CIGRE Study Committee A2
PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP (1)

WG N° A2.48	**Name of Convenor :** Greg Hanna (IR) **E-mail address**: greg.hanna@esbi.ie
Technical Issues # (2): 8	**Strategic Directions # (3): 1, 2, 3**

The WG applies to distribution networks (4): No

Title of the Group: Technology and utilization of Oil Insulated High Voltage Shunt Reactors

Scope, deliverables and proposed time schedule of the Group :

Background :

The number of long transmission lines at extra high voltage is increasing from day to day, and coupled with that is the increase in the transmission voltage levels. This in turn means more and more demand on shunt reactors applications for the long transmission lines. Reactors play an important role of counteracting the Ferranti effect on slightly loaded or unloaded long transmission lines, thereby bringing the voltage within the design voltage level of the substation equipment. Moreover, the increasing demand for underground cables plays also a significant role on the increasing demand for shunt reactors.

Shunt reactors are normally treated more or less the same way, in terms of electrical testing and condition monitoring, as transformers based on the in-tank content. It is however the fact that shunt reactors are exposed to conditions which are different from what the transformers experience. Shunt reactors may be regularly switched on/off that cause frequent electrical and mechanical stresses. Reactors are always operating at full loading capacity but may also be switched off for long periods. Moreover, reactors experience vibrations that are far above to what the transformers experience.

There are currently insufficient literature available strictly addressing HV shunt reactors, not much is published on the accumulated experience by manufacturer and end users. Reactor failures and failure modes have not been widely and explicitly analysed and the assumption has been that the criteria is the same as for transformers. In today’s complexity of the network, the unavailability of a reactor can easily render the circuits not switchable. It is therefore important that reactors be looked at carefully in terms of design, manufacturing, testing, operation, maintenance, and condition monitoring – so that the reliability of this equipment can be improved.

The ultimate goal is a contribution to the improvement of high voltage shunt reactor reliability (U_m ≥ 72 kV), including UHV applications.

Scope :

The working group will examine the following topics:

- Specification and design review
- Design considerations, single/three phase, secondary windings, regulation windings, etc.
- Reactor noise: standard values and low noise reactors, mitigation solution for existing reactors
- Type/routine tests and criteria: noise, losses, vibration, temperature rise, etc.
- Reliability in service, failure rate and age for different voltage classes
- Failure mechanism, failure investigations, lessons learned
- Condition assessment and monitoring, DGA interpretation.
- Inrush current, reactor switching on and off, transients
- Experience with reactor maintenance, particularities
- Determine how the health index and other critical information can be used to prioritise condition based maintenance replacement, or to make other asset management decisions.
- Provide details of health indexes or condition assessment tools currently in use, and provide examples of how they can be applied.

Deliverables : Brochure, ELECTRA. Publication and workshop

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

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman : M. Waldron

Date : 18/12/12

(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	Interactive communication with the public and with political decision maker