

Cable diagnostics as a powerful sustainability tool

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ABSTRACT

The medium voltage network can represent up to 80% of the total value of fixed assets of electricity distribution companies, yet its condition is often deficient or unknown. An important challenge are complex power cable networks where, unlike in case of overhead lines, visual inspections are not possible. The only way to verify the actual condition of the cable insulation is by performing diagnostic measurements. Cable diagnostics is an investment tool as it enables long-term planning of investments in the network, extends the lifetime of devices, and increases the reliability of electricity supply. As a basis for predictive maintenance of the power cable network, it represents an important sustainability tool. This paper presents the practical experience of an electricity distribution company with the implementation of cable diagnostics and its contribution.

KEYWORDS

Cable diagnostics, diagnostic methods, partial discharges (PD), loss factor ($\tan \delta$), dissipation factor, cable insulation, predictive maintenance, sustainable tool.

INTRODUCTION

The Elektro Gorenjska group provides electricity supply to more than 90.500 power network users in the predominantly mountainous northwest of Slovenia, achieving high standards of quality and reliability. We have the largest share of power cable network to overhead lines among all five Slovenian electricity distribution companies, which further contributes to reliability. We upgrade it annually in accordance with development and financial capabilities. At the end of 2021, the total share of the power cable network, medium voltage (MV) and low voltage (LV), was already 78,5%. MV power cables have almost exclusively extruded, mostly XLPE insulation.

Power cable networks offer many advantages, but due to

aging insulation or human factors, despite the robustness of such systems, breakdowns occur. Finding different types of faults and carrying out repairs is more challenging as cables are hidden underground. Therefore, without appropriate measuring or diagnostic devices and relevant skills, those cannot be recognized and located.

In our company, we are aware of the aging of the power cable network so we have approached a systematic solution and the implementation of predictive maintenance of the power cable network. As the first electricity distribution company in Slovenia, we invested in appropriate testing and diagnostic equipment in 2017. Today, we regularly carry out diagnostic measurements of both old and new MV power cables. We evaluate the results and store them in the GIS environment. In these few years, we have carried out over 200 diagnostic measurements of the MV cables and gained experience, both in performing measurements and evaluating the results. Identified critical sites are urgently rehabilitated.

We believe this represents the beginning of a different, more modern view of power cable network maintenance.

CABLE DIAGNOSTICS AS AN INEVITABLE FACT

Today, identifying the condition of devices in the power network is crucial. Only if we know the condition of a particular device can we take appropriate action on time, preventing unnecessary interruptions and thereby increasing the reliability of the power supply. Network elements such as transformers, overhead transmission lines, HV circuit breakers, lightning protection and earthing systems, HV and MV substations with all associated equipment are regularly maintained and tested in order to prevent breakdowns and maintain network stability. Adequate monitoring is carried out for each device, and there is no doubt about the importance of this type of maintenance.

Optimizing the lifetime of power cables

Minimize maintenance costs for MV power cable networks

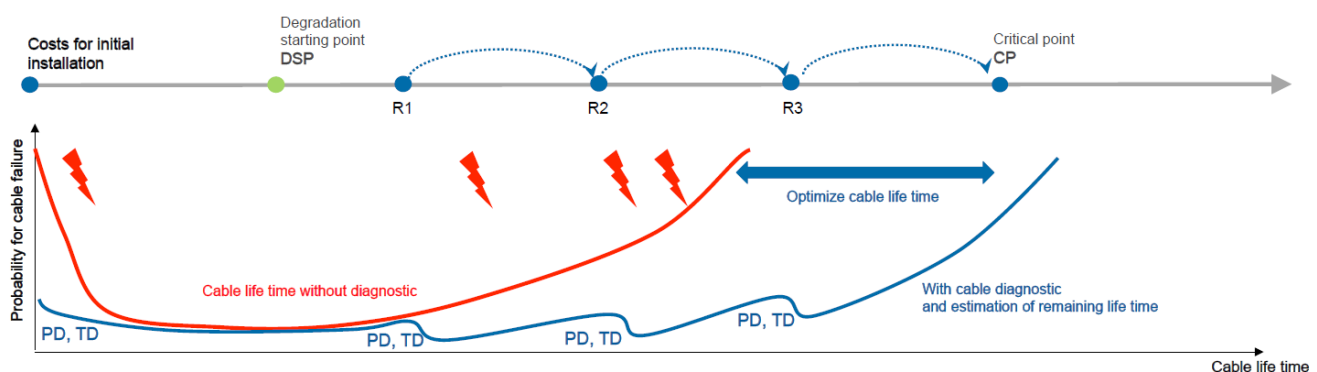


Figure 1: Power cable lifetime optimization [1]