AGEING UG SYSTEMS : THE SMARTLIFE INITIATIVE

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ABSTRACT

The so-called SmartLife initiative is a European coordination project relating to the asset management of distribution and transmission networks.

After a short introduction to the SmartLife objectives, this paper highlights the main results achieved in the first two years of works.

CONTEXT

The so-called SmartLife initiative is a European coordination project, gathering 26 partners mainly from utilities, but also from test laboratories, R&D institutes and universities from 9 countries, relating to the asset management of distribution and transmission networks. The project deals with 2 main concerns :

On one hand, as significant parts of European networks have been developed in the 60-70s and are now getting close to their expected lifetime, utilities have to plan renewals, requiring significant investment.

On the other hand, it is expected that the networks will undergo changes as a result of distributed generation and market changes.

The project was intended to gather knowledge and skills of experts to benefit from sharing of resources/efforts, data, tools and methods, enabling findings of relevant ideas and best practices. Furthermore, it was intended to define research and development activities needed to prepare for the expected, above mentioned, network changes.

In 2008–2010, works were performed within 3 user-groups on underground links, overhead lines, transformers and 2 user-groups on asset management practices of Transmission and Distribution System Operators.

This paper presents the main findings from the underground links user-group.

UNDERGROUND LINKS ISSUES

The main objectives of the user-group dedicated to underground systems are the following ones:

- identifying critical technologies and key factors influencing failure and ageing mechanisms through a large-scaled analysis of the experience outcome,
- identifying promising on-site diagnostic methods and relevant laboratory analyses on cables removed from the field, in order to better estimate the failure risk and thus the residual lifetime of equipment,
- analysing health index methodologies to facilitate decisions in asset management (support to criteria for maintenance and/or renewal of equipment),
- identifying best practices and technological innovations enabling to specify (with optimization of the global cost) new components intended to ensure transition towards future networks.

USER EXPERIENCE

Statistical information on the network components, failure rates and failure causes are necessary to relate certain cable families with a certain usage to a certain failure rate, to get a good understanding of ageing processes and to define replacement strategies.

It appeared that, in most countries, statistics are not available in the detail needed:

- often, only 2 large families are considered: paper cables and polymeric cables, without sufficient consideration on cable design e.g. belted or screened 3-core paper cables (i.e. radial or not radial electric field), with painted or extruded outer semi-conductive layer for polymeric cables.
- Regarding the location of a fault, it is not always clear whether it concerns a joint failure or a cable failure.
- The accessory design is not always (fully) addressed
- The failure cause is not always recorded (in some detail)

From the collected data, it can be concluded that at this moment, both paper and polymeric links ageing is not very significant, except for some cable designs (e.g. early XLPE cables manufacturing).

In some cases, it was possible to explain quite different fault records from different designs in use (for instance, cables with or without water barrier, heat or cold shrink accessories, some transition joints with weak water-tightness et cetera)

As a result of this work, guidance has been given towards the sort of data to collect in order to effectively use information databases to relate failures to potential causes.

FAILURE MECHANISMS

So far, general considerations, as stated in CIGRE or CIRED reports, are confirmed: leading cable ageing phenomena are partial discharges in paper cables and water-treeing in polymeric cables.

Accessories mechanical forces and fitting may lead to significant numbers of breakdowns, possibly linked to specific designs (e.g. heat shrink accessories or strippable outer semi-conductive layer …). Connectors, too, can be a problem to focus on (leading to accessories overheating)