CIGRE Study Committee B4

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

JWG B4/C1.65	**Name of Convenor :** PARISOT Alexandre (France) **E-mail address**: alexandre.parisot@rte-france.com
Technical Issues # : 3	**Strategic Directions # : 1**
The WG applies to distribution networks : No	
Title of the Group: Recommended voltages for HVDC grids	

Background :

Prior CIGRE activities within B4 recognized that agreeing on a set of recommended DC voltage levels to be used in HVDC Grids could be very beneficial, for anyone planning HVDC projects, which might potentially become part of a future HVDC Grid. However, whilst adopting the recommended DC voltages would facilitate future extensions towards HVDC grids, they would preclude the optimization of DC voltage levels in individual projects, thereby leading to potentially higher investment costs.

Therefore, while a first proposal for recommended voltages for HVDC grids could be produced, it was recognized that before these values and guidelines for their use could be published outside CIGRE, and used by e.g. IEC as input to standardization activities, the views and recommendations from System Development and Economics experts within CIGRE should be included. This working group is jointly organized with C1 for this purpose.

Scope :

The scope is limited to the steady state Pole to Ground and the Pole to Pole dc voltages. The emphasis will be on VSC HVDC schemes, but LCC HVDC schemes will also be considered. Insulation coordination aspects of HVDC grids will not be covered beyond the need of clear definitions for the values and limits in the provided recommendations.

The objectives of the JWG are to :

1. Assemble a survey of existing and future projects with respect to chosen voltage levels

2. Sketch a short historical review of harmonization and subsequently standardization of voltages in AC networks, as context for similar initiatives in DC grids

3. Review available literature and knowledge on insulation coordination of HVDC links and propose working definitions for voltage levels (nominal/operational, highest, lowest, temporary, transient, etc…) as basis for the recommendations to be provided. Coordination with other WG in B4 and with C4 will be needed to ensure coherence within CIGRE.

4. Assess relevant technical limits and perspectives in HVDC grids, including :
   - Insulation levels and overvoltage ratings from DC equipments and cable technology
   - Design aspects of multilevel VSC converters with respect to DC voltages
   - Power levels and limits including requirements on the AC side concerning the maximum power loss in any one incident, and operational margins for dynamic disturbances

   The assessment shall include the consideration of different grounding concepts, convertor topologies (symmetrical/non symmetrical, half-bridge/full-bridge, etc…)

5. Study economical aspects behind harmonization of voltages :
   - Comparison of strategies including initial optimization of the voltage or choice of recommended values with respect to initial cost and costs of interconnection or future integration of new terminals
   - Availability and cost assessment of upgrading (changing DC voltage) or interconnection (connecting two systems with different DC voltages) schemes

6. Present case studies illustrating items 4 and 5, using the framework defined in item 3

7. Derive from the items above possible recommendations for voltage levels to be used in HVDC grids in the near future

Deliverables : Technical brochure with summary in Electra

Time Schedule : start : 2013 **Final report** : 2015

Comments from Chairmen of SCs concerned : Bjarne Andersen. Contributing members from other SCs are welcome to join this WG

Approval by Technical Committee Chairman :
Date : 10/02/2013

(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