



Edison Electric  
INSTITUTE



America's Electric Companies:  
**Serving Our Customers and  
Planning for the Energy Grid of the  
Future With Electric Transmission  
Technologies and Innovation**



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## INTRODUCTION

The Edison Electric Institute's (EEI's) member companies—our nation's investor-owned electric companies—are making significant investments in the energy grid to make it smarter, cleaner, stronger, more dynamic, and more secure. These investments help to increase the integration of renewable energy resources, power the rapid increase in electric vehicles, and facilitate the adoption of a broad array of smart technologies to better serve our customers and our communities. In addition, investments in smarter energy infrastructure help to protect the energy grid from extreme weather and cyber-attacks; help predict and prevent outages; and help companies respond to and restore power faster when outages do occur.

Electric transmission is, perhaps, the most critical component of the energy grid and is about more than just efficiently delivering affordable, reliable, and safe electricity to homes, businesses, and communities when and where it is needed—it powers innovation.

A robust transmission system integrates an ever-increasing amount of renewable energy resources and delivers more clean energy to customers; enhances grid reliability and resiliency; enables the deployment of new technologies; optimizes the grid's performance; and lowers the cost of delivering energy by reducing congestion. All these attributes are singularly beneficial, and, in aggregate, they help keep electricity bills low for customers. In short, electric transmission is not only essential to meeting customer energy needs today, it is the key to delivering the energy future that electricity customers want and deserve.

This report highlights the critical role of advanced technology in the design and deployment of innovative and transformative electric transmission projects and explains how these investments benefit customers.

## INVESTING IN ADVANCED TRANSMISSION TECHNOLOGIES AND SOLUTIONS: CASE STUDIES

To ensure that they can continue to meet their customers' needs, EEI's member companies invest more than \$110 billion each year, on average, on generation, transmission, and distribution to make the energy grid smarter, stronger, cleaner, more dynamic, and more secure. These investments in smarter energy infrastructure are helping to achieve a shared vision of a smart, secure, and increasingly clean energy system that provides exceptional benefits for all customers. Maximizing the full potential of a modernized energy grid is an iterative process that requires ongoing investment.

Electricity customers continue to benefit from these investments in smarter energy infrastructure and from policy decisions made over the past century that have enabled transmission operators to increase connectivity, provide greater reliability over wider areas, reduce costs for customers, and integrate various cost-effective clean energy resources. By connecting more customers to an increasingly diverse and dispersed range of energy resources, the transmission system has helped foster societal, economic, and industrial changes across the country while delivering benefits to customers.

In addition to enabling the deployment and adoption of new customer-sited technology, rapid advancements in technology are enabling companies to design, build, and maintain transmission projects efficiently and cost-effectively. For example, EEI's member companies are incorporating augmented reality in the planning and engineering design process and are exploring innovative, less intrusive construction practices. Also, they are improving power quality and asset health and increasing longevity through digital monitoring and real-time analytics. This report presents case studies and illustrative projects from electric companies that demonstrate how advanced technology investments lead to innovative solutions that provide tangible customer value.

## PLANNING, ENGINEERING, AND CONSTRUCTION

Electric companies have incorporated new technologies into transmission operations for as long as the industry has existed, but companies now are relying increasingly on advanced technology to design and build projects long before breaking ground on a new facility.

Design and construction standards continuously evolve; therefore, electric companies must stress test their engineering and construction practices against new standards. Traditionally, that process has required transmission operators to make in-person site visits and to purchase construction and operation materials at a significant cost of time and money. American Electric Power (AEP) now uses an augmented reality program, known as the Stations Standards Augmented Reality Application (SSAA), to analyze and improve transmission construction and the corresponding engineering standards. As shown in Figure 1, SSAA enables a collaborative approach to these practices by allowing teams to perform virtual site visits in a full-scale, three-dimensional (3D) experience on models that have yet to be physically constructed. This allows AEP to provide cost-saving benefits to customers through early identification of potential safety and quality issues and to develop mitigation strategies prior to construction or implementation.

