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E-FILE

April 28, 2023

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, Pennsylvania 17120

**Re: PPL Electric Utilities Corporation
2022 Annual Reliability Report
Docket No. M-2016-2522508**

Dear Ms. Chiavetta:

Enclosed for filing on behalf of PPL Electric Utilities Corporation ("PPL Electric") is PPL Electric's 2022 Annual Reliability Report to the Pennsylvania Public Utility Commission. This report is being filed pursuant to the Commission's regulations at 52 Pa. Code § 57.195(a).

As required by the Commission's regulations, copies of the enclosed report have been served upon the Office of Consumer Advocate ("OCA") and the Office of Small Business Advocate ("OSBA").

Pursuant to 52 Pa. Code § 1.11, the enclosed document is to be deemed filed on April 28, 2023, which is the date it was filed electronically with the Commission's E-Filing System.

If you have any questions regarding the enclosed report, please call me or Nikki Jones, PPL Electric's Senior Director - Public and Regulatory Affairs, at (717) 603-4029.

Respectfully submitted,

A handwritten signature in blue ink that reads "Kimberly A. Klock". The signature is fluid and cursive, with the first name being the most prominent.

Kimberly A. Klock

Enclosures

cc via email: Patrick Cicero, Esquire
NazAarah Sabree

Mr. Daniel Searfoorce
Mr. Harry Bidelspach



**PPL Electric Utilities Corporation
2022 Annual Reliability Report
to the
Pennsylvania Public Utility Commission**

April 28, 2023

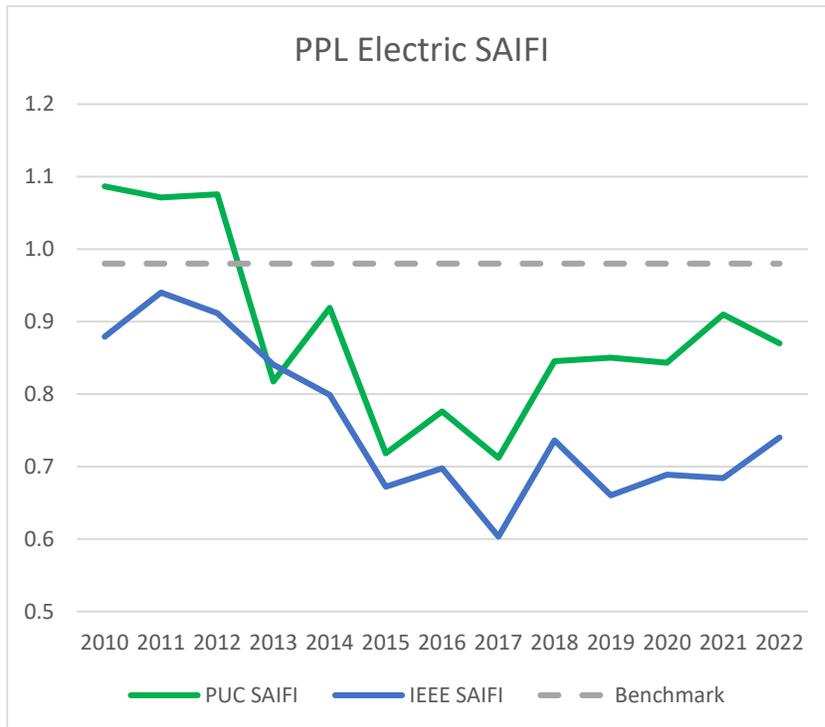
1) ***An overall current assessment of the state of the system reliability in the EDC's service territory including a discussion of the EDC's current programs and procedures for providing reliable electric service.***

SAIFI Performance

In 2022, PPL Electric customers continued to experience industry top quartile reliability performance during a year with the second highest total number of storms on record. PUC SAIFI finished at 0.87, or 11% below PUC benchmark, our 10th consecutive year below benchmark.

IEEE SAIFI finished at 0.74 which is expected to be top quartile industry performance among large electric utilities nationally, and potentially top decile.

Our ongoing focus around preventing customer interruptions through system automation, vegetation management and asset performance continues to directly support overall strong reliability results, with over 1.6 million outages saved since the inception of automation in 2017. This level of SAIFI performance is directly related to our high levels of customer satisfaction, with outages being reduced by 19% (IEEE and PUC) since 2012 as shown in the SAIFI graph below.



PPL Electric continues to drive high levels of reliability performance through:

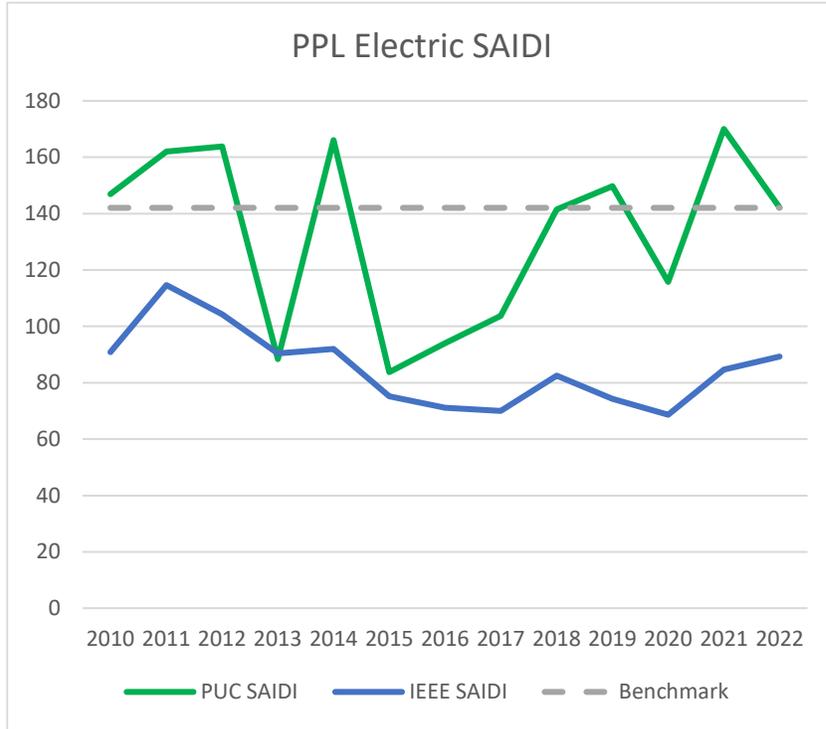
- Commitment to providing safe, reliable, affordable service to our customers.
- Strategic vegetation management program.
- Continued strategic investment in distribution automation technology such as:
 - Multi and single-phase Smart Grid Initiative.
 - Increased leverage of our Automated Distribution Management System (ADMS).
 - Full implementation of Fault Isolation and System Restoration (FISR) technology automatically restoring more than 1.6 million customers since 2015.
- Strategic data-driven reliability investments including asset replacement, and system improvements that include storm hardening standards.
- An increased focus on remediating momentary outages before they become permanent outages.
- Continued focus on outage response improvements.
- Moving to data driven condition based maintenance programs

2022 results were achieved in a year of near record storm frequency and intensity. 2022 saw 36 total storms, the second most on record. 2022 further saw the near record PUC storm cases, customers, and minutes.

