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FEDERAL EXPRESS

September 30, 2016

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, Pennsylvania 17105-3265

Re: PPL Electric Utilities Corporation
Biennial Inspection, Maintenance, Repair and Replacement Plan
For the Period January 1, 2018 – December 31, 2019
Docket No. M-2009-2094773

Dear Ms. Chiavetta:

Enclosed for filing on behalf of PPL Electric Utilities Corporation ("PPL Electric") an original of PPL Electric's Biennial Inspection, Maintenance, Repair and Replacement Plan for the Period January 1, 2018 – December 31, 2019 ("I&M Plan"). PPL Electric's I&M Plan is being filed pursuant to the Commission's regulations at 52 Pa. Code §§ 57.198.

Pursuant to 52 Pa. Code § 1.11, the enclosed document is to be deemed filed on September 30, 2016, which is the date it was deposited with an overnight express delivery service as shown on the delivery receipt attached to the mailing envelope.

In addition, please date and time-stamp the enclosed extra copy of this letter and return it to me in the envelope provided.

If you have any questions, please call me or Stephen J. Gelatko, PPL Electric's Manager –Distribution Asset Management at (610) 774-4785.

Very truly yours,

Kimberly A. Klock

Enclosures

cc: Mr. Paul Diskin
Tanya J. McCloskey, Esquire
Mr. John R. Evans
Mr. David Washko

Biennial Inspection, Maintenance, Repair and Replacement Plan of PPL Electric Utilities Corporation

For the Period of January 1, 2018 – December 31, 2019

Submitted by:

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Director - Distribution Asset Planning
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Dated: October 1, 2016

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PA PUBLIC UTILITY COMMISSION
SECRETARY'S BUREAU

PPL Electric Utilities Corporation

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PPL Electric Utilities Corporation

Introduction

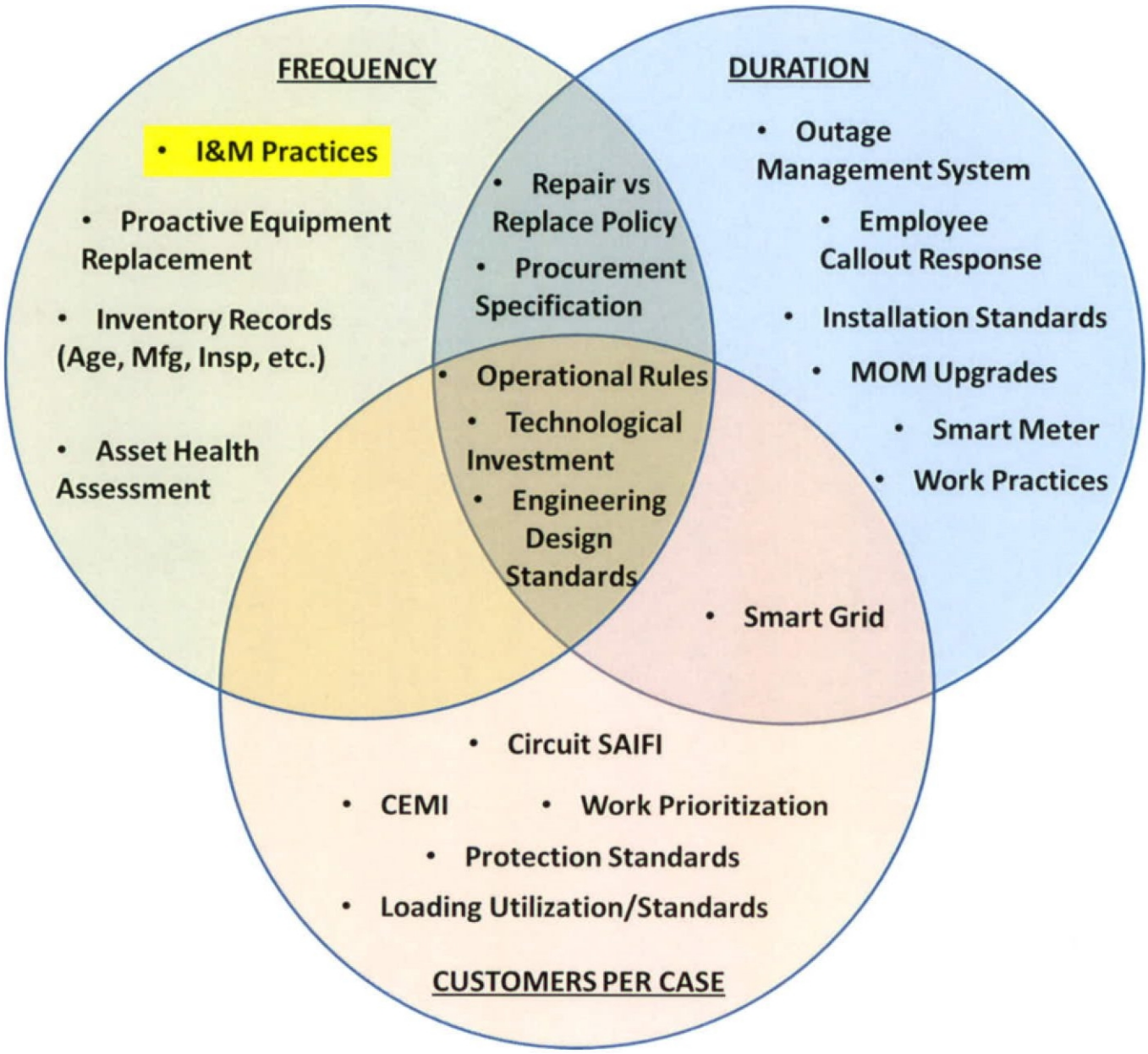
PPL Electric Utilities Corporation ("PPL Electric" or "Company") is firmly committed to maintaining high levels of customer satisfaction. Customer surveys repeatedly have demonstrated that successful achievement of high levels of customer satisfaction depends upon providing acceptable levels of reliability performance coupled with a reasonable cost of providing service.

PPL Electric has established a strong, long-term record of customer satisfaction and electric reliability. PPL Electric has earned 24 J. D. Power customer satisfaction awards – more than any other investor-owned utility in the country – since J. D. Power customer satisfaction began studying customer satisfaction among electric utility customers. PPL Electric has ranked highest among large electric utilities in the eastern United States in J. D. Power annual study of residential customer satisfaction 13 times: in 1999 and from 2001-2007 and 2012-2016.

Ultimately, all of the costs of maintaining reliability are borne by the ratepayers. Therefore, managing finite resources to produce optimal results is essential in order to deliver excellence in customer satisfaction. The criteria for program inclusion is not whether any given activity produces a positive reliability result, but, rather, what portfolio of activities produces the best result for a given expenditure of resources given the specific reliability challenges faced by PPL Electric at this point in time, and for the foreseeable future. PPL Electric's goal is focused on results (i.e., the reliability experienced by customers), not the rote execution of particular tasks.

Reliability performance is driven by a mixture of manageable and unmanageable factors. The most impactful of the unmanageable factors is the frequency and severity of weather events, which can vary dramatically over time and geography. The manageable factors have an effect on service interruption frequency, duration, or number of customers affected, or a combination of all three. The figure below depicts a portfolio of manageable factors with inspection and maintenance ("I&M") practices being one of many.

PPL Electric Utilities Corporation



Reliability Programs and Policies

PPL Electric's philosophy is that the first step in improving reliability is to prevent outages altogether. The primary focus is, therefore, on the manageable factors that reduce the frequency (number) of cases. Efforts that typically overlap are those designed to minimize the number of customers affected should an outage occur. Realizing that not all outages are preventable, PPL Electric also directs rigorous efforts designed to reduce the duration of the outages that do occur. Examples of PPL Electric initiatives addressing each of the three reliability sectors, frequency (number of cases), customers affected per case, and duration are addressed below.

Frequency (number of cases)

- **Inspection and maintenance practices and programs:** PPL Electric remains focused on equipment performance and service interruption avoidance through the application of effective inspection and maintenance practice and programs. A comprehensive discussion has been provided to the PUC via PPL Electric's I&M filing on a biennial basis since the initial report in 2010. The scope of these programs, procedures and activities covers all areas of the electrical infrastructure to include transmission, substations, distribution, and vegetation.

  Transmission
  Transmission inspection programs include aerial patrols and structure inspections, treatments and replacements. The patrols focus on comprehensive inspections, routine inspections and identification of emergency work. The inspections encompass all equipment, including poles, arms, line switches, interrupters, arresters, grounding, guying, anchors and other key transmission components.

  Substation
  Substation maintenance programs include inspections, condition testing and preventative maintenance of equipment, such as power transformers, circuit 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 timely manner. In addition to time and condition-based maintenance, thermo-graphic inspections help to ensure that substation equipment does not operate at elevated temperature levels, which could lead to premature failures.

  Distribution
  Distribution encompasses many maintenance aspects similar to transmission and substations, and also includes load surveys that assist in determining peak load requirements, and circuit analyses that help identify lines requiring maintenance work, voltage relief, or other capital improvements. Overhead line inspections identify the weak links in the system so that damaged or deteriorated equipment can be repaired or replaced. In addition, distribution maintenance includes inspections of poles, voltage regulators, line switches, capacitors, and other key distribution equipment. PPL Electric also tests underground cable for integrity 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 is maintained utilizing a combination of several management techniques. These include reclearing, ground-to-sky trimming, hazard tree removal, tree pruning, and herbicide application. The work is prioritized based on the conditions observed and past performance.

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

- **Asset Optimization Strategy ("AOS"):** PPL Electric conducted a major condition assessment and maintenance study of its distribution. This project was initiated to identify and address the challenges created by the Company's aging infrastructure. The objectives were to assess equipment health in seventeen distribution asset classes comprising approximately 30,000,000 units of equipment, and generate a strategy for capital replacements and maintenance improvements to address these challenges. PPL Electric conducts effectiveness reviews of the various programs comprising this strategy to ensure that aging infrastructure continues to be appropriately addressed.