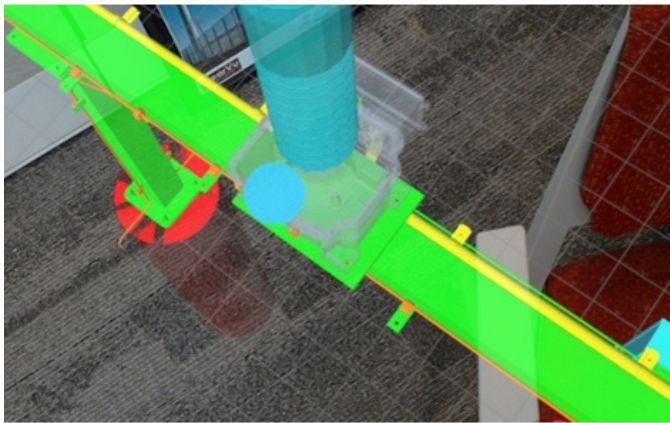
**Figure 1: Tool development collaboration between AEP Augmented Reality and Virtual Reality Product Line team and AEP Station Engineer Design Standards team; courtesy of American Electric Power.**



Identifying design and operational issues in a life-size 3D stereoscopic virtual environment, as demonstrated in Figure 2, shortens design time and standards revision, and SSAA promotes efficiency and allows for innovation in transmission design.

SSAA increases productivity for the AEP Transmission Station Engineering Design Standards team by up to 10 percent. The combination of error reduction and increased productivity results in lower costs and more reliable service to customers.

**Figure 2: Capacitor Voltage Transformer bolt hole misalignment with structure in Augmented Reality; courtesy of American Electric Power**



In addition to design standards testing, natural terrain and limits on rights-of-way also present design and engineering challenges during the transmission planning and construction phases. Duquesne Light Company (Duquesne Light) faced these challenges when engineering a transmission line over the Ohio River in Pittsburgh, Pennsylvania in December 2018. Because of right-of-way limitations, towers and transmission lines were required to span the river diagonally, resulting in a line span of 3700 feet

rather than 2400 to 2900 feet for a perpendicular river crossing (see Figure 3).

**Figure 3: 3M ACCR conductor used to reduce sag and limit pole heights, which were the result of the long span lengths and difference in elevation; courtesy of Duquesne Light Company.**



To accommodate such an abnormally long span, Duquesne Light's overhead transmission conductor standards called for transmission towers of more than 200 feet in height to ensure adequate line tension and to prevent unsafe sagging. This presented several engineering challenges, including:

- Federal Aviation Administration (FAA) requirements provide that structures more than 200 feet tall must have lighting for visibility.
- Standard lattice transmission towers (example shown in Figure 4) could not be used due to space limitations within the right-of-way.
- The use of a singular (monopole) structure (example shown in Figure 4) measuring more than 200 feet tall would require a base that would be too large for drilling the watertight foundations.
- The ability to maintain these structures would be challenging and require specialized equipment.

To address these engineering challenges, Duquesne Light installed a reinforced aluminum composite conductor with technology developed from the Space Shuttle program that can operate at high temperatures and provides increased ratings while also producing the necessary tension to reduce sag. Use of this specialized conductor allowed planners to reduce the tower height to 185 feet. The lower height meant only shield wire and conductor

markers were needed to meet FAA visibility requirements, instead of lighting, and the shorter monopole structure allowed for a more manageable size for the tower base, avoiding the associated costs of the other alternatives.

**Figure 4: High-Voltage Monopole and Lattice Transmission Towers, California; courtesy of Argonne National Laboratory.**



The construction of underground transmission lines can be an innovative solution, where appropriate, to improve reliability, reduce outages caused by storms, garner community approval by promoting visual aesthetics, and facilitate construction in congested urban areas. ITC Transmission (ITC), a subsidiary of ITC Holdings, Corp., responded to the need for greater electric reliability and increased capacity in the Ann Arbor, Michigan area by constructing approximately 3 miles of vital underground transmission line, known as the Apex-Phoenix Project. The area's growing technology sector, excellent schools, and rich cultural and recreational opportunities have made Ann Arbor an increasingly desirable place to live and work in southeast Michigan. In turn, high-quality, reliable power is increasingly important as homes, businesses, and institutions are filled with advanced technologies of their own that can be affected by costly and inconvenient power outages.