Year	Non Reportable Storms	PUC Major Events	PUC Storms	Total Storms	PUC Storm Cases	PUC Storm CI	PUC Storm CMI
2002	12	1	7	20	3,787	448,916	99,462,247
2003	8	4	1	13	998	82,650	14,689,512
2004	14	0	4	18	2,882	302,418	97,539,670
2005	9	1	4	14	2,088	203,184	41,309,452
2006	19	0	9	28	5,067	547,811	148,541,051
2007	22	1	5	28	3,973	427,012	98,060,819
2008	20	0	7	27	3,952	443,305	137,727,147
2009	16	0	4	20	2,692	257,598	52,777,061
2010	19	0	10	29	4,239	410,544	103,813,180
2011	24	3	6	33	3,327	382,914	111,501,018
2012	16	1	8	25	2,690	365,386	113,548,058
2013	13	0	3	16	1,112	127,021	26,326,830
2014	11	0	5	16	3,250	294,917	132,991,117
2015	19	0	1	20	1,015	167,931	28,418,978
2016	20	0	4	24	2,696	266,922	54,674,446
2017	16	0	10	26	3,000	258,504	71,286,608
2018	17	1	5	23	3,952	305,482	110,654,537
2019	16	0	10	26	5,339	409,578	131,734,085
2020	19	0	8	27	6,446	460,988	98,853,825
2021	27	0	15	42	10,230	616,913	177,625,959
2022	27	0	9	36	7,861	514,250	127,928,021

SAIDI Performance

2022 PUC SAIDI performance was well within standard, and effectively on benchmark at 142.2. IEEE SAIDI, which is more weather-normalized, shows 2022 SAIDI performance at 89.3 which is expected to be top quartile industry performance among large electric utilities nationally, and potentially top decile.

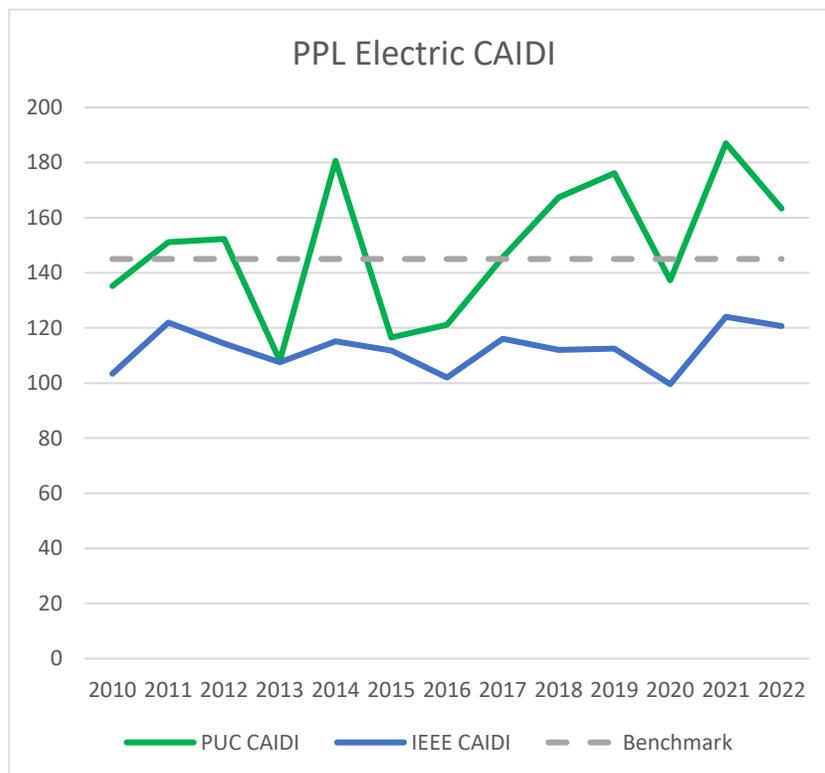


CAIDI Performance

In 2022 PUC CAIDI was heavily impacted by storms and was 12.7% above benchmark. 2022 CAIDI was improved over 2021 CAIDI by 24 minutes. Our more weather normalized IEEE CAIDI was 120.7, versus the non-weather normalized PUC value of 163.

With 2022 storms nearing record storm frequency and magnitude, along with automated systems preventing and converting outages to momentary interruptions, higher CAIDI values are not unexpected. However, several initiatives continue to be evaluated to improve CAIDI performance. Some of these strategic areas include:

- Optimize resource planning and scheduling.
- Setting Restore vs. Repair strategy early on in storm response.
- Resource Strategy/Optimization.
- Resource scheduling and prearranging resource availability.
- Leveraging data technology to isolate impact and dispatching of resources needed to address outages.



IEEE Metrics

PPL Electric’s IEEE Metrics are shown below. Note that weather events during 2022 had an impact on the volatility of our reliability metrics. The IEEE 1366 standard is a widely used methodology that allows for weather normalized performance evaluation that better reflects system performance during non-major storm events.

PPL Electric is consistently a first quartile SAIFI and SAIDI performer. The table below lists PPL Electric’s IEEE performance metrics compared to the 2021 (most recent available) performance quartiles for large utilities nationally, as issued by the IEEE annual reliability survey. PPL Electric’s continued focus on improving system reliability is directly related to its strong SAIFI and SAIDI performance. As a company on the forefront of automation, PPL Electric’s CAIDI is predictably a median performer.

	IEEE CAIDI	IEEE SAIFI	IEEE SAIDI
2017	116	0.60	70.0
2018	112	0.74	82.5
2019	113	0.66	74.3
2020	100	0.69	68.6
2021	124	0.68	84.6
2022	121	0.74	89.3
IEEE First Quartile Ceiling	103	0.88	100
IEEE Second Quartile Ceiling	117	1.09	139

Reliability Programs

It is PPL Electric’s continuing goal to achieve and maintain best in class levels of electric delivery service to its customers in a cost-effective manner. Maintenance programs are one of the key elements that focus on maintaining system and circuit reliability, equipment performance, and interruption prevention. The scope of these maintenance programs, procedures, and activities covers all areas of the electrical infrastructure.

These programs include:

Transmission

Transmission inspection programs include aerial patrols conducted via helicopter or UAV (Unmanned Aerial Vehicle). These patrols focus on comprehensive inspections and routine “stop and go” inspections for identification of maintenance work. Inspections focus on all transmission line equipment, including poles, arms, line switches, interrupters, arresters, grounding, guying, anchors, and other key components. Proactive replacement programs are in place to target specific risk areas (e.g. cellon treated wood poles, upswept wood arms, etc.) and to apply data-driven approaches to mitigate known reliability risks (e.g. avian interference, lightning performance, etc.).

Substation

Substation maintenance programs include inspections and overhauls of equipment, such as breakers, disconnects, power cables, and security equipment. Some equipment is

maintained on a time basis; other equipment is condition-monitored. These two methods help ensure that maintenance work is performed in a cost-effective manner and keep rates low for our customers. Besides time and condition-based maintenance, thermo-graphic inspections help ensure that substation equipment does not operate at elevated temperature levels for an extended period of time, which helps prevent equipment failure.

