CIGRE Study Committee D1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP (1)

WG* N° D1.64	**Name of Convenor :** Naoki HAYAKAWA (JP) **E-mail address**: nhayakaw@nuee.nagoya-u.ac.jp
Technical Issues # (2): 9	**Strategic Directions # (3): 1**
The WG applies to distribution networks (4): Yes	
Title of the Group: Electrical insulation systems at cryogenic temperatures	

Scope, deliverables and proposed time schedule of the Group :

Background :

Superconducting power apparatus may help to increase the environment-friendliness, efficiency and reliability of the electric power networks for the next generation. Today, relevant systems have been developed and tested, e.g. in a 275 kV high temperature super-conducting (HTS) cable project in Japan. The technology of electrical insulation systems at cryogenic temperatures has been recognized as one of the most critical issues for the design of various superconducting power apparatus. However, there is a lack of data and knowledge on the behaviour of dielectrics and electrical insulation systems at cryogenic temperatures. Besides superconducting power apparatus, such information would be also useful for fusion reactors, accelerators and industry applications.

Scope :

Fundamentals and applications on electrical insulation techniques for superconducting power apparatus and other applications to be operated at cryogenic temperatures. The items to be studied are as follows:

1. Summary of state-of-the-art on discharges in solids (papers, films, FRP, epoxy resin, etc.), liquids (liquid nitrogen, liquid helium, etc.), gases (gaseous nitrogen, gaseous helium, etc.), vacuum and their composite insulation systems (liquid/solid and liquid/gas composite insulation system for bath and forced-flow cooling, vacuum/solid composite insulation systems for conduction cooling) at cryogenic temperatures.
2. Principles and mechanisms of electrical insulation phenomena at cryogenic temperatures for various insulation systems: e.g. partial discharge, surface discharge, ageing and breakdown under electrical (ac, dc, impulse voltage), thermal (steady, transient heating) and mechanical and combined stresses.
3. Major design and test issues for electrical insulation systems of superconducting power apparatus (cables, fault current limiters, transformers, rotating machines, SMES, etc.), superconducting magnets (fusion reactors, accelerators, NMR/MRI, etc.) and their components (bushing, current lead, etc.) to be operated at cryogenic temperatures.

Deliverables : Technical Brochure, Summary Report in Electra and Tutorial Presentation.

Time Schedule : start : 2016 **Final report** : 2019

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman :

Date : 08/12/2015

(1) Joint Working Group (JWG) – (2) See attached table 1 – (3) See attached table 2 – (4) Delete as appropriate

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

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)

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	Preparation of material readable for non technical audience