



50Hz Partial Discharge Diagnostics – Experiences of N-Ergie AG Minimising cable failures by Reliability-Centered Maintenance of Networks



Ir. Hans-Jürgen CHRISTL, NexaTec GmbH (Germany) Hans-juergen.christl@nexatec.de

Ir. Stefan LINK, N-Ergie (Germany) Stefan.link@n-ergie.de

Translation: Ir. Frank Verschraegen, IMCORP Europe BVBA (Belgium) frank.verschraegen@imcorp.be

Due to market liberalisation, network operators are facing increasing costs. This has led to the introduction of new investment and maintenance strategies.

Before liberalisation, network operators mainly focused on maintaining a high level of continuity of supply. This was obtained by preventive replacement of (bad) cables, in order to avoid power outages in the future. However, as budgets and staff are being reduced, a tendency towards event-oriented maintenance is currently being observed. This will inevitably lead to more power outages. As the national regulator is planning to penalise network operators in case of poor network reliability, the need for new maintenance strategies arises. These strategies should solve the paradox of „low budgets and high reliability“.

N-Ergie Asset Management tries to solve this paradox with a Reliability-Centered Maintenance Strategy. Maintenance actions are based on the condition and on the importance of each cable in the network, as presented in the action matrix (Figure 1).

The condition of the cable is determined by:

- data about the asset
- diagnostic results

The importance is determined by:

- energy not supplied in case of a failure of the asset
- the asset outage rate
- time needed to take the asset back into service after a failure
- public importance of the power consumer (e.g. airport, railway station, police, hospital, etc.)
- criticality of the asset in the network

Importance is always considered to have a higher priority than condition.

Even if the condition of an asset is assessed „medium“, it may still be replaced if the importance is assessed as very high. Although this exception is not in line with the action matrix, these cases may occur from time to time.

In order to make a better assessment of the cable's condition, N-Ergie Aktiengesellschaft chose Imcorp's 50Hz Partial Discharge Diagnostics System for following reasons:

- the test conditions match the service conditions (because of 50Hz test frequency).
- very short dwell time (a few seconds).
- the test results can be compared to the factory test results (e.g. Tan delta).
- the diagnostic system has proven to deliver good results for PILC and extruded cable, splices and terminations.

Examples of delamination in PE-cable, oil-deficiency in PILC cable and poor workmanship in a splice are documented (see further).

The diagnostic tests in the N-Ergie network are performed by the company NexaTec, a 100% daughter company of N-Ergie Aktiengesellschaft. In partnership with Imcorp, NexaTec also offers the cable diagnostic service to other network operators.

Between August 2004 and December 2005, NexaTec has tested 93 cables in the N-Ergie network, which equals a total of 114 km of cable:

- 46 km of extruded cable
- 13 km of PILC cable
- 55 km of mixed cable (PILC + extruded)

At external customers, a total of 84 cables was tested with a total length of 45 km:

- 29 km of extruded cable
- 3 km of PILC cable
- 12 km of mixed cable (PILC + extruded)

Condition				
	BAD	Event-oriented test	Re-test after 1 to 2 years	Re-test after 1 year
	MEDIUM	Event-oriented test	Re-test after 5 years	Re-test after 2 to 3 years
GOOD	Event-oriented test	Re-test after 10 years	Re-test after 10 years	
	LOW	MEDIUM	HIGH	
			Importance	

Figure 1