

SUCCESS STORY



EPRI Helps KEPCO Evaluate and Enhance Fault Location Technology for Underground Transmission Systems

VALUE REALIZED: EPRI worked with KEPCO to evaluate and enhance its time-frequency domain reflectometry cable fault location technology. The joint study demonstrated the effectiveness of this tool to locate cable faults on both HVDC and HVAC underground transmission cables.

OPPORTUNITIES AND UNIQUE CHALLENGES

Significant trends are developing in applications of high-voltage direct-current (HVDC) cable systems for power grid integration and interconnections. Increasingly, HVDC cable systems and high-voltage alternating-current (HVAC) submarine cable systems are being used for power transmission from remote renewable energy generation to power grids. The line distances of HVDC cable circuits are steadily increasing for both land and submarine applications.

Off-line fault location is critical in the power cable industry for determining the location of a fault within power transmission cable systems. Limited access to underground or submarine transmission cables creates challenging environments to effectively locate cable faults. To address these challenges, Korea Electric Power Corporation (KEPCO) developed an off-line fault location system for long HVDC cables and presented the developed concepts, initial laboratory test results, and initial applications at several venues. The fault location system includes the application of a concept of time-frequency domain reflectometry (TFDR) as a method for effectively locating transmission cable faults. KEPCO and EPRI then carried out a joint study to expand and enhance TFDR technology for HVAC cable system applications.

RIGOROUS TESTING

KEPCO and EPRI collaborated to develop a test plan, perform laboratory tests, and report results using the off-line fault location technology developed by KEPCO for HVDC cables and to apply TFDR technology to HVAC cable systems.

“ *Building on the outstanding performance and technological value of the KEPCO developed fault location technology, KEPCO appreciates the collaboration with EPRI on this project. KEPCO looks forward to continuing the excellent partnership with EPRI.* ”

~ **DR. CHAEKYUN (CK) JUNG**

*Underground Transmission Research Team Lead,
Korea Electric Power Corporation (KEPCO)*

The TFDR cable fault detection method was demonstrated on a 154-kV single-phase 2,000 mm² cross-linked polyethylene (XLPE) cable with simulated cable faults at KEPCO's Gochang Underground Cable Laboratory, and on a KEPCO 113-km HVDC submarine cable.

In addition, EPRI conducted tests at its Charlotte Laboratory on 138-kV, three-core submarine cables. The EPRI test setup included two separate sections of cable which allowed the installation of a simulated joint to replicate actual circuits. Simulated faults of varying impedance were installed directly to the cable and at the joint connection locations.

The results of the laboratory and field tests demonstrated accurate detection performance using the TFDR technology.

NONINVASIVE AND COST-EFFECTIVE METHOD AVAILABLE TO OTHERS

EPRI recognized KEPCO with a Technology Transfer Award for this joint study that led to a more effective tool to locate faults on both HVDC and HVAC underground transmission cables. The TFDR tool can be applied by other electric service providers through technology transfer with EPRI and



KEPCO or applied by an EPRI and KEPCO team at electric utility sites as part of a demonstration or supplemental project. Successful applications of such technology can provide another noninvasive and cost-effective method for fault location on all constructions of underground transmission cables and enhance the technology for widespread applications.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, and affordable access to electricity across the globe. Together...shaping the future of energy.

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