

PPL Electric Utilities
Summer Readiness Overview
June 2014

SUMMARY

For PPL Electric Utilities (PPL Electric), summer readiness means we must be up to the task to respond effectively to summer storms as well as provide reliable electricity every day for 1.4 million customers. Detailed below are various actions we have undertaken or plans for future enhancements to our system.

A. RELIABILITY ENHANCEMENT PROGRAMS

a. Enhanced Vegetation Management

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

In 2013, PPL Electric launched ground to sky trimming on multi-phase circuits and accelerated our efforts to identify and remove trees outside of the ROW that have the potential to cause outages. These efforts, combined with several years of more aggressive tree trimming on higher voltage lines, have resulted in a 43% reduction in the number of tree-related outages in 2013, when compared to the average of the previous three years. In 2014, the initiatives continue with the expectation of further reductions in vegetation related service interruptions, a critical factor in reliability.

b. Storm Hardening

PPL Electric is implementing several new initiatives to improve system resiliency in 2014. These initiatives include construction specification changes to increase the reliability of the system during storms, decrease the risk of broken poles, and improve restoration times.

For example, if we identify an area of significant tree threats that cannot be mitigated through tree trimming, we are building the circuit to a higher strength design. This often includes installing a higher class (thicker) and taller pole. The storm hardening also includes designing stronger overhead components. The intent is to avoid a pole breaking, which can lead to extended outage time to make repairs.

We completed our first storm hardening project in 2013 in southern Lehigh County. The project included:

- Installing 172 poles, which are thicker and 10 feet taller than existing poles for better vegetation clearance, and spaced closer together to support new equipment.
- More rigorous tree clearing where rights allow.
- Installing 4.4 miles of new stronger insulated conductor.
- Adding automated switching to limit the extent of power outages.
- Adding smart grid technology in 2014 -- remote-controlled equipment that automatically registers the exact location of damage and reroutes power.

PPL Electric is also partnering with a national trade association and several large utilities on a storm hardening study. The study includes physical destructive testing at an outdoor laboratory and PPL Electric is exploring the possibility of testing some of our new hardening techniques. Information garnered from these tests can help us design and build a more robust system in the future.

c. Fuses/Reclosers

In 2013, PPL Electric initiated a program for mass installation of fuses on single phase taps that were previously unprotected in order to limit the number of customers who experience a service interruption due to an outage. This initiative has already resulted in a reliability improvement in these areas and will continue to provide added protection into the summer months.

PPL Electric has also made a change to recloser specifications so that all three phase recloser installations going forward will be vacuum interrupting devices with telemetry. This will not only give added reliability benefit over the previous oil interrupting reclosers, but will also allow for remote operation.

d. Smart Grid

PPL Electric conducted a \$38 million Smart Grid pilot program in Dauphin and Cumberland counties in 2012. Results indicate a 35% reduction in customer minutes interrupted vs. non-automated circuits in the same geographic area, validating our long term commitment to distribution automation and the utilization of advanced technology. A similar project was recently completed in Northeast region of PPL Electric's service territory.

Smart grid technology is being utilized in our service territory as part of an ongoing, long-term commitment to distribution automation. Approximately 50 devices were installed through May 31, 2014 with the plan to install almost 400 by the end of 2014. This large investment in distribution automation will benefit more than 120,000 customers over 168 circuits throughout PPL Electric's service area. Additional circuits will be targeted over the next several years across our service territory. Our long-term infrastructure improvement plan calls for expanding distribution automation over the next four years to improve reliability for more than 90% of our customers.

e. Automatic Splice Connections

Automatic splice connections continue to be inspected as part of a comprehensive overhead inspection process and identified defects are replaced accordingly. PPL Electric

remains dedicated to piloting new technologies and conducting cost-benefit analyses for inspection and reliability improvement techniques that become available.

f. Other Relevant Activity

PPL Electric has several other noteworthy reliability improvements across the system including a targeted approach to installing animal guards on our equipment, projects and communications targeted at customers experiencing multiple service interruptions, reconductoring sections of circuits, and building new substations.

B. PREVENTIVE MAINTENANCE PROGRAMS

a. Capacitor Inspections

PPL Electric is transitioning to condition based inspections of its multi-phase capacitors by installing automated controls and sensors. This will allow PPL Electric to target maintenance in a more effective and cost-efficient way, and alert operators of potential issues in a timely manner.

