EPRI

2024

AT A GLANCE

Underground Distribution Assets

Program 180.002

Research Value

- Improve specifications, inspection and maintenance approaches, and workmanship practices associated with underground switches, transformers, cable, and cable accessories
- Enhance strategic intelligence on emerging technologies
- Increase engineering staff expertise in underground distribution
- Improve the quality in underground distribution system design
- Lower underground distribution maintenance costs
- Gain more accurate and timely knowledge about asset condition and life expectancy
- Improve system reliability and safety and reduce environmental impacts

For more information
scan the QR code or visit
distribution.epri.com/underground.

Utility companies that own and operate underground distribution systems face a number of challenges, including aging infrastructure, limited accessibility to perform inspection and maintenance, and institutional knowledge loss due to worker attrition. In addition, significant changes to underground electric distribution systems are underway, including the application of new load types, changing load profiles due to electrification, increasing distributed generation sources, new equipment and materials, and automation technologies.

This research aims to produce results that support utility managers in addressing these challenges, including the knowledge to better acquire, maintain, and optimize underground distribution infrastructure. These results can improve the industry's understanding of the expected performance, failure modes, and service life of underground assets. Key focus areas include:

- Understanding asset aging and degradation mechanisms to inform specifications, diagnostics, maintenance options, and workmanship approaches.
- Identifying effective diagnostic, inspection, assessment, and maintenance approaches to understand asset health, extend asset life, and inform investment decisions.
- Gathering and sharing knowledge for managing underground distribution systems.
- Investigating and preparing for the implications to underground components in a grid with increased automation, distributed energy resources, changing load profiles, and increased customer expectations.

Research Highlights

- **Underground Switch Automation Forensics** – This research task plans to focus on the expected long-term performance of padmounted and subsurface designs, including investigation of degradation and failure modes. EPRI also plans to continue developing content for the Underground Switch Guidebook.
- **Cable and Cable Accessory Performance** – Investigation of cable and cable accessories, including joints, terminations, and separable connectors, to understand their life-cycle performance. In 2024, EPRI plans to continue its investigation of newer cables, such as lead-free EPR and EAM insulated cables, focusing on implications of material selection and exploration of diagnostic and online monitoring approaches.
- **Underground Distribution Transformers** – In 2024, EPRI intends to document and examine emerging underground transformer options. EPRI also plans to investigate leading practices and technologies for extending the life of existing fleets.
- **Diagnostics Techniques for Underground Systems** – Planned activities for 2024 include continued examination of heating in medium-voltage components under different conditions to inform the use of infrared thermography. EPRI will also explore the efficacy of commissioning test options, such as VLF withstand testing or partial discharge testing, to identify cable accessory workmanship issues.
- **Online Monitoring Technologies** – EPRI aims to scout online monitoring technology options for underground distribution systems, such as voltage and current monitors in separable connectors, partial discharge monitors in UG structures, and transformer monitors that measure pressure, temperature, and oil level.
- **Equipment Corrosion Mitigation** – For 2023, EPRI began research to understand corrosion rates of commonly used underground equipment metals in submersible environments. This research will continue in 2024, including a comparison of observed field corrosion rates with selected accelerated aging corrosion rates. The goal of this research is to develop guidelines for identifying and assessing equipment in underground structures and for selecting appropriate corrosion prevention and mitigation techniques.
- **Underground Structure Events** – EPRI plans to test gas monitoring sensors using a novel approach EPRI developed in 2023. In addition, EPRI will continue research into detection of other non-gas-related manhole event precursors.
- **Update to the Underground Distribution Systems Reference Book (Bronze Book)** – EPRI will produce an update to the *Underground Distribution Systems Reference Book*. Planned new content includes content on personal protective grounding in underground distribution systems.
- **Technology Scouting** – The pace of change in distribution technology is accelerating, with new technologies, approaches, vendors, and service providers entering the market and offering new solutions. This research will scout new technologies for underground distribution and identify opportunities for further investigation and demonstrations.

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