CIGRE Study Committee B4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG* N° B4.62	**Name of Convenor :** Nalin Pahalawaththa (AUSTRALIA) **E-mail address**: nalin.pahalawaththa@transgrid.com.au
Technical Issues # (2): 3	**Strategic Directions # (3): 1**
The WG applies to distribution networks (4): Yes	
Title of the Group: Connection of Wind Farms to Weak AC networks	

Scope, deliverables and proposed time schedule of the group :

Background :

Many countries are experiencing a fast growth of renewable generation in general, and wind based generation in particular, imposing significant stresses on transmission grids. The future wind power developments are very likely to:

a) utilise power electronic converters for converting either some or all of the power output from the generators (e.g. Type 3 - DFIGS or Type 4 - full scale converters)
b) connect to remote and weak parts of the transmission and distribution grids
c) load the transmission systems beyond their firm capacities and may be operated closer to short term ratings of the transmission lines

Presently, there are concerns regarding reliable operation of power electronic driven wind generators in weak AC networks. These concerns include fast dynamic response of wind generator converter systems following system disturbances, and interactions between wind generator converter systems and any other power electronic driven network assets (e.g. HVDC links and FACTS devices) in the vicinity. The wind farms connected through or in the vicinity of series compensated transmission lines or HVDC lines may also be vulnerable to sub synchronous oscillations.

Hence wind farm developers are looking for either classical (e.g. synchronous condenser) or FACTS based solutions for addressing expected operational issues.

Short Circuit Ratio (SCR - the ratio of the short circuit power at a given location in the network and the rating of the generator connecting to that location) is a common analytical indicator used in the industry to quantify system strength. Low values of SCR indicate risk of insufficient system strength for reliable operation of the connected generation and transmission plant. There is no industry consensus in the methodology for calculating SCR, particularly for applications with several adjacent wind plants, or for wind plants adjacent to HVDC terminals.

There are also concerns on the veracity of dynamic models available and on the suitability of presently used tools and methods, for assessing the impacts of wind farms connecting to weak ac networks.

The working group will identify the equipment related issues anticipated in connecting the wind farms to weak AC networks, the underlying causes and possible solutions. It will complement the work, and add to the body of knowledge created by previous Cigre working groups such as WG B4.39, B4.55, JWG C1/C2/C6.18, C4.601, and IEEE covering transmission, system operation and market operation needs of large wind farm connections.

Scope :

1. Review of previous work by Cigre WGs (e.g. WG B4.39, B4.55, JWG C1/C2/C6.18, C4.601) and other relevant publications (e.g. IEEE), to identify the gaps and overlaps, and to avoid duplications.

2. Discussion on practical experiences of wind farms connected to systems with low SCRs

3. Identification of issues associated with connection of wind generators onto weak AC networks, and differentiation of the issues associated (a) with operation and dynamics of the equipment (b) with the operation and dynamics of the network, and (c) with dynamic interaction of other near by transmission equipment

4. Development of a guideline on models, analytical tools and methodologies to be used for power system studies when connecting wind farms to AC networks with low SCRs

5. Development of a guideline for estimating and interpreting SCR for multi-plant applications, in particular for connecting wind generation to transmission grids.

6. Confirmation of the assumptions, input data and models required for modelling and assessment of the issues identified in above step (3)

7. Assessment and confirmation of underlying reasons and phenomena or equipment causing the issues

8. Possible solutions for addressing the identified issues including (a) modification to equipment or their controls (b) augmenting the capability of the networks (c) imposing operation and dispatch constraints

9. Communication of the recommendations and any further work.

Deliverables : Technical Brochure with summary in Electra

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

Comments from Chairmen of SCs concerned : Bjarne Andersen: the WG will welcome contributing members from other SCs.

Approval by Technical Committee Chairman :
Date : 10/02/2013 M. Wald

(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