Automated controls and sensors will allow for real-time monitoring and remote operation of switched capacitor banks, improving the quality of the power we deliver. This program precludes the need to conduct physical inspections.

b. Vegetation Management

Distribution System Maintenance - PPL Electric continues regular tree-trimming cycles for all aerial distribution lines. Lines are trimmed every four years in the southern half of the service territory, and every five years in the more rural northern service territory. Some lines are trimmed more frequently based on need. We also refined our prioritization tool to more effectively rank the order of circuits trimmed throughout the year to maximize the impact of the trimming program and minimize tree related outages. In addition, we increased the removal of hazard trees from outside transmission and distribution corridors and 'ground to sky' trimming and clearing is performed on multi-phase distribution lines wherever possible.

Bulk Electric System Maintenance (BES) – We maintain more than 1,500 miles of BES Transmission lines over a recurring 3-year period. Line clearances are maintained between overhead power lines and any vegetation.

138kV Electric System Maintenance – We maintain 385 miles of 138kV transmission lines over a recurring 3-year period. In residential areas, we selectively remove vegetation that is not compatible from the PPL Electric right of way on customer property. Whenever feasible, we will not disturb trees and other vegetation that are compatible with high-voltage transmission lines.

69kV Electric System Maintenance – We maintain 3,025 miles of 69kV Transmission lines over a recurring 3-year period. In 2013, PPL Electric began implementing a new standard of clearing right-of-way (ROW) on 69kV transmission lines to improve reliability. The new standard requires clearing to the full extent of the ROW on all 69kV lines.

c. Substation Inspections

Distribution substations have a monthly visual inspection and annual infrared inspection. Transmission substations have a quarterly visual inspection and annual infrared inspection.

d. Aerial Patrols

Helicopter patrols on the transmission line include routine patrols, comprehensive patrols, and annual infrared inspections. The routine patrols occur during early summer to look for larger potential issues on the transmission system. In addition, a forester typically participates to identify potential danger trees. These flights give a once-a-year look at the entire system. The comprehensive patrols are flown on a quarter of the system every year so every line is inspected every four years. These patrols typically take place after the routine patrol. These are much slower so that the helicopter can stop at every structure and take pictures. The object of these patrols is to look for damaged equipment. Infrared patrols are performed in the early winter to scan all splices and connectors on the transmission line and take corrective action if any hot spots are found.

e. Infrared Inspections

PPL Electric's infrared (IR) line inspections are a routine part of maintenance that occurs on the system to find potential equipment failures that cannot be detected from visual inspections. PPL Electric's IR inspection process is programmatically applied to all multi-phase lines adjacent to roadways on a two year cycle. These inspections are conducted in the winter months to take advantage of the relatively high and consistent loads associated with heating demands and the colder weather providing a lower ambient temperature for greater contrast. Consequently, repairs associated with the results of infrared scanning are generally completed before summer creating conditions for greater reliability.

Supplementary infrared scanning may be conducted throughout the year. Circuits planned for load transfer may be scanned based on circuit performance indicators. Additionally, specific areas may be scanned to augment condition-based visual inspections

f. Any other relevant activity

PPL Electric has a wide portfolio of maintenance activities and continuously seeks to optimize maintenance cycles to maintain reliability of service with cost.

C. CAPACITY PLANNING

PPL Electric regularly reviews reliability performance on a system wide, regional, local and circuit basis to identify needed improvements due to load or performance. PPL Electric's system planning process works to strike a balance between service reliability and cost of service.

In 2013, demand for electricity peaked at 7,190 megawatts (mW) on the PPL Electric system. This peak occurred on the afternoon of Thursday, July 18, 2013. This represented a small increase from the summer 2012 peak of 7,182 megawatts but fell

short of the all-time summer peak of 7,554 mW recorded in July 2006. A new all-time winter peak of 7,879 megawatts was recorded on January 7, 2014. PPL Electric experienced no issues during this peak. Forecasted load for this summer is not projected to exceed the all-time peak.

We do not foresee concerns with our system's delivery capacity during the upcoming summer based on its performance during prior summer heat waves, our ongoing investments in reliability, capacity upgrades and customer adoption of energy efficiency and conservation opportunities.

D. 2013/2014 STORM UPDATE AND LESSONS LEARNED

PPL Electric experienced a lower than average number of storm events in 2013 which included three PUC-reportable storms. Currently, there are two PUC-reportable storms on record for 2014.

Four of the five PUC-reportable storm events referenced above were storm events where outages were restored within 24-36 hours. However, the Nika ice and snow storm on February 5, 2014, was a significant event on our system, affecting 92,283 customers with 74,891 of those customers located in our Lancaster operating region. Restoring all customers back to service required several days.

