

## ACCELERATING 132 KV OFFSHORE WIND ARRAY CABLES TO MARKET: BUILDING CONSENSUS ON REQUIREMENTS FOR WET, DRY, STATIC, DYNAMIC 132 KV ARRAY CABLES

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### ABSTRACT

*The High Voltage Array Systems (Hi-VAS) Project found 132 kV to be the optimal next operating voltage for offshore wind farm arrays.*

*The project has since carried out further work to address uncertainty around 132 kV array cables. Broad consensus has been reached on most technical design and performance requirements. Significant gaps have been highlighted in qualification standards, particularly for 132 kV wet-static cables, with improvements to tests proposed and fundamental research questions highlighted.*

*The Hi-VAS project will next conduct a testing programme to provide clarity on qualification standards for 132 kV wet-static cables.*

### KEYWORDS

High voltage, array cables, offshore wind, 132 kV, qualification standards.

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### INTRODUCTION

Increasing the array voltage of offshore wind farms is fundamental to unlocking the dramatic cost savings that the next generation of offshore wind turbines (>14 MW) will deliver. The High Voltage Array Systems (Hi-VAS) project was set up to investigate the optimal array voltage for >14 MW turbines. The Hi-VAS project is a collaboration of Carbon Trust with 10 leading offshore wind farm developers (EnBW, Equinor, Ocean Winds, Ørsted, RWE, ScottishPower Renewables, Shell, SSE Renewables, TotalEnergies and Vattenfall), which sits within Carbon Trust's Offshore Wind Accelerator research, development and deployment programme.

In June 2022, the Hi-VAS project found that 132 kV is the optimal next array operating voltage. It also found that there is urgency for the industry to make this transition [1].

Although no showstoppers were identified for the transition to 132 kV, challenges still remain to step up from 66 kV (the current standard array operating voltage level) to 132 kV.

132 kV array cable was identified as a critical area where further technical development and greater consensus across the industry are required.

Work package 9 (WP9) of the Hi-VAS project was devised to understand the 132 kV array cable requirements, build industry-wide consensus on these requirements, and to scope further work for the Hi-VAS project to address any remaining uncertainties regarding 132 kV array cable [2]. This paper summarises the findings of WP9.

### OBJECTIVES

The initial aim of the Hi-VAS project was to identify the optimal next array voltage and the challenges in getting there. After the project identified that 132 kV will be the next array voltage, the next aim of the Hi-VAS project became to accelerate and de-risk the transition to 132 kV.

The work presented in this paper aimed to:

- Build consensus on functional requirements for 132 kV array cables to provide greater clarity to the offshore wind developers and the supply chain
- Gain an understanding of planned developments of cable and cable material suppliers and the art of the possible
- Identify where gaps in understanding for 132 kV array cables exist and propose how these could be addressed
- Make information available to CIGRÉ, IEC etc., to support development of new qualification standards

### METHODOLOGY

The Hi-VAS project built consensus on 132 kV array cable requirements through widespread engagement across a broad spectrum of major offshore wind farm developers, array cable suppliers and material suppliers. The perspectives of these stakeholders were gathered through questionnaires and in 1:1 meetings. On the basis of this, draft 132 kV array cable requirements were produced.

The wider industry (e.g., TSOs, WTG manufacturers, regulators, research institutions etc.) were engaged in a stakeholder workshop to seek feedback on proposed draft 132 kV array cable requirements.

Gap analysis was conducted on the perspectives gained through the stakeholder engagement and review of testing standards to identify areas of consensus and highlight gaps in research and qualification standards, which need to be addressed to bring suitable 132 kV array cables to market.

During the work, information has been made available to a CIGRÉ Task Force focusing on qualification of wet cables >72.5 kV.