

PPL Electric Utilities
Testimony before the Pennsylvania Senate Democratic Policy Committee
Grid reliability, Storm Preparedness and Winter 2020-21

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Chairman Boscola and members of the Pennsylvania Senate Democratic Policy Committee:

PPL Electric Utilities delivers every day for its 1.4 million customers and our record of innovation and commitment prepares us to deliver safe, reliable, and resilient service.

PPL serves a 10,000-square-mile service area that includes all or part of 29 counties in central and eastern Pennsylvania, including the state capital.

In this service territory, which is larger than New Jersey, our more than 2,000 employees help us excel in reliability, with PPL regularly ranking among national leaders in lowest frequency of outages a customer experiences on average in a year.

The advancements, practices, and performance contained in this testimony are part of PPL's drive to be one of the best electric utilities in the United States. Innovative projects now underway will further improve our performance going forward.

COVID-19

We've taken steps during the pandemic to keep our employees safe through new protocols and personal protective equipment.

As an example, we established small work groups and remote reporting to minimize contact and increase social distancing measures. We also substantially reduced employee access and activity at our service centers for the same reasons.

To date, we've successfully managed the pandemic with little to no exposure to our PPL field or control center employees, allowing us to continue all work on our system.

Planning for and adjusting to working through the pandemic benefits our customers and helps maintain strong reliability.

Because of COVID-19, we've increased our stocks of critical material and equipment and implemented COVID protocols for contractors, as well as visiting crews when they supplement our personnel for specific storms. We also participate in mutual assistance programs for critical equipment, like transformers, to mitigate today's supply chain challenges.

Smart Grid

We believe our power grid, with its combination of over 10,000 sensors, communication systems, and automation, is one of the most advanced in the United States.

Our automation allows our smart grid to both recognize an outage and instantly reroute power to reduce the footprint of the outage. Other systems in many cases require manual action to reroute power.

We recently recorded one million avoided outages due to smart grid since 2015. That's 100 million more minutes with the lights on for families, businesses, government buildings, schools and more.

The smart grid network is part of a significant investment made by PPL in the power grid over the past decade. Our customers today are experiencing about 30 percent fewer outages than in 2011.

We invite you to visit our smart grid web page, ppllectric.com/smartgrid, to view more information and a video.

Vegetation Management

Trees contacting power lines remain the top cause of storm-related customer power outages.

Our vegetation management efforts have significantly reduced storm-related outages in recent years, and it's an area we continue to focus on.

We're using data analytics to target potential trouble early and make our work more efficient and effective. We have been able to reduce our distribution maintenance costs on a per mile basis by 46 percent over the past three years due to efficiencies in scope selection, planning and execution. We have improved vegetation-related customer reliability by 11 percent compared to the same period last year.

Rights of way are addressed on a multi-year cycle, but in any given year we actively work on about 8,000 miles of right of way.

We also look for trees outside the right of way that could hit power lines if they fell. Sometimes, those trees – called hazard trees - are diseased or leaning and we then work with the property owner to take the tree down and eliminate the power outage risk. Since last January, we've worked with property owners to remove more than 70,000 hazard trees, each time eliminating a potential outage.

Infrastructure Hardening

Our grid has become more resilient to storms through investments in asset replacements and system reinforcements along with installing new smart grid technologies and operational systems to allow faster system response and isolation during events.

More than a decade ago, PPL completed a comprehensive study of all the equipment on its grid and embarked on a plan to increase reliability and reduce customer outages. One of the ways we did that was to address equipment at the end of its lifespan.

In many cases, that meant replacing older wood transmission line poles with new, stronger steel poles that are much more resistant to storms and tree contacts.

These upgrades have taken place across our service territory. Since 2012, we have removed or replaced 22,857 wood poles on our transmission grid.

In many strong storms in recent years, these types of investments have helped us avoid transmission system outages. That's important because transmission is the backbone of the grid and feeds substations which ultimately get electricity to the end user – homes and businesses.

On the distribution grid, we have instituted a host of improvements including, but not limited to:

- Upgrading assets to address aging infrastructure and enhance system performance
- Installing advanced smart grid technologies for real time asset health monitoring and to respond faster to system events
- Updating our standards with a focus on system hardening including stronger poles and more robust design of our structures to prevent vegetation outages
- Adding operational flexibility using automated technologies

Over 100,000 distribution poles and 7,000 reclosers have been replaced over the past decade.

Data and Technology

PPL is using data analytics to help drive reliability improvements across its grid.

We previously mentioned its use in our vegetation management efforts, but its application is more widespread.

