

IMPACT OF ELECTRIFICATION ON DISTRIBUTION ASSETS

Understanding New Technologies and Impact of Electrification



PROJECT HIGHLIGHTS

- Development of test protocol to understand the impacts of electrification on medium-voltage assets
- Testing to understand how electrification may impact asset performance, degradation, and failure
- Exposure to newer and nascent distribution assets in a controlled environment that can simulate harsh conditions and accelerate aging

Background, Objectives, and New Learnings

Utility companies are facing many challenges related to distribution assets, including supply chain issues, uncertainty using new vendors and new technologies, increased efficiency expectations, and changing demand characteristics. Electrification is amplifying these issues, creating additional burden for standards engineers and decision makers regarding new equipment specification, existing fleet management, and future replacement planning.

Supply chain and equipment availability have driven utilities to consider alternate suppliers, materials, and designs. While this diversification may reduce risk of supply disruptions, it also introduces uncertainty regarding equipment quality and lifespan. Research activity is needed to establish and execute a testing protocol to understand performance and risk.

New and alternative distribution technologies are rapidly entering the market or gaining market share. Examples include solid dielectric transformers, solid-state transformers, and advanced conductors. These technologies all hold promise for improved performance, but significant testing is needed to determine real-world performance, life-cycle characteristics, and inspection and maintenance needs. In some cases, the existing standards may not apply, and new standards and tests will need to be developed.

The impact of new demand characteristics may be the largest unknown regarding distribution asset life and performance. Many questions exist regarding the impact of electrification (particularly electric vehicle charging) on asset heating patterns and how those heating patterns impact long-term asset life.

EPRI plans to apply different loading scenarios to equipment while monitoring operational characteristics, including typical loading on today's system, loads that include electric vehicles, and expected future load profiles.

Benefits

This research is designed to address both short and long-term challenges related to medium voltage distribution equipment. This could benefit the public through improved reliability and lower costs.

Benefits to the funding utilities includes reduce risk of asset failure, greater awareness of emerging technology, reduced costs, and increased ability to comply with potential future regulations.

Project Approach and Summary

This research includes the following activities:

1. Develop representative load profiles
This task will develop load profiles that could be representative of potential electrification scenarios. These could include existing load profile, heavy-EV, and fully electrified profiles. Each profile will include information regarding real power, reactive power, and harmonic content. Reverse power flow would also be considered.
2. Develop inventory of assets of interest
This task will prioritize assets for laboratory testing. These assets may include transformers (including solid dielectric), conductors, connectors, and other assets. These assets will then be acquired (either commercially or through utility contributions) for testing in the laboratory.
3. Test plan development
This task will develop a test plan for each asset of interest, including load profiles, degradation mechanisms, and assessment criteria (describing how impacts will be quantified).
4. Impact of various load patterns on asset life
This research examines how changing loading (and therefore asset heating) patterns impact life. EPRI will subject multiple samples of different asset types to various load profiles and will assess age and perform forensic analyses throughout the project. Asset types include transformers (including solid dielectric), connectors, conductors, with potential for others. Load profiles include traditional, heavy-EV, and 100% continuous load.

Deliverables

The deliverables from this research include:

- Test reports and for various assets
- Report describing how different equipment types are impacted by load profiles expected from increased electrification

Price of Project

This project costs \$100k per utility participant. It is expected that five participants are required to execute the full research scope as described here. This project qualifies for self-directed funding (SDF) funding.

Project Status and Schedule

This project is expected to take three years to complete due to the time needed for asset aging. Some tasks will be completed early. Results from each task will be shared each quarter throughout the project.

Who Should Join

This research is designed to address challenges faced by asset owners and operators of medium voltage distribution systems.

Contact Information

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