- **Asset Health Assessment:** In 2015, health and criticality scores for 12 kV circuit breakers, power transformers, and substation battery banks based on operational data, test and inspection data, corrective maintenance history, and documented manufacturer issues were captured and evaluated. The criticality scores were based on customer and system impact if a failure were to occur. AOS replacement programs for these asset classes were further refined based on the score ranking to achieve the most effective reliability impact per dollar invested. Additionally, LTN (Low Tension Network) underground vault network protectors and network transformers employ health scores based on test and inspection data collected on a six month periodicity. LTN inspections and replacement programs are being adjusted to optimize cost and reliability based on the conditional health scoring. Projects currently in progress include assessing overhead recloser contact wear (in near real-time), overhead airbreak switch health based on periodic inspection data, and also pole mounted voltage regulator wear based on tap change operations. These continued health calculation efforts enable PPL Electric to more effectively mitigate risk and optimize reliability.

- **Long Term Infrastructure Improvement Plan:** In 2012 PPL Electric developed and filed a Long Term Infrastructure Improvement Plan (LTIIP) that was approved by the Pennsylvania Public Utility Commission ("PUC") in January 2013. This Plan was submitted pursuant to the requirements of Subchapter B, Distribution Systems, of the Public Utility Code, 66 Pa.C.S. §§ 1350-1360, and the Public Utility Commission's ("PUC") Implementation Order for Establishment of a Distribution System Improvement Charge ("DSIC"). PPL Electric's most recent updates are included in the March 2016 filing of its Annual Asset Optimization Plan. The Plan is a continuation of AOS infrastructure replacements in addition to prudent capital investments such as the proactive installation of animal guards, new sectionalizing devices, distribution automation, asset life extension methods, replacement of deteriorated equipment, and capital projects aimed at addressing worst performing circuits ("WPCs"). The investment is expected to mitigate the growth in equipment failure projections in the short-term and reverse the trend in the long-term. Equipment failure trends, in addition to asset specific contribution to system level metrics, are analyzed on an ongoing basis to ensure funding is invested appropriately.

- **Customers Experiencing Multiple Interruptions ("CEMI") Program:** The goals of the CEMI Program are to reduce the number of interruptions experienced by customers such that no customer has more than eight interruptions in a calendar year, and to communicate in an effective and timely

manner with customers when multiple service interruptions do occur. CEMI performance is monitored closely by regional distribution planners and reliability supervisors to identify cost-effective solutions which are submitted to the CEMI Task Force for evaluation and consideration.

Performance improvement over time has been noteworthy. In 2011 the goal was to limit the number of customers having 10 or more interruptions annually to not more than 150. As performance improved, the goal has steadily progressed to its current status, which is to have no customers interrupted more than eight times annually.

The CEMI program is structured around three key attributes:

- Anticipate – monitor, forecast, and attempt to prevent multiple service interruptions from occurring.
- Mitigate – when multiple service interruptions occur, determine root causes, develop solutions, and ultimately implement corrective actions to reduce the risk of future interruptions.
- Communicate – following multiple service interruptions, contact customers to inform them that PPL Electric is aware that a service interruption has occurred, provide the cause of the service interruption, and the Company's plans to prevent future service interruptions, among other pertinent details. In addition, when solutions are implemented, contact customers and advise them of the improvements.

- **Distribution and substation animal guarding:** Two programs were established in 2009 to limit service interruptions caused by animals. The first was to install animal guards on distribution overhead transformers and switches in locations with a high density of animal-related service outages, and the second was to install animal guard materials at all distribution substations by 2019. This has proven effective. The past five years (2011-2015) have averaged 5% fewer animal related outages than the previous ten year low. In addition, the average animal related outages for the same years is 54% lower than the previous ten year average.

Customers affected per case

- **Expanded Operational Reviews ("EOR"):** EORs are performed on each circuit on a four-year cycle. The review analyzes and addresses both operational and reliability characteristics of each circuit. Voltage support, phase balancing, power factor maintenance and loading issues are addressed from an operational perspective. Service outage analysis, exposure analysis and field checks address reliability and power quality.

- **Reliability Principles and Practices ("P&P") Revisions:** The P&P sets forth a set of principles that PPL Electric follows to plan, protect and operate the Electrical Distribution System ("EDS"). These principles are implemented through a set of standard practices that are used as guidelines in designing the EDS. These practices are reviewed regularly to ensure they remain reasonable,

acceptable and align well in accordance with good utility practices. Additional revisions to PPL Electric's P&P are underway to reduce the overall impact to our customers as the Company implements smart grid strategies.

- **Circuit SAIFI:** In 2013, PPL Electric launched a system wide initiative to install approximately 1,000 new fuses on single phase taps to limit the number of customers exposed to an outage on a given circuit. The Company continues to evaluate areas where fuse installation may reduce customer exposure to outages. As of 2016, over 1,500 locations have been fused, with more installations planned.

- **MAIFI**: In 2016, PPL Electric became one of the first electric utility companies in the nation to launch a concentrated effort to reduce momentary interruptions (defined as any power interruption less than five minutes) that customers experience. Through tracking momentary interruptions and concentrating on circuits that experience higher than average momentary interruptions per customer, PPL Electric is reducing the number of momentary power outages on the system.

Duration (minutes/case)

- **Mobile Operations Management ("MOM"):** As of September 2016 all Operations vehicles are outfitted with laptop computers and software for mobile work management and trouble order completion. This software provides crews with their work for the day, as well as access to maps, directions, transmission and distribution system information, and more. The real-time view of field work, assisted by built-in GPS capability, means more timely and accurate dispatching and job tracking. In addition, as work is completed, the priorities of remaining work are readjusted to ensure that the next job also is the most critical. In 2017, all MOM laptops will migrate to a new software platform called PPL Restore, to be created by the Company's Information Technology group. This custom software suite will create a seamless one-stop-shop for all mobile needs and utilizes a modern web based platform.

- **Automated Callout:** In 2013, a new automated system to call employees into work for after-hours emergencies was implemented. This new system performs callouts simultaneously, whereas the previous system performed callouts sequentially, which shortens response time under storm conditions when large numbers of employees must be called out to restore service to customers.

- **Outage Management System ("OMS") enhancements:** In 2015, PPL Electric completed another upgrade of its OMS system. Numerous improvements have been made to the software, including a stronger model of the network grid, improved system response time, and improved outage scenario modeling.

- **Storm Central:** Storm Central is a user friendly tool that allows personnel to quickly find the information and tools, developed under PPL Electric's Emergency Response Plan, needed to support the restoration of service to our customers after an emergency event.

- **Distribution Automation:** In 2010, PPL Electric launched a "smart grid" pilot project that enables the Company to react rapidly to changes on the delivery system, and automatically re-route power around problems that occur. The project initially focused on the Harrisburg, Pa. area, but has since been rapidly expanded to cover all of our service territory. The project included the implementation of an advanced Distribution Management Systems (DMS), which is a breakthrough technology that enables our operators to see the real-time status of our distribution network in real-time. PPL Electric recently completed a system wide rollout of FISR (Fault Isolation and Service Restoration) 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. This milestone is an industry first and looks to significantly reduce overall outage durations. Future plans include the installation of thousands of automated smart devices through 2018. Such installations allow for remote operation and monitoring of circuit sectionalizing equipment, and advanced fault location technology. The goals of these improvements are threefold:

    - Reduce the number of upstream customers affected by a service outage.

    - Reduce the time necessary to restore customers by transferring circuit sections to alternate sources and limiting long-duration service outages to smaller circuit sections involving fewer customers.

    - Facilitate fault location and reduce the time necessary for repair and restoration.

  The end-result will be a delivery system that operates more efficiently, recognizes problems immediately, and responds in seconds to restore the service for many customers who otherwise need to wait for crews to physically respond to an outage.

- **Smart Meter Technology:** PPL Electric is a national leader in the use of advanced metering technology for the benefit of customers, having installed an advanced metering system for all customers between 2002 and 2004. The Company has used the technology to improve the efficiency of responding to service outages – especially during storm emergencies – and as a tool for reliability planning. PPL Electric has embarked on implementing the next generation Advanced Metering Infrastructure (AMI), beginning in 2016. The four year project will replace the existing power line carrier based system with a radio frequency based communication network that will allow for even more improvements in outage detection and restoration as well as proactive reliability planning and customer service.

PPL Electric Reliability Results

The reliability planning and investment process employed by PPL Electric has been very effective, as evidenced by reliability performance being maintained at the benchmark levels and below the standards that existed prior to the Electricity Generation Customer Choice and Competition Act ("Customer Choice Act"). This has been accomplished while preserving a reasonable cost of providing service.

PPL Electric Utilities Corporation

	2013	2014	2015	2013-2015 AVG	PUC Benchmark	PUC 12 Mo. Std.	PUC 36 Mo. Std.
SAIFI	0.82	0.92	0.72	0.82	0.98	1.18	1.02
SAIDI	88	166*	84	86	142	205	142
CAIDI	107	180	117	135	145	174	138

** PPL Electric was affected by a significant ice storm concentrated in the Lancaster region in February, 2014. Due to the concentrated nature of the storm, it did not affect enough customers to be declared a PUC major even. Excluding this storm, 2014 system values would be: SAIDI 122, CAIDI 143, and SAIFI 0.85 – all within the benchmark.*

PPL Electric Reliability Metrics

PPL Electric Utilities Corporation

PPL Electric Reliability Planning Process

PPL Electric's process is forward-looking and proactive. It consists of the following:

- Analyze the historical trends of causes of service outages and other power service problems.
- Identify the drivers of those trends.
- Forecast future reliability metrics (SAIDI, SAIFI, and CAIDI) given existing mitigation programs' effect on the identified drivers.
- Identify new programs, policies and activities to add to or substitute for existing mitigation programs to avoid any forecasted gaps between future reliability and the desired levels.
- Identify, evaluate and implement new technologies that enhance its condition monitoring strategy
- Continually evaluate and adjust programs, policies and activities to produce the desired future results.
- The resulting portfolio of existing and new programs, policies and activities are incorporated in to PPL Electric's I&M plan.

