.

3-year average: Increased from 0.76 outages in 2015 to 0.86 outages in 2016; achieved standard by 36 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 16 and Figure 17. The past year trend shows a negative performance trend, yet below benchmark reliability. PECO has consistently sustained benchmark performance in every reliability category for the past four years.

Figure 18 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 19 shows the historical trend of the top three main outage causes. The most frequent outage cause is equipment failure. PECO's Long-Term Infrastructure Improvement Plan (LTIIP) was approved in 2015 to fund the replacement of aging infrastructure which will reduce equipment failures.[20] PECO continues storm hardening activities through infrastructure improvements and enhanced vegetation management. PECO has installed more than 25 miles of tree-resistant wire in areas impacted by high incidences of vegetation-related outages and removed more than 3,000 hazardous trees in 2016 to enhance system performance and reduce service interruptions.

PECO's LTIIP, or "System 2020" plan, will spend an additional $274 million through 2020 on system resiliency and storm hardening system improvements. These investments are in 3 key areas: storm hardening and resiliency measures; accelerated cable replacements; and the

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

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 reduce the number of outages caused by equipment failure which has been trending higher during the past three years. The Commission will continue to perform extra monitoring of equipment failures in 2017.

Under the Top Priority Circuits Program, PECO analyzes at least 5 percent of the system's worst performing circuits on an annual basis. The company takes steps to enhance reliability by installing reclosers for distribution automation, identifying and repairing issues through visual and thermographic inspections, increasing vegetation management activities, installing and upgrading fuses, and replacing cable and other equipment. Selected underground cables were replaced in Philadelphia and the suburban regions to reduce cable-related service interruptions and subsequent excavation and repair work.

Through Distribution Automation, PECO installed more than 500 3-phase reclosers in automated loop schemes in Bucks, Chester, Delaware, Montgomery, Philadelphia, and York counties during the last 5 years; bringing the total to 1,754 reclosers. These reclosers reduce the number of customers affected by outages and automatically restore service to sections of circuits where repairs are not needed.

PECO's ongoing advanced grid investments enhance reliability through: microprocessor-based relay upgrades; fiber optic communications among substations; disturbance monitoring equipment across the transmission system; modern computer systems for outage management (OMS); geographic information system (GIS); and distribution system real-time management (DMS). In addition, PECO implemented an expanded version of its Advanced Metering Outage System (AMOS), which provides the ability to create, analyze and escalate customer outage events. As part of PECO's meter upgrade project, AMOS has been enhanced to support outage management of the new AMI meters. The tool provides better visibility of an outage, which can lead to targeted restoration efforts. As of March 2017, more than 1.739 million new electric meters have been installed across the PECO service territory.

As part of PECO's aerial line inspections and broader Circuit Patrol & Thermography Program, PECO inspects automatic splice connections and related equipment. PECO also performs infrared thermography and visual inspections on the solid portion of aerial circuits on a biennial frequency. Visual and thermographic inspections of aerial distribution lines help identify potential issues before an outage occurs.

In 2016, PECO achieved benchmark performance in every performance category.

Figure 16 PECO CAIDI (minutes)

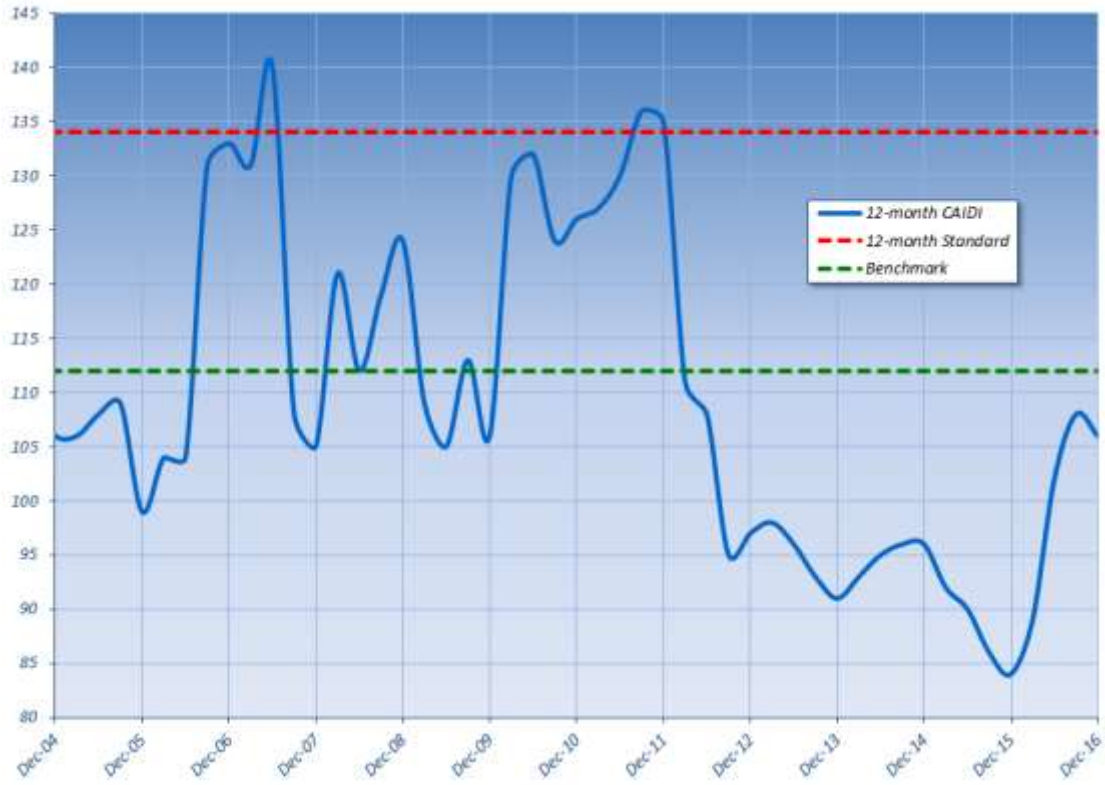


Figure 17 PECO SAIFI (interruptions per customer)

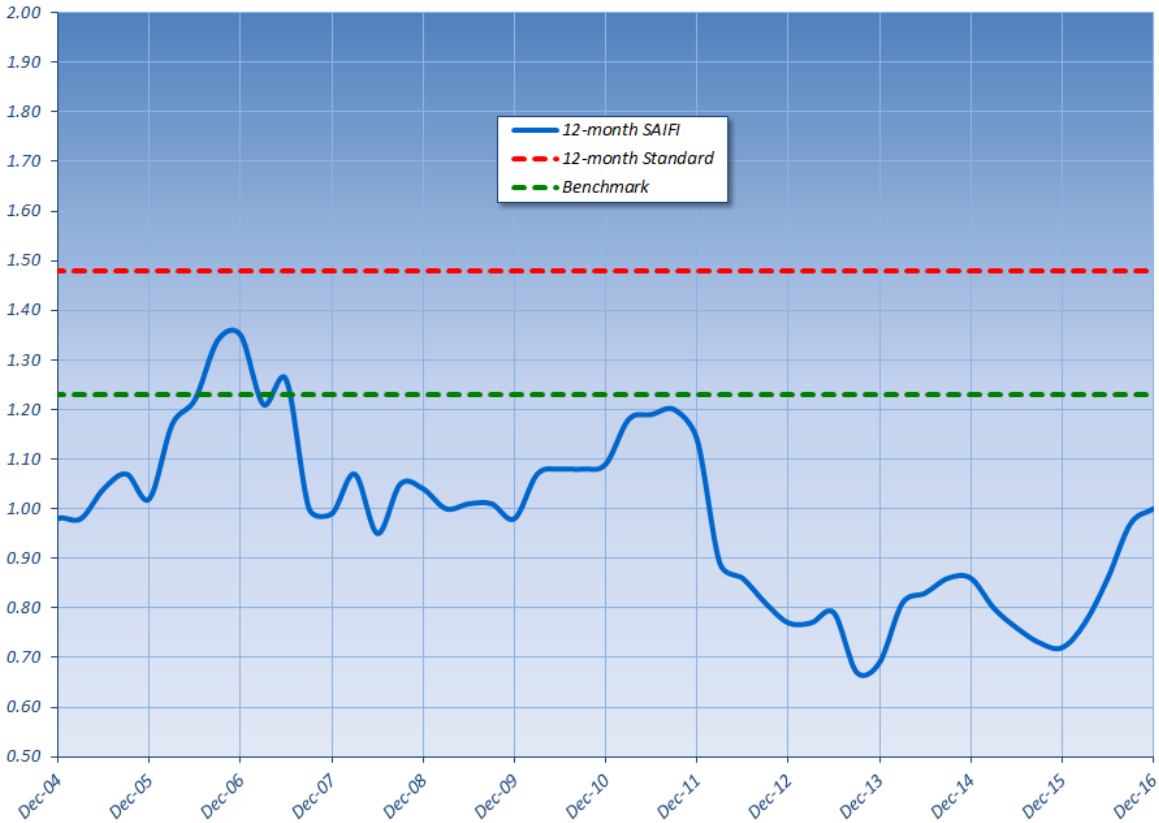


Figure 18 PECO Outage Causes (percent of total outages)

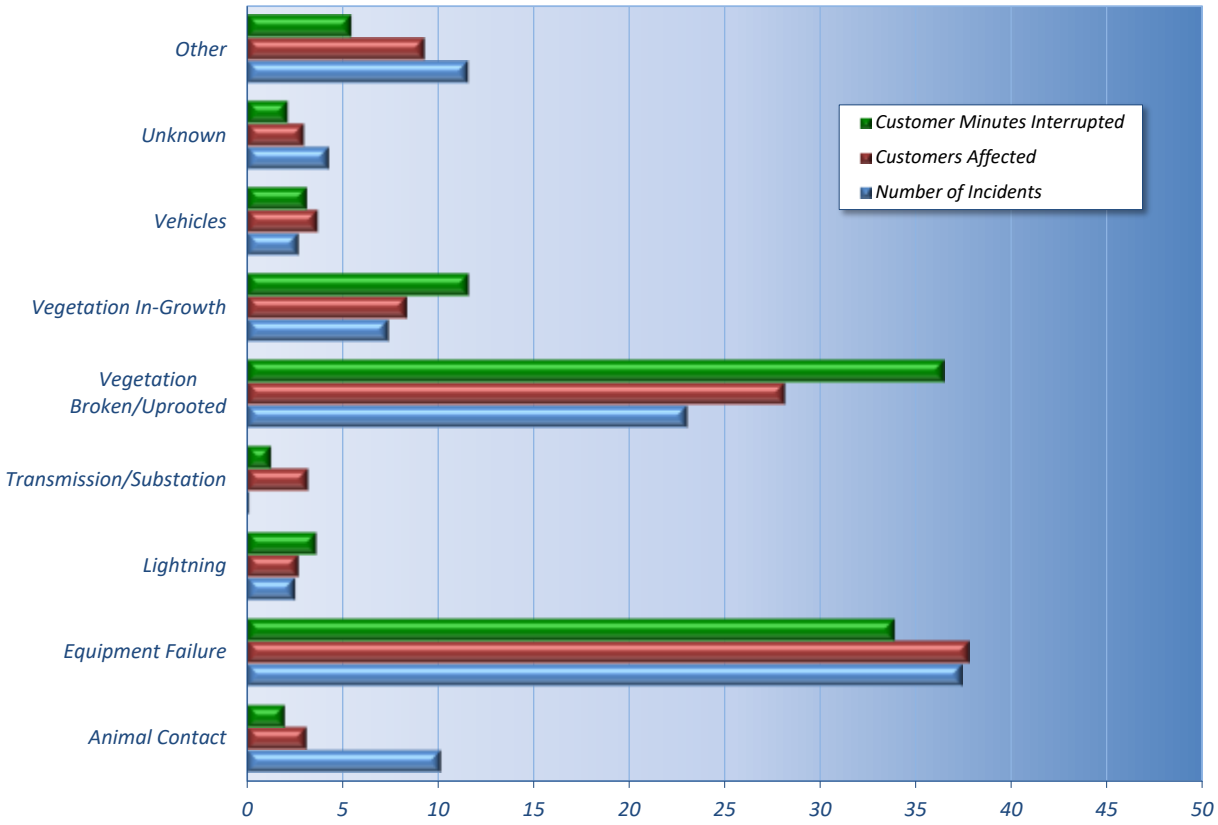
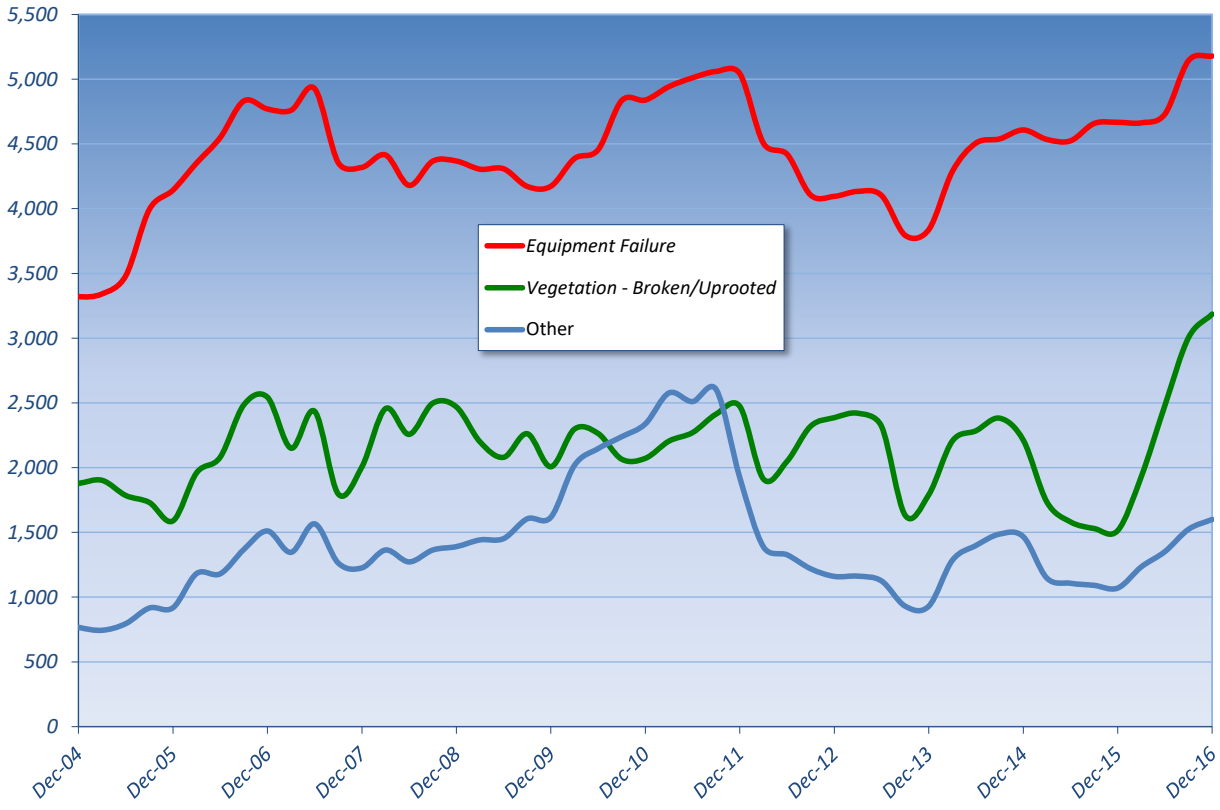


Figure 19 PECO Outage Tracking (number of incidents)



Pennsylvania Electric Company

Penelec has a service territory of about 17,600 square miles serving 582,000 customers. In 2016, Penelec experienced 833,315 customer interruptions and 99.6 million minutes of interruption, compared to 2015, when customers experienced 792,673 customer interruptions and 111.2 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 140 minutes in 2015 to 120 minutes in 2016; and failed to achieve benchmark by 3 percent.

3-year average: Increased from 125 minutes in 2015 to 126 minutes in 2016; achieved standard by 2 percent.

SAIDI

Rolling 12-month: Decreased from 191 minutes in 2015 to 171 minutes in 2016; failed to achieve benchmark by 16 percent

3-year average: Decreased from 183 minutes in 2015 to 182 minutes in 2016; failed to achieve standard by 2 percent.

SAIFI

Rolling 12-month: Increased from 1.36 outages in 2015 to 1.43 outages in 2016; failed to achieve benchmark by 14 percent.

3-year average: Decreased from 1.46 outages in 2015 to 1.45 outages in 2016; failed to achieve standard by 4 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 that trees and equipment failures are the top two significant causes of outages and customer interruption minutes. Figure 23 shows a historical trend of the top main outage causes.

In 2014, 2015, and continuing into 2016, the Commission's Reliability and Emergency Preparedness Section of the Bureau of Technical Utility Services (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.[21]

[21] 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.[22] The LTIIP was designed to help improve storm hardening, system resiliency, and reliability.