Distribution

Distribution programs encompass many maintenance aspects similar to transmission and substations, and also include load surveys that help engineers determine peak load requirements, circuit analyses for the identification of lines requiring maintenance work, voltage relief, or other capital improvements. Overhead line inspections identify damaged or deteriorated equipment that is repaired or replaced proactively. In addition, distribution maintenance includes inspections of poles, voltage regulators, line switches, capacitors, and other key distribution equipment. PPL Electric also tests underground cable to determine if the cable needs to be replaced, repaired or cured to prevent future failures.

Vegetation

The vegetation on PPL Electric's transmission and distribution rights-of-way (ROW) is maintained utilizing a combination of several management techniques. These include tree pruning, tree removal, and incompatible brush management. Lines are surveyed on a routine basis through a combination of remote-sensing technology and field observations. The work is scheduled and budgeted based on the conditions observed and past performance. Outside of the ROW, hazard trees with the potential to contact PPL facilities are evaluated for removal when possible.

Each of these programs is more fully described in Appendices A through D.

- 2) *A description of each major event that occurred during the year being reported on, including the time and duration of the event, the number of customers affected, the cause of the event and any modified procedures adopted in order to avoid or minimize the impact of similar events in the future.*

No major events occurred during 2022.

3) *A table showing the actual values of each of the reliability indices (SAIFI, CAIDI, SAIDI, and if available, MAIFI) for the EDC's service territory for each of the preceding 3 calendar years. The report shall include the data used in calculating the indices, namely the average number of customers served, the number of sustained customer interruptions, the number of customers affected, and the customer minutes of interruption. If MAIFI values are provided, the number of customer momentary interruptions shall also be reported.*

<i>Year</i>		2020	2021	2022¹	3 Yr. Avg.
SAIFI	BM 0.98	0.84	0.91	.87	.87
	STD 1.18	0.84	0.91	.87	.87
CAIDI	BM 145	137	187	163	162
	STD 174	137	187	163	162
SAIDI	BM 142	116	170	142	143
	STD 205	116	170	142	143
MAIFI		5.3	2.6	1.4	3.1
Customers Served²		1,438,204	1,445,611	1,451,712	1,445,175
Number of Sustained Customer Interruptions (Trouble Cases)		20,877	24,242	23,882	23,000
Number of Customers Affected		1,212,136	1,309,328	1,256,631	1,259,365
Customer Minutes of Interruptions (CMI)		166,414,603	245,413,282	206,385,043	206,070,976
Number of Customer Momentary Interruptions		7,639,856	3,817,912	2,020,520	4,492,762

¹ Any slight variations from data provided previously are the result of error corrections.

² PPL Electric calculates the annual indices using customers served at the end of the period. This is consistent with the method used to calculate PPL Electric's benchmarks.

- 4) *A breakdown and analysis of outage causes during the year being reported on, including the number and percentage of service outages, the number of customers interrupted, and customer interruption minutes categorized by outage cause such as equipment failure, animal contact, tree related, and so forth. Proposed solutions to identified service problems shall be reported.*

The table shows a breakdown of service outage causes for 2022. Service interruption definitions are provided in Appendix E. PPL Electric has maintenance programs to address controllable service outages. Those programs are detailed in Appendices A through D.

Cause Description	Trouble Cases	Percent of Trouble Cases	Customer Interruptions	Percent of Customer Interruptions	Customer Minutes	Percent of Customer Minutes
Animals	4,317	18.1%	84,480	6.7%	5,417,193	2.6%
Contact / Dig-In	162	0.7%	14,550	1.2%	1,140,639	0.6%
Directed by Non-PPL Authority	62	0.3%	5,464	0.4%	387,252	0.2%
Equipment Failures	5,727	24.0%	299,406	23.8%	32,545,324	15.8%
Improper Design	-	0.0%	-	0.0%	-	0.0%
Improper Installation	3	0.0%	92	0.0%	5,753	0.0%
Improper Operation	2	0.0%	859	0.1%	48,189	0.0%
Nothing Found	966	4.0%	59,760	4.8%	6,131,204	3.0%
Other Controllable	61	0.3%	11,113	0.9%	748,923	0.4%
Other Non-Control	181	0.8%	16,301	1.3%	1,328,304	0.6%
Other Public	25	0.1%	2,923	0.2%	296,898	0.1%
Tree Related	11,552	48.4%	630,045	50.1%	143,657,997	69.6%
Unknown	-	0.0%	-	0.0%	-	0.0%
Vehicles	824	3.5%	131,638	10.5%	14,677,367	7.1%
Total	23,882	100.0%	1,256,631	100.0%	206,385,043	100.0%

Analysis of causes contributing to the majority of service interruptions:

Weather Conditions: PPL Electric records weather conditions, such as wind or lightning, as contributing factors to service interruptions, but does not code them as direct interruption causes. Therefore, some fluctuations in cause categories, especially tree- and equipment-related causes, are attributable to weather variations. For the current reporting period, weather was considered a significant contributing cause in 50% of cases, 57% of customer interruptions, and 75% of CMI.

Tree Related: Vegetation is one of the largest single contributors to the number of cases of trouble, customer interruptions and customer minutes. For the current reporting period, approximately 79% of the cases of trouble, 81% of the customer interruptions and 90% of the customer minutes attributed to tree related outages were weather-related.

Animals: Animals accounted for approximately 18% of PPL Electric's cases of trouble. Although this represents a significant number of cases, the effect on SAIFI and CAIDI is small because approximately 74% of the number of cases of trouble were associated with individual distribution transformers. However, when animal contacts affect substation equipment, the effect may be widespread and potentially can interrupt thousands of customers on multiple circuits. In addition to guarding new distribution transformers and substations, PPL Electric initiated distribution and substation animal guarding programs in 2009 to focus systematically on protecting existing facilities most at risk of incurring animal-caused interruptions. A complete effectiveness review of this strategy is being evaluated.

Vehicles: Although vehicles cause a small percentage of the number of cases of trouble, they accounted for a large percentage of customer interruptions and customer minutes, because main distribution lines generally are located along major thoroughfares with higher traffic densities. In addition, vehicle-related cases often result in extended repair times to replace broken poles. PPL Electric has a program to identify and relocate poles that are subject to multiple vehicle hits.

Equipment Failure: Equipment failure is one of the largest single contributors to the number of cases of trouble, customer interruptions and customer minutes. However, approximately 37% of the cases of trouble, 43% of the customer interruptions and 54% of the customer minutes attributed to equipment failure were weather-related and, as such, are not considered to be strong indicators of equipment condition or performance.

Nothing Found: This description is recorded when the responding crew can find no cause for the interruption. That is, when there is no evidence of equipment failure, damage, or contact after a line patrol is completed. For example, during heavy thunderstorms, when a line fuse blows or a single-phase OCR locks open and when closed for test, the fuse holds, or the OCR remains closed, and a patrol reveals nothing.

