CIGRE Study Committee A3

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]

WG N° A3.41	**Name of Convenor: René Smeets** (Netherlands) **E-mail address**: rene.smeets@dnvgl.com
Strategic Directions #[2]: 1, 3	**Technical Issues #[3]: 10**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 1; 2; 4; 6	
Title of the Group: **Interrupting and switching performance with SF_6 free switching equipment**	

Scope, deliverables and proposed time schedule of the Group:

Background:

Modern switching equipment for the highest voltages is based on SF_6 gas technology, because of the excellent arc quenching and dielectric insulation properties of the gas. However, SF_6 is the greenhouse gas with the highest global warming potential factor and is one of the six gases designated in the Kyoto Protocol in 1997.

Several efforts has been conducted to develop different SF_6 free switching equipment with considerable lower global warming potential factor such as the mixtures of perfluoroketones ($C_5F_{10}O$, F-Ketones) with CO_2 / O_2 and perfluoronitriles (C_4F_7N, F-Nitriles) with CO_2. CIGRE updated the reference paper on interrupting performance with SF6 alternative gases published in the Electra, No.291, April 2017. First pilot projects to demonstrate these switchgear already have been started in the transmission and distribution networks.

In CIGRE, WG A3.27 published TB 589 “Vacuum Switchgears at transmission voltages” and reported that up to 145/168 kV HV circuit breakers were put in service at transmission voltages.

The WG will collect information focusing on the interrupting and switching performance with SF_6 free switching equipment and investigate these capabilities during the expected lifetime under typical switching conditions. In addition, a technical feasibility of EHV circuit breakers will be briefly addressed by considering cost and economic aspects.

The survey will closely collaborate with WG B3.45 “Application of non-SF6 gases or gas-mixtures in medium voltage and high voltage gas-insulated switchgear” and WG D1.67 "Dielectric performance of new non-SF6 gases and gas mixtures for gas-insulated Systems” followed by the WG D1.51 “Dielectric performance of eco-friendly gas insulated systems”.

Scope:

In the scope of the working group is:

- Collect available interrupting and switching performance data with different SF_6 free gas alternatives
- Review the advantages and disadvantages of all SF_6 free solutions in comparison with the state of the art solution based on SF_6
- Collect the field experiences from the pilot projects along with expectations and

opinions from the pilot utilities

- Evaluate the interrupting and switching performance during the expected lifetime and consider long term stability and impact on the maintenance works related to switching
- Evaluate possible feasible study on EHV vacuum circuit breakers by considering its economic aspect.
- Provide a guidelines for the utilities. For example, to reveal which factors have to be kept in mind when they use it as alternative solution.
- Provide possible feedback or recommendation for the standards and testing procedures

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: April 2018 **Final Report**: October 2021

Approval by Technical Committee Chairman:

Date: 01/03/2018

Notes: [1] or Joint Working Group (JWG), [2] See attached Table 2, [3]See attached Table 1, [4] Delete as appropriate, [5] Presentation of the work done by the WG, [6] See attached table 3

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
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 (ref. 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

Table 3: Potential benefit of work

1	Commercial, business or economic benefit for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical direction
5	Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures
6	Work likely to have a safety or environmental benefit