Underground power cable health indexing and risk management

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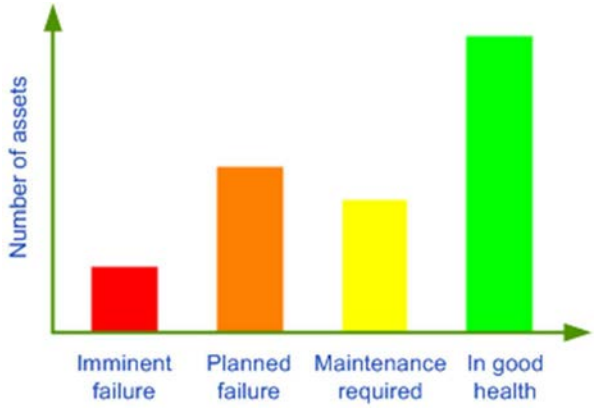
Nowadays, network operators are facing challenges in managing their grid effectively and in meeting a range of increasing stakeholder performance demands (safety, reliability, environmental, and financial impact). Meanwhile, the underground power cables installed throughout the grids are continuously ageing, increasing the failure probability and associated risks. As a result, estimating the expected time to failure and timely taking mitigating measures becomes more relevant by the day.

Among the substantial amount and diversity of underground power cables found in modern electricity networks, each having its specific inherent ageing behaviour and failure impact, the asset manager's challenge is to decide which cable circuits require attention first and what actions need to be taken.

To give asset managers insight into the required long-term maintenance and replacement activities an advanced health indexing and risk assessment model for underground power cables has been developed and implemented.

Based on CIGRE Technical Brochure 358 - Remaining Life Management of Existing AC underground Lines - and in-house experience, a library of condition-assessment algorithms was developed. The health indexing model uses these algorithms to assess the asset remaining life (linked to probability of failure) and the time to additional maintenance. Through the use of Monte Carlo simulations the model is able to determine a certainty level to the assessment.



The model uses data from a variety of sources such as cable system specific data: age, ratings, loading data, short-circuit currents, failure data and condition data; and more general data: typical ageing trends and failure statistics. In case data is missing or inaccurate, deduction models and statistical inference are used to provide best estimates. The model provides clear overviews and visualizations for asset managers to help them oversee the health development of their overall asset base down to each individual cable circuit in detail.

Modern network operators use a risk-based asset evaluation to support decision making. Therefore, one needs to estimate the impact of a cable failure and prioritize all circuits on the basis of the resulting risk. Therefore, in an additional model, the determined health indices of the cable systems are being combined with selected business values, like safety, reliability, economy and environment, to end up with the overall risk per cable circuit. Related risk matrix plots visualize the various risk results. This all enables clear and structured overviews for asset managers to support appropriate actions at the right time.