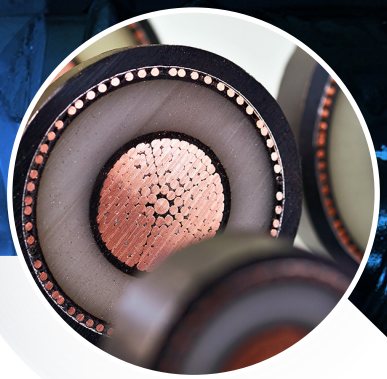
AT A GLANCE



Underground Transmission

Program 36

Research Value

- Develop tools and methods to design and operate systems with increased power flow
- Gain more accurate and timely knowledge about asset condition and life expectancy
- Acquire strategic intelligence on emerging technologies

Member Benefits

- Improve transmission system reliability and safety and reduce environmental impact
- Improve efficiency and quality in underground transmission system design
- Reduce construction, installation, operation, and maintenance costs
- Increase engineering staff efficiency and expertise
- Collaborate with other transmission planners, expert researchers, and technology specialists to solve near- and long-term issues

Key Research Activities

- Aging and failure studies of both extruded and laminar dielectric cables and accessories
- Cost reduction of constructing and installing underground transmission lines
- Cable thermo-mechanical design and performance
- Advanced sensing and monitoring techniques
- Laminar dielectric cable diagnostics and performance improvement techniques
- HVAC and HVDC long-distance underground cable systems for remote renewable energy transmission

The Underground Transmission program focuses on assisting utilities in resolving challenges related to the design, construction, installation, operation, and maintenance of underground transmission systems consisting of extruded and laminar dielectric cables and accessories. Cross-cutting research addresses design calculations, cable ratings, and inspection technologies. The goal of this program is to help members more effectively design and build new underground transmission lines and manage existing underground lines.

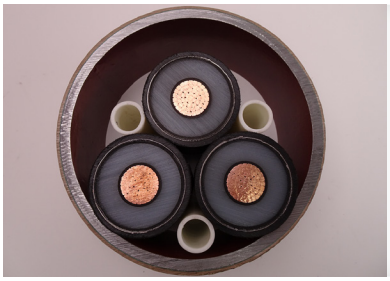
The approach includes laboratory investigations at EPRI test facilities, analytical work using EPRI software and other tools, development of innovative and patented solutions, and technology applications such as field assessments, feasibility studies, and forensic analysis. Research specific to extruded dielectric cable systems focuses on cable thermo-mechanical behaviors, sensing and monitoring, and component and system aging characteristics. Research specific to laminar dielectric cable systems is concentrated on cable and system diagnostics and assessment, buried steel pipe corrosion, and failure root causes. One project is designed to focus on principles, experiences, and knowledge capture of transmission cable engineers who work for utilities installing or considering underground transmission lines. The HVDC Cable and HVAC Submarine Cable Systems project addresses grid integration and interconnections, and long-distance transmission from remote renewable energy generation sources.

EPRI Technical Contact

TOM ZHAO, *Sr. Program Manager*

704.595.2532, tzhao@epri.com

Research Highlights

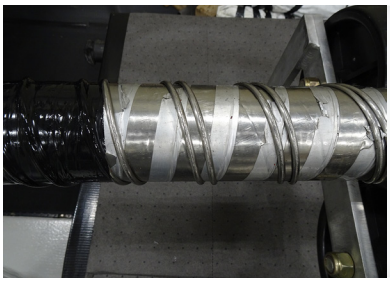


P36.001: Design, Construction, Rating, and Operation and Maintenance of Underground Transmission Systems

This project develops technologies, software tools, and guides, and provides technical bases for safe, reliable, and efficient underground transmission systems of both extruded and laminar dielectric cables. Research results can help cable users make more informed decisions, improve efficiency, productivity, and quality in underground cable system construction, assess conditions of existing lines to develop fact-based maintenance and replacement strategies, and reduce overall costs.

P36.002: Extruded Dielectric Cable Systems

This project intends to help improve engineering-based design and installation procedures to accommodate electrical, mechanical, and thermal requirements for long-term performance, considering especially thermo-mechanical behaviors of cables and accessories. Results can help utilities with effective inspection and monitoring methods for cable system condition assessment, as well as a better understanding of cable and component aging and failure mechanisms and end-of-life criteria.



P36.003: Laminar Dielectric Cable Systems

Laminar dielectric cable systems, including high-pressure fluid-filled (HPFF), high-pressure gas-filled (HPGF), and self-contained fluid-filled (SCFF) types, generally have provided long-lasting service. However, replacement costs for laminar systems are high, and the consequences of electrical failures or fluid leaks are significant. This research produces new understanding, methods, and tools to help engineers and planners assess the condition of the systems and take steps in operation and maintenance to extend asset life and prevent unexpected outages.

P36.006: Principles and Practices of Underground Transmission

Reliability of an underground transmission system depends on highly skilled utility engineers working throughout the life cycle of design, construction, installation, operation, and maintenance of the system. This project intends to provide resources and technical supports to current and future cable engineers. Research results may help improve underground transmission system design and project execution while increasing staff retention and/or transfer of institutional knowledge.

P36.008: HVDC Cable and HVAC Submarine Cable Systems

Increasingly, HVDC cable and HVAC submarine cable systems are being used for power transmission from remote renewable energy generation to power grids, with steadily increasing line distances enabled by advances in HVDC cable and converter technologies. Utilities can use the research results to effectively apply, operate, and maintain the cable systems, as well as extend asset life and prevent unexpected outages.

For more information, contact:

EPRI Customer Assistance Center
800.313.3774 • askepri@epri.com

3002030530 **June 2024**

EPRI

3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 650.855.2121 • www.epri.com