Based on an internal lessons learned exercise from the 2014 Nika storm event, as well as discussions with the Pennsylvania Public Utility Commission (PUC), national, state, regional and local emergency management agencies and other utilities, we are committed to enhancing our storm response with continued collaboration to improve communications with state agencies, emergency organizations, other utilities and customers as well as working to more effectively manage estimated restoration times (ERTs) and operations.

Other emergency preparedness highlights include:

- **Formalizing a process to “De-Centralize a Region.”** Work is ongoing to formalize a process to use the less impacted regional command centers and support personnel to remotely dispatch crew areas within the affected region to accommodate the influx of resources to effectively manage all outages within a region during a major storm event.
- **Modeling similar de-centralized processes for Damage Assessment and Wire Guarding.** We are developing guidance and direction to ensure supporting regions provide vehicles, kits and coordinators when sending damage assessors and wire guards.
- **Evaluating breaking defined work areas down into smaller operating areas.** We are evaluating how existing work areas within the regions can be further broken

down into smaller operating areas which would allow for better division of work when decentralizing a region.

- **Gaining Efficiency in Storm Restoration through use of an Incident Action Plan.** We are developing a process where the Emergency Command Center sets clear priorities for the next 24-hours, which are documented and communicated through an incident action plan. Supporting regions would then develop Regional Operations Plans (ROPs) to meet the given objectives of the incident action plan.
- **Developing a Process to use Regional Operations Plans (ROPs) to manage ERTs.** We intend to build daily reports based on the work committed to in the ROPs to facilitate customer outreach communications.
- **Evaluating Improvements to the Field System Operator Representative Process.** The need to implement the Field System Operator Representative (FSOR) process will be evaluated and identified earlier in the response to the storm event so the turnover of jurisdiction can be completed prior to foreign crews arriving.
- **Evaluating Mutual Assistance - Process Improvements.** PPL Electric will seek to further identify, in advance, the capabilities of the arriving mutual assistance crews. Some crews are self-contained and come with all resources needed to turn over a piece of the electric distribution system for restoration. In addition, improved planning for the appropriate type of work packets for mutual assistance crew's arrival will occur. Once the estimated time of arrival (ETA) of the mutual assistance crews is known, communicate the ETA with the receiving regions so staging area can be established and onboarding support for the arriving crews can be arranged.

E. 2014 SUMMER READINESS

a/b. Capacity Additions and Transmission Preparedness

PPL Electric plans more than \$470 million in capital improvements this year to maintain and improve reliability and meet increased demand on its transmission and distribution systems – continuing a trend of increased investment in system reliability. Additionally, substantial capital is being deployed for new large transmission expansion projects such as the 500kV Susquehanna – Roseland line and the Northeast/Pocono Reliability Project.

Our crews and contractors are hard at work building new substations and transmission lines, upgrading existing facilities, replacing older transmission lines and poles, improving distribution circuits and upgrading technology for better, more efficient operation. These improvements will strengthen the system to effectively handle summer peak loads and improve overall reliability.

More than 52 load-based and reliability projects on the transmission and distribution systems were completed through May 2014, strengthening our network in time for peak summer demand. Additional system modernization work is underway, as well as dozens of system improvements that will be completed through the remainder of the year.

Examples of key projects include:

- Rebuilding and reconductoring several older transmission lines.
- Completion of long-planned 69-kV transmission upgrades serving Lehigh and Bucks counties.
- Improved lightning protection on targeted transmission facilities.
- Helicopter patrols for transmission line inspections (comprehensive and routine).
- Expansion and upgrades to bulk power substations (circuit breakers, transformers, capacitor bank replacements).
- Construction of new transmission substations and lines to relieve load on existing facilities and improve operational flexibility.
- Modify transmission substations to improve reliability.
- Right-of-way line clearance along 1,650 miles of 115-, 138-, 230-, and 500-kV transmission lines.
- First-year of a three-year plan to complete ROW clearance along 2,250 miles of 69-kV transmission facilities.
- Expanded right-of-way and clearance on targeted transmission lines where reliability improvement is needed.
- Replacement of circuit breakers and transformers at distribution substations.
- Installation of remote monitoring and control equipment at certain substations.
- Construction of seven new distribution substations.
- Construction of new distribution lines to relieve load and improve operational flexibility.
- Rebuilding existing distribution lines with upgraded conductors to better handle load in certain growing areas and improve reliability.

c. Event Preparedness

PPL Electric is committed to the effectiveness of our emergency preparedness and will continue to take steps toward continuous improvement based on recent experience and industry best practices. There are currently 86 defined storm support roles within PPL Electric with several new roles and responsibilities under development. A process is in place to assign all PPL Electric employees a storm role within their first few months of joining PPL Electric. We are currently working to improve the role of the Damage Assessment Lead and Wire Guard Lead to ensure these areas have the appropriate level of oversight. To ensure personnel are familiar with their storm role and responsibilities and the processes which they perform are repeatable, storm role-related documents and drills are developed and maintained to enhance PPL Electric's storm response effectiveness.