**Figure 5: Open house meetings in Ann Arbor inviting public input; courtesy of ITC Holdings, Corp.**



Since construction in urban areas can be disruptive, ITC held open houses to introduce the underground project and gain feedback from residents and landowners who played a significant role in reviewing the new electric transmission lines. As shown in Figure 5, ITC continued to engage with stakeholders throughout the design and construction process to identify optimal project routes that minimized impacts to properties and the greater community.

Underground construction proceeded in 3 phases to lay nearly 3 miles of underground duct bank to hold the transmission cables (shown in Figure 6) and a manhole system to facilitate maintenance worker access. Since its completion in 2019, the Apex-Phoenix Project has enhanced electric service to Ann Arbor residents, businesses, and institutions and will support future growth across southeast Michigan.

**Figure 6: Underground duct bank construction; courtesy of ITC Holdings, Corp.**



Advanced construction techniques also are used to build above-ground transmission structures. AEP has introduced prefabricated metal pile foundations to reduce transmission construction time and minimize environmental impacts. Prefabricated metal piles are large steel tubular and/or finned piles that range from 18-36 inches in diameter and 8-40 feet long (as shown in Figure 7). These piles are driven into the ground using a vibratory hammer and excavator. This technology can be used in lieu of drilled piers less than 40 feet long and in soils without large cobbles or stone. The technique is particularly beneficial in cases where drilling holes is difficult and time consuming due to wet or soft soil conditions such as peat moss bogs.

**Figure 7: A crew member cuts a helical pile with a torch during night construction (left). High-reveal helical pile pedestal set on the side of a slope. The helical piles are welded to the pile cap which serves as the base for the transmission tower (right); courtesy of POWER Engineers Inc.**



Additionally, this technology improves job-site safety by reducing the amount of excavation and open holes. Decreasing the amount of soil spoils and concrete mitigates environmental risks.

## OPERATIONAL EFFICIENCY AND POWER QUALITY

After initial construction, EEI's member companies and their partners continue to make transmission system investments to enhance the reliability, operational efficiency, and power quality of electricity delivered to customers. To improve reliability, New York Transco, an innovative owner and developer of electric transmission solutions in New York, was selected by the New York Independent System Operator (NYISO) to build the New York Energy Solution (NYES), a 55-mile transmission line

and substation upgrade project replacing older lattice tower structures with monopole structures that traverse through 11 towns and 3 counties. The project is intended to relieve transmission congestion and to facilitate the flow of renewable resources from upstate generators to downstate customers.

Projected to be completed in 2023, this project will provide 1850 megawatts (MW) of additional transfer capacity between upstate and downstate New York, a key interface in the state's power system. The monopole towers, with their increased spans, minimize visual and land resource impacts by re-using existing transmission rights-of-way and reducing the number of structures and lines.

Transmission congestion is a major concern for operators. Reducing congestion on transmission lines is necessary to help ensure that lines are not pushed to their operating limits and, therefore, unable to transport additional lower-cost energy to customers. To reduce congestion and lower costs for customers in the PJM Interconnection footprint, Duquesne Light was chosen to reconductor approximately 7 miles of an existing double-circuit transmission line installed on lattice towers built in the 1960s.

Although the congestion could be solved by replacing conductors on only one side of the tower, having two different conductor configurations with unequal weight could cause conductor-to-conductor clearance issues and result in additional loading on the existing towers. Replacing the towers to meet present day safety engineering codes to mitigate the additional loading would require replacing the conductors with heavier and higher temperature-rated lines on both sides of the tower, which would increase the scope of the project and result in increased cost to customers and the unnecessary replacement of lines and towers that had not yet reached the end of their useful lives.

Duquesne Light solved this problem by installing a new lighter and stronger aluminum composite conductor with higher temperature operating characteristics, yet similar in size and physical properties to the 1960s era conductor (see Figure 8). This new conductor increased line ratings by 79 percent and required minimal tower reinforcements due to the similar loading characteristics of both conductors. This solution increased transmission line capacity and eliminated congestion, resulting in \$22.14 million in customer savings due to improved economic dispatch of generation resources.