5) *Specific remedial efforts taken to date and planned for circuits that have been on worst performing 5% of circuits list for a year or more.*

Twenty-four PPL Electric circuits have been on the worst performing circuit list for a year or more.

Circuit 26604 -- BROOKSIDE 66-04

Remedial Actions

- In 2022, additional fusing was installed.
- In 2022, a Smart Grid device was installed.
- In 2022, six single-phase reclosers were installed.
- In 2022, additional animal guarding was installed.
- In 2023, three existing reclosers will be replaced with single-phase reclosers.
- In 2023, additional animal guarding will be installed.
- In 2023, numerous porcelain cutouts will be replaced.
- In 2023, a section of difficult-to-access three-phase conductor will be relocated.
- In 2023, five single-phase reclosers will be installed.
- In 2024, a battery storage system will be installed on this circuit.
- In 2024, a section of this circuit will receive tree shielding cable.

Circuit 46001 -- BERWICK 60-01

Remedial Actions

- In 2022, full circuit trimming was performed.
- In 2022, additional fusing was installed.
- In 2022, several poles and cross-arms were replaced.
- In 2022, an additional single-phase recloser was installed.
- In 2022, a section of difficult-to-access conductor was eliminated, and the downstream customers transferred to an adjacent circuit.
- In 2023, a new three-phase tie will be constructed.
- In 2023, a section of this circuit will be evaluated for reconductoring and relocation.
- In 2024, a new single-phase tie will be constructed.
- In 2025, a new line and terminal will be constructed for this circuit.

Circuit 47002 -- HUGHESVILLE 70-02

Remedial Actions

- In 2022, an existing recloser was replaced with a Smart Grid device.
- In 2022, an existing cutout was replaced.
- In 2023, a section of difficult-to-access single-phase will be evaluated for relocation.
- In 2024, several sections of this circuit will be storm hardened.

Circuit 11506 -- FREEMANSBURG 15-06

Remedial Actions

- In 2022, full circuit trimming was performed.
- In 2022, additional single-phase reclosers were installed.
- In 2022, clearances were increased on a section of conductor.
- In 2023, a section of this circuit will be reconfigured.
- In 2023, a section of this circuit will be reconductored.
- In 2023, additional fusing will be installed.
- In 2024, a new substation will be built that will improve transfer capability for this circuit.
- In 2024, the circuit will be split to reduce loading.

Circuit 15001 -- BLUE MOUNTAIN 50-01

- In 2022, four additional single-phase reclosers were installed.
- In 2022, additional fusing was installed.
- In 2022, the protection scheme was evaluated. Several protection settings will be revised as a result.
- In 2023, a pole was replaced.
- In 2023, additional fusing will be installed.
- In 2023, additional animal guarding will be installed.
- In 2024, an additional single-phase recloser will be installed.
- In 2024, a section of this circuit will be transferred to an adjacent circuit.
- In 2024, a Proactive Circuit Analysis will be performed.

Circuit 53601 -- DALMATIA 36-01

Remedial Actions

- In 2023, additional fusing will be installed.
- In 2023, a single-phase recloser will be relocated.
- In 2023, a section of three-phase will be evaluated for reconductoring.
- In 2023, a three-phase device will be upgraded to remote operability.
- In 2025, a three-phase tie will be constructed to the HUNTER circuit.

Circuit 56501 -- ROCKVILLE 65-01

Remedial Actions

- In 2022, working with the local borough, guide rail was installed to protect a pole which had previously been struck by a vehicle.
- In 2022, 547 danger trees were removed.
- In 2023, additional animal guarding will be installed.
- In 2023, a single-phase tie will be evaluated.
- In 2023, two new fuses will be installed.
- In 2023, three additional three-phase sectionalizing devices will be installed.
- In 2023, a new three-phase recloser will be evaluated.
- In 2024, full circuit trimming will be performed.
- In 2025, a three-phase tie will be installed.

Circuit 25801 -- SULLIVAN TRAIL 58-01

Remedial Actions

- In 2022, hazard tree removal was performed.
- In 2022, a Proactive Circuit Analysis was performed with several minor remediations performed.
- In 2023, additional fusing will be installed.
- In 2023, additional hazard tree removal will be evaluated.
- In 2023, a section of heavily wooded conductor will be evaluated for undergrounding.

Circuit 10601 -- BLOOMING GLEN 06-01

Remedial Actions

- In 2022, additional fusing was installed at nine locations.
- In 2022, two single-phase reclosers were installed.
- In 2022, hot spot trimming was performed.
- In 2022, a section of inaccessible conductor was re-sourced.
- In 2022, full circuit trimming was performed.
- In 2022, a section of this circuit was re-conducted.
- In 2023, additional animal guarding will be installed.
- In 2023, additional fusing will be installed.
- In 2023, an additional single-phase recloser will be installed.
- In 2023, a section of conductor will be evaluated for relocation.
- In 2023, an additional multi-phase tie line will be evaluated.
- In 2024, a section of this circuit will be relocated.
- In 2024, two additional multi-phase protective devices will be installed.

Circuit 10904 -- COOPERSBURG 09-04

Remedial Actions

- In 2022, five additional single-phase reclosers were installed.
- In 2022, additional trimming was performed.
- In 2022, a section of difficult-to-access single-phase was relocated.
- In 2022, a single-phase recloser was upgraded.
- In 2022, predictive fault indicators were installed.
- In 2022, a three-phase recloser was replaced.
- In 2023, additional animal guarding will be installed.
- In 2023, an additional single-phase recloser will be evaluated.
- In 2023, additional fusing will be installed.
- In 2023, a section of conductor in a heavily wooded area will be evaluated for reconductoring with covered conductor.
- In 2023, a section of this circuit will be evaluated for reconfiguration.
- In 2025, a new substation will be constructed at a new location.

Circuit 47001 -- HUGHESVILLE 70-01

Remedial Actions

- In 2022, additional single-phase reclosers were installed.
- In 2022, voltage regulators were installed.
- In 2022, full circuit trimming was performed.
- In 2023, additional animal guarding will be installed.
- In 2024, a section of single-phase will be relocated to underground.

Circuit 64201 -- KINZER 42-01

Remedial Actions

- In 2022, an existing tie switch was replaced with a Smart Grid device.
- In 2022, additional animal guarding was installed.
- In 2022, additional fusing was installed.
- In 2023, additional fusing will be installed at two locations.
- In 2023, a single-phase tie will be evaluated.
- In 2023, resourcing a section of conductor will be evaluated.
- In 2023, several poles will be evaluated for relocation.
- In 2024, full circuit trimming will be performed.

Circuit 43201 -- MILLVILLE 32-01

Remedial Actions

- In 2022, a section of difficult-to-access conductor was relocated.
- In 2022, two additional single-phase reclosers were installed.
- In 2023, a section of single-phase will be evaluated for additional sectionalizing.
- In 2023, full circuit trimming will be performed.
- In 2023, a section of single-phase will be transferred to an adjacent circuit.
- In 2024, a section of conductor will be relocated underground.
- In 2024, a section of three-phase conductor will be reconducted and storm hardened.

