Cable Quality Assurance of Offshore Projects in the German North Sea

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ABSTRACT

Following its legal obligation, TenneT Offshore GmbH started to build grid connections in the German North Sea in the year of 2006. Until today, approximately 3.700 kilometres HVDC and HVAC XLPE cables have been installed. TenneT is now the biggest operator of DC XLPE cable systems worldwide. In the last eight years, the company had to face huge challenges and gathered plenty of experience from the projects. In this paper, the challenges, experiences and some new thinking will be presented from an offshore TSO's point of view in the different project phases, especially regarding the cable quality assurance.

KEYWORDS

Offshore, HVDC, HVAC, Quality Assurance, Cable Manufacturing, Cable Installation, Testing, Non-Conformance

INTRODUCTION

Depending on transmission capacity, length of the grid link system and other boundary conditions, there are two technical variants to be chosen to connect OWF with the onshore grid: HVAC and HVDC. For a small transmission capacity and a short transmission distance, an HVAC link system can be realized, i.e. a direct link between the grid connection point (NAP) of the OWF and the onshore grid coupling point (NVP). If the required transmission capacity and/or the transmission distance exceed the economic and technical breakeven point, the HVDC variant is preferred[1].

However, the choice of the grid connection variants must be subject to a particular project-relevant investigation, i.e. initial study, execution of a pre-survey, consideration of permissions etc. Especially the grid development scenario issued by the German Government has to be applied as basis for this investigation. In the summation of today's demands, there is a tendency of using HVDC connection systems with high transmission capacity in the German North Sea.

Figure 1 shows the schematic of a typical grid connection system using HVDC VSC technology. The electrical power generated by wind turbines is collected at the substation of the OWF and is transmitted to the offshore converter substation via HVAC submarine cables. These cables have a typical length of up to 30 kilometres.

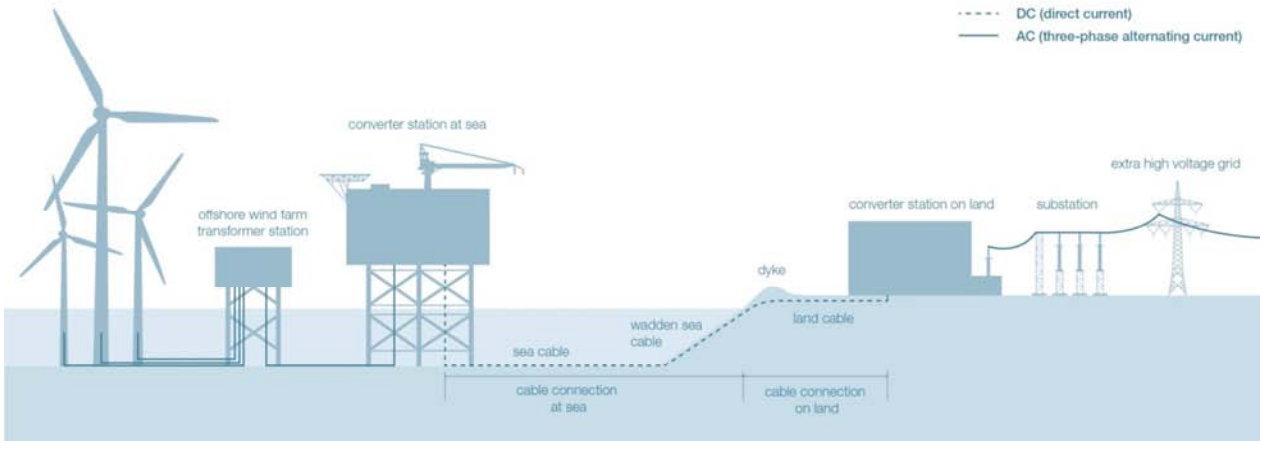

Fig. 1: Typical offshore grid connection with the application of HVDC VSC technology

Due to the advantages of the HVDC VSC technology, such as the black-start capability and independently adjustable active and reactive power flow, it has been applied in both converter stations, onshore and offshore, linked by HVDC XLPE submarine and land cables.

According to the geographical location of OWFs, there are four clusters for the use of offshore wind energy in the German North Sea: BorWin, DolWin, HelWin and SylWin, which are defined by the allocated high-capacitive transmission routes and NVPs to the 400 kV transmission grids [2].