Each of the six operating regions conduct monthly drills in their Regional Command Center to ensure the facility and support personnel are ready to respond based on established procedures and checklists. To ensure a repeatable, consistent process across all operating regions, a regional command center best practice team was established early in 2013. This team works with drill coordinators to ensure consistency across regions and continually looks at lessons learned to develop enhancements.

- d. Training
PPL Electric has implemented a continuous learning program for Journeymen and Leader levels in the company in addition to scheduling additional helper schools.

In an effort to increase storm restoration time and improve on ERT accuracy, the role of damage assessor is becoming more valuable for storm response. In order to increase our pool of damage assessors, PPL Electric is training engineers throughout the company as storm damage assessors.

F. STORM RESPONSE

- a. Outage Restoration Strategy
First priority is given to public health and safety facilities, such as hospitals and 911 call centers. After those facilities are restored, focus is then on restoring trouble cases that will bring the most customers back on line as quickly and safely as possible.

Improvement opportunities continue to be identified. The Field System Operator Representative (FSOR) process that was developed in 2013 was implemented for the first time during the Nika Ice storm. However, it was determined that the need to implement the transfer of jurisdiction for the FSOR should be evaluated and completed, if appropriate, prior to the arrival of the foreign crews.

- b. Communications and Outreach
Although PPL Electric's efforts are extensive and generally well received, we recognize the need for continuous improvement related to public communications. We continue to evaluate our existing processes to provide accurate, timely and frequent status updates and other helpful information appropriate to the storm event to all stakeholders. We also continue to refine our process to work more closely with the county emergency management agencies to assess priorities and establish a communication path between PPL Electric and affected communities.

We have established processes to develop and disseminate information in a consistent and timely manner to various audiences, including periodic daily conference calls with public officials, proactive media outreach, direct contact with customers using PPL Alerts, automated telephone messages and broadcast e-mails, the utility's mobile-ready web site, and social media. Employees have been trained and designated to monitor social media and provide online customer engagement.

Key personnel collaborate with the Pennsylvania Public Utility Commission, national, state, regional and local emergency agencies and other utilities to share best practices and seek ways to improve emergency response. PPL Electric recently became engaged in the PUC's newly formed Critical Infrastructure Interdependency Working Group and is an active participant in the Commission's emergency preparedness best practices initiative.

- c. Restoration Material Staging and Delivery Efficiency Best Practices

PPL Electric has recently completed the construction of a 40 foot storm trailer containing materials for emergency power restoration. The trailer is mobile and can be moved to any staging location as needed in a storm emergency. The trailer and its contents are in addition to the 150 storm kits that are currently kept in stock, so we may quickly provide materials to the arriving mutual assistance crews. An additional material delivery best practice is currently underway, as PPL Electric has made arrangements with several vendors to provide additional pole delivery trucks and equipment as needed in a storm emergency. One of these pole delivery vendors was utilized during the February ice storm Nika that affected the southern portion of PPL Electric's service territory.

d. Mutual Aid Crew Assignment and Staging Efficiency Best Practices

PPL Electric is establishing communications with the arriving mutual assistance crews while en-route to establish an estimated time of arrival and discuss the capabilities of the arriving crews. Once the crew capabilities are known, work packets can be built according to the arriving crews' capabilities. Some crews are self-contained and come with all resources needed to turn over a piece of the electric distribution system for restoration. Communicating crew arrival times as soon as they are known, preferably the day prior to their arrival, allows for more efficient on-boarding of personnel and identification of staging area needs. PPL Electric is considering the need to activate a staging area lead role.

CONCLUSION

PPL Electric Utilities appreciates the opportunity to outline our programs, projects and activities in preparation for the peak demand and storms of the summer season.

Executing our seasonal maintenance program, along with strategic investments and system improvements, enables us to deliver the safe, reliable power our customers expect.

Based on our planning, execution of our work plans, and storm response improvement initiatives, PPL Electric Utilities believes it is operationally ready for summer to meet our customer needs and expectations.