Circuit 28602 -- BLYTHEBURN 86-02

Remedial Actions

- In 2022, additional animal guarding was installed.
- In 2022, an additional Smart Grid device was installed.
- In 2022, a Proactive Circuit Analysis was performed with several minor remediations performed.
- In 2022, hazard tree removal was performed.
- In 2023, three single-phase reclosers will be installed.
- In 2024, full circuit trimming will be performed.
- In 2024, two single-phase ties will be constructed with five additional reclosers added.
- In 2025, a three-phase tie line will be constructed.

Circuit 56802 -- BENVENUE 68-02

Remedial Actions

- In 2022, additional fusing was installed.
- In 2022, a section of single-phase was relocated and reconfigured.
- In 2022, two single-phase reclosers were installed.
- In 2023, a single-phase tie line will be evaluated.
- In 2023, full circuit trimming will be performed.
- In 2023, a recloser will be upgraded for remote operability.
- In 2025, a section of single-phase will be relocated underground.

Circuit 45402 -- WEST BLOOMSBURG 54-02

Remedial Actions

- In 2022, six single-phase reclosers were installed.
- In 2022, full circuit trimming was performed.
- In 2023, additional sectionalizing will be evaluated.
- In 2023, a single-phase tie will be evaluated.
- In 2023, additional animal guarding will be installed.
- In 2023, additional fusing will be installed.
- In 2023, a section of difficult-to-access conductor will be relocated underground.
- In 2023, an additional single-phase recloser will be installed.
- In 2024, additional reconductoring and storm hardening will be performed.

Circuit 55001 -- NEWPORT 50-01

Remedial Actions

- In 2022, a 2.1-mile section of three-phase conductor in a heavily wooded area was relocated.
- In 2022, three fuses were installed.
- In 2022, a section of single-phase was reconductored.
- In 2022, 75 hazard trees were removed.
- In 2023, a single-phase tie will be evaluated.
- In 2023, a section of single-phase will be resourced.
- In 2025, an additional three-phase sectionalizing device will be installed.
- In 2025, a section of single-phase will be reconductored.

Circuit 55002 -- NEWPORT 50-02

Remedial Actions

- In 2022, a single-phase recloser was installed.
- In 2022, an additional animal guard was installed.
- In 2022, a section of three-phase was inspected by drone, with several minor remediations completed.
- In 2023, a new three-phase sectionalizing device will be evaluated.
- In 2023, two single-phase ties will be evaluated.
- In 2023, a three-phase tie will be evaluated.
- In 2024, full circuit trimming will be performed.

Circuit 17803 -- GILBERT 78-03

Remedial Actions

- In 2022, three poles were replaced.
- In 2022, two single-phase reclosers were installed.
- In 2022, a Smart Grid device was replaced.
- In 2022, numerous porcelain cutouts were replaced.
- In 2022, full circuit trimming was performed.
- In 2023, additional animal guarding will be installed.
- In 2023, three single-phase reclosers will be installed.

Circuit 54701 -- NEW BLOOMFIELD 47-01

Remedial Actions

- In 2022, three additional fuses were installed.
- In 2022, five single-phase reclosers were installed.
- In 2022, an additional sectionalizing device was installed.
- In 2022, hazard tree removal was performed.
- In 2023, a single-phase tie will be evaluated.
- In 2023, additional fusing will be installed.
- In 2023, a section of single-phase will be reconfigured.
- In 2023, relocating a section of single-phase will be evaluated.
- In 2025, two sections of single-phase will be relocated underground.

Circuit 52402 -- GREEN PARK 24-02

Remedial Actions

- In 2022, full circuit trimming was performed.
- In 2022, two additional single-phase reclosers were installed.
- In 2022, a section of single-phase was relocated.
- In 2022, a section of single-phase was reconducted.
- In 2022, two sections of single-phase were re-sourced.
- In 2023, two single-phase reclosers were installed.
- In 2023, additional animal guarding will be installed.
- In 2023, a new battery storage installation will be installed.
- In 2024, a single-phase recloser will be installed.
- In 2025, ten additional sectionalizing devices will be installed.
- In 2025, a substation conversion will be performed.
- In 2025, several sections of single-phase will be storm hardened.

Circuit 17802 -- GILBERT 78-02

Remedial Actions

- In 2022, a single-phase recloser was installed.
- In 2022, full circuit trimming was performed.
- In 2022, hot spot trimming was performed.
- In 2022, several poles were replaced or relocated.
- In 2023, additional animal guarding will be installed.
- In 2023, two sections of difficult-to-access single-phase will be relocated.
- In 2023, three single-phase reclosers will be installed.

Circuit 21901 -- HUMBOLDT 19-01

Remedial Actions

- In 2022, a single-phase tie was constructed.
- In 2022, an existing three-phase recloser was upgraded to remote operability.
- In 2023, a single-phase tie to the GIRARD MANOR 24-01 will be constructed.
- In 2023, thirty-three additional fuses will be installed.
- In 2023, eleven additional reclosers will be installed.

Circuit 26001 -- WEST DAMASCUS 60-01

Remedial Actions

- In 2022, two additional single-phase reclosers with downstream fusing were installed.
- In 2022, several poles and cross-arms were replaced.
- In 2022, additional fusing was installed.
- In 2023, full circuit trimming will be performed.
- In 2023, additional animal guarding will be installed.
- In 2023, several poles will be replaced.

- 6) *A comparison of established transmission and distribution inspection and maintenance goals/objectives versus actual results achieved during the year being reported on. Explanations of any variances shall be included.*

Inspection & Maintenance Goals/Objectives	2022		Variance (%)
	Budget	Actual	
Transmission			
Transmission C-tag poles (# of structures)	54	54	0.0%
Transmission arm replacements (# of arms)	40	40	0.0%
Transmission air break switch inspections (# of switches)	1	1	0.0%
Transmission surge arrester installations (# of sets)	541	541	0.0%
Transmission structure inspections (# of activities)	8,627	8,627	0.0%
Transmission tree side trim-Bulk Power (linear feet)			
Transmission herbicide-Bulk Power (# of acres)			
Transmission reclearing (# of miles) BES Only	563	563	0.0%
Transmission reclearing (# of miles) 69 kV	1004	1004	0.0%
Transmission reclearing (# of miles) 138 kV	57	57	0.0%
Transmission danger tree removals-Bulk Power (# of trees)			
Substation			
Substation batteries (# of activities)	386	417	8.0%
Circuit breakers (# of activities)	423	36	-91.5%
Substation inspections (# of activities)	1,862	1,624	-12.8%
Transformer maintenance (# of activities)	126	112	-11.1%
Distribution			
Distribution C-tag poles replaced (# of poles)	1,238	1,845	49.0%
C-truss distribution poles (# of poles)	1,400	1,438	2.7%
Capacitor (MVAR added)	39.9	39.9	0.0%
OCR Replacements (# of)	0	2	
Distribution pole inspections (# of poles)	64,370	56,625	-12.0%
Distribution line inspections (miles)	2,200	2,200	0.0%
Group re-lamping (# of lamps)	24,100	0	-100.0%
Test sections of underground distribution cable	649	649	0.0%
Distribution tree trimming (# of miles)	4,288	4,314	0.6%
Distribution herbicide (# of acres)	422	422	0.0%
Distribution >18" removals within R/W (# of trees)	4,422	4,422	0.0%
Distribution hazard tree removals outside R/W (# of trees)		7,412	
LTN manhole inspections (# of)	326	163	-50.0%
LTN vault inspections (# of)	361	107	-70.4%
LTN network protector overhauls (# of)	84	17	-79.8%
LTN reverse power trip testing (# of)	28	5	-82.1%

Explanation of variances greater than 10%:

Substation

Circuit Breakers (# of Activities): Circuit breaker maintenance activities were deferred to 2023 to allow higher priority maintenance activities to be performed.