**Figure 8: One side of a double circuit 138 kilovolt (kV) transmission line reconducted using 795 ACSS conductor and toughened glass insulators; courtesy of Duquesne Light Company.**



**Figure 9: Delivery of the first 69kV vacuum circuit breakers to be piloted on PPL's system; courtesy of PPL Electric Utilities.**



To increase efficiency in system performance and maintenance, and to meet evolving environmental standards, PPL Electric Utilities (PPL) initiated a pilot program to test an innovative circuit breaker technology on its system (see Figure 9). Vacuum circuit breakers are an environmentally friendly alternative to chemicals for insulating medium- and high-voltage electrical equipment. Vacuum technology uses dry air as insulation material and has been demonstrated as highly reliable through 10,000 open/close mechanical operations tests. In addition to resolving the environmental and safety concerns associated with the use of chemical insulation, vacuum technology has an extended maintenance cycle and reduced arcing time, which allows for substantially more switching operations prior to required maintenance.

To promote reliability, PPL developed modeling software in 2019 to optimize the placement of surge arresters that strategically reduce the impact of lightning on the transmission system (see Figure 10). Historically, PPL successfully applied surge arresters to every structure with high outage rates to reduce the number of lightning-related outages. However, with recent analysis showing that lightning-related outages are becoming more frequent, PPL looked for an innovative solution to improve line performance during lightning season. PPL developed a new modeling method that enables evaluation of transmission line performance to identify where surge arresters should be placed to increase reliability. Based on modeling results, placing surge arresters on 61 percent of PPL's structures resulted in an 81 percent expected reduction in lightning outages. PPL plans to continue to use this model to evaluate its transmission lines and further reduce lightning outages to enhance system reliability in an efficient and cost-effective manner.

**Figure 10: Innovative modeling method results in optimal placement of surge arresters; courtesy of PPL Electric Utilities.**



Improving operational awareness to maintain voltage stability is a key component of reliability and power quality. Southern Company (Southern) teamed up with its operating companies Mississippi Power and Alabama Power to pilot state-of-the-art voltage control devices, known as Edge of Network Grid Optimization (ENGO) units. This research project takes a multifaceted approach, incorporating different aspects into each deployment phase of the project. The first phase included the installation of a mesh network communication system and the deployment of more than 360 ENGO devices across Meridian, Mississippi. The second phase of this demonstration involved the installation of 330 additional ENGO devices across western Alabama (see Figure 11). This phase used a cellular communication network to interact with each ENGO device.

**Figure 11: Installed ENGO unit; courtesy of Southern Company.**



Larger-scale deployment of these devices provides benefits across generation, transmission, and distribution through improved system flexibility, reduced voltage variability, and improved power quality and control at the edge of the energy grid. Using the fine-tuning capabilities of the ENGO devices, along with widescale voltage regulation of the distribution system, Southern can better manage system loading to resemble an energy storage system – benefitting customers, the grid, and generating assets. The pilot demonstrated specific transmission benefits in the form of more control and optimization of the load flow and the ability to perform system peak demand reduction, saving customer costs at times of high demand.

Phasor measurement units (PMUs) are devices installed on transmission equipment that provide high-speed telemetry for transmission system measurements for greater visualization of system operation. With these devices, transmission operators can view power oscillations which can lead to excessive vibrations in generators and system instability. Measuring these oscillations can identify sources of grid disturbances, evaluate protection settings, and improve situational awareness.

When PMUs are synchronized with a global positioning system (GPS), transmission operators can analyze simultaneous measurements from transmission facilities covering a wide area and can identify general locations of transmission disturbances or imbalance. These high-speed, synchronized measurements from PMUs allow grid operators to identify significant events and issues on the grid that could lead to widespread power outages.



Exelon subsidiary Commonwealth Edison's (ComEd's) PMU deployment began as a pilot project supported by a Department of Energy (DOE) grant pursuant to the American Reinvestment and Recovery Act of 2009. Building on that program, ComEd launched an initiative in 2015 to increase its PMU deployment significantly, from a total of 12 PMUs to a production system capable of supporting 500 to 1,000 PMUs. ComEd has deployed more than 70 PMUs at more than 30 substations across its footprint, and the company plans to more than double the number of PMUs deployed by the end of 2021. ComEd's goal is to have deployed PMUs at every 345-kV substation, and at many of its 138-kV substations, by 2022.