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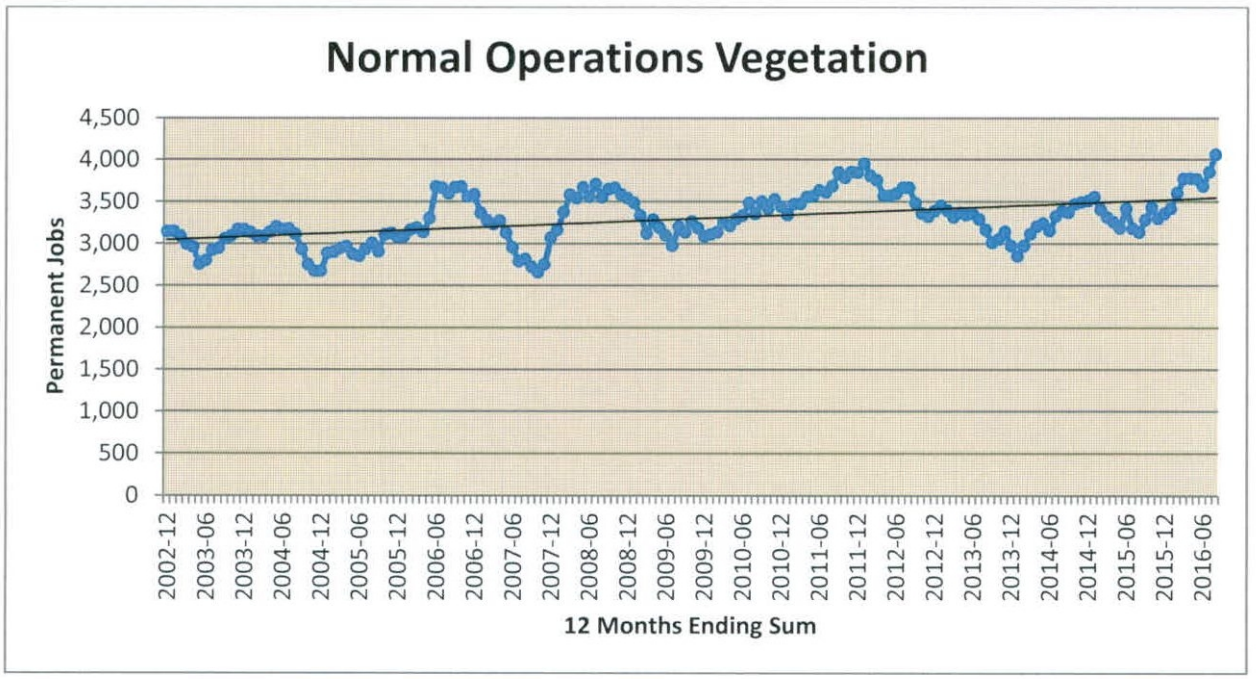
PPL Electric Reliability Analysis

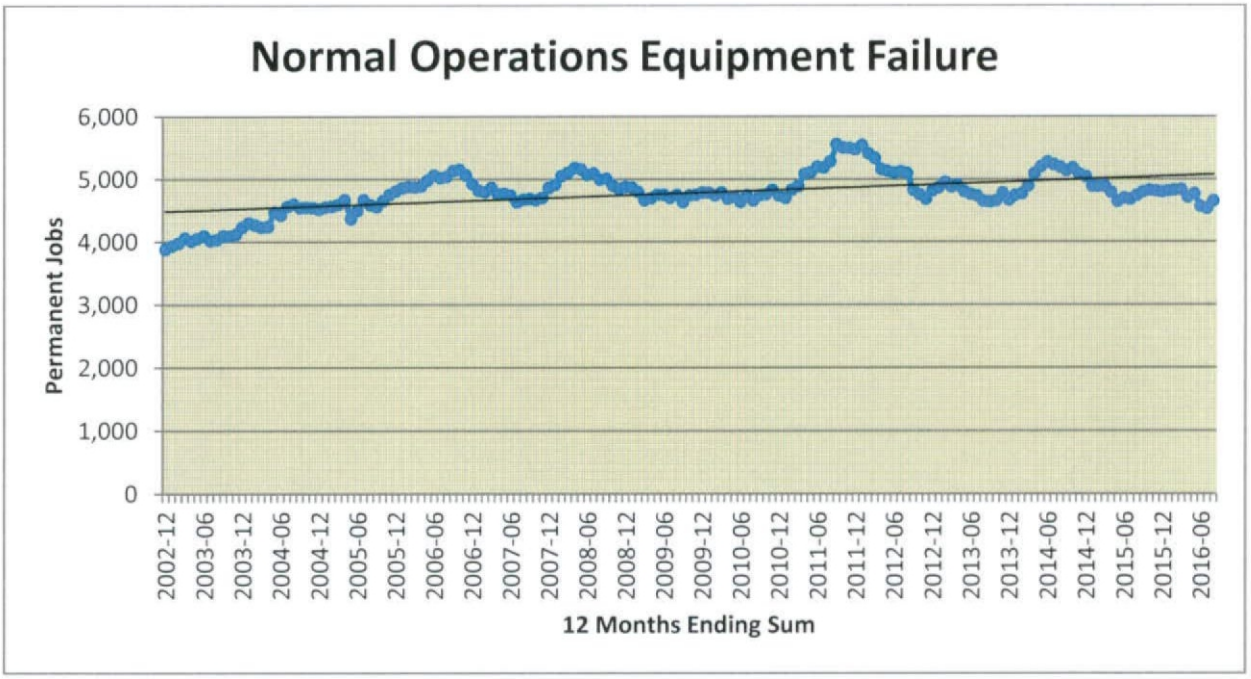
Identification and understanding of trends creates the opportunity to plan programs to mitigate undesirable trends. Most of the year-to-year variation in service interruptions is explained by differences in storm experience. Therefore, PPL Electric generally removes all storm caused service outages for internal analysis to identify other causal trends affecting reliability. Each data point in the following charts represents a 12-month ending value to eliminate the effect of seasonal variation.



Vegetation Related Service Interruption Cases

PPL Electric is committed to continuing an aggressive tree trimming program to address the threat of tree related outages. However, it is worth noting that when excluding major and PUC reportable storm events, 66% of vegetation related outages occur during adverse weather conditions.

A significant risk to PPL Electric's ability to meet reliability benchmarks is the large portion of distribution facilities, which were installed in the 1960's and 1970's, that are now beyond or nearing the end of their design lifetime. The resultant effect on non-storm-related equipment failure is illustrated by the chart below.

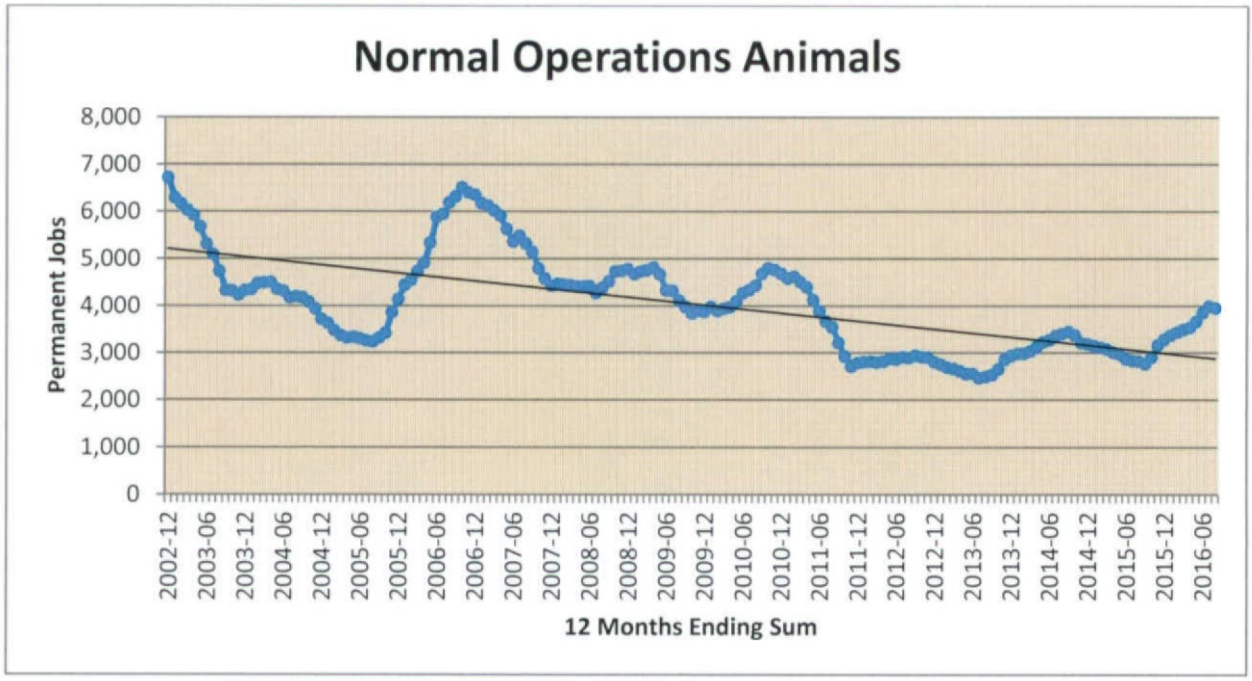


Equipment Failure Service Interruption Cases

The annual number of outages due to equipment failure rose steadily through mid-2011 and has generally stabilized or declined since then but the Company has seen positive results with the replacement of some aging infrastructure through the DSIC mechanism.