Substation Inspections (# of Activities): In the year-to-date actual count provided in fourth quarter 2022, Substation Infrared Inspections were inadvertently not included. Adding in these sub inspection activities brings the total activities to 1805, which is within the 10% margin.

Transformer Maintenance (# of Activities): Some Transformer Maintenance activities were deferred to 2023 to allow higher priority maintenance activities to be performed.

Distribution

Distribution C-Tag Poles replaced: Lower unit costs allowed more work to be completed.

OCR Replacements: Two additional failures were replaced.

Distribution Pole Inspections (# of poles): There was a strategic deferral implemented for poles with fourth quartile WPC rankings.

Group Relamping: Deferred for higher priority work.

LTN Manhole Inspections: Some manhole inspection jobs with a low reliability impact were deferred.

LTN Vault Inspections: Some vault inspection jobs with a low reliability impact were deferred.

LTN Network Protector Overhauls: Some network protector overhaul jobs with a low reliability impact were deferred.

LTN Reverse Power Trip Testing: Some reverse power trip testing jobs with a low reliability impact were deferred.

7) *A comparison of budgeted versus actual transmission and distribution operation and maintenance expenses for the year being reported on in total and detailed by the EDC's own functional account code or FERC account code as available. Explanations of any variances 10% or greater shall be included.*

The following table provides operation and maintenance expenses for PPL Electric, and includes the work identified in the response to Item (6).

Activity	2022 Budget (\$000)	2022 Actual (\$000)	Variance (%)
Provide Electric Service	5,799	7,477	29%
Vegetation Management	33,292	47,690	43%
Customer Response	60,906	71,546	18%
Reliability Maintenance	21,217	25,187	19%
System Upgrade	3,870	543	-86%
Customer Service/Accounts	109,576	141,940	30%
Others	63,970	74,760	17%

Explanation of variances of 10% or greater:

Provide Electric Service – Higher volume of new service requests than budgeted.

Veg Management – Increased vegetation spending driven by power service problems, Data Directed Maintenance, and customer requests.

Customer Response - Higher than projected driven by number of storms.

Reliability Maintenance – Higher than projected costs due to substation planned and unplanned maintenance.

System Upgrade - Lower than projected costs related to System Facilities Upgrade

Customer Service/Accounts – Higher than projected costs due to increase in residential accounts receivable. Also driven by increased call volumes associated with significant price increases in energy in 2022.

Other – Driven by pension income reclassification to other income, and lifestyle account funding.

- 8) *A comparison of budgeted versus actual transmission and distribution capital expenditures for the year being reported on in total and detailed by the EDC's own functional account code or FERC account code as available. Explanations of any variances 10% or greater shall be included.*

The following table provides capital expenditures for PPL Electric which includes transmission and distribution activities.

Activity	2022 Budget (\$000)	2022 Actual (\$000)	Variance (%)
New Service/Revenue	92,169	118,071	28%
System Upgrade	205,389	215,325	5%
Reliability & Maintenance	500,801	453,725	9%
Customer Response	34,262	50,467	47%
Other	27,172	31,191	15%

Explanation of variances of 10% or greater:

New Service/Revenue – Consistent with higher volume of new service requests.

Customer Response - Higher than projected driven by number of storms.

Other – Driven by the acceleration of two large projects from 2023 to late 2022.

Quantified transmission and distribution inspection and maintenance goals/objectives for the current year detailed by system area (that is, transmission, substation and distribution).

Inspection & Maintenance Goals/Objectives	2023 Budget
Transmission	
Transmission C-tag poles (# of poles)	88
Transmission arm replacements (# of sets)	18
Transmission air break switch inspections (# of switches)	0
Transmission surge arrester installations (# of sets)	72
Transmission structure inspections (# of activities)	14,524
Transmission tree side trim-Bulk Power (linear feet)	N/A
Transmission herbicide-Bulk Power (# of acres)	N/A
Transmission reclearing (# of miles) BES Only	901
Transmission reclearing (# of miles) 69 kV	1,651
Transmission reclearing (# of miles) 138 kV	57
Transmission danger tree removals-Bulk Power (# of trees)	N/A
Substation	
Substation batteries (# of activities)	457
Circuit breakers (# of activities)	223
Substation inspections (# of activities)	1,460
Transformer maintenance (# of activities)	786
Distribution	
Distribution C-tag poles replaced (# of poles)	1,800
C-truss distribution poles (# of poles)	2,400
Capacitor (MVAR added)	N/A
OCR Replacements (# of)	33
Distribution pole inspections (# of poles)	80,000
Distribution line inspections (miles)	400
Group re-lamping (# of lamps)	0
Test sections of underground distribution cable	N/A
Distribution tree trimming (# of miles)	5,261
Distribution herbicide (# of acres)	N/A
Distribution >18" removals within R/W (# of trees)	N/A
Distribution hazard tree removals outside R/W (# of trees)	N/A
LTN manhole inspections (# of)	0
LTN vault inspections (# of)	70
LTN network protector overhauls (# of)	48
LTN reverse power trip testing (# of)	33

10) Budgeted transmission and distribution operation and maintenance expenses for the current year in total and detailed by the EDC's own functional account code or FERC account code as available.

The following table provides budgeted operation and maintenance expenses for PPL Electric and includes the work identified in the response to Item (9).

Activity	2023 Budget (\$000)
Provide Electric Service	4,867
Vegetation Management	32,144
Customer Response	55,137
Reliability Maintenance	16,632
System Upgrade	2,144
Customer Service/Accounts	100,417
Others	64,476
Total O&M Expenses	275,818

11) Budgeted transmission and distribution capital expenditures for the current year and detailed by the EDC's own functional account code or FERC account code as available.

The following table provides budgeted capital expenditures for PPL Electric and includes transmission and distribution activities.

Activity	2023 Budget (\$000)
New Service/Revenue	81,753
System Upgrade	255,756
Reliability & Maintenance	365,545
Customer Response	44,107
Other	22,024
Total	769,185

12) Significant changes, if any, to the transmission and distribution inspection and maintenance programs previously submitted to the Commission.

No significant changes were requested.

