**CIGRE Study Committee D1**

**PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]**

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| **WG* N° D1.48** | **Name of Convenor :** Serge Pélissou (CA)<br>**E-mail address**: pelissou.serge@ireq.ca |
| **Technical Issues #[2]: 8** | **Strategic Directions #[3]: 2** |
| **The WG applies to distribution networks (4): Yes** | |
| **Title of the Group:** Properties of insulating materials under VLF voltages | |

**Background :**

Very low frequency (VLF) testing is being used more and more in the testing of medium voltage cable systems. Properties such as dielectric loss, electrical tree growth and Partial discharge (PD) characteristics have been studied at the stresses normally used in medium-voltage cable systems. VLF test equipment is now becoming available at much higher voltages up to 400 kV. However, little is known about the properties, e.g., electrical tree growth rate, in materials such as XLPE, EPR and SiR under VLF at higher stresses, even though VLF tests are being used as acceptance/after laying tests and diagnostic tests. Knowledge of these properties of these materials is necessary so that valid acceptance and maintenance tests for cables can be developed. In addition the dielectric loss of different EPRs is not well characterized as well as XLPE/EPR/SiR interfacial behaviour at VLF. Interfacial behaviour is important to ensure that the electrical stress distribution under VLF is similar to that at power frequency otherwise misleading results could occur.

**Scope :**

1. Review of the literature to determine what knowledge is available on :
   a) Breakdown voltage of insulating materials such as XLPE, EPR and SiR using VLF voltages,
   b) Electrical treeing resistance of insulating materials such as XLPE, EPR and SiR using VLF voltages,
   c) partial discharge (PD) characteristics such as inception and extinction voltages, magnitudes, repetition rates of known defects in XLPE, EPR and SiR materials, and their respective interfaces under VLF voltages,
   d) tan delta variation with temperature of XLPE, EPR and SiR at VLF,
   e) electrical stress distributions along XLPE/EPR/SiR interfaces subjected to VLF voltages
2. A critical review of the data should be made to indicate gaps in the knowledge needed to use VLF as an acceptance/after laying tests method and as a diagnostic tool.
3. If no test methods exist, the development of tests to measure breakdown voltage, the electrical treeing resistance, and PD characteristics of known defects in XLPE, EPR and SiR and their interfaces. In addition tests should be made to determine the electrical stress distribution along the above-mentioned interfaces.

**Deliverables :** Technical brochure with summary in Electra

**Time Schedule** : start : 2012 **Final report** : 2015

**Comments from Chairmen of SCs concerned** : B1

**Approval by Technical Committee Chairman** : Klaus Fröhlich **Date** :24/01/2012

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2

## Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

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| **1** | Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network. |
| **2** | The application of advanced metering and resulting massive need for exchange of information. |
| **3** | The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation. |
| **4** | The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation. |
| **5** | New concepts for system operation and control to take account of active customer interactions and different generation types. |
| **6** | New concepts for protection to respond to the developing grid and different characteristics of generation. |
| **7** | New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control. |
| **8** | New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics. |
| **9** | Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network. |
| **10** | An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future. |

## Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

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| **1** | The electrical power system of the future |
| **2** | Making the best use of the existing system |
| **3** | Focus on the environment and sustainability |
| **4** | Interactive communication with the public and with political decision maker |