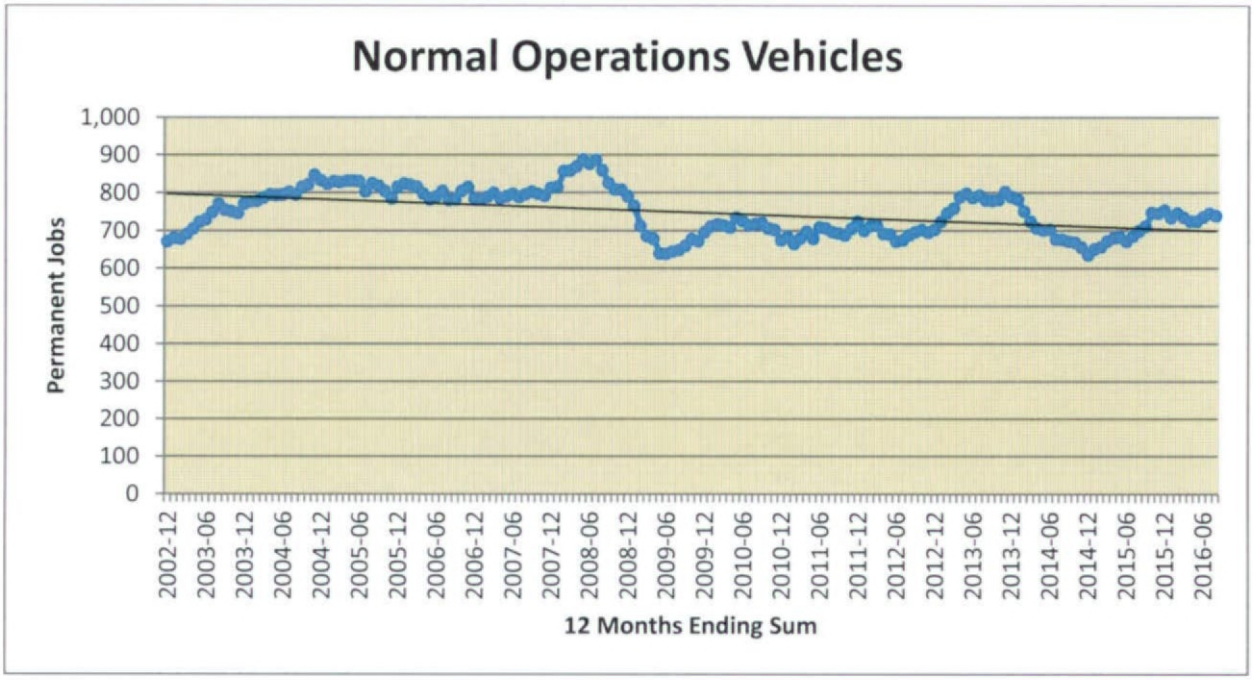
Other initiatives contributing to this stabilization are equipment replacements identified through Expanded Operational Reviews of 25% of circuits annually, aggressive worst performing circuit remediation, implementation of PPL Electric's Asset Optimization Strategy, enhanced pole inspection and treatment, distribution automation including a new Distribution Management System, and infrared inspections.

Although these programs have successfully slowed equipment failure growth rates in the short-term, PPL Electric faces a long-term challenge regarding aging infrastructure. PPL Electric is committed to mitigating the aging infrastructure challenge through effective use of proactive replacement programs. Scheduled replacement of that infrastructure is necessary to avoid accelerating failure rates due to end of life fatigue.



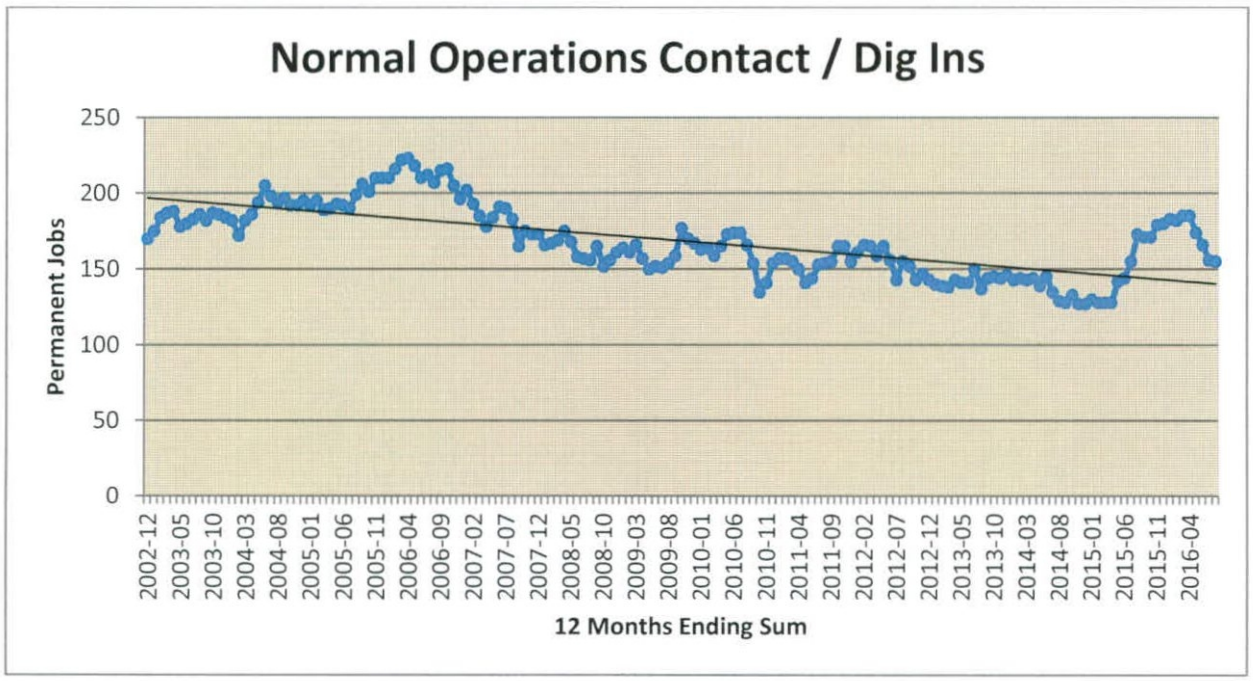
Animal Related Service Interruption Cases

PPL Electric is effectively reducing the impact of animal caused outages through the development of targeted distribution and substation animal guarding programs as can be seen above. The customer impact of animal caused outages continues to decline compared to other key reliability factors.



Vehicle Related Service Interruption Cases

The long-term trend (see above) in vehicle-related cases indicates a fairly steady, slightly downward trend with some volatility, such as the elevated 2013 levels. PPL Electric identifies facilities with multiple vehicle hits and evaluates them for potential relocation.



Overhead Contact/Underground Dig-in Service Interruption Cases

Overhead contacts and underground dig-ins generally are the result of construction activity around distribution facilities. The incidence of these events has generally declined (see above).

All Other Causes Service Interruption Cases

Service interruptions due to all other causes have declined since 2006.

PPL Electric Utilities Corporation

Reliability is the largest contributor to overall customer satisfaction and satisfaction levels vary depending upon the amount of information provided to the customer regarding their outage. Providing customers with accurate information about their outage is increasingly important. Customers are more understanding of storm and weather-related service outage impacts than they are of other outage causes, such as utility equipment failures. But since not all customers get information about their outage, outage duration remains more important than the value of outage information, like the cause of the outage. Hence it is still prudent that analyses be conducted to determine the most cost-effective programs to reduce durations.

If it is more cost-effective to offset an increase in equipment failure cases with a program to reduce vegetation-related cases, the ratepayer is better served by this cost-effective choice. Similarly, if a program that reduces the average number of customers affected by each service outage is more cost-effective than a program to reduce the gross number of service outages, the more cost-effective program should be chosen. The management challenge is to maintain reliability within acceptable parameters in the most cost-effective manner.

52. Pa. Code § 57.198 (b) Plan Consistency

PPL Electric's I&M Plan is consistent with the National Electric Safety Code ("NESC"), Codes and Practices of the Institute of Electrical and Electronic Engineers ("IEEE"), Federal Energy Regulatory Commission Regulations ("FERC") and the provisions of the American National Standards Institute, Inc ("ANSI").

52. Pa. Code § 57.198 (c) Requested Deviations

PPL Electric is again requesting acceptance of the following deviations from the intervals in the Commission standard as were included in the three previous I&M reports (2012-2013, 2014-2015, and 2016-2017):

- Section 57.198 (n)(2). Pole Inspections. (vi) A load calculation.
- Section 57.198 (n)(4). Distribution overhead line inspections.
- Section 57.198 (n)(6). Distribution transformer inspections.

PPL Electric is again requesting acceptance of the following deviations from the intervals in the Commission standard as were included in the previous I&M filing (2016-2017):

- Section 57.198 (n)(7). Recloser inspections.

For the first time, PPL Electric is requesting acceptance of the following deviations from the intervals in the Commission standard:

- Section 57.198(n)(8). Substation inspections.

52. Pa. Code § 57.198 (m) Recordkeeping

Inspection and maintenance activities performed by PPL Electric employees are tracked by electronic work requests in the Company's Work & Asset Management System (WAM) software application which date-stamps transactions and captures an electronic signature of the employee certifying completion.

Inspection and maintenance activities performed by PPL Electric contractors are documented with itemized records, which identify when and what type of work was performed, before invoices for the work are paid.

52. Pa. Code § 57.198 (n)(1). Vegetation Management. *The Statewide minimum inspection and treatment cycle for vegetation management is between 4-8 years for distribution facilities. An EDC shall submit a condition-based plan for vegetation management for its distribution system facilities explaining its treatment cycle.*

PPL Electric Utilities Corporation

Program Description

All PPL Electric rights-of-way will be maintained to the originally established clearances or the limits as defined in the right-of-way agreement, whichever is greater.