In 2016, Penelec replaced porcelain cutouts on 69 circuits and plans to replace cut-outs on 80 circuits in 2017. In 2016, Penelec continued to proactively remove Ash trees deemed a threat due the Emerald Ash Borer beetle. Penelec accelerated danger tree removal of trees outside of the right-of-way on over 425 circuit miles and plans to accelerate the process on approximately 955 miles in 2017. Penelec conducted a targeted circuit rehabilitation which helps strengthen the electrical system. In 2016 15 circuits were upgraded and 4 circuits are planned for upgrades in 2017. Penelec installed 17 SCADA-controlled switches in 2016, and the company plans to install an additional 14 in 2017. In 2016, Penelec replaced or reinforced 3,966 wood poles and plans on completing 2,287 in 2017. Penelec improved 1 radial circuit in 2016 by installing 1 circuit tie and loop and plans on completing another in 2017.

Penelec, along with the other FirstEnergy companies, performs infrared thermography on an as-needed basis. Examples of when the thermography may be used include, but are not limited to, identifying hot spots on a distribution circuit with heavy load, or reviewing a circuit when recent outages were related to overheated connecters, fuses or switches. Areas where the Companies may use thermography include worst performing circuits or circuit rehabilitation.

Penelec has failed to achieve benchmark performance in every reliability performance category in the last 10 rolling 12-month quarters, but has been trending toward benchmark performance. A significant effort is underway by Penelec management to achieve benchmark performance by 2018. Penelec's LTIIP and RIP activities should begin to show positive reliability trend improvements in 2016. The PUC will continue extra monitoring of Penelec's performance.

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

Figure 20 Penelec CAIDI (minutes)

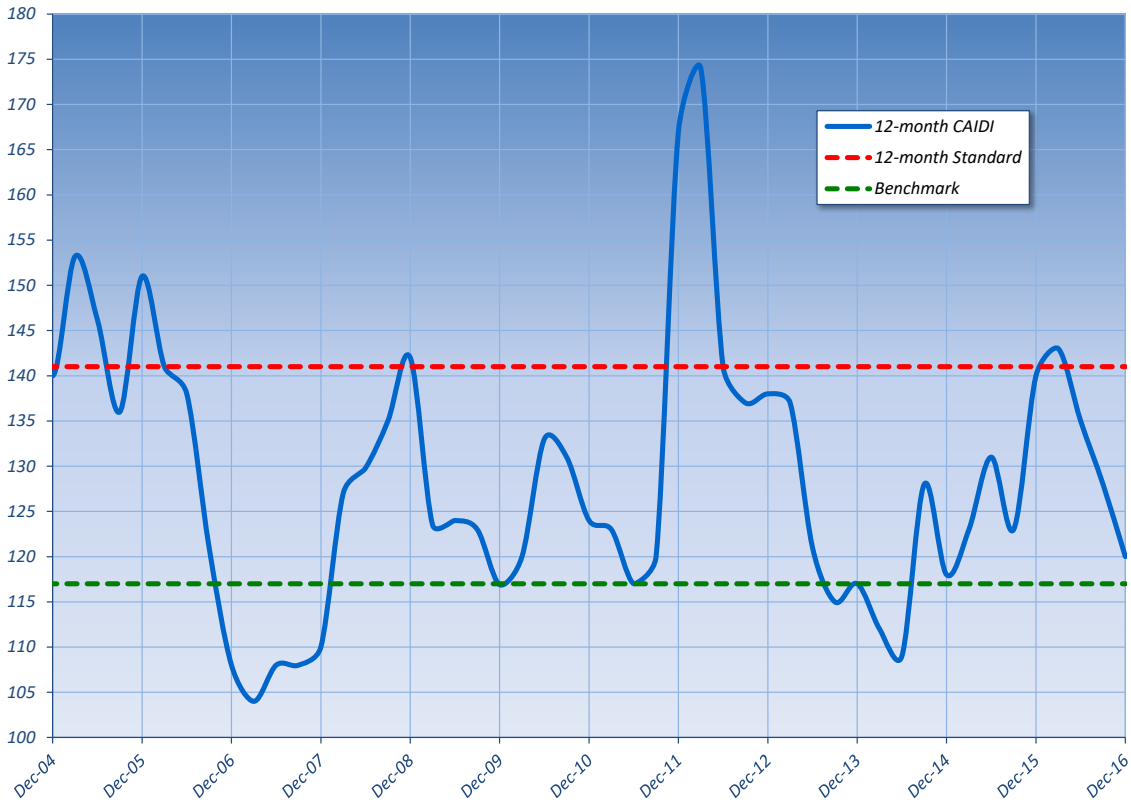


Figure 21 Penelec SAIFI (interruptions per customer)

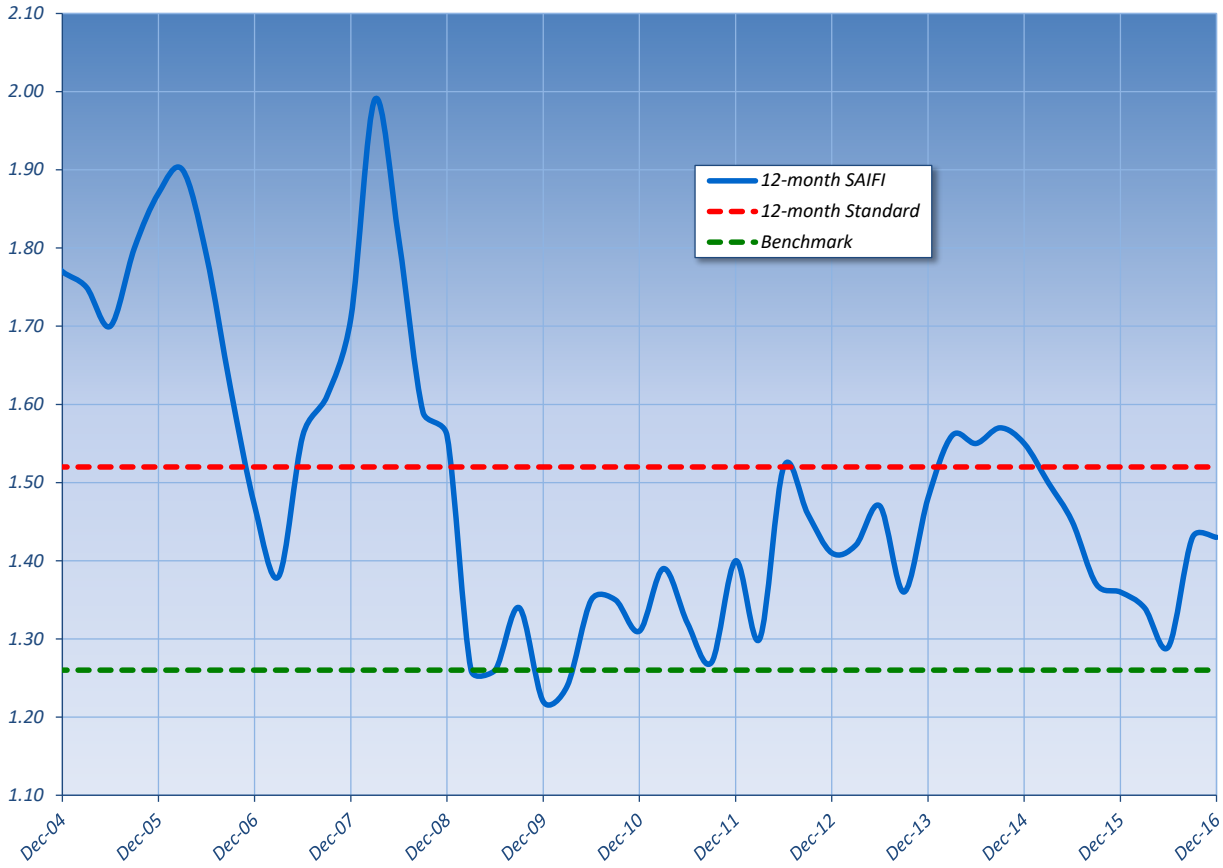


Figure 22 Penelec Outage Causes (percent of total outages)

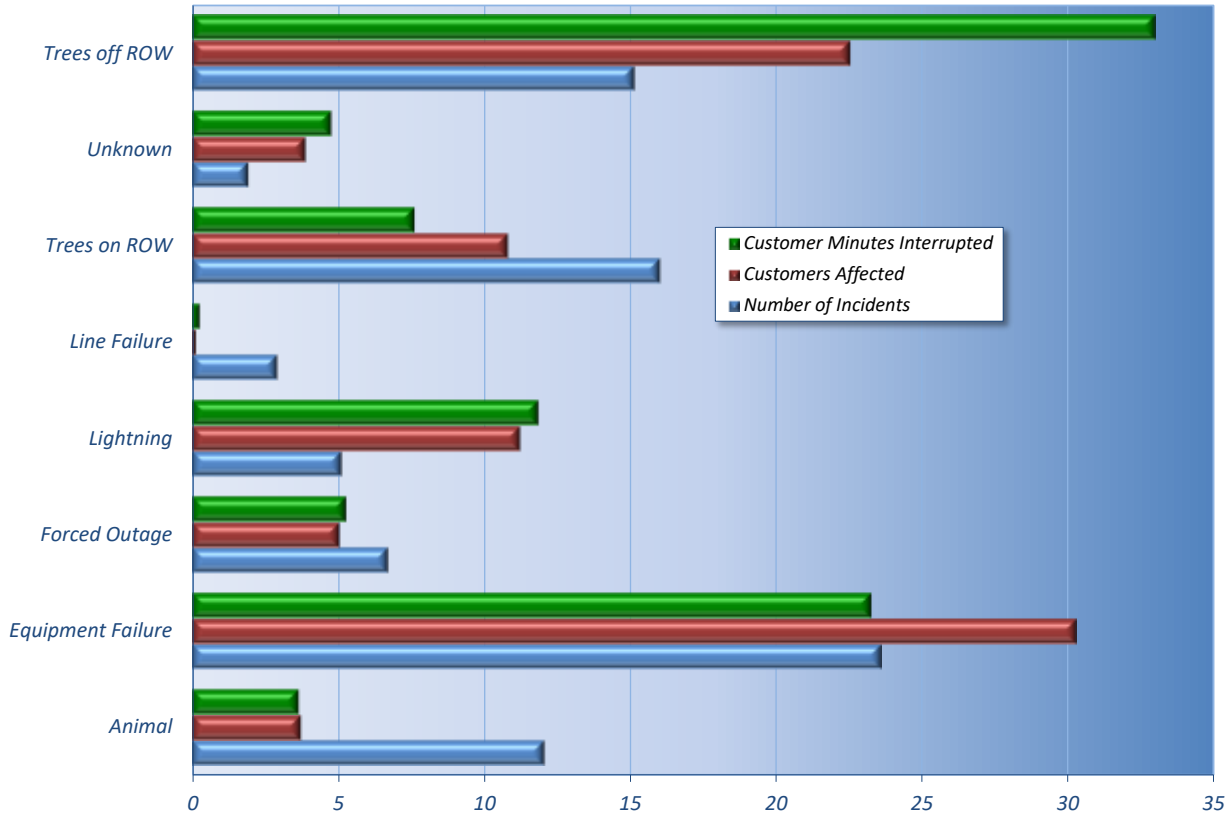
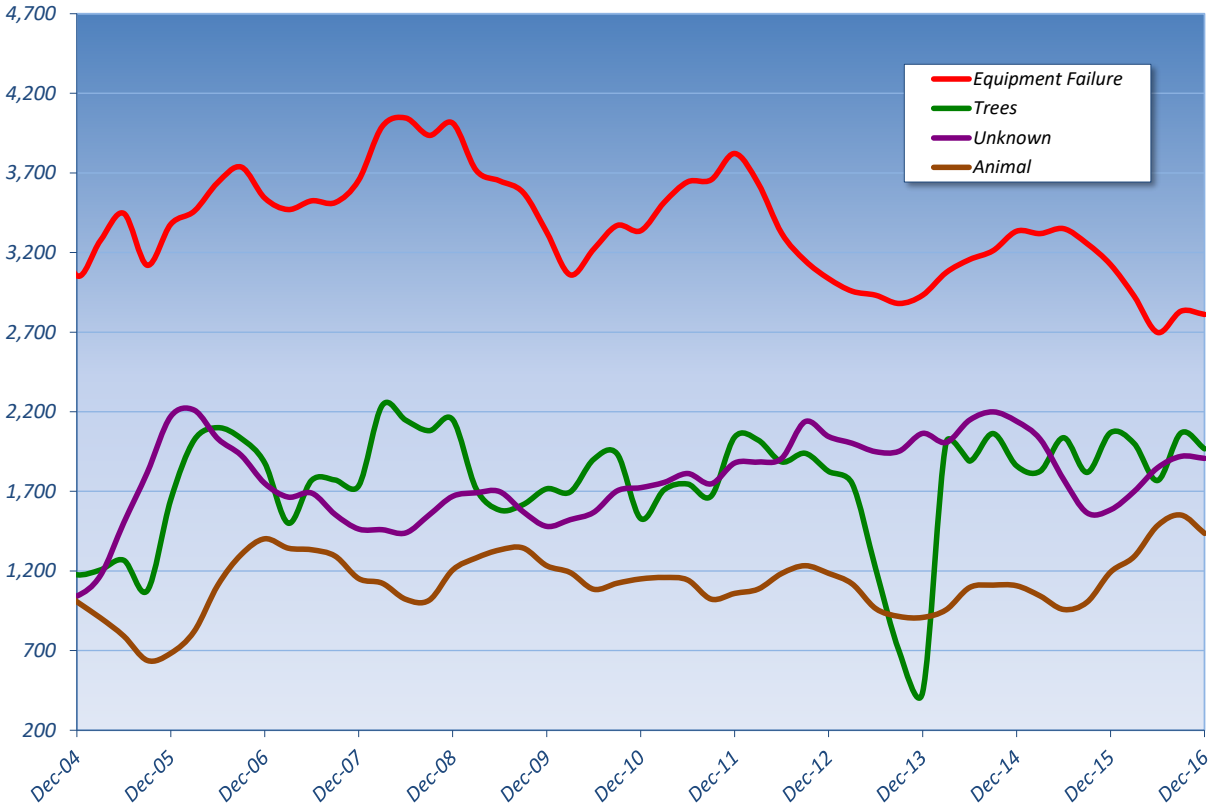


Figure 23 Penelec Outage Tracking (number of incidents)



Pennsylvania Power Company

Penn Power has a service territory of about 1,100 square miles that serves about 159,500 customers. In 2016, Penn Power experienced 176,968 customer interruptions and 16.8 million minutes of interruption, compared to 2015, when customers experienced 181,479 customer interruptions and 18.2 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 100 minutes in 2015 to 95 minutes in 2016; and achieved benchmark by 6 percent.

3-year average: Decreased from 115 minutes in 2015 to 100 minutes in 2016; and achieved standard by 10 percent.

SAIDI

Rolling 12-month: Decreased from 114 minutes in 2015 to 104 minutes in 2016; and achieved benchmark by 8 percent.

3-year average: Decreased from 140 minutes in 2015 to 112 minutes in 2016; and achieved standard by 18 percent.

SAIFI

Rolling 12-month: Decreased from 1.14 outages in 2015 to 1.09 outages in 2016; and achieved benchmark by 3 percent.

3-year average: Decreased from 1.20 outages in 2015 to 1.11 outages in 2016; and achieved standard by 10 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 2016 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 2016.

Figure 27 shows the historical trend of the top three main outage causes. The most frequent outage cause was trees.

In early 2014, the Commission's Reliability and Emergency Preparedness Section of the Bureau of Technical Utility Services (TUS) began increased monitoring and assessment of Penn Power's reliability due to poor reliability performance. TUS required Penn Power to initiate a Corrective Action Plan (CAP). After implementing its CAP, Penn Power has since achieved benchmark performance in all categories in 2016. TUS no longer requires Penn Power to submit quarterly improvement plan and performance monitoring was curtailed.

In 2016, Penn Power performed additional tree trimming on 400 circuit miles and in 2017 plans to trim 685 miles. In 2016, Penn Power added 30 SCADA switches on the transmission system and 5 on the distribution system. In 2017, Penn Power plans on installing 14 switches on the distribution system.

In 2016, Penn Power installed loops on 13 radial circuits. In 2017, Penn Power plans to install 10 circuit ties, loops, or new sources. In 2016, Penn Power conducted a targeted circuit rehabilitation to help strengthen the electrical system and completed rehabilitation on 24 miles of 69 kV circuit. In 2017, Penn Power plans to rehabilitate another 24 miles. In 2017, Penn Power plans on targeted replacement of 25,000 feet of underground residential distribution (URD) cables with un-insulated concentric neutral wires, which are prone to failure. In 2016, Penn Power replaced or reinforced 351 wood poles and in 2017, plans on completing 480.

