CIGRE Study Committee C4

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

JWG C4/B4.38	**Name of Convenor : Zia Emin** (United Kingdom) **E-mail address**: zia.emin@pbworld.com
Technical Issues # (2): 3, 8	**Strategic Directions # (3): 1, 2**
The WG applies to distribution networks (4): Yes / ~~No~~	
Title of the Group: Network Modelling for Harmonic Studies	

Scope, deliverables and proposed time schedule of the Group :

Background :

Power system performance issues associated with steady-state harmonic voltage distortion is becoming even more pronounced as connection of nonlinear devices and/or loads increases driven by integration of renewable energy sources and connection of new HVDC converters. Proper harmonic voltage distortion performance specification is therefore crucial as it impacts the subsequent design of harmonic filters. In order to draw up proper specifications or limitations to coordinate the emission of harmonics onto the system, the vast majority of cases require proper modelling of the power system for this purpose. This in turn suggests the need for an appropriate model for each individual electrical plant. For example, the effect of resistive damping provided by certain plants is often ignored and it is important to establish clear guidelines as to how this should be taken into account. Availability of information and guidance for such modelling requirements are either scarce or in scattered form, mostly delegated to appendices of various documents (examples are the short articles in Electra 164 and 167 published in 1996 and the recent TB 553). The source of many of these models has been lost in history, and reference can only be made to publications, some of them by CIGRÉ, which contain formulae for the representation of network components but with little or no proof of derivation. Both Electra articles are authoritative in nature but suffer from the issues outlined above, and are also becoming out-dated and inaccessible. There is also a lack of guidance on the way of treating existing nonlinear loads embedded into the network. Loads at low voltages are usually not part of the larger transmission models and hence it is desirable to know the most suitable voltage level these should be connected to as an equivalent and how that equivalent should be represented. Therefore, there is a need for collating all the available information in the literature and formulating a study and modelling guidance document for practising power system engineers while performing harmonic voltage distortion analysis.

Scope :

1. Collate and provide all available information in the literature on modelling individual electrical plant including equivalent loads for harmonic voltage distortion analysis purposes.

2. Evaluate and suggest best practice in the use of available models to modern equipment.

3. Identify any shortfalls with available models and the possible need for further development in this area.

4. Provide clear and concise guidelines on modelling existing nonlinear loads (HVDC converter station, wind farm generation etc) within the system of interest. Approach manufacturers to identify suitable harmonic models for equipment where appropriate.

5. Provide guidelines on general approach to such studies and the availability and choice of tools. Identify any shortfalls with the available analysis tools and suggest possible developments. The JWG will also work closely with SC B1 and seek two qualified experts from SC B1 as members of this JWG given the fact that high-voltage insulated cables do also have a significant impact on power system performance issues related to harmonics. **Deliverables :** Technical Brochure with summary in Electra **Time Schedule** : start : November 2014 **Final report** : December 2017
Comments from Chairmen of SCs concerned :
Approval by Technical Committee Chairman : M. Wald **Date** : 23/05/2014

(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