PPL Electric currently employs four-year and five-year inspect and trim cycles for its southern and northern territories respectively. The demarcation line for the northern and southern areas is the Blue Mountains which does not follow the borders of PPL Electric's regions. Based on conditions the cycle schedule may be modified, but not beyond established requirements. Additionally, a three-year inspect and trim cycle is currently applied to transmission lines in PPL Electric service territories.

- Purpose

Taller species of trees that are permitted to grow under power lines eventually will contact the wires, causing service interruptions and unsafe conditions. It is necessary for PPL Electric to trim or remove these trees to continue safe and reliable electric service

To safeguard the reliability of its electric distribution system, PPL Electric has developed a comprehensive program to manage vegetation around power lines. Keeping trees and other vegetation away from high-voltage lines is very important. If trees touch these lines, there can be short-circuits and widespread service outages.

- Process

Distribution

Multi-phase lines will be pruned to the full extent of the established tree line, not to exceed 25' from centerline and ground to sky pruning will be utilized.

Single-phase lines will be pruned to the full extent of the established tree line, not to exceed 15' from centerline and to a distance of 15' above the line. All dead or structurally weak limbs which could fall or blow into the conductor are removed regardless of their distance above the conductor.

Exceptions: Trees on the opposite side of any thoroughfare, where normal line construction exists (not alley arms), should be considered for proper lateral pruning using the centerline of the thoroughfare as a guideline. Fast growing tree species may need more aggressive pruning.

Another enhancement is hazard tree removal. "Hazard trees" are those trees outside the right of way that may be leaning, diseased, or otherwise pose a threat of falling on a distribution line. PPL Electric bears all costs of removing hazard trees and conducts the removal either based on right of way agreements or with property owner permission.

PPL Electric Utilities Corporation

Transmission

PPL Electric Utilities operates thousands of miles of high-voltage transmission lines. Its vegetation management program is designed to promote the safe and reliable operation of the electric grid while taking into account the concerns of property owners and our obligations to electric customers. Low-growing grasses and other compatible species are permitted within the wire zone. In the remainder of the right-of-way, certain compatible trees and shrubs are allowed if they do not pose a reliability risk.

Inspection Plan

Distribution Vegetation Management			
	Area *(Line Miles)*	**Scheduled Trimming** *(Line Miles)*	
		2018	**2019**
PPL Electric Utilities Corporation *Total Line Miles (28,094)*	Lehigh (3,469)	822.18	774.32
	Northeast (5,190)	1022.07	978.32
	Central (4,535)	955.01	865.2
	Susquehanna (5,769)	1130.5	1357.92
	Harrisburg (4,822)	1124.2	906.1
	Lancaster (4,309)	1027.32	1083.56
	Totals	**6081.28**	**5965.42**

52. Pa. Code § 57.198 (n)(2). Pole Inspections. *Distribution poles shall be inspected at least as often as every 10-12 years except for the new southern yellow pine creosoted utility poles which shall be initially inspected within 25 years, then within 12 years annually after the initial inspection. Pole inspections must include:*

(i) Drill tests at and below ground level.
(ii) A shell test.
(iii) Visual inspection for holes or evidence of insect infestation.
(iv) Visual inspection for evidence of unauthorized backfilling or excavation near the pole.
(v) Visual inspection for signs of lightning strikes.
(vi) A load calculation.

Program Description

- Cycle

  Every ten years.

- Purpose

  Distribution poles are inspected to identify and measure the extent of decay and defects that may adversely affect safety or service reliability.

- Process

  Beginning in 2016, PPL Electric enhanced its pole inspection program from a partial excavation inspection program to a full excavation program. In a partial excavation program, each pole over the age of ten years that can be is excavated on two sides to a depth of 12 inches. In the current full excavation program, each pole over the age of ten years that is not set in concrete, asphalt or with a riser is fully excavated to a depth of 18 inches. The pole is inspected visually, sounded and bored above ground in addition to the full excavation. All measurable decay is entered into the contractor's engineering-based software program to determine the percentage of remaining strength, taking into consideration ANSI and NESC standards. If the percentage of remaining strength is below established parameters, a load calculation is performed to determine the pole's capacity to support the load in accordance with NESC standards. Poles younger than ten years are visually inspected only.

  Based upon the inspection and testing results, the pole is treated with a preservative, reinforced (by truss or fiber wrap) or replaced.

- Justification

  PPL Electric's pole inspection program generally complies with the intervals set forth in 52. Pa. Code §57.198 (n)(2), NESC rules and is consistent with industry practices.

PPL Electric proposes a continuance of the deviation from the requirement for a load calculation to be performed for each pole inspected. The design of PPL Electric's lines is based on its Distribution Engineering Instructions which are based upon NESC heavy loading conditions. These instructions provide adequate safety factors such that the allowable percentage of strength reduction does not compromise the ability of the pole to support the load. PPL Electric requires entities attaching facilities to its poles to perform their own load calculations before making the attachment. Load calculations are performed on poles when the estimated percentage of remaining strength falls below established parameters.

PPL Electric does not track service outages caused by pole equipment failure as a discrete category. Poles are contained within a category that includes poles arms, brackets, guys, push braces, pole top extensions and any other mounting hardware. In 2013, equipment failures requiring replacement in this category amounted to 729 (5.1% of total cases), of which only a small fraction are poles. Excluding pole fires, only 44 cases (0.3% of total cases) suggest broken PPL Electric-owned poles. (Forty-four poles represent less than 1/100 of one percent of PPL Electric's 880,000 wood distribution pole inventory.) Most of the limited numbers of pole failures are aggravated by weather conditions such as trees being blown into lines, so the potential risk reduction through a load calculation is insignificant.

Beginning in 2010, the Company's wood pole maintenance program was enhanced from an inspection-only process to an inspection and treat program, whereby all poles passing the inspection are chemically treated to arrest decay at the same visit. The preservative treatment permits the next inspection to be at a uniform ten years, rather than the former one to nine-year cycle after original inspection applied to individual poles. Changing to a uniform ten-year cycle will enable more economic geographic-based inspections where all poles in a defined area are inspected, rather than the current method of inspecting scattered poles with individually specified intervals which maximizes the employee travel involved.

Inspection Plan

In order to convert from the former variable inspection interval (where the annual scope varied from 5 to 15% of inventory) to a uniform interval, a higher number of poles than the steady-state value of approximately 10% of inventory are required in the early years. For the first cycle, geographic areas have to be defined in order to group together a sizeable portion of poles with similar inspection due dates.

PPL Electric Utilities Corporation

Distribution Wood Pole Inspections			
	Area *(Poles)*	**Inspections Planned** *(Poles)*	
		2018	**2019**
PPL Electric Utilities Corporation *Total Poles (880,556)*	Lehigh (117,671)	8125	8125
	Northeast (174,671)	11877	11877
	Central (157,682)	10722	10722
	Susquehanna (160,178)	10892	10892
	Harrisburg (139,540)	9489	9489
	Lancaster (130,814)	8895	8895
	Totals	**60,000**	**60,000**

52. Pa. Code § 57.198 (n)(3). Pole inspection failure. *If a pole fails the groundline inspection and shows dangerous conditions that are an immediate risk to public or employee safety or conditions affecting the integrity of the circuit, the pole shall be replaced within 30 days of the date of inspection.*

Corrective Maintenance

- PPL Electric obtains pole replacement data weekly. Critical poles, those that carry ≤3% remaining strength or those that pose an immediate safety concern, are reinforced or replaced as soon as possible, but no later than 30 days after notification. Other non-restorable rejected poles generally are replaced within one year of identification. Pole strength and loading calculations are provided for each rejected pole to assist in reinforce versus replace decisions and schedule prioritization.

- Reinforcement by steel C-Truss, a galvanized steel truss which is banded around the pole in order to regain the pole's original strength or fiber wrap, several layers of high-strength fiberglass wrapped onto the pole and saturated with resin is completed within 90 days of identification. The method of reinforcement is determined by the circumstances and/or location of the pole.

52. Pa. Code § 57.198 (n)(4). Distribution overhead line inspections. *Distribution lines shall be inspected by ground patrol a minimum of once every 1-2 years. A visual inspection must include checking for:*

(i) Broken insulators.
(ii) Conditions that may adversely affect operation of the overhead transformer.
(iii) Other conditions that may adversely affect operation of the overhead distribution line.

Program Description

- Cycle

  Infrared inspection: Multi-phase overhead lines adjacent to roadways every two years.

  Visual inspection: Condition based – selected line segments. Inspections are scheduled under various conditions to include CEMI and WPC circuits, if warranted based on EORs, and if power quality issues are experienced. Additional patrols used to ensure continued reliability include those in support of distribution construction projects as well as summer and winter readiness patrols.

  Pole inspection: Every ten years.

- Purpose

  The objective of an overhead line inspection is to identify and correct hardware or equipment defects that may lead to a future service interruption or pose a safety hazard. Defects are identified by inspection, ranked in order of priority and scheduled for repair.

- Process

  Infrared: Multi-phase distribution lines adjacent to roadways are scanned from vehicles. A roof-mounted infrared camera is employed to capture a thermal image of components carrying electrical current. Heat emission measurements are compared to reference temperatures. Probability of failure is estimated based upon the magnitude of temperature difference from reference. The method detects problems in current carrying components such as transformers, connections, splices, hot line clamps, disconnects, switches, lightning arresters, bridges disconnects, terminators, etc., whether or not there are visible

defects. A detailed report of findings is prepared and at-risk items are prioritized and mitigated by repair or replacement.

Visual: An analysis of actual service interruptions is conducted on selected circuits (e.g., poor performing circuits as measured by PPL Electric's CPI, circuits with excessive customers experiencing multiple service interruptions ("CEMI"), and circuits undergoing expanded operational reviews. If an analysis indicates a pattern of equipment failure exists, a visual line inspection is scheduled. In addition to looking for visible defects in current-carrying components, visual inspection looks for mechanical defects in anchors, guys, crossarms, insulators, offset brackets, grounding systems and poles.

