

EVALUATION OF OPTIONS FOR TRANSMISSION PIPE-TYPE TO EXTRUDED DIELECTRIC CABLE CONVERSION



Extruded pipe-type cables

PROJECT HIGHLIGHTS

- Retrofit existing underground cable steel pipes by using EPRI patented extruded pipe-type cable technology
- Reduce overall project costs and construction duration through reduced needs on civil construction
- Reduce project risk by developing and using leading industry practices for retrofit applications

Background, Objectives, and New Learnings

High-Pressure Fluid-Filled (HPFF) and High-Pressure Gas-Filled (HPGF) pipe-type cable systems make up a vast majority of the installed base of underground transmission infrastructure in North America. Many circuits of this type were installed in 1950s through 1970s. Most of these circuits are near or beyond their original design life but remain in service. While many systems continue to provide reliable service for power utilities, some failures are being reported. Fluid leaks, maintenance requirements of the fluid-filled cable system, concerns about continuing availability of manufacturing paper-insulated cables, and need for higher power transfer, have led utilities to consider using extruded dielectric cables to retrofit the existing steel pipes of the pipe-type cable systems. The ability to utilize the installed steel pipes from the existing cable systems and to install extruded dielectric (e.g., cross-linked polyethylene or XLPE) cables can considerably reduce overall replacement project costs. Several options are available to install extruded dielectric cables into the existing steel pipes. Challenges arise due to pipe diameter constraints which may result in complex trade-offs in design of the system such as conductor sizes, cable insulation dielectric stress, and cable sheath designs.

In recognition of the factors listed above, EPRI conducted research and developed a concept on an extruded pipe-type cable design. The concept is specifically used to replace conventional paper-insulated cables in a steel pipe. Features of the EPRI design concept focus on the use of metallic tape and insulating tape for cable sheath. The design would be more cost effective since the conventional extruded dielectric cable core is utilized and it would use less metallic materials for cable sheath, compared with conventional extruded cable designs. The design would result in reduced operation and maintenance requirements that would be similar to those for pipe-type cable systems but without the needs to manage the hydraulic fluid systems.

Objective of this project is to assist participants in evaluating available solutions and providing results in selecting options for conversion from pipe-type paper-insulated cables to extruded dielectric cables using the existing steel pipe.

New learnings of the project are expected to include results of the evaluation on available options to convert existing pipe-type cable systems using extruded cables, through laboratory tests and analytical investigations. Practices and guidance are expected to be provided to assist in future implementations.

Benefits

The project may benefit the public through ongoing utilization of existing underground assets, leading to improved reliability and reduced construction, operation, and maintenance costs. This may reduce the impact by new circuit installations and minimize construction work in urban city streets.

Project Approach and Summary

The project plans to assess technical challenges and available technologies related to retrofit of pipe-type cables using extruded cables and existing steel pipes. In this task, the project team plans to work on requirements on cable design and manufacturing, cable joint and termination design, manufacturing and installation, and cable constraint systems within underground manholes.

The project also plans to perform laboratory tests and analytical investigations to evaluate cable design concepts, joint and termination designs, cable constraint systems, ampacity and thermal profiles, and cable aging and performance.

This task plans to perform desktop studies to determine feasibility of such potential projects, including target circuit design ratings, possible installation obstacles, system qualifications, and estimated costs to achieve the project goals.

The project plans to participate in potential pilot demonstration projects to gain insights in implementation challenges and provide engineering

supports in the demonstration projects at participant sites.

Deliverables

Deliverables are intended to provide results of evaluation on conversion options from pipe-type cable systems using extruded dielectric cables in existing steel pipes. The deliverables plan to cover technical challenges and solutions.

Price of Project

The cost for each participant is \$100,000. A minimum of five participants are required. The project is eligible for use of Self-Directed Funds (SDF).

Project Status and Schedule

This project is new and will begin as soon as the minimum number of participants has joined. The project would take approximately 18 to 24 months to complete.

Who Should Join

Utilities considering options for retrofit of pipe-type cables with extruded dielectric cables and interested in solutions to leverage the existing steel pipe asset installed underground.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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