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

WG N° A2.57	**Name of Convenor :** Dejan Susa (NO) **E-mail address**: Dejan.Susa@statnett.no
Technical Issues # (2): 3,6,8	**Strategic Directions # (3): 2, 3**

The WG applies to distribution networks (4): Yes

Title of the Group: Effects of DC Bias on power transformers

Scope, deliverables and proposed time schedule of the Group :

Background :

There has been some concern in the electric power industry that Geo–magnetically Induced Currents (GIC), i.e. dc-quasi currents, have caused, and may cause, significant overheating damage to large numbers of power transformers installed in some regions of the World and consequently cause large scale and long duration system blackouts. Based on the same principle, other sources of DC Bias, depending on the corresponding parasitic dc current level, may also similarly affect the transformers, for example, applications involving power electronic components, (DC transmission or traction systems).

There have been a considerable number of publications on this subject in recent years. There have also been attempts to specify requirements for operation under permanent or quasi-permanent dc bias (dc bias current; duration; limits in temperature rise of components, reactive power absorption, etc). Moreover, IEEE Guide for establishing power transformer capability while under geomagnetic disturbances has been recently published. Therefore, it is considered that now is a good time to consolidate this information and present to the power industry a definitive view on the effect of these currents on power transformers.

Scope :
The scope of this working group is to address the effect of DC Bias (including GIC) on power transformers and how to prove the transformer withstand capability. Shunt reactor susceptibility will also be addressed. Particular areas of focus will be:

- State of the art (phenomena, sources, application to transformer, case studies, scenarios)
- Effect on power transformers (harmonic generation, VAr consumption, noise, losses, temperatures/overheating, failure modes)
- Calculations, modelling, model verification
- Requirements for transformer specification and design review
- Methods to prove the withstand capability
- Design and technology susceptibility

Within which the following will be specifically addressed:
- Typical DC current patterns that transformers should be designed to withstand
- Typical B/H and V/I characteristics and for core steel and transformers at very high flux levels
- Design implications & best practices for transformers to withstand such stresses
- Methods to can prove the capability of the transformer to withstand such stresses and possible effects (e.g. design review)
- Tests that can be performed to assess such capability
- Definition of possible mitigation and monitoring techniques for existing transformers.

Deliverables :

Report to be published as Technical Brochure with summary in Electra and a Tutorial.

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

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman : M. Waldron
Date : 29/04/2016

(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