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***PPL Electric Utilities Corporation
Transmission Programs & Procedures***

Program	Activity
Helicopter Inspections – Routine	Aerial linemen perform annual routine transmission line patrols from a helicopter. They identify damaged or deteriorated equipment. Engineers review the findings and develop plans for repair or replacement.
Helicopter Inspections – Comprehensive	Aerial linemen perform an overhead comprehensive inspection of transmission line facilities on a risk-based time cycle. Detailed condition reports with close up digital photos are prepared for each specific component problem found along the transmission line and right of way. Engineers review the findings and schedule corrective maintenance as needed.
Helicopter Inspections – Emergency	Aerial linemen perform patrols of transmission lines that operate abnormally. This inspection focuses on identifying damage that may have been caused by lightning, inclement weather, equipment failure or vandalism. Because of the nature of this work, corrective actions are usually expedited.
Field Inspections – Emergency	Line personnel perform emergency foot patrols to inspect transmission lines that operated abnormally. This inspection focuses on identifying damage that may have been caused by lightning, inclement weather, equipment failure or vandalism. Due to the nature of this damage, corrective actions are generally expedited.
Steel Structure Inspection/Repair	Personnel inspect steel structures at the ground line for corrosion, mechanical damage and foundation degradation. Structural components are coated, and repairs are made based on the findings of the inspections as necessary.
Equipment Maintenance	During helicopter and foot patrols, equipment and facilities are identified that require repairs. Based on need and criticality, repairs are either scheduled or completed as soon as possible.
Planned Replacement Programs	Lightning arresters and avian guards are installed on targeted 69kV and 138kV facilities based on a data-driven risk analysis to improve reliability of worst performing circuits.
Line Switches – Maintenance & Inspection	Line personnel inspect, maintain, and perform operational tests on 138kV and 69kV transmission line switches to assure proper operation.

Appendix A

Program	Activity
Line Switch Upgrades	Transmission line switches are being programmatically upgraded to include motor operators to allow for remote sectionalizing that substantially improves switching times during outages.
Circuit Analysis	Engineers analyze circuit loading and performance to identify areas needing increased line capacity or improved line reliability. Circuits are also reviewed based on operational performance and ranked yearly in a WPC list, with appropriate circuits identified for targeted reliability improvements.

***PPL Electric Utilities Corporation
Substation Programs & Procedures***

Program	Activity
Load Survey	Automatic monitoring devices such as Supervisory Control and Data Acquisition (SCADA) provide continuous, real-time loading information. Engineers review equipment loading and identify facilities and transfer capabilities approaching capacity limits. A portion of the load may be supplied from a different source, the existing facilities may be upgraded, new lines and equipment may be added, or a new substation may be built to address capacity deficiencies.
Substation Inspection/Repair	Electricians inspect substations for security and equipment reliability on a time based maintenance cycle. They attempt to identify and correct potential equipment problems before a failure or interruption of service occurs.
Equipment Service	Electricians perform operational tests on power transformers, load tap changers (LTC), voltage regulators, circuit breakers, circuit switchers, vacuum switches, air break switches and transformer protective switches on a time based maintenance cycle to assure that equipment is operating within established parameters. Equipment serviced includes batteries, battery chargers, protective relays, HV fuses and high-speed automatic grounding switches. Depending on the type of equipment, “service” can include actions other than operational testing.
Inspection & Overhaul	Electricians inspect and overhaul circuit breakers, wave traps, ground switches, stick-operated disconnects, gang-operated disconnects and motor-operated disconnects on a time based maintenance cycle to assure proper operation.
Insulation Testing	Technicians perform power factor testing on power transformers, potential transformers, lightning arresters, current transformers, select circuit breakers and power cables on a time-based maintenance cycle. Testing also includes other instrument transformers (capacitance coupled voltage transformer, coupling capacitors, potential devices, etc.). They also perform high-potential testing on 12kV oil, air and vacuum circuit breakers to assure proper operation.

Appendix B

Program	Activity
Condition Monitoring of Station Equipment	Technicians perform dissolved gas-in-oil, dielectric, oxygen, and oil acidity tests for oil in power transformers and impedance and capacity tests on station batteries to assure equipment is within normal parameters. Periodically, AC power factor tests, hi-potential tests, contact resistance tests and motion tests are performed on circuit breakers. Oil dielectric testing is conducted for oil circuit breakers.
Thermographic Inspections	Technicians perform thermography surveys of substation facilities to identify components operating at elevated temperature. Based on the findings, engineers develop plans to repair or replace the component(s) prior to failure.
Minor Improvements	Maintenance activities may identify conditions where additions or upgrades are needed to assure reliability. Engineers evaluate the need and develop action plans and schedules to complete the work.
DC Station Service Improvements	Repairmen identify deteriorated station batteries, battery chargers and battery components. Engineers schedule repair or replacement as necessary.
Capacitor Bank Protection	Engineers monitor the need for synchronous closing schemes on vacuum switches on 69kv capacitor banks. They plan and schedule installations as needed.
Area/Regional Supply	Engineers develop specific projects aimed at improving capacity shortfalls or replacing deteriorated or substandard station equipment.
SCADA Replacement	Engineers identify deteriorating substation SCADA equipment and develop plans to repair or replace it.

***PPL Electric Utilities Corporation
Distribution Programs & Procedures***

Program	Activity
Load Survey – of equipment that is not continuously monitored	Line personnel measure the loading of facilities during peak periods. Engineers use this data for system studies.
Load Survey – by automatic monitoring devices	Automatic monitoring devices such as SCADA provide continuous, real-time loading information. Operators use this data to assure that loads do not exceed design limits. Engineers use this data for system studies.
Circuit Analysis	Engineers analyze circuit voltage profiles to balance loads and to identify areas requiring voltage support to maintain required voltage at the customer facility.
Voltage Regulator – Inspection & Maintenance	Inspectors examine existing equipment for potential failure, and inspect and maintain controls and tap changers to assure proper operation. Line personnel repair or replace any defective equipment.
Overhead Line Switch – Inspection & Maintenance	Inspectors examine switch installations to identify cracked or broken insulators / bushings, stuck or misaligned blades, insulation or gasket deterioration or other operational problems. Line personnel repair or replace any defective equipment.
Transformer Maintenance	Engineers analyze customer usage data to identify overloaded transformers. Transformers that are heavily loaded are replaced with higher capacity units or part of the load is transferred to other nearby transformers.
Wood Pole – Inspection, Maintenance, Replacement, Trussing, Fiber Wrap (reinforcement)	Inspectors examine wood poles for deterioration and measure the degree of rot. Based on the results, the pole is either scheduled for a future inspection, reinforcement for extended life or replacement.
Overhead Line Inspection	Inspectors examine overhead facilities to identify damaged, deteriorated or substandard equipment. Line personnel repair or replace any defective equipment. Includes visual and thermographic inspections.
Circuit Performance Review	Engineers use PPL Electric’s WPC score to ascertain the need for additional circuit reviews or inspections. The improved index looks at a circuit’s overall impact to system SAIFI and circuit SAIDI. Actual service interruption history is analyzed to identify causal or geographic patterns.

