

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

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Technical Issues # 3	Strategic Directions # 1
The WG applies to distribution networks (4): Yes	
Title of the Group: Medium Voltage Direct Current (MVDC) Grid Feasibility Study	
Scope, deliverables and proposed time schedule of the Group : Background : <p>Following “HVDC Grid Feasibility Study” initiated by WG B4-52 in 2009, the R&D studies for HVDC grids and micro DC grids have been greatly enhanced worldwide. In particular some demonstration projects of micro DC grids have already been built to show their feasibility and benefits. Due to the requirements imposed by high penetrations of distributed energy resources (DERs) and energy storage (ES), and in order to meet the needs of smart grid development, MVDC grids have been attracting global attentions recently, particularly in Europe and China. There is an urgent need to undertake R&D studies on MVDC grids.</p> <p>Future power system will involve coexistence of the regional AC transmission and distribution networks and DC grids. The future regional distribution network must adapt to the needs of open access for small and medium DERs and ES, and to cater for demand side management and interaction between the power suppliers and customers. An active intelligent DC power distribution network should enable bi-directional control of power flow with high power supply reliability and energy efficiency.</p> <p>Comparing to an AC grid, a DC grid offers not only increased flexibility and reliability at a lower cost by sharing resources, but also a number of other advantages. The advantages include that there are no inherent synchronization stability issues in the DC grid; active and reactive power can be controlled rapidly and independently; provision of reactive power support; enhanced fault ride through capability; and achieving power complementary of multiple energy resources.</p> <p>There is an urgent need for MVDC grids with the fast growth of DC loads (such as LED lights, electrical vehicles, data and computer centres), integration requirements of DERs and ES into the AC power systems, and users’ requirements for higher reliability and power quality.</p> <p>MVDC grids not only are the best technical solution for integrating renewable energy resources and solving shortage issues of distribution corridors, but also can reduce power losses and impacts of the DERs on the distribution networks, improve the efficiency and reliability of power supply and increase power transfer capability.</p> <p>However, although MVDC power grids have obvious advantages as addressed above, there are also some drawbacks. Currently, voltage source converters (VSCs) are the most popular and promising technology used for HVDC systems and would also be adequate for the MVDC grids. As under development stage, the VSC-MVDC stations are larger and more expensive than conventional AC substations. The corresponding losses of the converter stations are also much higher. DC circuit breakers are required to clear DC faults but MVDC circuit breakers are under early development stage at the moment and not commercially available in the market. DC/DC converters which are also under early development are required for the interconnection of two DC systems at different voltage levels. These disadvantages discourage and delay the application of MVDC into distribution networks, but they will be overcome as the capacity and capability of the semi-conductor devices for VSC technology increases. It is foreseen that MVDC grids will become a reality following on from the growth of individual point to point DC systems and multi terminal DC (MTDC) systems.</p> <p>Though the feasibility study for HVDC grids has been carried out by SC B4-52 (TB533), since a MV distribution network would have its own features and characteristics which might be different from transmission systems, it is necessary to undertake MVDC grid feasibility study based on the experience and achievements obtained by SC B4-52. The needs of MVDC grids and their impacts on</p>	

the development and operation of AC distribution networks should also be surveyed and analysed.

Scope :

The objective of this Working Group is to investigate the needs and feasibility of building MVDC grids. A large amount of data and information will be collected during the life of the WG and is expected to be of benefit to the future WGs which will look further into the details of some of the topics of MVDC grids. The following specific activities will be undertaken by the working group:

1. Global survey on needs of MVDC grids globally, highlighting the drivers, motivation, policy, Strategies and planning for MVDC grids in different countries and regions.
2. Summary and review of the status/milestone, projects (if any) and R&D studies so far having been carried out internationally with regards to the benefits which MVDC can offer.
3. MVAC network expansion, operation and motivation of MVDC Grids
 - 3.1 Historical practice of MVAC network expansion and operation
 - 3.2 Motivation and applications of MVDC Grids
 - 3.3 Technical and economic comparison of MVAC and MVDC grids
 - 3.4 Technical and economic comparison of HVDC, MVDC and micro DC grids
 - 3.5 Summary and review of benefits offered by a MVDC grid
 - 3.6 Impacts of MVDC grids on AC distribution networks
4. MVDC grid configurations and planning
 - 4.1 Review of different grid configurations between HVDC and MVDC
 - 4.2 MVDC grid topologies for different applications
 - 4.3 System earthing
 - 4.4 Recommended DC voltages
5. Finished by a technical brochure:
Investigation the needs and feasibility of building MVDC grids

Deliverables : Report to be published in Electra, technical brochure with summary in Electra, material and concept for tutorial

Time Schedule : start : September 2015

Final report : August 2017

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman :



Date : 07/07/2015

- (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