Beginning 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.[23]

In 2016, Penn Power's CAP, or Reliability Improvement Plan (RIP), incorporated projects and programs to enhance overall reliability. Additionally, Penelec's Long Term Infrastructure Improvement Plan ("LTIIP") was approved on Feb 11, 2016.[24] The LTIIP was designed to help improve storm hardening, system resiliency, and reliability.

Penn Power, along with the other FirstEnergy companies, performs infrared thermography on an as-needed basis. Examples of when the thermography may be used include, but are not limited to, identifying hot spots on a distribution circuit with heavy load, or reviewing a circuit when recent outages were related to overheated connecters, fuses or switches. Areas where the Companies may use thermography include worst performing circuits or circuit rehabilitation.

Penn Power has made improvements in SAIFI, CAIDI, and SAIDI metrics during 2016 and has become a benchmark performer in all three reliability metric categories in 2016. Continual execution of Penn Power's LTIIP and RIP activities in 2017 should help sustain benchmark performance in the future.

[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 on Feb 11, 2016 at Docket No. P-2015-2508931.

Figure 24 Penn Power CAIDI (minutes)

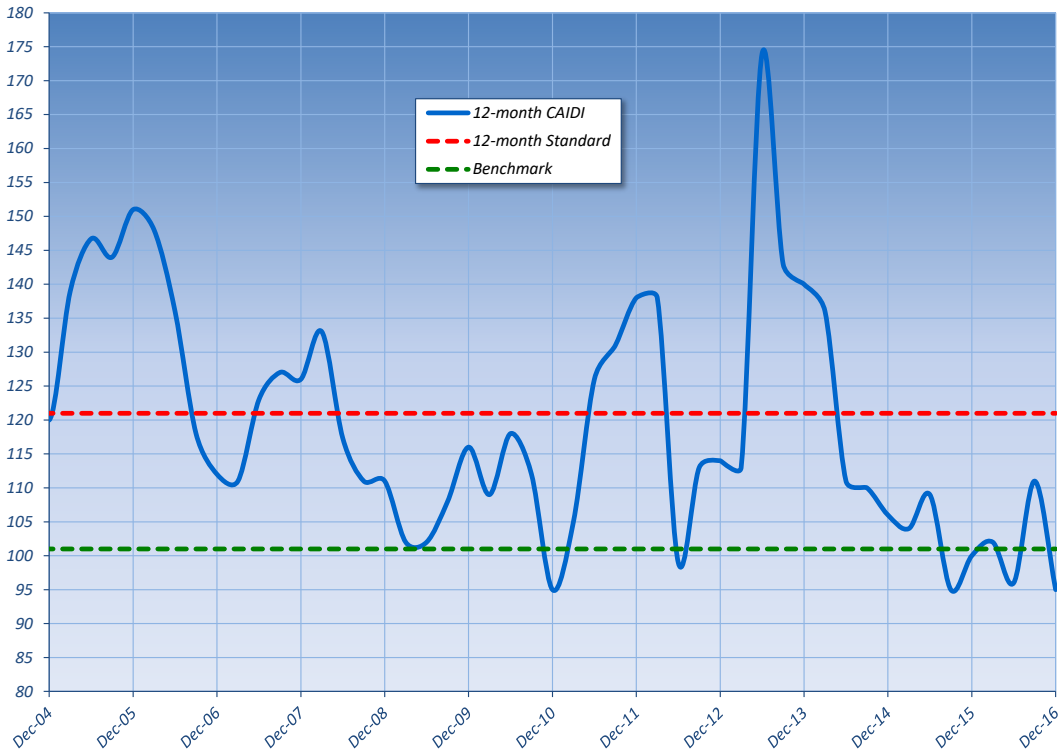


Figure 25 Penn Power SAIFI (interruptions per customer)

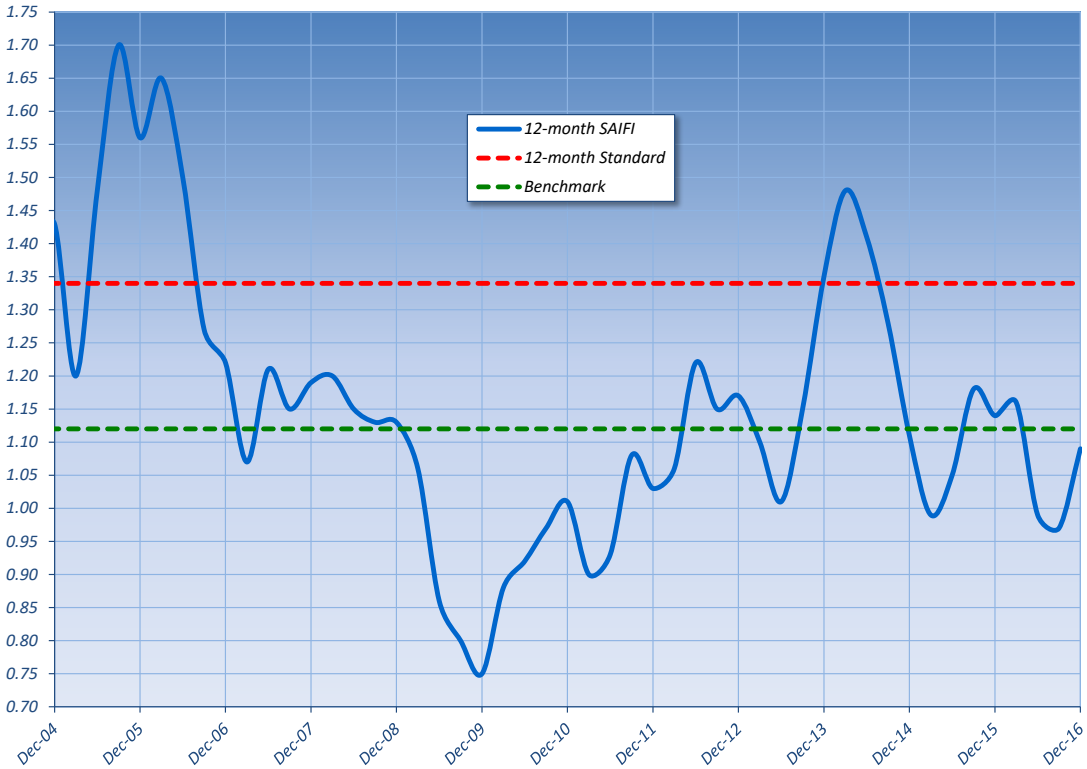


Figure 26 Penn Power Outage Causes (percent of total outages)

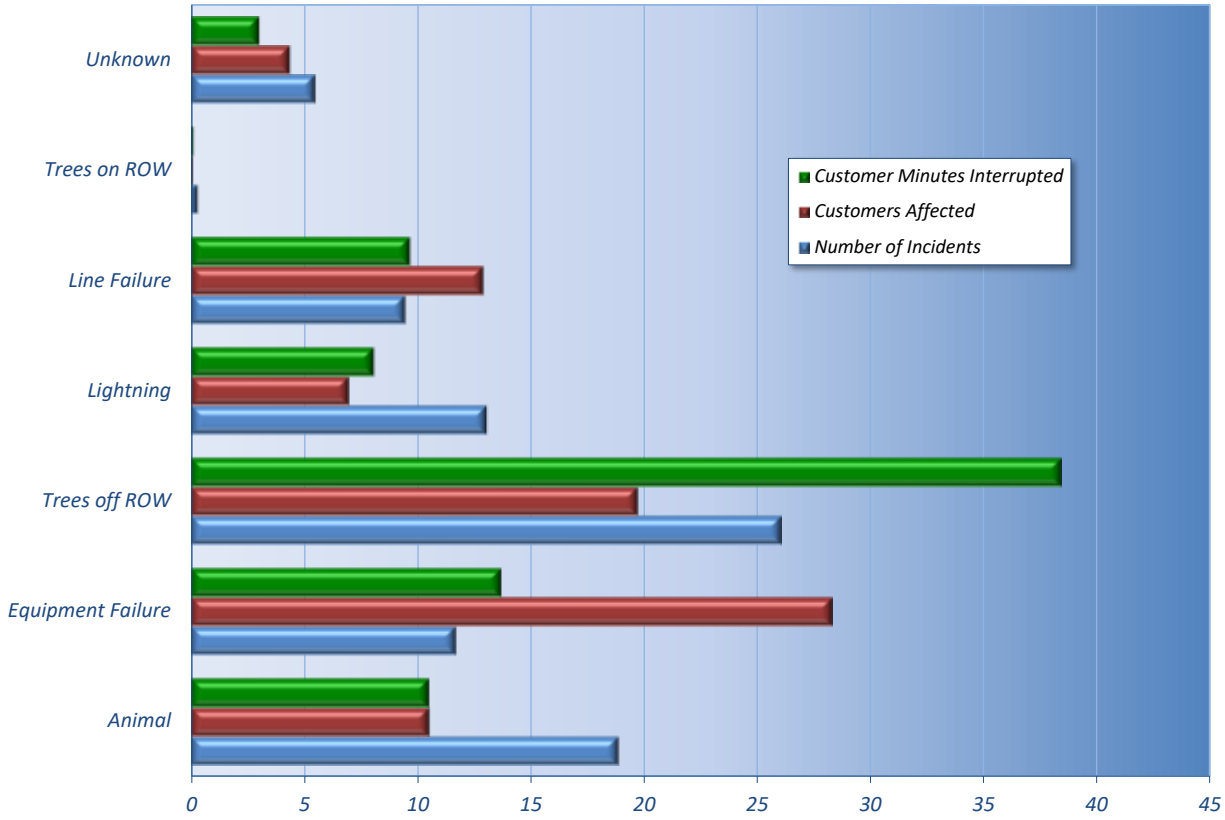
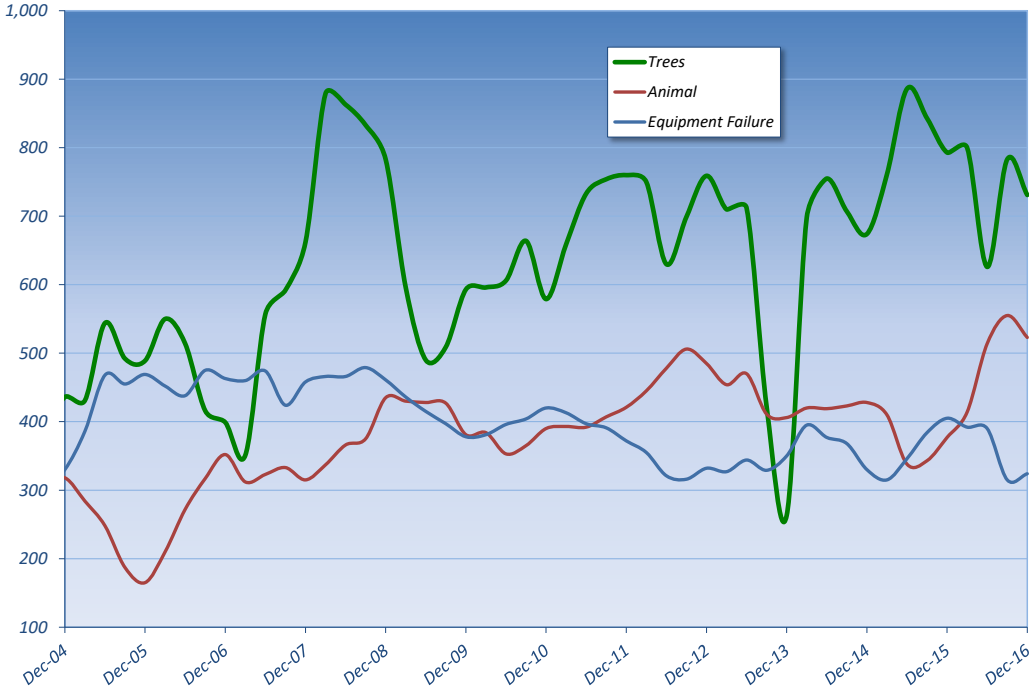


Figure 27 Penn Power Outage Tracking (number of incidents)



Pike County Light & Power Company

Pike has a relatively small operating service area with about 4,550 customers in 44 square miles. Pike County is primarily fed from two 34.5-kilovolt (kV) feeders supplied from New York substations and the eastern portion of Pike County service territory is fed by two 13.2 kV feeders from Matamoras Substation.

In 2016, Pike County experienced 1,735 customer interruptions and 394,826 minutes of interruption, as compared to 2015 when customers experienced 1,821 interruptions and 367,000 minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 205 minutes in 2015 to 228 minutes in 2016; and failed to achieve benchmark by 31 percent.

3-year average: Increased from 173 minutes in 2015 to 180 minutes in 2016; and achieved standard by 6 percent.

SAIDI

Rolling 12-month: Increased from 78 minutes in 2015 to 87 minutes in 2016; achieved benchmark by 18 percent.

3-year average: Decreased from 185 minutes in 2015 to 130 minutes in 2016; failed to achieve standard by 0.5 percent.

SAIFI

Rolling 12-month: Remained the same from 0.38 outages in 2015 to 0.38 outages in 2016; achieved benchmark by 38 percent.

3-year average: Decreased from 1.24 outages in 2015 to 0.96 outages in 2016; failed to achieve standard by 43 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 28 and Figure 29. Pike County's CAIDI score is above benchmark. However, Pike County's SAIDI and SAIFI scores are below benchmark. Figure 30 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 31 shows the historical trend of the top two main outage causes. The most frequent outage causes were trees and equipment failure.

In early 2014, the PUC began increased monitoring and assessment of Pike County's reliability due to poor SAIFI and SAIDI performance. The PUC required Pike County to initiate a Corrective Action Plan (CAP).

In 2016, Pike continued upon the Reliability Action Plan it initiated in 2014. Pike continues to use smart fault indicators ("SFI"). In 2017 some fault indicators will be relocated to the river crossing to assistant in isolation and restoration.

Pike continues to remove danger trees. Pike routinely removes those danger trees within rights-of-way areas when identified. Danger trees that exist outside of the Company's right-of-way

areas can only be removed with customer or municipal authorization. Pike has begun tracking danger trees that it is unable to mitigate. Pike will continue to coordinate the removal of identified danger trees with County Commissioners' office, Boroughs of Matamoras and Milford, Townships of Westfall and Milford, and the Milford Shade Tree Commission.

Pike inspects all three-phase mainline circuitry annually using infrared thermography. Single phase circuitry is inspected on a three-year cycle. The 2017 infrared survey is scheduled for the late August time frame.

Pike County's CAIDI, SAIFI, and SAIDI performance achieved benchmark in the 2nd quarter of 2016. Pike was a benchmark performer in SAIDI and SAIFI in the last two quarters of 2016; however benchmark was not achieved for CAIDI during the last two quarters. Pike continues to execute the CAP improvement plan and effective tree management.