In addition to these efforts, ComEd is installing a static synchronous compensator, or STATCOM, to mitigate voltage flicker issues caused by a steel mill. Flicker, or rapid changes in voltage, not only causes lights to dim and brighten, it also can disrupt industrial processes at other points on the energy grid. PMUs have been installed to monitor the flicker phenomenon and to ensure that the STATCOM effectively mitigates the issue.

American Transmission Company (ATC) installed the first Geomagnetic Induced Current (GIC) blocker in 2015 at one of its transmission substations in Wisconsin (see Figure 12). The GIC blocker was an early concept device designed to mitigate the damaging effects of solar storms on the electrical transmission system. ATC worked extensively with the product developer for more than a year to add automation and instrumentation to make the device ready for its operations and maintenance departments by installing enhancements, providing training on system functionality, and ensuring appropriate documentation protocols.

**Figure 12: GIC blocker; courtesy of ATC.**

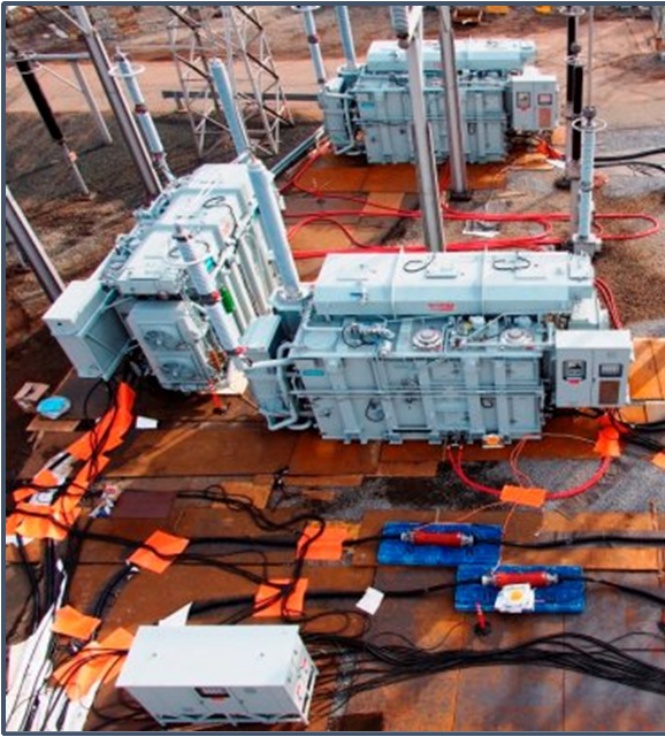


The blocker uses standard, off-the-shelf capacitors in series with a power resistor to block GIC flow in the path of the 345-kV transformer when total GIC is above 5 amps. Initially, the device was set at an artificially low threshold to gain more operating experience to share with the electric power industry. The device's blocking capabilities are entirely automated in response to the dynamics of solar disturbances.

In service for more than 5 years, the GIC blocker has demonstrated its value through its robust and simple design, making integration into ATC's system seamless and virtually transparent to its operators.

While steps have been taken to increase reliability and to prevent outages as described above, when significant grid disturbances and outages do occur, EEI's member companies also have incorporated advanced technologies into their response and mitigation efforts. Consolidated Edison, Inc. (Con Edison) has piloted mobile transformers and switchgear, as shown in Figures 13 and 14. The equipment fits into different electrical configurations to facilitate switchgear replacements during emergencies, when equipment goes out of service, or during planned outages.

**Figure 13: Mobile transformer;**  
courtesy of Consolidated Edison, Inc.



The mobile transformers are designed for minimized installation time and operational flexibility that can change between different load capacities at the flip of a switch. The transformers can be transported in 3 single-phase units and combined on-site. This makes the equipment easier to transport, particularly in the dense load areas of New York City.

**Figure 14: Mobile switchgear;**  
courtesy of Consolidated Edison, Inc.



The transformers require minimal on-site assembly, reducing installation time and allowing restoration of equipment in days rather than weeks. These transformers have environmentally friendly features including biodegradable insulating fluid that can be transported with the unit and eliminate the need for oil processing on-site. The transformers can accept either plug-in cable/feeder connectors or plug-in air bushing connections. The mobile switchgear similarly can be used at different voltage levels across the system without changes to settings. The mobile equipment promotes operational flexibility, rapid restoration, and resilience.

