CIGRE Study Committee B5

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

JWG* N° B5/C4.61	**Name of Convenor:** Ray Zhang (UK) **E-mail address**: Ray.Zhang@nationalgrid.com
Technical Issues # (2):6	**Strategic Directions # (3): 1, 2**
The WG applies to distribution networks (4): Yes	
Title of the Group: Impact of Low Inertia Network on Protection and Control	

Scope, deliverables and proposed time schedule of the Group:

Background:

The increased use of power electronic components in electrical networks leads to new and increasing challenges. For example, the characteristics of fault current and residual voltage may change significantly both in the transient and in the stable phase of short circuit. Besides, high penetration of power electronic components will also reduce the inertia of the power network significantly, which is threatening power system stability. In these conditions, the schemes adopted by traditional protection may not be suitable for certain faults (fault location or fault type). The components connected via power electronic with low inertia may include:

- FACTS components
- New non-synchronous generation sources
- Battery storage and other new type of loads
- HVDC Interconnectors.

Scope:

The WG shall consider the challenges of protecting electrical networks with reduced system inertia and changed fault characteristics. The following items will be discussed:

1. The analysis of fault characteristic (fault level, harmonic, non-linear parameter, variable parameter etc.) and how they affect traditional protection schemes, including site experience and simulation methods
2. How the reduced inertia affects the system stability margin and the protection mechanism of detecting the loss of stability under disturbance
3. Ideas or methods of mathematic modelling for power electronic components (may be different for protection and stability control) to simulate transient fault phenomena for protection studies and tests.
4. Countermeasures or new schemes for protection and automation to adapt to this evolution of electric networks
5. Control methods and tactics to facilitate operation of protection systems (e.g injection of negative or zero sequence currents in normal operation or in emergency) including control tactics of the power electronic component itself.

A survey of operators worldwide is to be conducted to establish the scale of the problem, related to the above topics. The study will focus on how the reduced inertia/changed fault characteristics will affect the existing power system protection and control (philosophy, methodology and equipment/systems etc.), and possible mitigations. The WG shall

investigate impacts upon fault clearance times, system stability and possible deficiencies in existing protection and control techniques as well as emerging techniques which may be better suited. This shall include how technologies such as FACTS or HVDC may assist stability control and protection.

The WG shall liaise with and refer to the work of WG B5.48 (Detecting Faults on Networks with Low Fault Levels and System Inertia due to Application of new Technologies) to avoid duplication of effort.

Deliverables:

- Technical Brochure
- Summary in Electra
- Abstract for Electra
- Tutorial Proposal Forms and Power Point slides

Time Schedule: start: January 2017 **Final report**: December 2020

Approval by Technical Committee Chairman:

Date: 17/01/2017

(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