Figure 28 Pike County CAIDI (minutes)

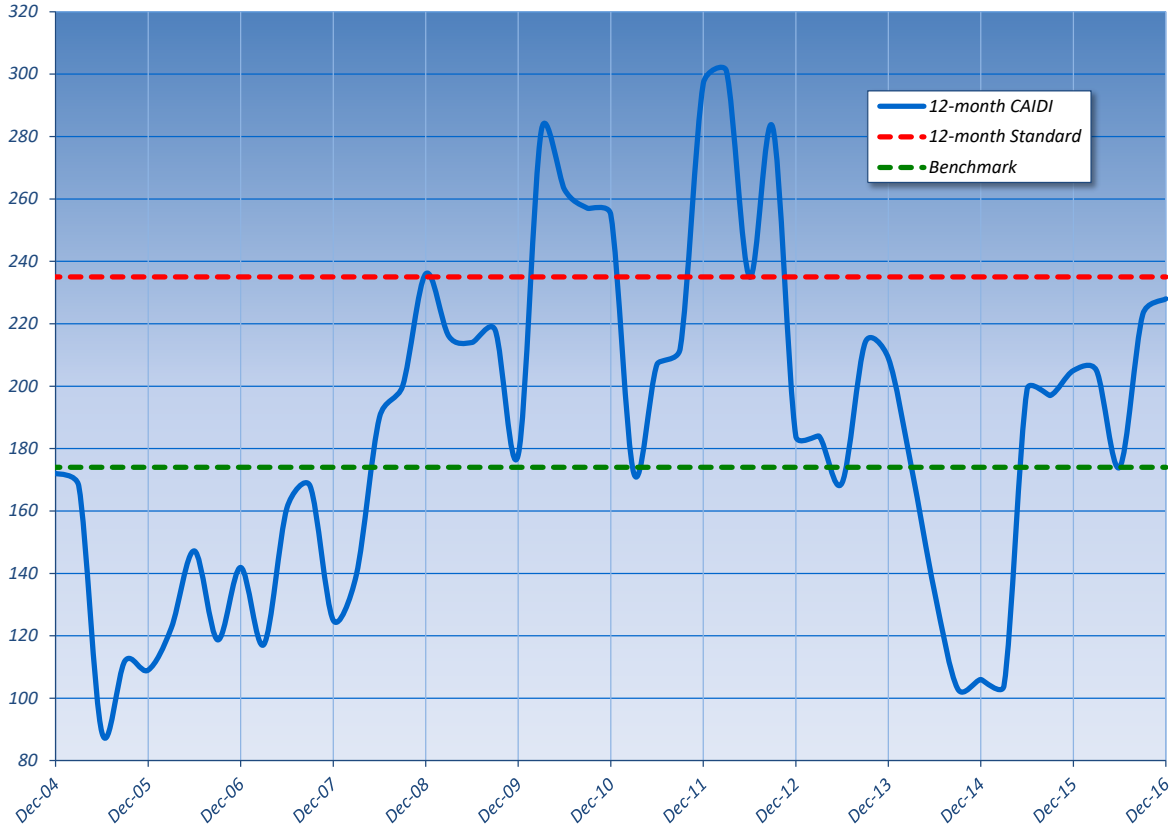


Figure 29 Pike County SAIFI (interruptions per customer)

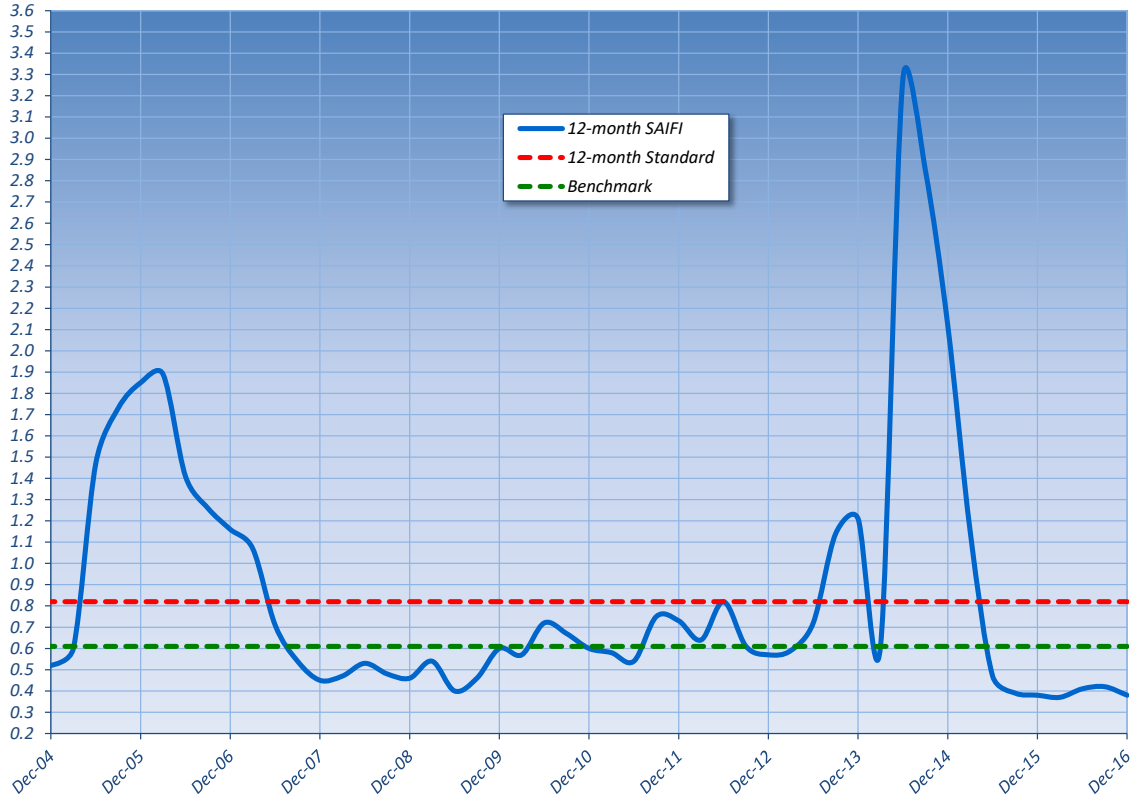


Figure 30 Pike County Outage Causes (percent of total outages)

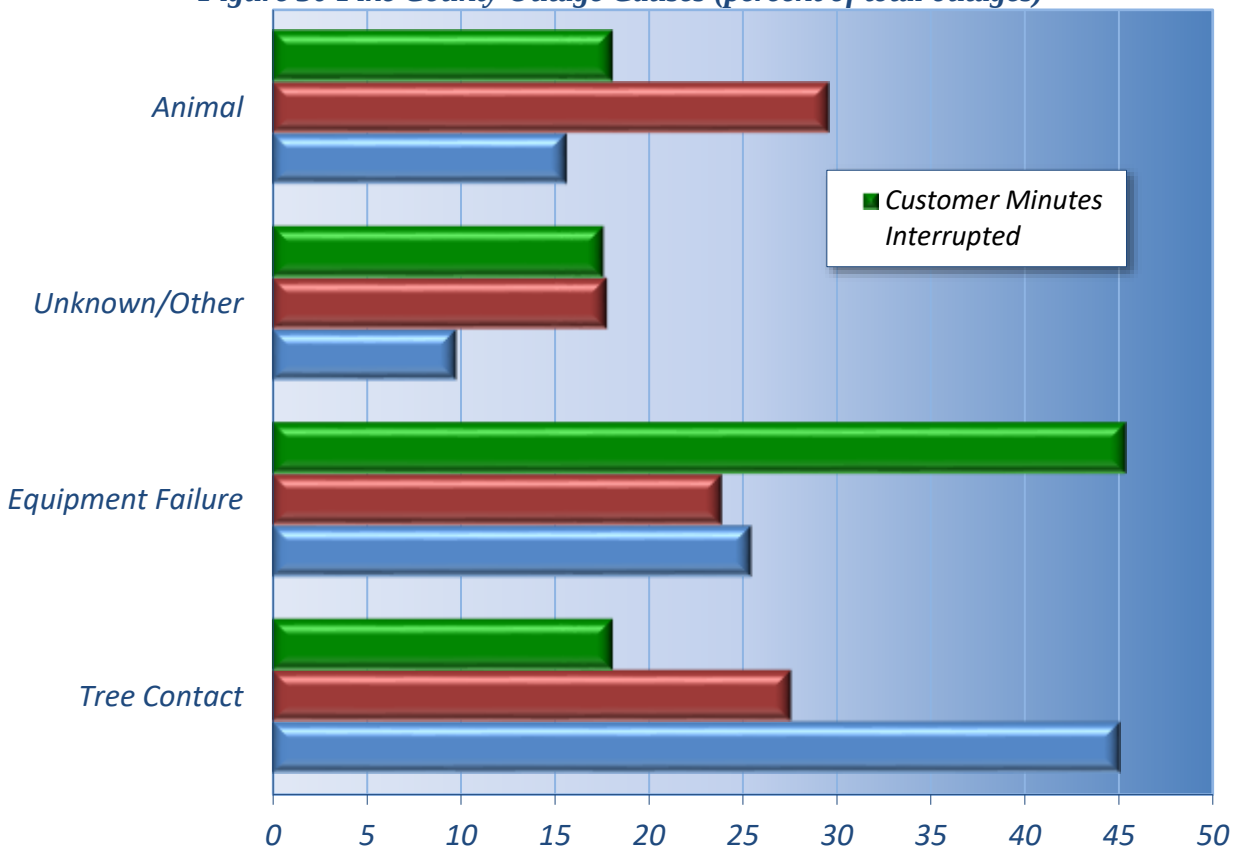
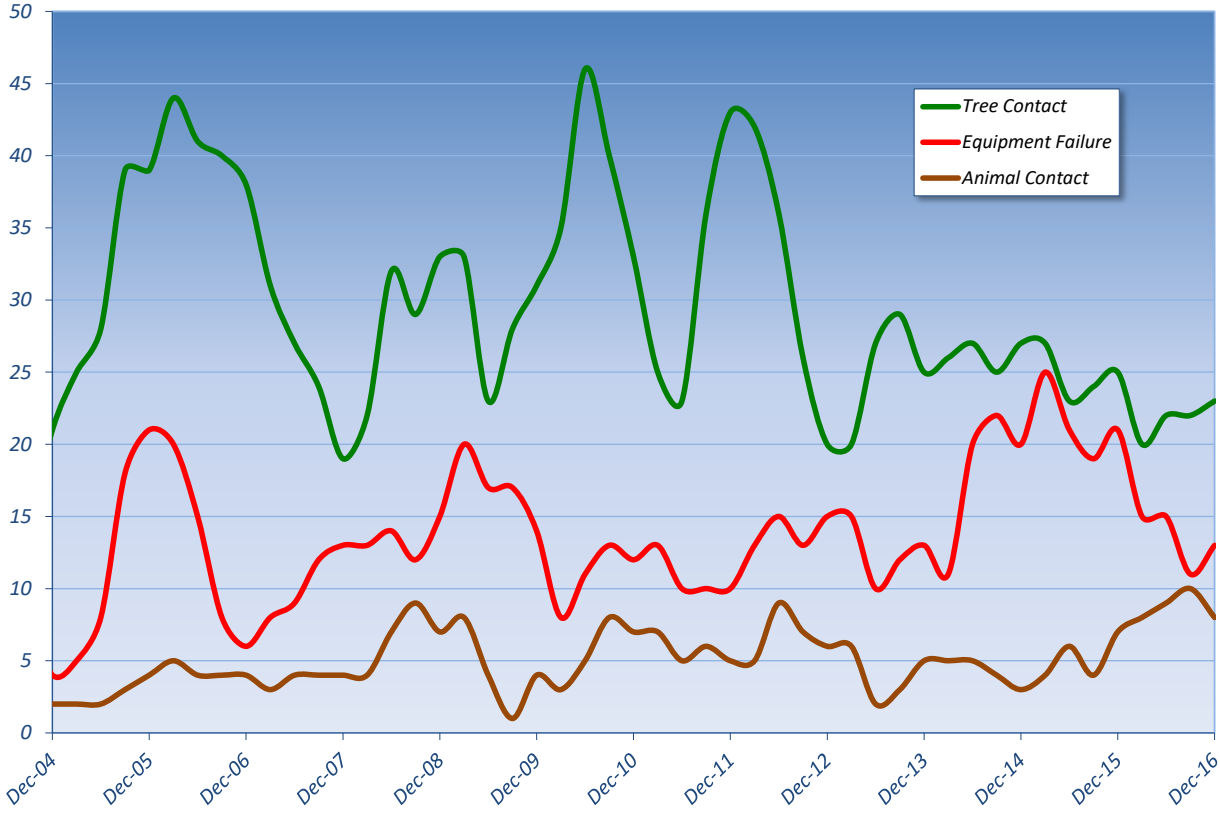


Figure 31 Pike County Outage Tracking (number of incidents)



PPL Electric Utilities Corporation

PPL has a service territory of about 10,000 square miles and serves about 1.4 million customers. In 2016, PPL experienced 1.1 million customer interruptions and 132.9 million minutes of interruption, compared to 2015, when customers experienced 1 million customer interruptions and 118.5 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 118 minutes in 2015 to 121 minutes in 2016; and achieved benchmark by 17 percent.

3-year average: Increased from 135 minutes in 2015 to 140 minutes in 2016; achieved standard by 13 percent.

SAIDI

Rolling 12-month: Increased from 84 minutes in 2015 to 94 minutes in 2016; and achieved benchmark by 34 percent.

3-year average: Increased from 113 minutes in 2015 to 114 minutes in 2016; achieved standard by 34 percent.

SAIFI

Rolling 12-month: Decreased from 0.82 outages in 2015 to 0.78 outages in 2016; achieved benchmark by 20 percent.

3-year average: Decreased from 0.82 outages in 2015 to 0.81 outages in 2016; achieved benchmark by 25 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 32 and Figure 33. The recent trend is that outages are less frequent and the duration is increasing slightly. Figure 34 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 35 shows a historical trend of the top three main outage causes. The most frequent outage causes were trees and equipment failure.

PPL's recognizes that trees are generally the most common cause of power outages and its 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). PPL's programs also seek to minimize outages from vegetation located adjacent to the ROW.

In 2013, PPL Electric launched more comprehensive 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, have resulted in a reduction in the number of tree-related outages, compared to the average of the previous 10 years. In 2017, these initiatives continue with the expectation of further reductions in vegetation-related service interruptions.

PPL also has a Hazard Tree Program, where trees that are a damage risk to PPL power lines are identified and addressed. With the Emerald Ash Borer infestation in Pennsylvania, PPL Electric is

taking measures to remove all ash danger trees on the company's transmission lines. Additionally, 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 in all regions for both transmission and distribution circuits.

PPL is also continuing its storm hardening initiatives. 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. These initiatives include changes to engineering instructions and construction specifications to enhance the reliability of the distribution system during storms. For example: steel poles and fiberglass crossarms are replacing wood poles and crossarms for certain types of applications; taller poles are now used in locations where heavier equipment is installed; and remote service kits are deployed in various rural areas to improve restoration times for residential customers.

In 2015, PPL Electric began full implementation of a 10-year plan to replace existing 3-phase hydraulic reclosers with communication-enabled vacuum circuit reclosers. This allows for remote operation of these devices, in addition to remote monitoring to facilitate the move toward condition based maintenance. These devices play a crucial role in reducing the number of customers interrupted by an outage.

In 2017, PPL Electric will continue to roll out 3-phase fusing and single-phase tripping on 3-phase lines. Prior to this approach, when a 3-phase smart grid device tripped, or went out of service due to a fault, all 3 phases tripped. Under the new approach a single-phase fault only impacts customers on that phase, which reduces outages for the other two-thirds of the customers on that line. While single phase tripping is not appropriate for all locations, PPL Electric is actively implementing this reliability enhancement.

PPL continues to invest in its Smart Grid initiative. A pilot program conducted in Dauphin and Cumberland counties showed a 35 to 50 percent reduction in customer minutes interrupted versus non automated circuits in the same geographic area. PPL conducted another project in the Pocono region that saw outage durations reduced by an average of 30 percent.

PPL implemented an advanced Distribution Management System (DMS) in 2014, which is a software solution that provides system operators real-time situational awareness of how the system is performing. One of its groundbreaking features is the ability for the software to detect a fault from smart sensors on the distribution system and quickly develop and execute an optimized restoration plan. This technology is dramatically improving the ability to quickly restore customers, particularly in conjunction with the FISR (Fault Isolation and Service Restoration) technology, which is now in use on all feeders. PPL Electric continues to monitor and refine its usage of FISR technology. FISR identifies faulted sections and quickly develops an optimized restoration plan, then automatically executes that plan. Customers typically can be restored within five minutes from the start of the outage. These enhancements have made the Smart Grid device relay programming yield more consistent results. In addition, further improvements have been made in the technology that analyzes the severity and location of a fault, enabling field forces to more rapidly respond to the trouble location.

In 2016, PPL Electric embarked on a pilot program for utilizing Load-Tap Changing (LTC) power transformers on its distribution system as part of the company's voltage regulation strategy. The move toward using LTC transformers on the distribution system has provided improved voltage regulation that allows the company to better-meet any voltage conservations that may be required. In 2016, PPL Electric installed LTC transformers at 5 of its distribution substations as part of this pilot program. For future years, the company plans to continue this program at substations that require on-site voltage regulation.

PPL Electric has set-up a momentary outage task force and program in 2016 to investigate and mitigate the causes of multiple momentary outages. This program is intended to reduce momentary outages for customers and should also reduce permanent outages that may have occurred through 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. Additionally, PPL Electric 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's infrared thermography (IR) line inspections are a routine part of maintenance to identify potential equipment failures that cannot be detected from visual inspections. PPL Electric's IR inspection process is programmatically applied to all multi-phase lines adjacent to roadways on a two-year cycle. Inspections are conducted in the winter months to take advantage of the relatively high and consistent loads associated with heating demands; the colder weather also results in a lower ambient temperature for greater contrast. Consequently, repairs associated with the results of infrared scanning are completed before summer creating conditions for greater reliability. Supplementary infrared scanning may be conducted throughout the year. Circuits planned for load transfer may be scanned based on circuit performance indicators. Additionally, specific areas may be scanned to augment condition-based visual inspections.

In 2016 PPL was considered a benchmark performer in all quarters. PPL continues to proactively improve grid resiliency, reliability, sustainability, and storm hardening.