Pole Inspection: As an integral part of the ten-year pole inspection process, the wood poles are observed, with at-risk conditions of all pole attachments, specifically crossarms, braces, conductors, transformers, fuse cutouts, lightning arresters, reclosers, regulators, capacitors, switches, wildlife protection, vegetation encroachment, guys, anchors, ground wires and rods noted and reported.

- Justification

PPL Electric hereby proposes a continued deviation from the 1-2 year inspection cycle on the basis of an effectiveness evaluation and cost benefit analysis in favor of the program described herein. Resources that would be applied to shorter visual cycles than this proposal would reduce the resources applied to other more cost-effective reliability programs described in this plan.

PPL Electric conducted a trial of infrared inspections of multi-phase lines in 2006. The trial inspections cost $122,500 and identified repairs costing $100,000, saving an estimated 1,460,000-2,600,000 CMI, at a cost of $0.15 to $0.09 per CMI saved. PPL Electric restructured the infrared service contract gaining further efficiencies in 2014. The cost benefit as calculated by the 2016 program effectiveness review suggested that the two programs, at a yearly cost of $327,000, save an estimated 819,000 CMI, at a cost of $0.40 per CMI saved.

PPL Electric employs a $2.00 per CMI saved cost threshold[1] as a principal criteria for evaluating new projects for inclusion in the portfolio of reliability programs. Costs below

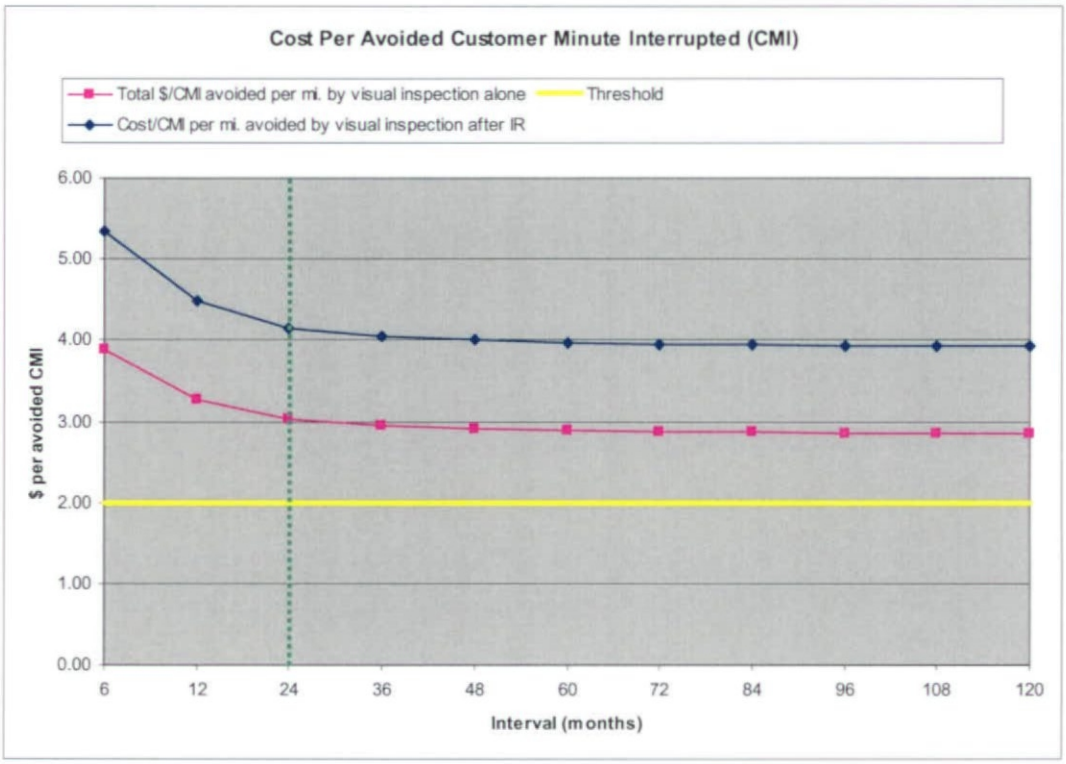
[1] Cost threshold recommended by Richard E. Brown, Sr. Vice President and co-founder of Quanta Technology, a firm specializing in technical and management consulting for utilities. Dr. Brown has provided consulting services to most major utilities in the U.S. Dr. Brown has published more than 90 technical papers related to asset management and is the author of Electric Power Distribution Reliability, CRC Press, 2009.

that threshold are generally considered to be prudent investments, while those above typically provide less benefit for the cost. The cost threshold assists in applying finite resources to programs producing better results, thus enabling the most effective portfolio of programs. Because infrared costs per CMI saved are well below the threshold, PPL Electric instituted a two-year infrared cycle for accessible multi-phase lines.

PPL Electric also conducted an overhead line visual inspection cost benefit study in 2010. The study calculated a reliability benefit as a probability that inspections and the associated repairs will reduce equipment failure service interruptions. The overall probability is the product of (a) the probability that an equipment failure service outage is preceded by a visible condition, (b) the probability that the visible condition exists at the time of inspection, (c) the probability that an existing condition is detected and (d) the probability that the condition is repaired before a service interruption occurs. For seven of the thirteen overhead distribution component codes, actual inspection data established little likelihood of visible conditions preceding failure. For the remaining six component codes, subject matter experts were surveyed. The resulting probability estimates were applied to actual service outage data to estimate avoided CMI per mile. The inspection and repair cost per mile divided by CMI avoided per mile yielded an estimate of cost per CMI avoided. The graph below shows these costs per CMI for various inspection intervals.

The study also estimated avoided CMI/mile for visual inspections that follow infrared inspections because there is significant overlap between the two methods: infrared identifies both visible and hidden defects in current carrying components, while visual inspection detects only visible defects in electrical and mechanical components. The second graph below shows these costs per CMI for various inspection intervals.

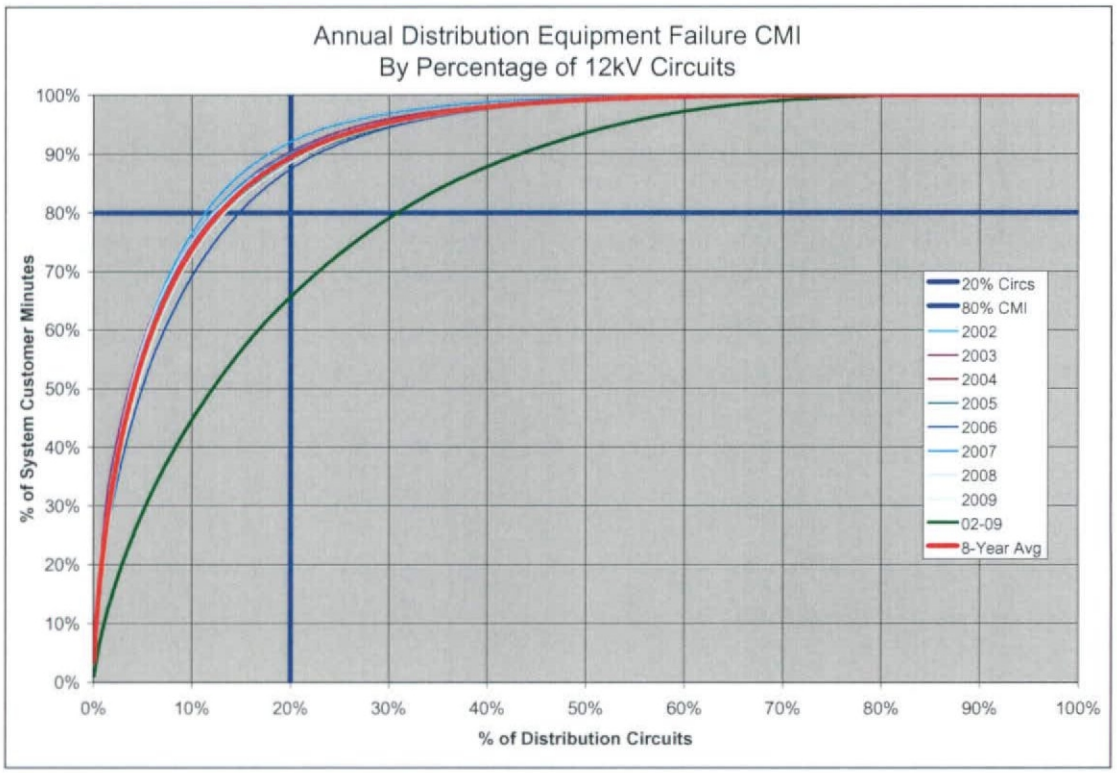
As the graph below shows, given PPL Electric's reliability parameters, there is no interval for visual overhead inspections that meets the established cost threshold, particularly when performed in conjunction with infrared inspections. Visual inspections alone at two-year intervals are 50% above the threshold; two year visuals done in conjunction with infrared are 100% above the threshold.



Overhead Line Inspection Cost per Avoided CMI

Although universal overhead visual inspections are not cost-effective, targeted visual inspections have more value. The graph below shows that in a typical year, less than 15% of the circuits are responsible for 80% of equipment failure CMI. For the period 2002 to 2009, 30% of the circuits were responsible for 80% of equipment failure CMI.

Consequently, PPL Electric employs the condition-based visual inspection approach described above, combined with Expanded Operational Review field checks and overhead inspections in conjunction with pole inspections. The efficacy of this approach is confirmed by the flattening of the growth curve of equipment failures.



Cumulative Circuit Contribution to Equipment Failure CMI (excluding Major Events only)

PPL Electric Utilities Corporation

Inspection Plan

PPL Electric will inspect multi-phase drivable lines every other year, per the total mileage listed in the chart below.