As an example, we developed and implemented predictive failure algorithms designed to pick up on voltage patterns and signatures that precede the failure of Coupling Capacitor Voltage Transformers (CCVTs) and Potential Transformers (PTs) to allow for safe removal and proactive replacement of the equipment.

These voltage signatures can precede a failure by minutes or years, so understanding them was crucial to developing effective predictive algorithms. This solution allows PPL to maximize its operational and maintenance investments by shifting to a condition-based maintenance strategy.

We took a similar approach with underground power lines, using data analytics and comprehensive modeling to not only accurately determine the average life expectancy of our underground conductors, but also identify the at-risk subpopulations that need a more proactive replacement or monitoring strategy.

Reliability Performance Measured Against Peers

PPL participates in an annual survey by the Institute of Electrical and Electronics Engineers (IEEE) of about 100 participating utilities, including 32 large utilities that each have more than a million customers.

We have been a first quartile performer every year since 2015 in low average outage frequency across our grid. We were top decile in 2017 and expect to be top decile in the 2019 results due out shortly.

PPL Electric Utilities was recognized in 2019 by PA Consulting as a recipient of the 2019 ReliabilityOne™ Most Improved Utility Award for its dramatic gains in grid reliability over the past decade. We are the only Pennsylvania utility to hold this distinction.

The driving force behind all our reliability investments is to prevent outages from occurring in the first place.

Prepared for Storms

PPL belongs to two industry mutual aid groups, the Southeast Exchange (SEE) and the North Atlantic Mutual Assistance Group (NAMAG).

We've assisted other utilities in storm restoration many times over the years, and in turn have benefitted from assistance from utilities from other parts of the region and country. Each mutual assistance request for our resources is carefully evaluated while considering what PPL must have on hand to keep its own customer population well served.

Our sister utilities in Kentucky - Louisville Gas & Electric and Kentucky Utilities – are typically our first resource for staging in advance of a storm if we need to supplement PPL crews and contractors.

They can provide an additional 150 to 300 FTEs with a 24- to 36-hour response capability. We used these resources in two of our major storms in 2020, on Easter weekend and during Hurricane Isaias.,

Storm Response

It's been a busy storm year so far in the PPL service area, with 21 storms to date, compared to a historical 18-storm average in the same period. Five of those storms were PUC reportable, including Isaias, where we restored 90 percent of affected customers in less than 24 hours.

A PUC reportable event is when at least 2,500 customers are out of service for more than six (6) hours because of a single event (storm or non-storm).

Our strong storm restoration metrics continue to improve. Examples include:

- We reduced the average number of customers affected by an outage by 11 percent in 2019 versus the average of the previous five years.
- We're experiencing the best year in our history for completing work within the stated estimated restoration time (ERT). Our accuracy rate is 86 percent (YTD) compared to 82 percent last year.
- We achieved the lowest percentage of customers interrupted for more than eight hours during PUC reportable storms, performing 25 percent better than our previous best year.

In addition to our success in reducing average outage frequency, we're also driving down average outage duration.

Grid Safety

PPL Electric Utilities has developed a system for safely and automatically identifying and shutting off power to a downed power line, something we believe is a first of its kind.

The system first operated in February 2019 and four other times since then. We are currently finalizing the patent for the algorithm that allows the automated power shutoff in this process.

Downed power lines may be unavoidable for an electric utility, but the technology we developed substantially reduces the odds that such an event will have tragic consequences for our employees and the public.

Restoration Priorities

- Our first priority is supporting firefighters, police and critical public safety facilities, like hospitals. We also prioritize reports of downed wires.
- We then focus on major power lines and substations that serve large numbers of customers. Where we can, we use switches and smart grid technology to reroute power to as many customers as possible until repairs can be made.
- We give higher priority to repairs that will get the largest numbers of customers back in service as quickly as possible.
- We then restore power to smaller neighborhoods and individual homes and businesses.

- During any storm, but especially during this pandemic, our crews work around the clock to restore power as safely and quickly as possible.

Recent Industry Honors

- Eight consecutive J.D. Power residential customer satisfaction awards for large utilities in the eastern U.S.
- ReliabilityOne™ Most Improved Utility Award (2019)
- Smart Electric Power Alliance (SEPA) Power Players Investor-owned Utility of the Year (2019) for work to encourage adoption of renewable energy, while maintaining grid reliability and power quality. PPL was selected for its work on the creation of a Distributed Energy Resource Management System (DERMS).
- Achievement Award from the Association of Edison Illuminating Companies (2019) for downed wire safety technology.