## ADVANCED SUBSTATIONS

Electricity is transported at high voltages on the transmission system to cover long distances easily. The voltage is lowered, or stepped down, for delivery on the distribution system to homes and businesses. The energy transformation takes place in substations located at critical points along the transmission system. As such, they are essential and capital-intensive assets. Public Service Electric & Gas (PSE&G) typically uses periodic manual inspections with calendar-based maintenance programs to help ensure the health of substations and associated assets. However, to provide greater station visibility that allows for increasingly informed and cost-effective asset management decisions, PSE&G has started using Intelligent Substations, which combine advanced monitoring, machine learning models, and visual analytics. PSE&G anticipates Intelligent Substations will lead to more advanced notice of abnormal system conditions.

Over the last 15 years, PSE&G has set the stage for the transition to Intelligent Substations by installing high bandwidth fiber optic communication lines where possible, replacing electromechanical relays with high-speed microprocessor relays, and installing advanced transformer monitoring through PSE&G's Transformer Monitoring Program that aggregates data back to a centralized computer for monitoring. PSE&G has installed these technologies at existing stations, and the company also installs these technologies when replacing or rebuilding substations.

PSE&G's \$390 million North Central Reliability Project provided an opportunity to install this technology at the Fanwood Substation (see Figure 15) as part of the overall design to deliver electricity required by north-central New Jersey businesses, relieve transmission system overloads, provide improved power quality, and reduce transmission system congestion. The Fanwood Substation, a 230-kV/13-kV air insulated substation that is representative of a large portion of PSE&G's stations, was selected as proof of concept for Intelligent Substations.

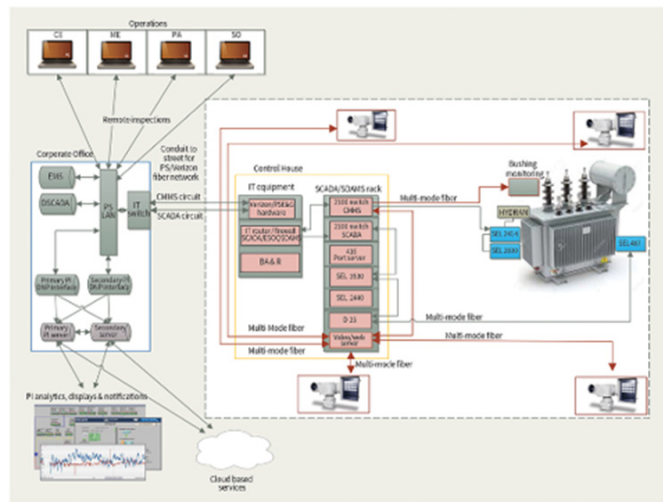
**Figure 15: Fanwood Substation; courtesy of PSE&G.**



PSE&G has incorporated several advanced technologies to transform the Fanwood Substation further into an Intelligent Substation (see Figure 16) including:

- Optical and thermal imaging cameras to provide real-time visibility on critical substation equipment to identify abnormal conditions and prevent equipment failure proactively; and,
- Transformer bushing monitoring to augment existing transformer monitoring, providing detailed insight into degradations of a key component of transformers and extracting correlations between transformer oil monitoring and bushing monitoring trends to avoid costly transformer failures while enhancing safety.

**Figure 16: Intelligent Substation design; courtesy of PSE&G.**



Intelligent Substations will bring a more robust asset management process through improved visibility of key assets by continuous monitoring, enabling just-in-time response. The actual and projected benefits to customers include reduced incidents of catastrophic failure; improved reliability; improved event response and safety of personnel; reduction in outage time; longer maintenance cycles with fewer needs to take the substation offline; and outage savings.

## ASSET MANAGEMENT AND HEALTH DIAGNOSTICS

Routine maintenance is key to ensuring a highly reliable transmission system. However, maintenance often requires facilities to go offline and necessitates numerous personnel to inspect each element of the transmission system visually. EEI's member companies increasingly are deploying digital asset health diagnostics to assess the state of their assets in real-time. This approach limits both downtime and the need for physical site visits.

