**CIGRE Study Committee C4**

**PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP**

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| **WG* N° C4.32** | **Name of Convenor: W. A. Radasky (USA)**<br>**E-mail address: wradasky@aol.com** |
| **Technical Issues: Item No. 10** | **Strategic Directions: Item No. 2** |
| **The WG applies to distribution networks: No** | |
| **Title of the Group:** Understanding of the geomagnetic storm environment for high voltage power grids | |

**Scope, deliverables and proposed time schedule of the Group :**

**Background :** Geomagnetic storms created by solar activity have caused problems for the operation of high voltage power grids throughout the world, including in Quebec, Canada in March 1989 and in South Africa in November 2003. It is understood that the variations of the Earth's magnetic field due to the injection of solar storm generated charged particles into the magnetosphere of the Earth are responsible for the creation of quasi-dc currents that flow in high voltage transmission lines, thereby causing AC transformers to saturate, leading to increased reactive power demand and transformer heating. These geomagnetically induced currents (GICs) can lead to grid voltage collapse and in some cases to damage of high-voltage transformers. While there has been some improvement in the understanding of how power grids are affected, there is a need to understand the variations in the different types of geomagnetic storm waveforms including electrojet storms, sudden impulses and coronal holes. Each of these storm types has different characteristics that can impact power grids at different geomagnetic latitudes in different ways. It is the objective of this study to evaluate the measured geomagnetic data over ~30 years to develop an understanding of the nature of these storms relative to their potential impacts on high voltage power grids. This information will be useful for the development of operational measures for existing power grids and for the development of future high voltage power grids at different locations throughout the world.

**Scope :**

1. To produce a TB to characterize the different types of geomagnetic storms and how they can affect high voltage power grids.

2. To evaluate measured geomagnetic storm B-field waveforms from different types of storms at different geomagnetic latitudes to establish their likelihoods, and to estimate the magnitudes of future waveforms.

3. To identify the relationship between the B-field environments and the electric fields that are created in the Earth, as a function of the deep earth conductivity.

4. To identify the impacts of geomagnetic storms on high voltage electric grids in terms of the orientation of the grids, the presence of land/ocean boundaries, the voltage level of a power grid, the use of static var compensators, etc.

5. To identify the state of the art in geomagnetic storm warnings and to provide recommendations to power grid companies to be prepared for arriving storms.

**Deliverables :** A technical brochure with a summary in Electra

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| **Time Schedule** : Start : January 2013 | **Final report** : December 2015 |
| **Comments from Chairmen of SCs concerned** : | |
| **Approval by Technical Committee Chairman** :<br>**Date** : 23/10/2012 | M. Wald |

## Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

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| **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)

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| **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 |