Figure 32 PPL CAIDI (minutes)

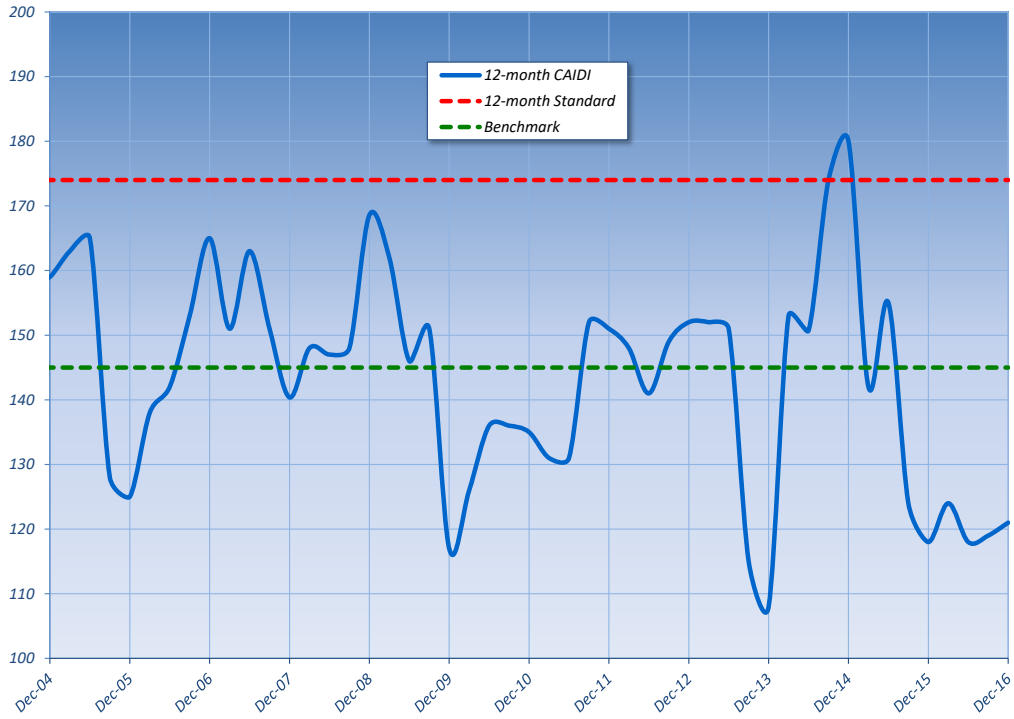


Figure 33 PPL SAIFI (interruptions per customer)

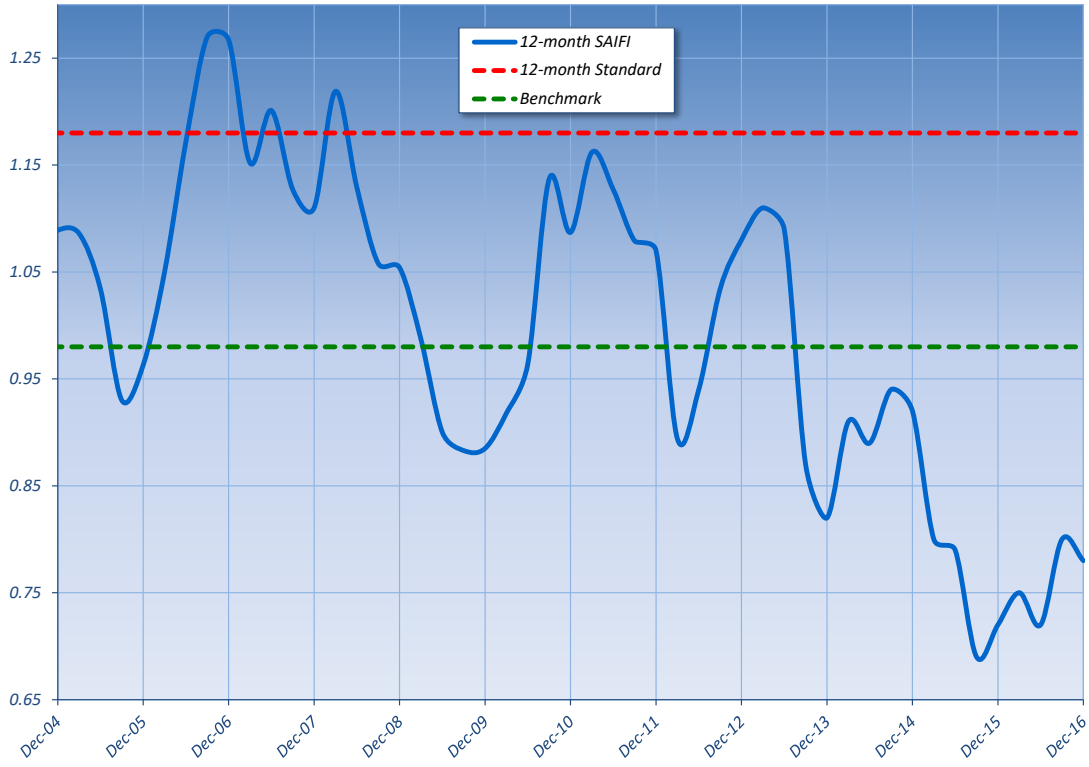


Figure 34 PPL Outage Causes (percent of total outages)

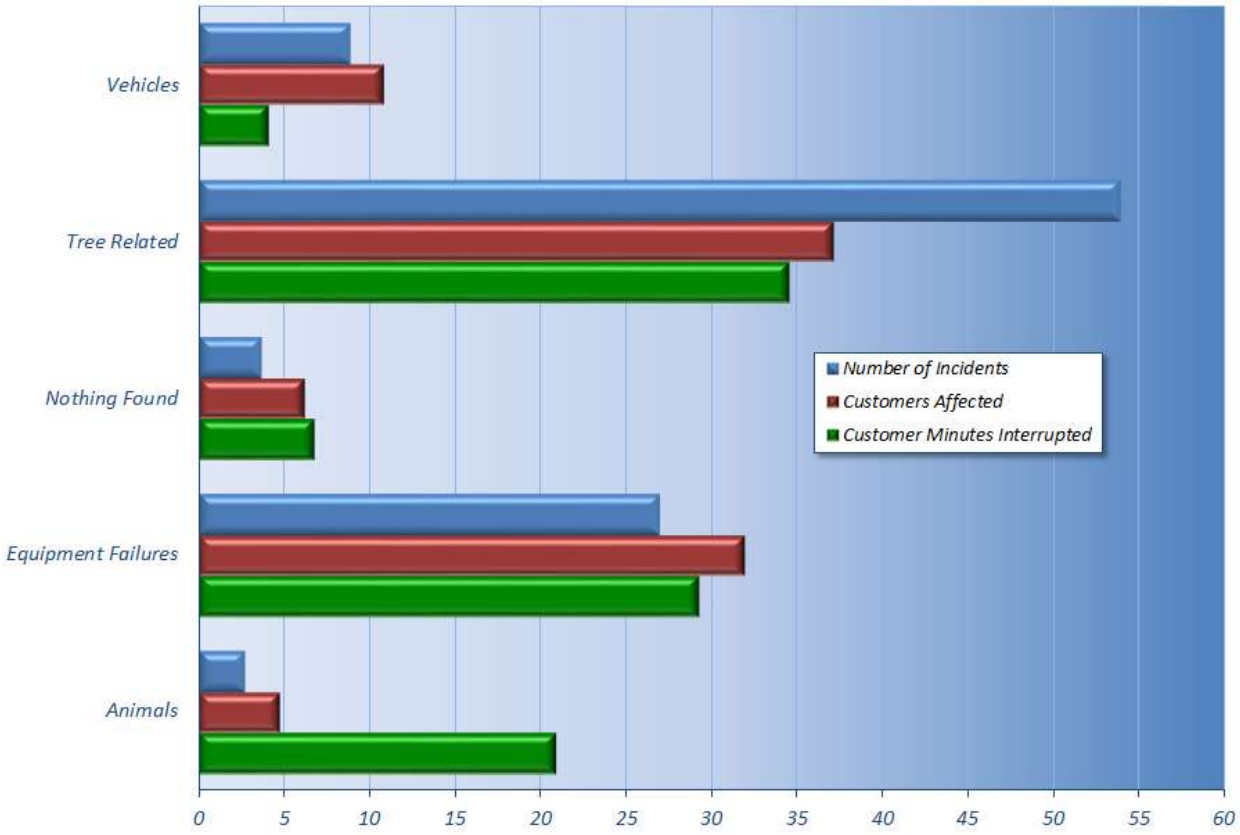
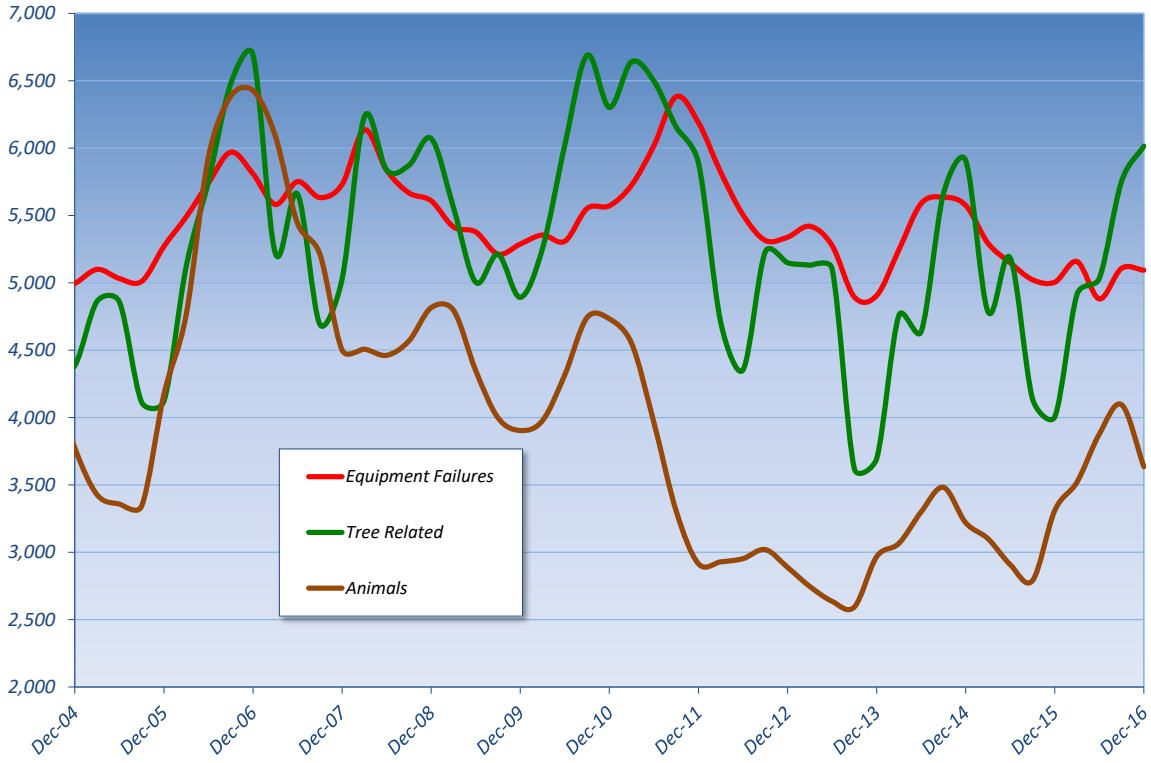


Figure 35 PPL Outage Tracking (number of incidents)



UGI Utilities Inc.

UGI has a service territory of about 410 square miles and serves about 61,200 customers. In 2016, UGI experienced 38,909 customer interruptions and 4.85 million minutes of interruption, compared to 2015, when customers experienced 24,122 customer interruptions and 2.48 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 103 minutes in 2015 to 125 minutes in 2016; achieved benchmark by 26 percent.

3-year average: Increased from 119 minutes in 2015 to 124 minutes in 2016; achieved standard by 33 percent.

SAIDI

Rolling 12-month: Increased from 41 minutes in 2015 to 78 minutes in 2016; achieved benchmark by 44 percent.

3-year average: Decreased from 63 minutes in 2015 to 61 minutes in 2016; achieved standard by 64 percent.

SAIFI

Rolling 12-month: Increased from 0.40 outages in 2015 to 0.63 outages in 2016; achieved benchmark by 24 percent.

3-year average: Decreased from 0.54 outages in 2015 to 0.49 outages in 2016; achieved standard by 46 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 36 and Figure 37. Figure 38 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 39 shows the historical trend of main outage causes. The most frequent outage causes were trees and equipment failure, which have increased since last year.

UGI initiated a Distribution Automation Pilot Project in 2015 and based on its success, a 5-year project plan was been 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 capabilities 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.

UGI plans to bolster its existing Danger Tree Mitigation Program by adding additional vegetation clearance resources in 2017 to address the looming vegetation issue caused by the Emerald Ash Borer's 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 of 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 and identified over 190 locations for new devices. UGI has completed installation 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 is designed to move 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 performs infrared thermography on an as-needed basis and does not have a time frequency based formal infrared thermography program for aerial distribution system.

In 2016, UGI reviewed and then decided to eliminate the manual call-out system and will replace it in 2017 with a more efficient and effect automated system.

In the last four years, UGI achieved benchmark performance in every category and this positive performance is expected to continue in 2017.

Figure 36 UGI CAIDI (minutes)

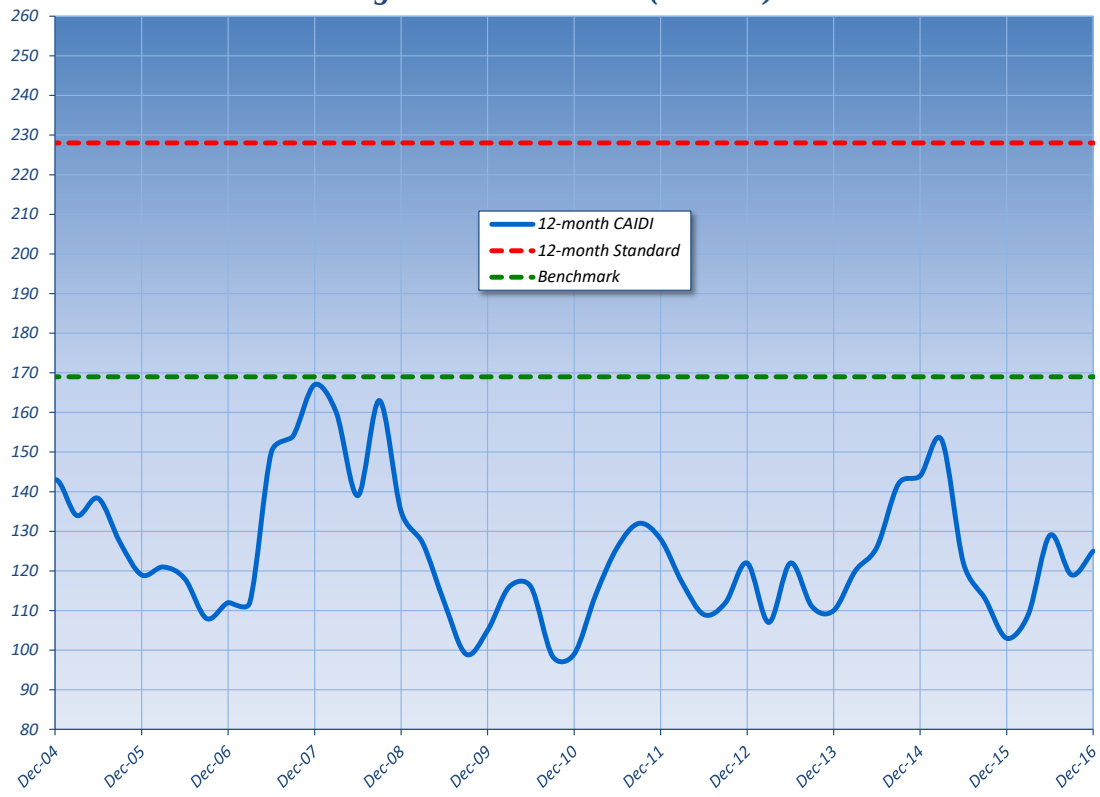


Figure 37 UGI SAIFI (interruptions per customer)

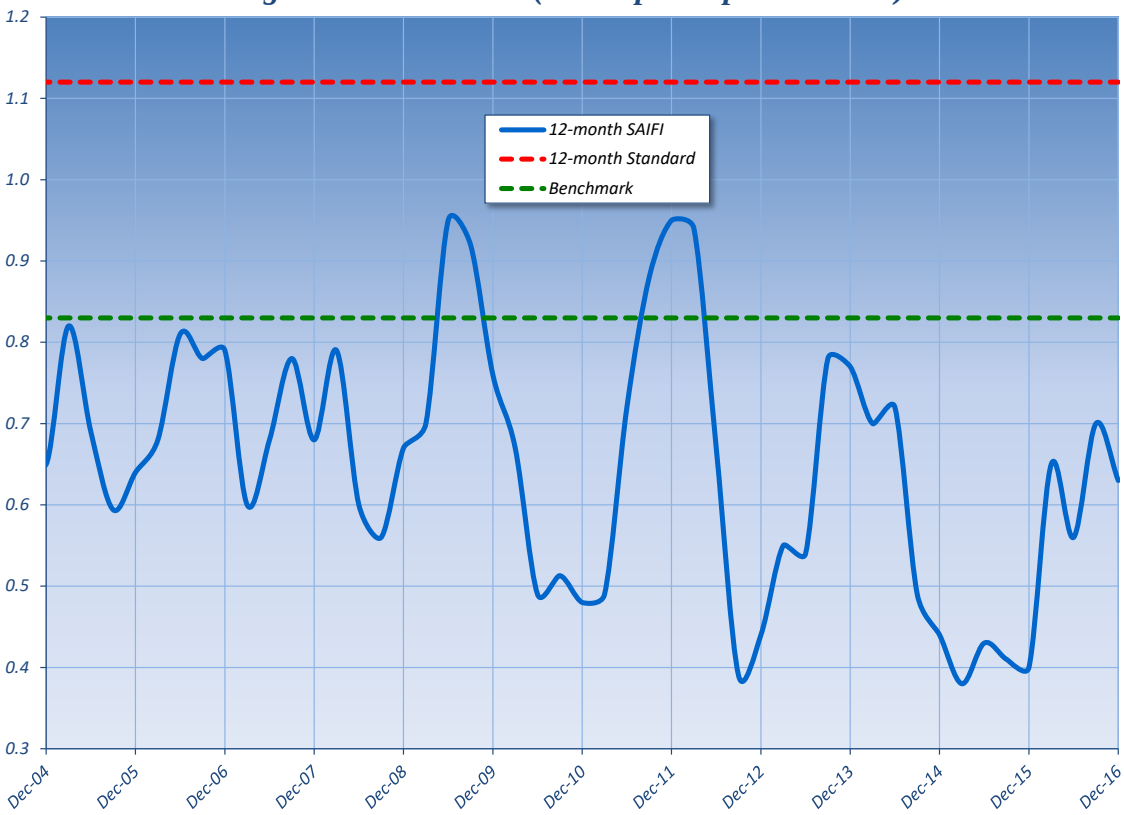


Figure 38 UGI Outage Causes (percent of total outages)