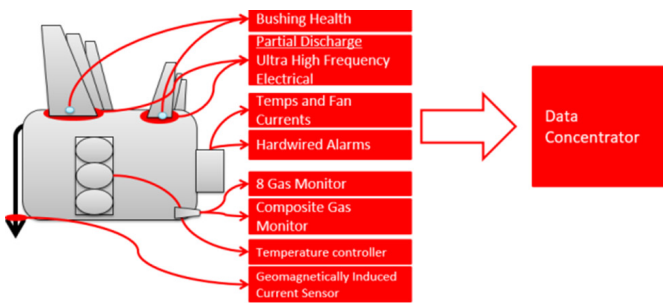
The AEP Transmission Asset Health Monitoring System (AHM) is an example of this technology and has two main components: (1) an analytical software platform with algorithms that provide health indices, risks of failure, and actionable notifications, and (2) a fleet of field-deployed asset monitoring devices that provide near real-time information through a robust communication infrastructure on their associated assets.

The software platform currently in use by AEP is the ABB Asset Health Center<sup>®</sup>. It combines information from field-deployed asset health monitoring devices with off-line historical maintenance records to feed asset-specific performance algorithms that score and rank the

health and risk associated with different assets. A variety of dashboards are generated and supported with analytics to assist end-user decision making.

The asset health monitoring devices deployed to date in the field are focused mainly on monitoring major transmission assets, like extra-high voltage transformers and shunt reactors. This includes multiple sensors, as shown in Figure 17, which are connected and configured to alarms when pre-set warning and emergency thresholds are exceeded, while also providing captured measurements to data historians for future analysis.

**Figure 17: Overview of the asset health monitoring devices included in a typical EHV Transformer; courtesy of AEP.**



With its two key components, the AHM deployed by AEP allows operators to anticipate and prevent major equipment failures, shift to condition-based maintenance prioritization, and assist in asset renewal decision-making by ranking and prioritizing assets in need of more analysis.

When the AHM system originally was proposed, it was expected to assist in preventing 25 percent of unexpected and potentially catastrophic failures in AEP's transformer fleet. Since 2014, leveraging the AHM system has allowed AEP to achieve close to a 58 percent success rate on uncontrolled failure prevention.

These prevented failures alone have produced an estimated cost savings to the company of up to \$45 million since 2012, including avoided equipment purchases, collateral damage, and failure cleanup costs. The employee safety and public vulnerability benefits of removing close-to-failure equipment from service in a controlled manner have been incalculable, allowing AEP to keep employees away from, and alerting them in advance to, at-risk equipment, avoiding potential oil spills from ruptured transformer tanks, and avoiding public impacts from fire and smoke.

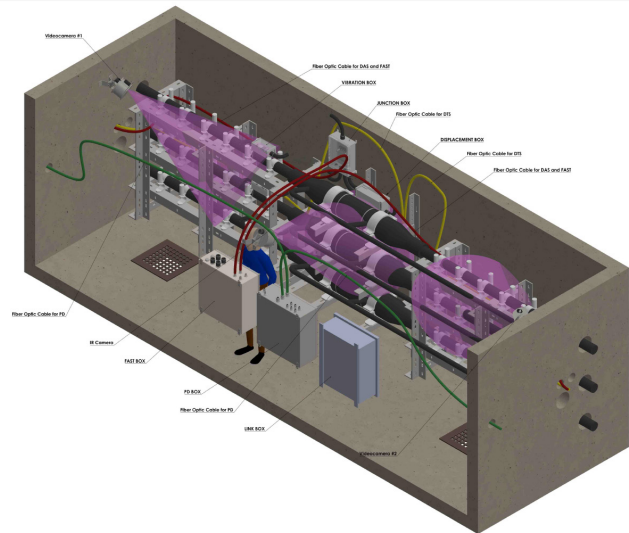
Another example is Con Edison's pilot program using Fault Annunciating Self-Inspecting Transmission (FAST) Vaults transmission manhole design program. FAST incorporates communications, including video and infrared cameras

as well as sensors measuring vibrations, temperature, and displacement of joints connected to physical security alarms, to warn of adverse system operations. The sensors, as shown in Figure 18, provide automated information about faults, enable remote inspections of equipment, and enhance physical security on the feeder.

