

CIGRE Study Committee B4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG N° B4.99	Name of Convenor: Sofie Nilsson (Sweden) E-mail address: sofie.nilsson@hitachienergy.com	
Strategic Directions #²: 1		Sustainable Development Goal #³: 7, 9 & 13
The WG applies to distribution networks: <input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No		
Potential Benefit of WG work #⁴ : 1, 2 , 3, 4		
Title of the Group: Design and Construction of offshore Voltage Sourced Converter (VSC) Stations		
Scope, deliverables and proposed time schedule of the WG: Background: <p>The application of Voltage Sourced technology has greatly expanded in the past decade. With increase in the integration of offshore wind, voltage source converter technology proved to be the solution of choice. Voltage source converters for offshore applications have gone through many transformations to adapt to the limitation of the platform size plus the harsh environment. Presently offshore HVDC VSC converters of ratings up to 2 GW are planned and being tendered.</p> <p>Up to now all offshore HVDC stations have been built on steel supported platforms. This technique brings additional constraints that are normally not seen in onshore applications. Severe size and weight limitations exist. Current installation techniques are limited. Above 20.000 to 25.000 Tons there are only a handful of lifting vessels that can perform such task, leading to high risk of delay and cost overruns. So there is a high pressure to reduce the size and weight of offshore VSC converter stations.</p> <p>It is recognised that the size of an offshore platform is not only determined by the primary process of converting electrical power from AC to DC. Auxiliary systems such as power supply and cooling are essential and occupy large areas and contribute significantly to the weight of the platform. The need to allow for human presence during operation and maintenance requires additional space for living quarters and platform access. However, it is commonly accepted that large parts of the offshore converter stations need to be designed to operate without human supervision. Further, being an isolated installation there are safety concerns that must be considered.</p> <p>CIGRE has published two brochures regarding offshore stations. TB 483 is an extensive work on the design and operation of these offshore stations but is limited to AC offshore stations and TB 619 is specifically for DC but limited to the electrical performance without taking size and weight into consideration. The newly proposed working group will investigate specific topics related to offshore HVDC stations but with a focus on size and weight reduction.</p>		

Scope:

The scope of the WG will cover the design and construction aspects of the main HVDC converter station equipment such as converter, transformer, control and protection, DC cable terminations and accessories, DC GIS, AC/DC switchgear, DC bushings and instrument transformers for the offshore VSC HVDC systems as well as future design considerations such as the potential impact of multi-terminal systems on the offshore platforms. The main focus will be on the electrical and performance aspects of the equipment design and less on the human presence components and mechanical design of the platform.

As indicated the focus will be on the reduction of size and weight to facilitate transport and installation of the complete top side of the converter station. Additionally, the work will consider the pros and cons of splitting of the platform topside design into sections and partial transport and on-site assembly and installation. This would allow for smaller units to be transported and installed but may have impact on testing and commissioning.

The WG will undertake the following steps to determine the lowest possible size and weight:

- Review the existing standards and technical brochures.
- Identify the main size and weight drivers in the offshore HVDC station design.
- Assess the performance reduction such as availability and reliability of the station due to reduced design rules such as:
 - Reduced safety distances and other size reducing measures in insulation co-ordination.
 - Application of reduced design rules and redundancy in the auxiliary power system.
 - Application of reduced design rules and redundancy in the valve and transformer cooling system.
 - Assess the need for and possibility of removing separation walls between different areas in the offshore station.
 - Spare parts strategy and offshore availability.
- Assess the need for living quarters and human support systems.
- Assess the need for other support systems such as helicopter landing facilities.
- Consider splitting the offshore topside into smaller units that can easily be connected offshore.
- Assess the need to complete the equipment installation in harbour to facilitate testing and commissioning before sailing out.

Remarks:

- TB 483: Guidelines for the Design and Construction of AC Offshore Substations for Wind Power Plants
- TB 619: HVDC Connection of Offshore Wind Power Plants

Liaison experts from SC B1 might also be invited, if needed.

Deliverables:

- 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 | Q1 2026 |
| • Final TB | Q2 2026 |
| • Tutorial | Q3 2026 |

Time Schedule: start: February, 2024

Final Report: June, 2026

Approval by Technical Council Chairman:



Date: November 22nd, 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

<https://www.cigre.org/GB/about/official-documents>

- 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.