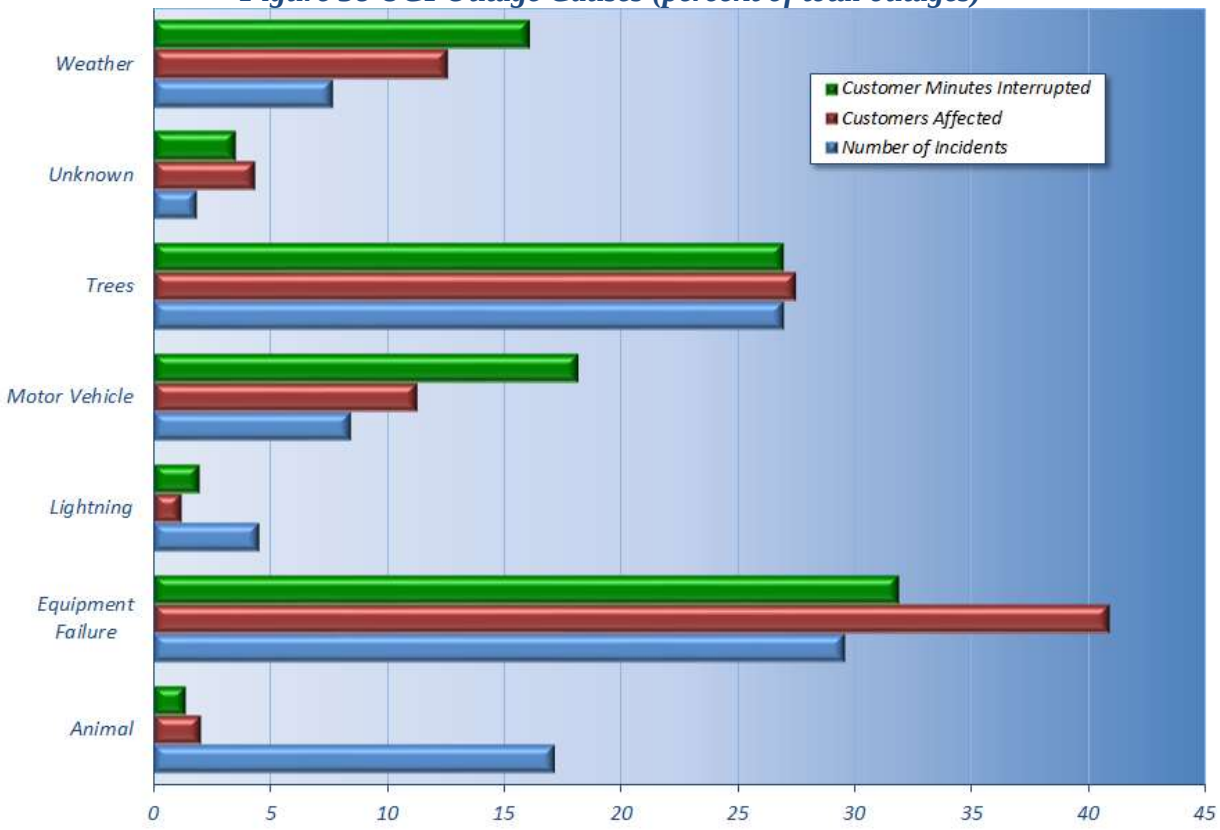
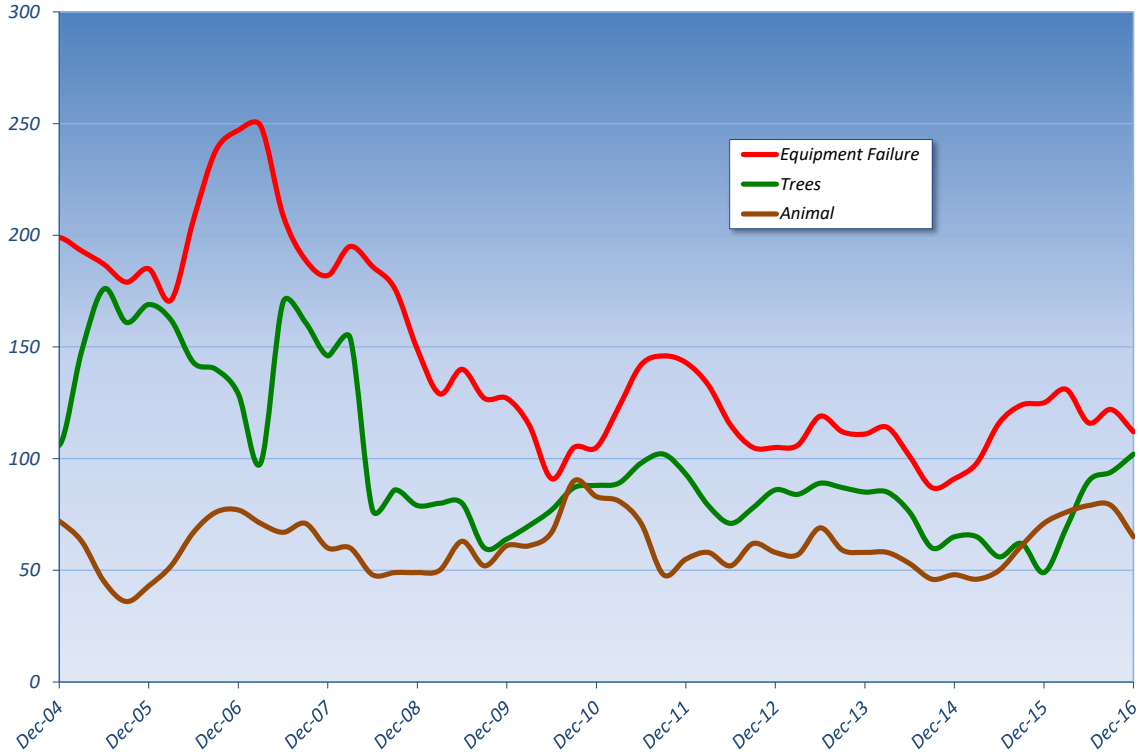


Figure 39 UGI Outage Tracking (number of incidents)



Wellsboro Electric Company

Wellsboro has a service territory of about 178 square miles and serves about 6,272 customers. In 2016, Wellsboro experienced 10,138 customer interruptions and 1.1 million minutes of interruption, compared to 2015, when customers experienced 5,209 customer interruptions and 496,803 minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Increased from 76 minutes in 2015 to 94 minutes in 2016; achieved benchmark by 24 percent.

3-year average: Increased slightly from 74 minutes in 2015 to 82 minutes in 2016 and achieved standard by 40 percent.

SAIDI

Rolling 12-month: Increased from 81 minutes in 2015 to 172 minutes in 2016; failed to achieve benchmark by 12 percent.

3-year average: Increased from 59 minutes in 2015 to 103 minutes in 2016; achieved standard by 44 percent.

SAIFI

Rolling 12-month: Increased from 1.06 outages in 2015 to 1.84 outages in 2016; failed to achieve benchmark by 50 percent.

3-year average: Increased from 0.80 outages in 2015 to 1.22 outages in 2016 and achieved standard by 9 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 40 and Figure 41. Figure 42 shows the distribution of outage causes as a percentage of total outages. Figure 43 shows the historical trend of main outage causes. The most frequent outage causes were equipment failure and animals, which are trending higher.

Wellsboro is continuing its programs to maintain electric reliability. Wellsboro continues to install overhead and underground fault indicators on various parts of the system to enable faster fault location. In 2016, Wellsboro completed installation of AMI advanced meters.

In 2017, Wellsboro will perform a detailed vegetation management inspection on 4 distribution circuits. This inspection will look for danger trees that could cause a problem to the distribution system and to determine the trimming cycle for all other vegetation. Wellsboro will perform a complete trimming and removal of danger trees on sixty miles of the Middlebury feeder distribution system.

Wellsboro continues to install permanent fault indicators on the distribution system. Wellsboro believes this will pinpoint more accurately the location of an outage problem and will help crews restore power faster to customers.

Infrared thermography imaging is conducted annually on all in-service substation equipment and select sections of the distribution system.

Wellsboro achieved benchmark performance for CAIDI, but failed to achieve benchmark for both SAIDI and SAIFI during the fourth quarter in 2016. Additionally Wellsboro has failed to achieve standard for SAIFI in the fourth quarter. The PUC staff will perform additional monitoring of Wellsboro reliability.

Figure 40 Wellsboro CAIDI (minutes)

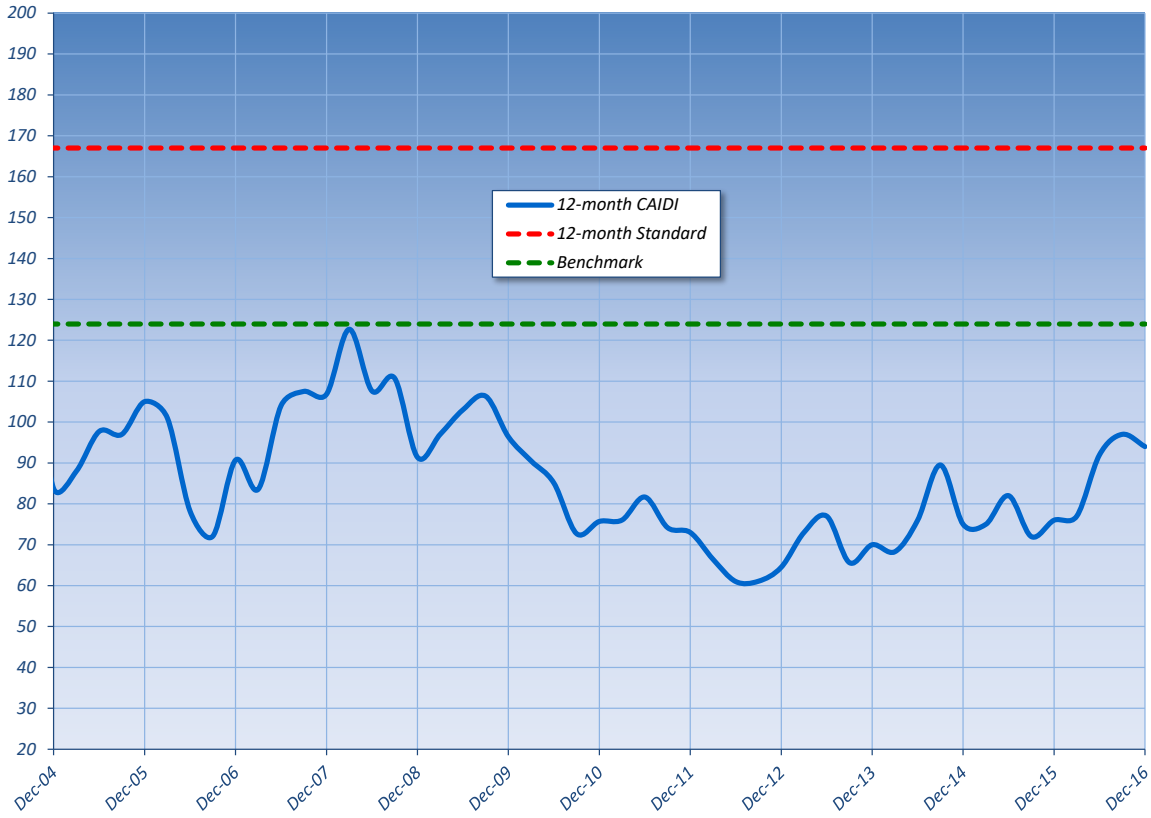


Figure 41 Wellsboro SAIFI (interruptions per customer)

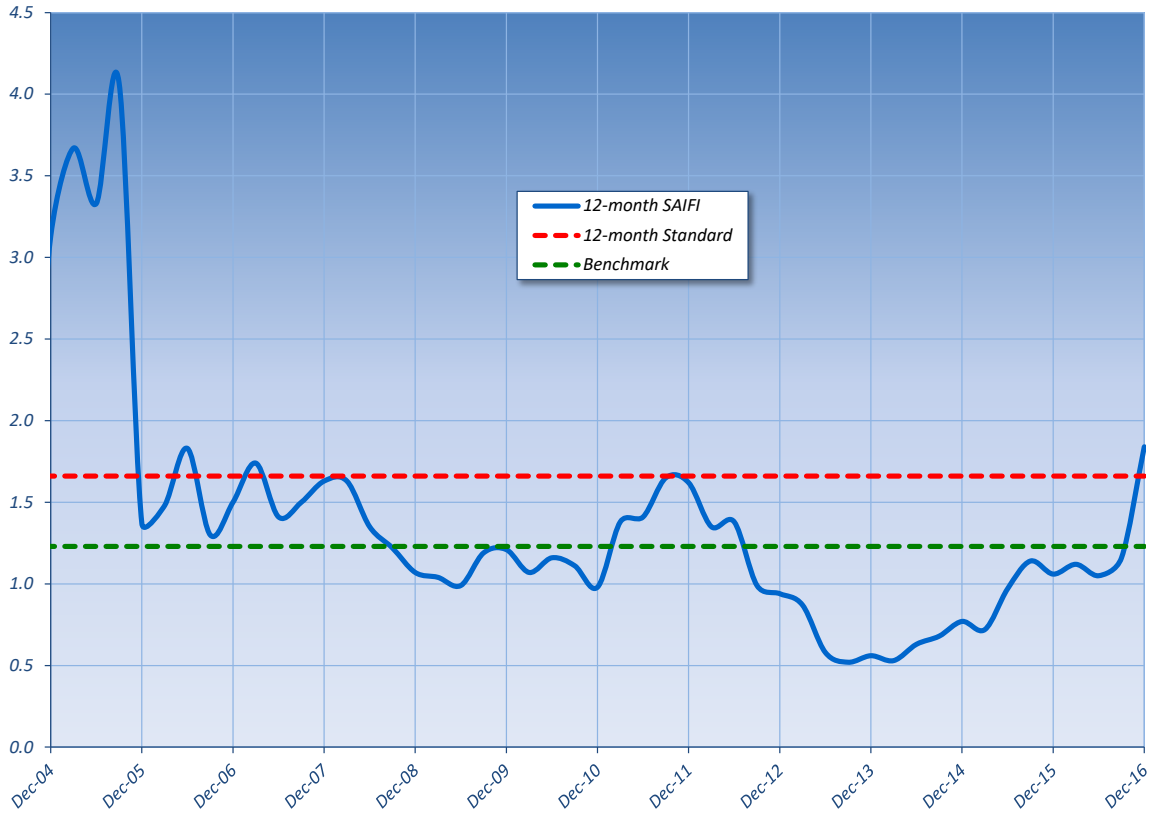


Figure 42 Wellsboro Outage Causes (percent of total outages)