Including these features in the design of underground transmission lines provides cost savings on operations and maintenance by reducing in-person inspections and enhances the safety of employees and the public by identifying construction hazards, as well as broken, bouncing, or misaligned manhole covers.

In a five-year pilot program, Con Edison placed the sensing equipment along a 5.7-mile underground transmission line in Queens, New York. The company will evaluate the system's ability to survive in the harsh environment of a New York City manhole and its effectiveness in reducing maintenance costs and expediting fault locating. Based on the performance, Con Edison may install the equipment on new underground transmission lines.

**Figure 18: FAST Vault; courtesy of Consolidated Edison, Inc.**



In 2019, PPL had multiple voltage transformers on its system at risk of imminent failure that subsequently were removed from service and replaced under emergency conditions. These transformers are vital to system operations, as they provide secondary voltage to protective relays and include metering devices that provide real-time voltage information to PPL's operations control center. Failure of these transformers can damage other energy grid equipment and injure field personnel. As such, developing a method to monitor this equipment and detect possible failure conditions is critical.

PPL has developed algorithms to read predictive voltage signatures that precede a transformer failure to identify transformers at risk, allowing proactive and safe removal and replacement. The implementation of this predictive technology ensures reliability and promotes safe system operations and maintenance by enabling PPL to replace this equipment in an efficient, planned fashion as opposed to emergency replacement conditions. While equipment deterioration is an unavoidable consequence of operating transmission facilities, PPL's solution facilitates optimization of its assets, reducing operations and maintenance costs, and increasing the safety of its employees and the public.

## **SUPPORTING INVESTMENTS IN COST-EFFECTIVE TRANSMISSION TECHNOLOGIES**

Transmission is the critical backbone of a reliable, affordable, and clean energy grid, and ongoing investment is required to support the increased flexibility and connectivity required to meet customer needs and expectations.

As America's electric companies continue to develop innovative, cost-effective investments that benefit customers, the Federal Energy Regulatory Commission (FERC) and state regulators play an important role. Congress recognized the importance of deploying advanced technologies in the Energy Policy Act of 2005 (EPAct 2005), directing FERC to encourage the deployment of new technologies that increase the capacity, efficiency, or reliability of existing or new transmission infrastructure. Recognizing the enormous benefits advanced technologies provide to customers, FERC should continue to enact flexible regulatory frameworks that incentivize the investment and deployment of transmission technologies that enhance the grid and the lives of the nation's electricity customers.

FERC has recognized the importance of advanced technologies and innovation and has taken commendable actions through its March 2020 notice of proposed rulemaking on transmission incentives as well as technical conferences on grid-enhancing technologies and other advanced technologies for transmission. EEI's member companies encourage FERC to continue to support the flexibility to adopt specific advanced technologies to ensure that these technologies benefit customers, are compatible with existing transmission systems, and enable compliance with existing reliability standards.

As demonstrated, EEI's member companies are investing in a wide range of advanced technologies that are

appropriate for their service territories and customers. FERC should resist mandating any specific technology, but rather encourage further deployment by fostering a flexible approach to technology incentives and pilot programs.

Together, the electric power industry and its regulators can foster robust deployment of advanced technologies and transmission solutions through collaboration and thoughtful public policies that encourage, enable, and support infrastructure investments essential to promoting reliability and operational efficiency, while keeping energy affordable for all customers.

EEI's member companies are committed to investing in the energy grid of the future and to continuing to make it smarter, cleaner, stronger, more dynamic, and more secure. We look forward to working with policymakers to continue to achieve these goals.

The **Edison Electric Institute** (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for about 220 million Americans, and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than 7 million jobs in communities across the United States. In addition to our U.S. members, EEI has more than 65 international electric companies with operations in more than 90 countries, as International Members, and hundreds of industry suppliers and related organizations as Associate Members.

Organized in 1933, EEI provides public policy leadership, strategic business intelligence, and essential conferences and forums.

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**Edison Electric Institute**  
701 Pennsylvania Avenue, NW  
Washington, DC 20004-2696  
202-508-5000 | [www.eei.org](http://www.eei.org)

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