Distribution Overhead Multi-phase Line Infrared Inspections			
Total Line Miles/Drivable Line Miles[2]	**Line Miles by Region**	**Infrared Inspections Planned** *(Line Miles)*	
		2018	**2019**
PPL Electric Utilities Corporation *(Total System Line Miles: 8,626/8,195)*	Lehigh (1,337/1,270)	635	635
	Northeast (1,446/1,374)	687	687
	Central (1,618/1,537)	768	769
	Susquehanna (1,264/1,201)	601	600
	Harrisburg (1,411/1,340)	670	670
	Lancaster (1,550/1,473)	737	736
	Annual totals	**4,098**	**4,097**

[2] For planning purposes, an assumption that 95% of multi-phase line miles are drivable is employed.

PPL Electric Utilities Corporation

Distribution Overhead Visual Inspections			
	Line Miles by Region	**Estimated Visual Inspections** *(Line Miles)*	
		2018	**2019**
PPL Electric Utilities Corporation *Total System Line Miles (28,094)*	Lehigh (3,469)	390	390
	Northeast (5,190)	540	540
	Central (4,535)	480	480
	Susquehanna (5,769)	600	600
	Harrisburg (4,822)	510	510
	Lancaster (4,309)	480	480
	Annual totals	**3,000**	**3,000**

52. Pa. Code § 57.198 (n)(5). Inspection failure. *If critical maintenance problems are found that affect the integrity of the circuits, they shall be repaired or replaced no later than 30 days from discovery.*

Corrective Maintenance Description

- Infrared

  Priorities for corrective maintenance are determined by the magnitude of the variance from normal operating temperature.

Distribution Overhead Infrared Inspections Corrective Maintenance		
	Variance from Normal Operating Temp.	**Days Allowed After Report Receipt for Service**
Secondaries	+20-60° C	8 weeks
	> +60° C	2 weeks
Disconnect Switches	+20-60° C	8 weeks
	> +60° C	2 weeks
All Other Facilities	+10-40° C	8 weeks
	> +40° C	2 weeks

- Visual

  The urgency for repairs is determined and an appropriate order of priority is assigned from four categories (Emergency, Priority, Unsatisfactory, and System Improvement) described below.

Distribution Overhead Visual Inspections Corrective Maintenance	
Definition	**I&M Standard**
Emergency; Defects which: (1) Threaten the safety of the public or employees; or (2) Will cause a service interruption at any moment Scheduling Priority: 1	Corrective Action taken Immediately
Priority; Defects with a high probability of causing a service interruption if not corrected promptly. Scheduling Priority: 2	Corrective Action must be taken within 30 days.
Unsatisfactory; Defects with a lower probability of causing a service interruption if not corrected promptly. Scheduling Priority: 3	Corrective action must be taken within 3 months.
System Improvement; Conditions which could be altered to improve service reliability, with no immediate reduction of risk of service interruption. Scheduling Priority: 5	Corrective action may or may not be taken.

52. Pa. Code § 57.198 (n)(6). Distribution transformer inspections. *Overhead distribution transformers shall be visually inspected as part of the distribution line inspection every 1-2 years. Above-ground pad-mounted transformers shall be inspected at least as often as every 5 years and below-ground transformers shall be inspected at least as often as every 8 years. An inspection must include checking for:*

(i) Rust, dents or other evidence of contact.
(ii) Leaking oil.
(iii) Installation of fences or shrubbery that could adversely affect access to and operation of the transformer.
(iv) Unauthorized excavation or changes in grade near the transformer.

Program Description

- Cycle

  Overhead: Overhead transformers are inspected as part of overhead visual line inspections, infrared inspections, and pole inspections. Additionally, load profiles are analyzed to identify and remedy overhead transformer locations that have consistent load demands exceeding design parameters.

  Pad-mount and below-ground: Inspections are scheduled when indicated by circuit performance, as measured by PPL Electric's Circuit Performance Index and confirmed by an analysis of actual service interruptions that identifies underground failures addressable by visual inspection.

  Pad-mount and below-ground transformers also are inspected as part of the underground residential development cable testing, replacement and curing program, which tests approximately 500 sections per year and cures approximately 600 sections per year.

  During 2012, PPL Electric performed a pilot of single phase pad-mounted transformer inspections of some of the older underground residential developments. The result was that, apart from some minor rusting, the conditions of the pad-mount transformers were in good working condition. These transformers were generally reliable so a formal inspection program would add little reliability benefit for excessive costs to the customer as outlined in the justification.

- Purpose

  The objective of a transformer inspection is to identify and correct hardware or equipment defects that may lead to a future service interruption or pose a safety hazard. Defects are identified by inspection, ranked in order of priority and scheduled for repair.

- Process

  Overhead and underground transformers are visually inspected for damage (rust, dents, cracks, locking devices, broken bushings, etc.), integrity of connections and leaks. In addition, pad-mounts and below-ground transformers have cables and elbows inspected for deterioration, foundations and covers inspected and animals, nests, cobwebs and vegetation removed.

- Justification

  PPL Electric hereby proposes a continued deviation from the fixed inspection cycle for transformers in favor of the condition-based inspection program described herein.

  The overhead line inspection cost benefit study described previously estimated that about 20,000 CMI annually could be saved via visual overhead transformer inspections. The estimated cost to inspect those transformers every two years would be $1.3 million or $65 per CMI avoided, well above the threshold employed by PPL Electric of $2.00 per CMI saved for identifying prudent reliability investments. Costs below that threshold are considered to be prudent investments, while those above typically provide less benefit for the cost. The cost threshold assists in applying finite resources to programs producing better results, thus enabling the most effective portfolio of programs.

  Similarly pad-mount transformers only contribute 500,000 CMI on average to overall system reliability. An inspection and maintenance program for transformer condition would cost millions in expense for little improved reliability over other underground reliability improvement programs.

  Resources that would be applied to shorter cycles than this proposal would reduce the resources applied to other more cost-effective reliability programs described in this plan.

52. Pa. Code § 57.198 (n)(7). Recloser inspections. *Three-phase reclosers shall be inspected on a cycle of 8 years or less. Single-phase reclosers shall be inspected as part of the EDC's individual distribution line inspection plan.*

Program Description

- Cycle

  PPL Electric has initiated an upgrade program to replace all three phase oil circuit reclosers ("OCRs") with vacuum circuit reclosers ("VCRs") based upon a review of the dominant failure modes and causes. The newer technology replaces oil with a vacuum as the interrupting media. This eliminates the OCR maintenance issues of carbonized oil, contact deterioration and the timing issues that sometimes occur with OCRs. In addition, the communication capabilities of the devices allows for PPL Electric to track data pertaining to the asset health which will allow PPL Electric to do condition based maintenance on these devices. PPL Electric received approval from the commission on January 3, 2014 to complete these replacements on a 10-year cycle starting in 2015. Three-phase VCRs are subjected to infrared inspection on the same 2-year cycle as OCRs.

  Three-phase OCR: 2-year infrared; 10-year replacement.

Single-phase OCRs: inspected as part of PPL Electric's distribution line inspection program.

- Purpose

  The purpose of the recloser replacement program is to ensure the reliable operation of reclosers by replacing deprecated equipment with new installations.

- Process

  Three-phase oil and vacuum reclosers are included in the two-year infrared line inspection program.

  Three-phase OCRs are replaced with new communicating VCR units based upon installation date and type.

- Justification

  PPL Electric hereby proposes a continued deviation for reclosers in favor of the program described herein.

  A recloser's function is to isolate faults while minimizing the number of customers affected by permanent service outages. Visual inspection of an OCR provides relatively little useful information about the unit's capability to perform its function compared to testing. Testing in place would require almost all of the same steps that are involved in replacement. Bench testing is preferable to testing in place and refurbishment requires the unit's removal from service. With the planned installation of these communicating vacuum units, the devices have a longer life expectancy, and inspections can be planned. As PPL Electric has been replacing older oil reclosing three phased units, reliability has improved from the decreasing number of failed units. In addition, PPL Electric experienced close to a 50% improvement in reliability within the initial smart grid pilot area.

Replacement Plan

Actual scope is determined annually based upon the number of OCRs on the system, age, and model type of OCR. The projections below are tentative until replacement recommendations are provided.

PPL Electric Utilities Corporation

Distribution Three Phase OCR Replacements			
	Area *(Number of Three Phase OCRs)*	**OCR Replacements Planned**	
		2018	**2019**
PPL Electric Utilities Corporation *Total Three Phase OCRs* (1,070)	Lehigh (165)	10	21
	Northeast (183)	9	19
	Central (216)	11	17
	Susquehanna (140)	7	17
	Harrisburg (200)	14	18
	Lancaster (166)	4	21
	Totals	**55**	**113**

52. Pa. Code § 57.198 (n)(8). Substation inspections. *Substation equipment, structures and hardware shall be inspected on a cycle of 5 weeks or less.*

Program Description

- Cycle

	Visual	Infrared
Distribution- Supervisory control and data acquisition ("SCADA") Controlled	Quarterly	Annual
Distribution-Non SCADA	Quarterly	Annual

- Purpose

  Periodic substation inspections verify the integrity of station physical security, record and correct any security breaches, verify the proper fluid levels and gas pressures, and identify any leaks, verify the proper operation of essential station equipment and initiate any necessary corrective actions.