Appendix C

Program	Activity
Underground Primary Cable – Testing, Maintenance, Replacement, Curing	Inspectors perform insulation and neutral tests on cable in residential developments with potential problems to identify deteriorated cable. Based on the results, the cable is placed back in service, repaired or replaced.
LTN Maintenance	Electricians will inspect, service, maintain and overhaul LTN vaults, manholes, cables, transformers, low voltage network protectors and primary transformer disconnect switches. Based on results, defective equipment is either repaired or replaced.
Public Damaged Facilities Review	A program aimed at identifying the locations of facilities that have been damaged by public contact more than once. Technicians evaluate those installations and, if relocation is possible, schedule work to move the facilities.
Underground Service Cable	Engineers resolve customer service problems that are due to deteriorated service conductors.
Oil Circuit Reclosers	Line personnel replace in-service oil circuit reclosers conditionally.
Line Protection Equipment	Line personnel replace in-service three phase oil circuit reclosers with communicating vacuum devices conditionally.
Capacitor Installation	Engineers perform voltage profiles to determine the need, location and size of any new voltage support equipment required to maintain adequate service voltage levels at customer facilities and provide needed reactive support for system stability. Line personnel install the required equipment.
Upgrade System Facilities	Engineers determine the need for additional capacity and design new and upgraded facilities to assure system reinforcements are constructed by the time they are needed.

***PPL Electric Utilities Corporation
Vegetation Programs & Procedures***

Program	Activity
Tree Pruning	Tree pruning is scheduled based on field conditions observed and/or a system prioritization process. All pruning is done in accordance with <u>American National Standard for Tree Care Operations-Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (ANSI A300)</u> .
Hazard Tree Removal	Trees located both within the right-of-way corridor and outside the right-of-way that may be a threat to line performance/ safety are removed when it is feasible to do so.
Herbicide Application	Tall-growing, undesirable vegetation present within the right-of-way corridor is selectively treated with herbicides. Low-growing vegetation that does not represent a hazard to the safe, reliable operation of PPL Electric’s facilities is preserved wherever possible.
Reclearing	Tall-growing, undesirable vegetation growing within the rights-of-way corridors is selectively managed in those situations where herbicides can’t be utilized. Low-growing vegetation that does not represent a hazard to the safe, reliable operation of PPL Electric’s facilities is preserved wherever possible.

***PPL Electric Utilities Corporation
Service Interruption Definitions***

Trouble Definitions: After field investigations and repairs are complete, PPL Electric linemen report the cause of each case of trouble. The definitions of the cause codes appear below. Note that while internal codes allow vegetation caused outages to be separated into trimming related and not trimming related, these categories are generally merged for internal reporting purposes, and consistent with the response to question 4.

Improper Design	Controllable	<ul style="list-style-type: none">• When an employee or agent of PPL Electric is responsible for an error of commission or omission in the engineering or design of the distribution system.
Improper Installation	Controllable	<ul style="list-style-type: none">• When an employee or agent of PPL Electric is responsible for an error of commission or omission in the construction or installation of the distribution system.
Improper Operation	Controllable	<ul style="list-style-type: none">• When an employee or agent of PPL Electric is responsible for an error of commission or omission in the operation or maintenance of the distribution system.
Trees –Trimming Related	Controllable	<ul style="list-style-type: none">• Outages resulting from conductors contacted by tree growth within the clearance zone defined by the current trimming specification (within the Right-of-Way).
Trees – Not Trimming Related	Non-Controllable	<ul style="list-style-type: none">• Outages due to trees, but not related to lack of proper tree trimming maintenance. This includes danger timber blown into PPL Electric facilities, and trees or limbs felled by the public.
Animals	Controllable	<ul style="list-style-type: none">• Any outage caused by an animal directly or indirectly coming in contact with PPL Electric facilities. This includes birds, squirrels, raccoons, snakes, cows, etc.
Vehicles	Public	<ul style="list-style-type: none">• When cars, trucks or other types of vehicles or their cargoes strike facilities causing a problem.
Contact/Dig-in	Public	<ul style="list-style-type: none">• When work in the vicinity of energized overhead facilities results in interruptions due to accidental contact by cranes, shovels, TV antennas, construction equipment (lumber, siding, ladders, scaffolding, roofing, etc.).• When contact is made by a non-employee with an underground facility causing interruption.

Appendix E

Equipment Failure	Controllable	<ul style="list-style-type: none"> • Outages resulting from equipment failures caused by corrosion or contamination from build-up of materials, such as cement dust or other pollutants. • Outages resulting from a component wearing out due to age or exposure, including fuse tearing or breaking. • Outages resulting from a component or substance comprising a piece of equipment failing to perform its intended function. • Outages resulting from a failure that appears to be the result of a manufacturer's defect or cannot be described by any other code indicating the specific type of failure.
Directed by Non-PPL Authority	Non-Controllable	<ul style="list-style-type: none"> • Interruptions under the control of a PPL Electric switchman or direction of a PPL Electric System Operator for the purpose of dropping load or isolating facilities upon request during emergency situations. • Interruptions which cannot be postponed or scheduled for a later time, and include situations like load curtailment during system emergencies, and requests of civil authorities such as fire departments, police departments, civil defense, etc. for interruption of PPL Electric facilities.
Other – Controllable (Lineman provides explanation)	Controllable	<ul style="list-style-type: none"> • Interruptions caused by phase to phase or phase to neutral contacts, resulting from sleet or ice dropping off conductors, galloping conductors, or any other phase to phase or phase to neutral contact where weather is a factor. • Interruptions resulting from excessive load that cause that facility to fail. • When restoration of service to a facility, which had been interrupted for repairs or other reasons, causes an additional interruption to another facility which had not been involved in the initial interruptions. • Controllable interruptions or Power Service Problems whose cause is not described by one of the previous controllable cause codes.
Nothing Found	Non-Controllable	<ul style="list-style-type: none"> • When no cause for the interruption can be found. • When there is no evidence of equipment failure, damage or contact after line patrol is completed. This could be the case during a period of heavy thunder and lightning, when a line fuse blows or a single phase OCR locks open. • When closed for test, the fuse holds or the OCR remains closed. A patrol of the tap reveals nothing.

Appendix E

Other Public (Lineman provides explanation)	Public	<ul style="list-style-type: none">• All outages resulting from gunfire, civil disorder, objects thrown, or any other act intentionally committed for the purpose of disrupting service or damaging company facilities.
Other – Non-Controllable (Lineman provides explanation)	Non-Controllable	<ul style="list-style-type: none">• Any outage occurring because of a fire, flood or a situation that develops as a result of a fire or flood. Do not use when facilities are de-energized at the request of civil authorities.• When an interruption is caused by objects other than trees, such as kites, balls, model airplanes, roofing material, or fences, being accidentally blown or thrown into overhead facilities.• All problems caused by contact of energized equipment with facilities of other attached companies or by trouble on customer owned equipment.• Interruptions or Power Service Problems whose cause is not described by one of the previous non-controllable cause codes, but is not affected by a PPL Electric employee's decisions.