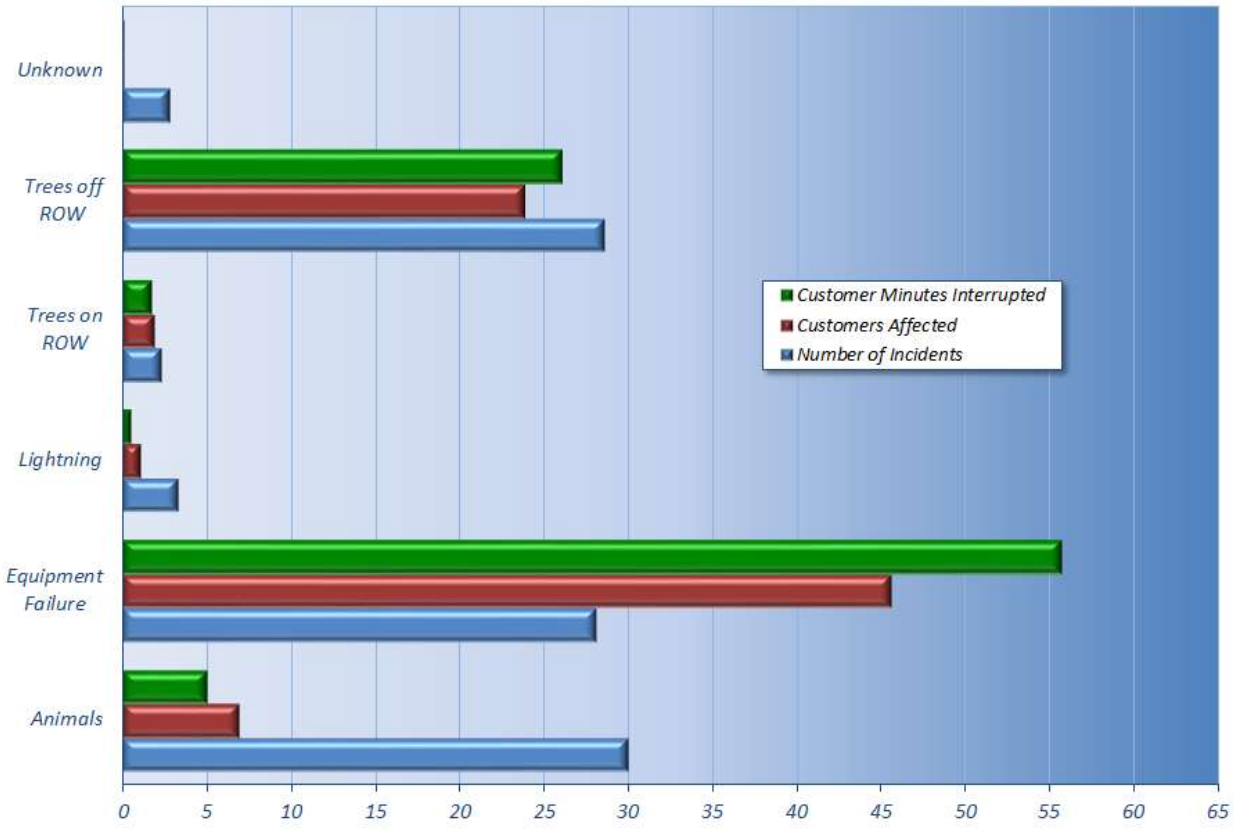
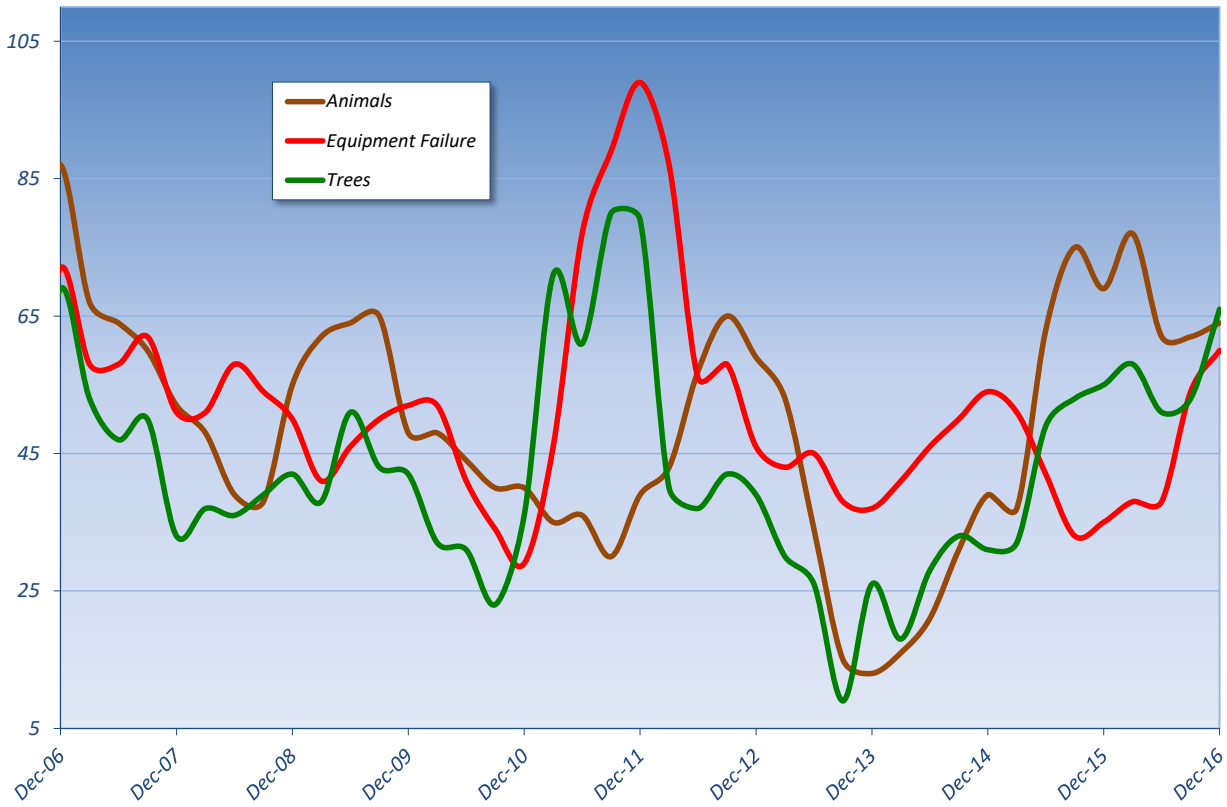


Figure 43 Wellsboro Outage Tracking (number of incidents)



West Penn Power Company

West Penn has a service territory of about 10,400 square miles and serves about 710,000 customers. In 2016, West Penn experienced 772,206 customer interruptions and 113.1 million minutes of interruption, compared to 2015, when customers experienced 827,613 customer interruptions and 127.3 million minutes of interruption.

CAIDI/SAIDI/SAIFI Evaluation

CAIDI

Rolling 12-month: Decreased from 154 minutes in 2015 to 147 minutes in 2016; and achieved benchmark by 14 percent.

3-year average: Decreased from 158 minutes in 2015 to 146 minutes in 2016; and achieved standard by 22 percent.

SAIDI

Rolling 12-month: Decreased from 179 minutes in 2015 to 159 minutes in 2016; and achieved benchmark by 11 percent..

3-year average: Decreased from 180 minutes in 2015 to 159 minutes in 2016; and achieved standard by 27 percent.

SAIFI

Rolling 12-month: Increased from 1.02 outages in 2015 to 1.17 outages in 2016; and failed to achieve benchmark by 11 percent.

3-year average: Increased from 1.08 outages in 2015 to 1.09 outages in 2016; and achieved standard by 6 percent.

Historical 12-month CAIDI and SAIFI trends are shown on Figure 44 and Figure 45. Figure 46 shows the distribution of outage causes that occurred during 2016 as a percentage of total outages. Figure 47 shows the historical trend of the main outage causes. The top two known causes were trees and equipment failure.

West Penn's Long Term Infrastructure Improvement Plan (LTIIP) was approved on Feb 11, 2016.[25] West Penn's LTIIP is designed to help improve storm hardening, system resiliency, and reliability. Additional plans include a Reliability Plan and Worst Performing Circuit Plan.[26]

In addition to normal on-cycle tree trimming, West Penn has introduced a program to accelerate the mitigation of trees subject to damage by the Emerald Ash Borer from its current five years to a new 3-year completion timeline for the sub-transmission system and the zone two (three phase lines after the first safety device downstream of the substation) portion of its distribution system. In 2016, West Penn removed 23,000 Emerald Ash Borer damaged trees and in 2017, plan to remove 50,000 trees.

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

[26] On March 30, 2015, the Commission issued an order directing West Penn Power to prepare and file a revised implementation plan relating to specific topics addressed in the report issued by the Commission's Bureau of Audits on February 12, 2015. *Implementation Plan for the Focused Management Audit of West Penn Power,* Docket No D-2013-2365994

West Penn installed new fused cutouts on unprotected circuits to minimize outage frequency and duration and ensure the adequate protection of circuits. West Penn installed fuses on 81 circuits in 2016, and plans to install fuses on approximately 60 circuits in 2017.

West Penn conducted targeted circuit rehabilitation, which helps reduce the number of and limit the duration and impact of interruptions to customers. Circuits are inspected and equipment is replaced as necessary. Equipment may include, but is not limited to: poles; switches; crossarms; insulators; braces; and cutouts. In 2016, 38 circuits were rehabilitated. West Penn plans to rehabilitate at least 55 circuits in 2017.

Select West Penn Worst Performing Circuits (WPCs) are targeted for enhanced rehabilitation, which also helps reduce the number of and limit the duration and impact of interruptions to customers. Improvements include hardware rehabilitation, coordination review, installation of additional protective devices, and recloser installations. In 2016, 6 WPCs received enhanced rehabilitation and West Penn plans to target an additional 6 WPCs in 2017.

Supervisory control and data acquisition (SCADA) provides communication with circuit breakers and line switches enabling workers to remotely operate the breakers or switches to reduce restoration time. West Penn's enhanced overcurrent protection and SCADA control program targets the installation of new electronic reclosers with SCADA control, which minimizes the number of customers affected during a lockout and allows remote switching to restore customers more quickly. Adding SCADA control to electronic reclosers in select substations with existing SCADA capabilities also provides additional monitoring capability. In 2016, West Penn replaced a total of 25 breakers with electronic reclosers at 5 substations and plans to install 28 electronic reclosers at 4 substations in 2017.

West Penn's sub-transmission modernization and automation program oversees the installation of SCADA-controlled reclosers and switches and automatic air switch modernization. This provides enhanced sectionalizing for larger blocks of customers at the substation source level. The SCADA-controlled switches also allow for remote switching to sectionalize and restore large blocks of customers more quickly, leading to reduced outage durations. In 2016, West Penn installed 56 automatic reclosers or switches at its substations and plans to install 65 reclosers or switches in 2017.

West Penn's underground getaway replacement program targets select underground substation exits that were installed prior to 1988 and are known to be prone to failure. A getaway is a cable that leads out of the substation to the overhead lines. Replacing these getaways may reduce interruptions to a circuit associated with the cable as well as the long interruption times associated with the replacement. In 2016, West Penn replaced underground getaways at 3 substations, which provided positive impact to 7 circuits.

West Penn's Underground Residential Distribution ("URD") Cable Replacement program helps reduce the number of outages by targeting the replacement of bare concentric neutral cable, which was manufactured without an insulating jacket around the concentric neutral wires. This design often caused the cable to fail prematurely. In 2016, West Penn replaced 13,000 feet of cable, and approximately 18,300 feet of cable is targeted to be replaced in 2017.

West Penn targets the replacement of wood poles that have degraded beyond restorable condition and the reinforcement of poles that are restorable. In 2016, West Penn replaced or reinforced 384 wood poles and plans to replace or reinforce approximately 370 wood poles in 2017.

West Penn, along with the other FirstEnergy companies, performs infrared thermography on an as-needed basis. Examples of when the thermography may be used include, but are not limited to, identifying hot spots on a distribution circuit with heavy load, or reviewing a circuit when recent outages were related to overheated connecters, fuses or switches. Areas where the Companies may use thermography include worst performing circuits or circuit rehabilitation.

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.[27]

West Penn has achieved benchmark CAIDI and SAIDI performance, and is very close to attaining SAIFI benchmark. The Commission expects West Penn to be a benchmark performer in all reliability performance categories in 2017 as they continue to implement their RIP.

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

Figure 44 West Penn CAIDI (minutes)

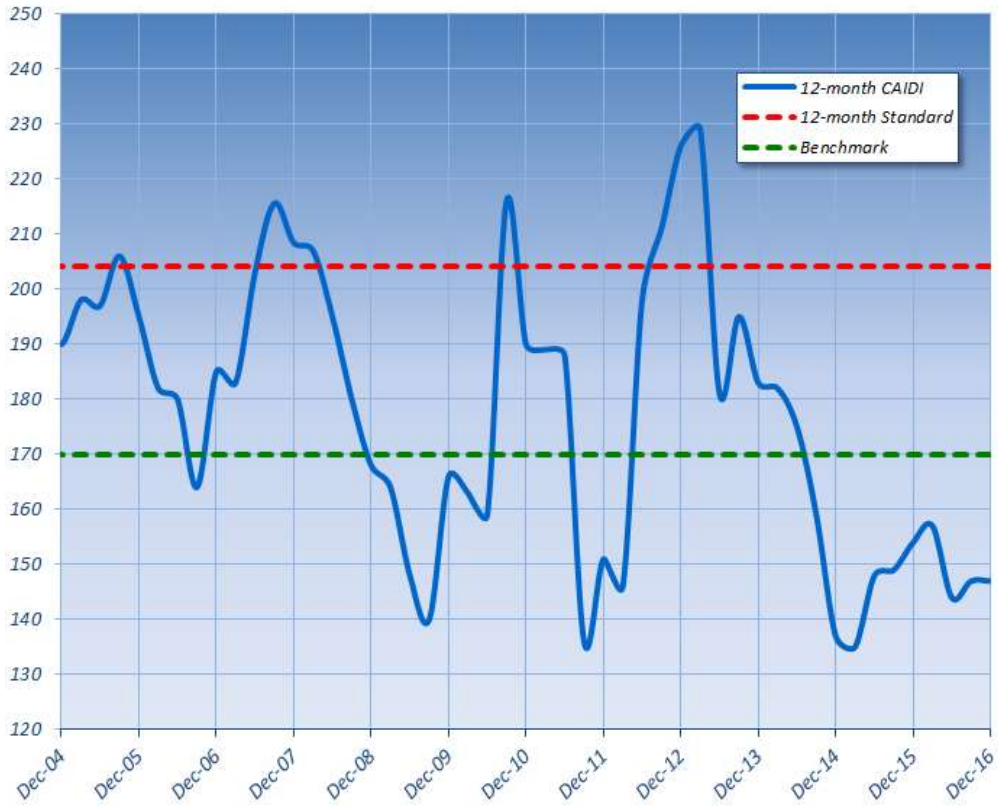


FIGURE 45 WEST PENN SAIFI (INTERRUPTIONS PER CUSTOMER)

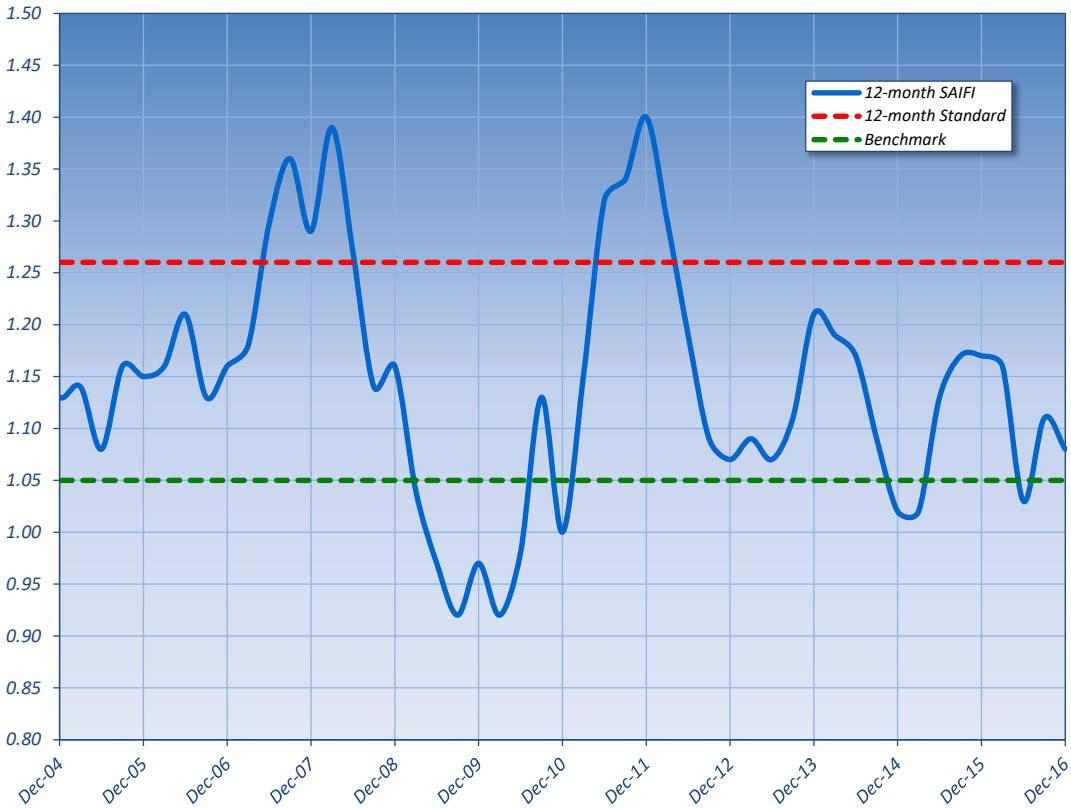


Figure 46 West Penn Outage Causes (percent of total outages)