- Process

  Inspection of substation equipment and recording abnormal conditions of the equipment. Equipment inspected includes, but is not limited to:

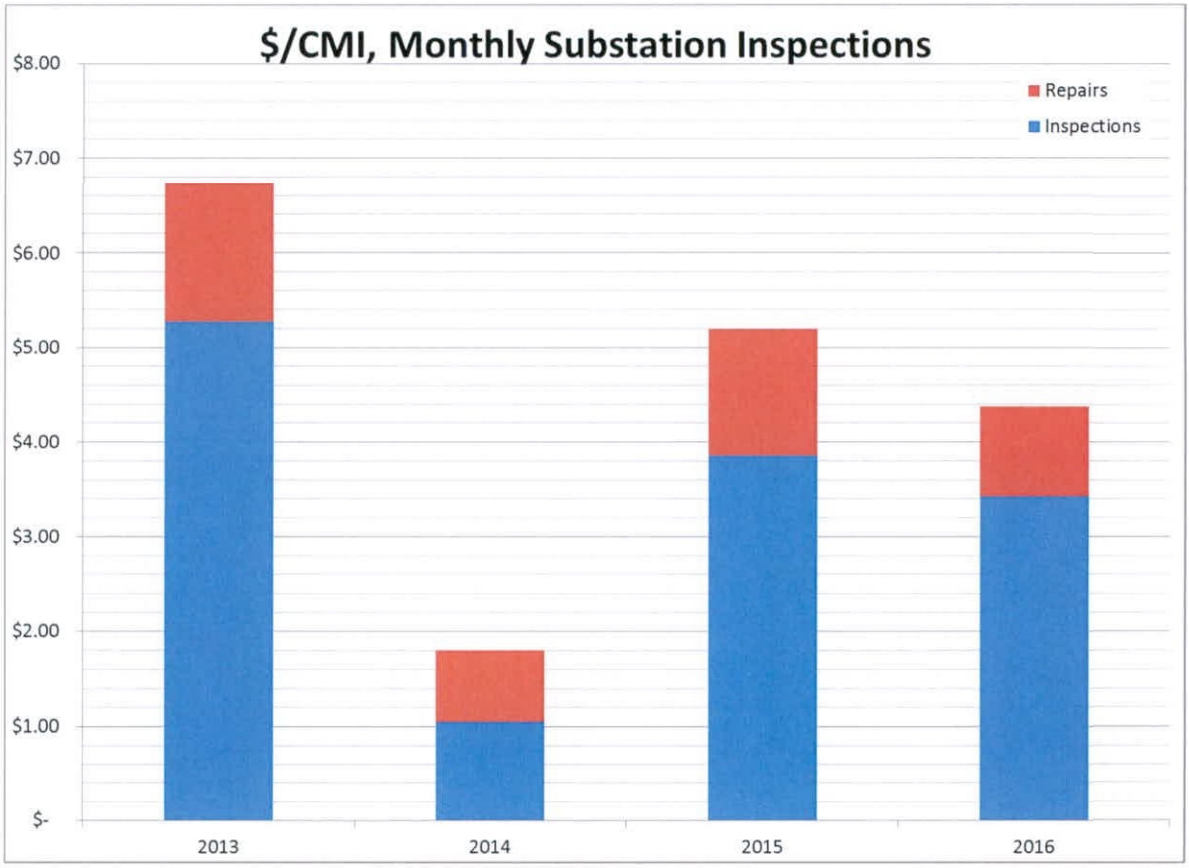
  - Power transformers
  - Circuit breakers
  - Auxiliary equipment
  - Batteries and chargers
  - Control house
  - Yard and perimeter

- Justification

PPL Electric hereby proposes a deviation from the five-week inspection cycle for substations in favor of the quarterly program described herein.

From 2013-2016, PPL Electric estimates that an average of 890k CMI was avoided through repairs identified via the monthly substation inspection. The costs of inspection plus repair averaged $2.75 million per year, or $4.53 per CMI avoided, over double the threshold employed by PPL Electric of $2.00 per CMI saved for identifying prudent reliability

investments. Costs below that threshold are considered to be prudent investments, while those above typically provide less benefit for the cost. The cost threshold assists in applying finite resources to programs producing better results, thus enabling the most effective portfolio of programs. See the figure below.



If PPL Electric were to inspect substations every quarter instead of every five weeks, the cost associated with the inspection would be decreased by 75%, with the repair costs remaining the same. In this scenario, the total cost per CMI would be $1.98, which is just below our threshold.

PPL Electric plans to have SCADA at every substation, which provides real-time telemetry of potential issues. Over 100 advanced circuit breaker relay packages have been deployed in the last five years, with seventeen more planned before 2018. The relay packages provide advanced health information about the breakers and signal when maintenance is required, negating the need for visual inspections of these assets. PPL Electric implemented an upgrade to the data historian software which allows the Company to be automatically alerted when substation abnormalities are detected, and automatically calculate remaining life on smart assets when operations occur.

PPL Electric Utilities Corporation

Over the last four years, none of the repairs scheduled due to the monthly inspections have been critical repairs due to imminent failure risk. The repairs have been minor, and could have waited 90 additional days to be identified.

Resources that would be applied to shorter cycles than this proposal would reduce the resources applied to other more cost-effective reliability programs described in this plan.

Inspection Plan

Distribution Substation Visual Inspections			
	Area *(# of Substations)*	**Inspections Planned**	
		2018	**2019**
PPL Electric Utilities Corporation *Total Substations 354*	Lehigh (62)	248	248
	Northeast (58)	232	232
	Central (67)	268	268
	Susquehanna (46)	184	184
	Harrisburg (60)	240	240
	Lancaster (61)	244	244
	Totals	**1416**	**1416**

Appendix A: Transmission Programs and Procedures

Program	Activity
Helicopter Inspections – Routine	Aerial linemen perform annual routine transmission line patrols from a helicopter. They identify damaged or deteriorated equipment and any apparent vegetation issues. Engineers review the findings and develop plans for repair, replacement or remediation.
Helicopter Inspections – Comprehensive	Aerial linemen perform an overhead comprehensive inspection of transmission line facilities on a four-year 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 generally are 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 generally are expedited.
Structures – Inspection, Treatment, Replacement, Reinforcement/Repair	Transmission structures are examined for deterioration and measure the degree of decay and deterioration. Basic treatment is applied to abate further deterioration. Based on the results of the inspection, the structure is either scheduled for a future inspection, reinforcement and/or repair for extended life or replacement.
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. Repairs are either completed by line crews or aerial line crews to ensure efficient and effective repairs.
Line Switches – Maintenance and Inspection	Line personnel inspect, maintain and perform operational tests on 138kV and 69kV line air break switches to assure proper operation.

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Program	Activity
Line Switch Upgrades	Line personnel install lightning arresters on 138kV and 69kV line switches to increase system reliability. Existing parallel break air breaks (PBAB) and load sectionalizing air breaks (LSAB) are being upgraded to motor operated load break air breaks (MOLBAB) to improve switching capabilities, outage restoration times, and sectionalizing ability.
Circuit Analysis	Engineers analyze circuit loading and performance to identify areas needing increased line capacity or improved line reliability.

Appendix B: Substation Programs and Procedures

Program	Activity
Load Survey	Automatic monitoring devices such as 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 identify and correct potential equipment problems before a failure or service interruption 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, high voltage fuses and high-speed automatic grounding switches. Depending on the type of equipment, "service" can include actions other than operational testing.
Inspection and Condition Assessment	Electricians inspect and perform condition assessments of 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, (CCVTs, coupling capacitors, potential devices, etc.). They also perform high-potential testing on12kV oil, air and vacuum circuit breakers to assure proper operation.

PPL Electric Utilities Corporation

Program	Activity
Condition Monitoring of Station Equipment	Electricians/Technicians perform dissolved gas-in-oil analysis, dielectric, and physical properties oil tests for oil in power transformers, and impedance and select 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	Electricians perform infrared 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.

Appendix C: Distribution Programs and 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's facility.
Capacitor – Inspection and Maintenance	Line personnel inspect and maintain associated electronic control equipment to assure proper operation. Line personnel repair or replace any defective equipment.
Voltage Regulator – Inspection and Maintenance	Line personnel inspect 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 and Maintenance	Line personnel inspect 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 portions of the load are transferred to other nearby transformers.
Wood Pole – Inspection, Maintenance, Reinforcement, Replacement	Wood poles are examined for deterioration and the degree of decay is measured. Based on the results, the pole may be treated with preservative to extend its life, treated and reinforced for extended life or replaced.
Overhead Line Inspection	Line inspection personnel examine overhead facilities to identify damaged, deteriorated or substandard equipment. Line personnel repair or replace any defective equipment.

PPL Electric Utilities Corporation

Program	Activity
Circuit Performance Review	Engineers use PPL Electric's Circuit Performance Index to identify worst performing circuits and ascertain the need for additional circuit reviews or inspections. The improved index looks at a circuit's overall impact to system SAIDI. Actual service interruption history is analyzed to identify causal or geographic patterns.
Underground Primary Cable – Testing, Maintenance, Replacement, Curing	Line personnel 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 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 deemed appropriate, schedule work to move the facilities.
Underground Service Cable	Engineers resolve customer service problems that are due to deteriorated underground service conductors.
Oil Circuit Reclosers	Line personnel replace in-service oil circuit reclosers on a time-based maintenance cycle. Removed units are tested, and may be refurbished and placed in inventory.
Line Protection Equipment	Line personnel replace in-service three phase oil circuit reclosers with communicating vacuum devices on a time-based maintenance cycle.
Capacitor and Voltage Regulator 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.

Appendix D: Vegetation Applications

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 American National Standard for Tree Care Operations-Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (ANSI A300).
Hazard Tree Removal	Trees located outside the right-of-way that represent a threat to line performance/ safety are removed when it is feasible to do so.
Herbicide Application	Tall-growing, undesirable vegetation growing within the right-of-way corridors 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 right-of-way corridors is selectively removed in those situations where herbicides cannot 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.

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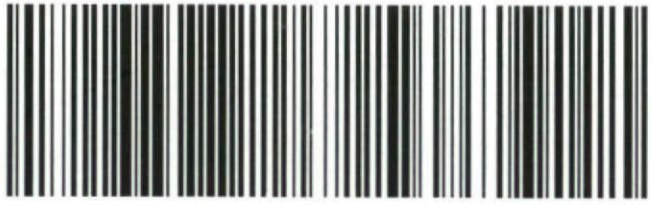

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.
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