CIGRE Study Committee B4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG B4-C4.97	**Name of Convenor: Arash Fazel Darbandi (CA)**
Strategic Directions #[2]: 1,2	**Sustainable Development Goal #[3]: 7, 13**
The WG applies to distribution networks: ☐ Yes / ☒ No	
Potential Benefit of WG work #[4] : 1, 2 , 3, 4	
Title of the Group: Benchmarking of simulation Models for control interaction in meshed AC networks with multiple converters	

Scope, deliverables and proposed time schedule of the Group:

Large integration of renewable energy sources and HVDC converters in power system has resulted in displacement of conventional power generation, lower system inertia and reduced short circuit capacity of the AC power system. The AC grids integrates multiple converters in the close vicinity that potentially influence each other. The interoperability and stability of the system with massive amounts of converters are regarded as key issues in future power systems and the decarbonization of the industry.

In recent years large-scale integration of solar, wind and HVDC converters, have resulted in several stability problems in the power system. Interaction phenomena between VSC-HVDC converters and other power electronics devices or passive HV components installed on the network, can have a wide range of frequencies: from interarea oscillations to sub-synchronous interaction and even high-frequency interaction (between 100 Hz up to several kHz). In addition, interactions due to nonlinear behaviour such as transformer saturation, control non-linearity, etc. can also occurs. TB 149 presented methods to coordinate controls of classical HVDC and FACTS in the same system, and also provides guidelines on the selection of the study area.

Now, the industry utilizes novel VSC (Voltage Sourced Converter) technologies, new approaches and recommendations for modelling of equipment's, new and more powerful offline EMT (Electro Magnetic Transient) simulations tools, and RTS (Real Time Simulation) tools connected to replica of control & protection cubical of the equipment. Various simulations tools and models from the converters and passive grid components are available. Through various papers presented in CIGRE conferences, it has been documented that the tools and models representing the active and passive components have a major influence on the study result. Recently, CIGRE WGB4.81- "Interaction between nearby VSC-HVDC converters, FACTs devices, HV power electronic devices and conventional AC equipment" provides recommendations and standards on modelling requirements, preferred tools to be utilized at which stage of the project life cycle to perform the required studies.

The objective of this working group is to establish a benchmark model in EMT, RMS and RTS platforms using the recommendation of CIGRE WGB4.81. The benchmark models will be used to demonstrate, compare, and validate the results of different methodologies and procedures discussed in CIGRE WGB4.81 in a benchmark representing a realistic large system scenario and using different simulation platforms. The use of the different techniques in a very realistic scenario and the limitations of each simulation platform will be highlighted. Utilization of different simulation platform during different stages of the project life cycle will be discussed, as well as possible strategies to define the area of study for different interactions.

Some points of this ToR were already covered by WG C4.56 (TB 881), but it has been identified that further work is required. This JWG between B4 and C4 will provide more comprehensive expertise to carry out the proposed scope and achieve the desired deliverables.

Scope:

The scope of the WG include:

- Specify the system model requirements of AC network and DC systems in RMS, EMT and RTS simulation platform for the control interaction studies including the impact of network equivalency, adequacy and accuracy as well as the limitations, benefits and applications of each simulation platform.
- Develop, benchmark and test models in RMS simulation platform.
- Develop, benchmark and test models in EMT simulation platform.
- Develop, benchmark and test model in RTS simulation platform.
- Analyse the methodologies presented in CIGRE WG B4.81 to assess the control interaction in meshed AC networks with multiple converters using the developed benchmark model.
- With the developed models demonstrate typical interaction scenarios presented in CIGRE B4.81

Liaison experts from SC C6 will also be invited.

☒ Annual Progress and Activity Report to Study Committee
☒ Technical Brochure and Executive Summary in Electra
☒ Electra Report
☐ Future Connections
☐ CIGRE Science & Engineering (CSE) Journal
☐ Tutorial
☒ Webinar

Time Schedule:

• Recruit members (National Committees)	Q4 2023
• Develop final work plan	Q1 2024
• Draft TB for Study Committee Review	Q3 2025
• Final TB	Q4 2025
• Webinar	Q1 2026

Time Schedule: Start : October 2023 **Final report** : October 2025

Approval by Technical Committee Chairman:

Date : August 11th, 2023

Notes:
[1] Working Group (WG) or Joint WG (JWG),
[2] See attached Table 1,
[3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work.
[4] See attached Table 3

WG Membership: refer Comments at end of document.

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits 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 directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.

Comments:

1) CIGRE Official Study Committee Rules: WG Membership

a. Only one member per country (by exception of SC Chair)

b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.

c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

2) Collaboration Space

https://www.cigre.org/article/GB/collaborative-tools-2

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.