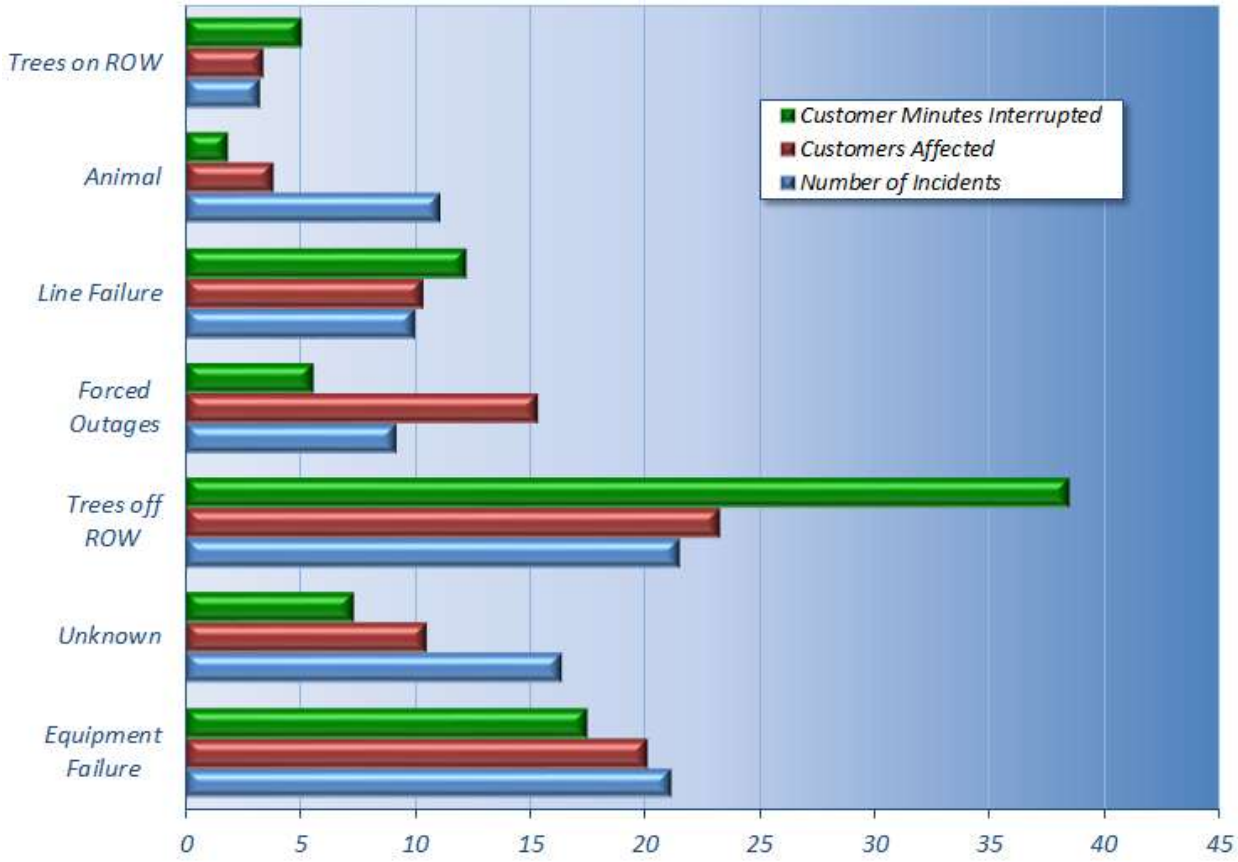
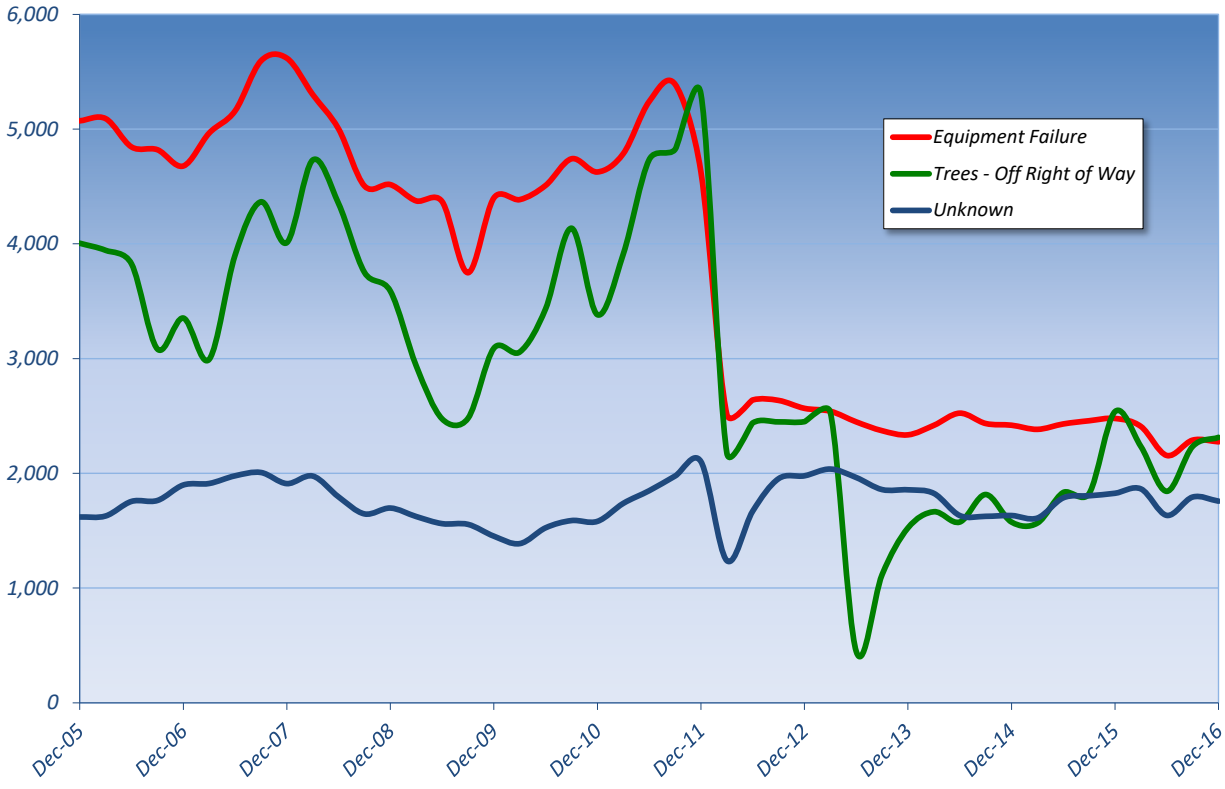


Figure 47 West Penn Outage Tracking (number of incidents)



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, 7 EDCs have approved Long Term Infrastructure Improvement Plans (LTIIPs).[28] 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 measures. It is expected that this should also reduce damage to the electric system during storms and contribute to a general overall reduction in the amount of outages in Pennsylvania.

The overall performance of the EDCs has been trending slightly in a negative direction from the previous year. In 2016, the EDCs reported quarterly CAIDI, SAIDI, and SAIFI metrics and failed to achieve benchmark 45 times total for the year; while in 2015 the total failure to achieve benchmark was 38 times total for the year. In 2016, EDCs failed to achieve standard 4 times total in the year; while in 2015 this was reduced to just one instance for the whole year.

Off Right of Way Danger Trees

In general, as noted in the 2014 and 2015 PUC Reliability Report, every utility is challenged with danger trees outside its right-of-way boundaries. These trees are a significant threat to electric reliability and cause significant damage to the distribution system during severe storms. Trees are a direct challenge to the resiliency and storm hardening of the distribution system during major storm events and are the number one cause of catastrophic power loss during storms. Pennsylvania EDCs continue to improve their aggressive vegetation management programs and recognize that removal of off-right-of-way trees are a chronic challenge due to private property rights laws. In order to more effectively improve reliability, it appears there would need to be a legislative solution that addresses widening the right of way to address trimming and removal of Danger Trees. Addressing the type of new growth allowed would also facilitate future maintenance and reliability of the electrical distribution system.

Blue Sky Goals

The PUC believes that EDCs should set internal goals to consistently achieve reliability performance scores below benchmark for what are called “blue-sky” days.[29] It is suggested that

[28] The 7 EDCs with approved LTIIPs are Duquesne Light, Met-Ed, PECO, Penelec, Penn Power, PPL and West Penn.

[29] “Blue sky” days are those days where no storm activity or other detrimental weather phenomenon occur (wind, snow, or heavy rain). As part of their benchmark calculations, EDCs factored in “normal” bad weather, which means they have factored a certain number of storm events (storm days) in to their determination of the benchmark metrics based on their actual experience during the benchmark period (1994-1998). This ensures the benchmark metrics reflect the average performance of the EDC during the period. “Blue sky” is a measure of the

EDCs consider implementing an internal goal of maintaining their reliability metrics about 20 percent below benchmark during "blue sky" days. Such a goal may provide a cushion within the reliability metrics to absorb storms and unforeseen system events and still achieve benchmark performance.

Pennsylvania EDC Working Group Collaboration with NATF

The PUC believes the Pennsylvania EDC working group, which was established after Super Storm Sandy to help develop best practices and continual improvement, should perform an assessment in 2017 as to the future direction of the group. The organization has been in place for about 5 years and has matured over this time period. The group has been affective in problem solving and protocol establishment for all Pennsylvania EDCs, especially in the areas of emergency outage management. The PUC believes continual improvement and developing excellence in operations needs to come from within the EDCs themselves. The PUC believes the Pennsylvania EDC working group is at an organizational maturity point to bring operational excellence and continual improvement to the collective Pennsylvania EDCs. Other organizations in electric generation and transmission offer a roadmap for developed self-assessment and best practice development tools.

It is suggested the Pennsylvania EDCs commit resources to establish and develop a functional group similar to the North American Transmission Forum (NATF) that was established after the August 2003 Blackout in the Northeastern United States and Southeastern Canada. The NATF group consists of six integrated programs that can directly apply to the electrical distribution system as tools and methods to continually improve and promote operational excellence, which cannot be achieved by Commission rules only. Since most of the Pennsylvania EDCs already belong to NATF, the EDC working group should reach out to NATF and develop an understanding of their policies, mission, and execution methods in order to apply these tools to Pennsylvania electrical distribution systems. In late 2016 and early 2017, the PUC began to facilitate some effort to establish contacts between the NATF and Pennsylvania EDC working group.

Infrared Thermography

Most EDCs in Pennsylvania have an Infrared Thermography program that inspects the aerial distribution system on a regular frequency. The PUC believes regularly scheduled Infrared Thermography is considered a value added non-invasive proactive best practice and should be adopted by all Pennsylvania EDCs. Infrared Thermography detects "hot spots" on electrical components that cannot be detected visually and provides an objective measurement to evaluate repairing/replacing electrical components prior to failure. This good practice is considered to add value by reducing emergency outages caused by equipment failure and increasing safety by reforming corrective maintenance through a scheduled planned outage that will be the least amount disruptive to customers. It is recommended by the end of 2017 that all EDCs have an Infrared Thermography program that inspects the aerial distribution system on a fixed frequency that does not exceed a reasonable predetermined frequency.

EDC's performance excluding any storm days, thus it can be assumed that the EDCs' reliability metrics on "blue sky" days should be better than that of average, "normal" days. By measuring performance on "blue sky" days, EDCs may be able to detect reliability issues not related to damage from storms.

Appendix A – Electric Reliability Metrics

12-Month Average Electric Reliability Indices for 2016

Customer Average Interruption Duration Index (CAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-16	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	108	105	141	2.9	-23.4
Duquesne Light	82	108	130	-24.1	-36.9
Met-Ed (FE)	124	117	140	6.0	-11.4
PECO	106	112	134	-5.4	-20.9
Penelec (FE)	120	117	141	2.6	-14.9
Penn Power (FE)	95	101	121	-5.9	-21.5
Pike County	228	174	235	31.0	-3.0
PPL	121	145	174	-16.6	-30.5
UGI	125	169	228	-26.0	-45.2
Wellsboro	94	124	167	-24.2	-43.7
West Penn (FE)	147	170	204	-13.5	-27.9
System Average Interruption Frequency Index (SAIFI)- outages/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-16	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	0.26	0.20	0.27	30.0	-3.7
Duquesne Light	0.85	1.17	1.40	-27.4	-39.3
Met-Ed (FE)	1.44	1.15	1.38	25.2	4.3
PECO	1.00	1.23	1.48	-18.7	-32.4
Penelec (FE)	1.43	1.26	1.52	13.5	-5.9
Penn Power (FE)	1.09	1.12	1.34	-2.7	-18.7
Pike County	0.38	0.61	0.82	-37.7	-53.7
PPL	0.78	0.98	1.18	-20.4	-33.9
UGI	0.63	0.83	1.12	-24.1	-43.8
Wellsboro	1.84	1.23	1.66	49.6	10.8
West Penn (FE)	1.08	1.05	1.26	2.9	-14.3
System Average Interruption Duration Index (SAIDI)- min/yr/cust				% Above (+) or	% Above (+) or
EDC	Dec-16	Benchmark	Standard	Below (-) Benchmark	Below (-) Standard
Citizens'	28	21	38	33.3	-26.3
Duquesne Light	70	126	182	-44.4	-61.5
Met-Ed (FE)	178	135	194	31.9	-8.2
PECO	106	138	198	-23.2	-46.5
Penelec (FE)	171	148	213	15.5	-19.7
Penn Power (FE)	104	113	162	-8.0	-35.8
Pike County	87	106	194	-17.9	-55.2
PPL	94	142	205	-33.8	-54.1
UGI	78	140	256	-44.3	-69.5
Wellsboro	172	153	278	12.4	-38.1
West Penn (FE)	159	179	257	-11.2	-38.1

*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 2014-2016

Customer Average Interruption Duration Index (CAIDI)-min/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2014*	*2015*	*2016*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	88	91	108	96	115	-16.8
Duquesne Light	102	95	82	93	119	-21.8
Met-Ed (FE)	128	113	124	122	129	-5.7
PECO	96	84	106	95	123	-22.5
Penelec (FE)	118	140	120	126	129	-2.3
Penn Power (FE)	106	100	95	100	111	-9.6
Pike County	106	205	228	180	192	-6.4
PPL	180	118	121	140	160	-12.7
UGI	144	103	125	124	186	-33.3
Wellsboro	75	76	94	82	136	-40.0
West Penn (FE)	137	154	147	146	187	-21.9

System Average Interruption Frequency Index (SAIFI)-outages/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2014*	*2015*	*2016*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	0.19	0.19	0.26	0.21	0.22	-3.0
Duquesne Light	0.62	0.75	0.85	0.74	1.29	-42.6
Met-Ed (FE)	1.11	1.19	1.44	1.25	1.27	-1.8
PECO	0.86	0.72	1.00	0.86	1.35	-36.3
Penelec (FE)	1.55	1.36	1.43	1.45	1.39	4.1
Penn Power (FE)	1.11	1.14	1.09	1.11	1.23	-9.5
Pike County	2.12	0.38	0.38	0.96	0.67	43.3
PPL	0.92	0.72	0.78	0.81	1.08	-25.3
UGI	0.44	0.40	0.63	0.49	0.91	-46.2
Wellsboro	0.77	1.06	1.84	1.22	1.35	-9.4
West Penn (FE)	1.02	1.17	1.08	1.09	1.16	-6.0

System Average Interruption Duration Index (SAIDI)-min/yr/cust				*3-Year*	*3-Year*	*% Above (+) or*
EDC	*2014*	*2015*	*2016*	*Average*	*Standard*	*Below (-) Standard*
Citizens'	17	18	28	21	25	-16.0
Duquesne Light	63	71	70	68	153	-55.6
Met-Ed (FE)	141	136	178	152	163	-7.0
PECO	82	61	106	83	167	-50.3
Penelec (FE)	183	191	171	182	179	1.5
Penn Power (FE)	118	114	104	112	136	-17.6
Pike County	224	78	87	130	129	0.5
PPL	165	84	94	114	172	-33.5
UGI	63	41	78	61	170	-64.3
Wellsboro	57	81	172	103	185	-44.1
West Penn (FE)	139	179	159	159	217	-26.7

*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 2015, effective January 1, 2017- December 31, 2018

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 year 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 year rather than 1 to 2-year cycle	Approved previously in the Jan. 1, 2013- Dec. 31, 2014 I&M Plan.
UGI	None	n/a

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 approval in the Jan. 1, 2017- Dec. 31, 2018 I&M Plan
Wellsboro	Pole loading calculations	Approved previously in the Jan. 1, 2012- Dec.31, 2013 I&M Plan

Pennsylvania Public Utility Commission