Challenges of cable engineering from offshore to onshore and project to operation

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ABSTRACT

As one of the German TSOs, TenneT TSO GmbH with its subsidiary TenneT Offshore GmbH has installed more than 4,000 km of EHV cables, especially HVDC cables in the German offshore and coastal areas for offshore grid connection projects in the last ten years. According to the grid development plan of the German federal government, approximately 2,000 km HVAC and 3,000 to 4,000 km HVDC cables will be realized in different grid extension projects in the grid regulation zone of TenneT Germany until 2025 additionally.

This paper will give an overview about the challenges in the field of cable engineering from offshore project to onshore projects and further from projects to operation.

KEYWORDS

Cable Engineering, Offshore, Onshore, HVDC, HVAC, Cable projects, Cable operation, Cable Maintenance, RPP, SLA

INTRODUCTION

According to the Grid Development Plan and Federal Requirements Plan, TenneT needs till 2025 in the German regulation zone at least:

For onshore grid extension:

- appr. 2,000 km 525kV HVDC underground cables (or 4,000 km 320 kV cables)
- appr. 1,600 km 380kV HVAC underground cables

For offshore grid connections:

- appr. 1,300 km 320 kV HVDC underground and submarine cables and
- appr. 100 km 155 kV three-core HVAC submarine cables.

Due to the huge demand, particularly more underground cable systems will be installed than submarine cable systems in the following years, tremendous challenges have to be faced in the project initial and execution phases, e.g. the qualification of new manufacturers and further production facilities, design and engineering of cables, quality assurance and control (QA / QC), additional testing etc. [1]

Furthermore, lots of projects after the construction phase will go to operation, especially cable systems for offshore wind. But the operation experience is quite limited for offshore grid connections and (E)HVDC cables and their accessories. Operation and maintenance for such “tailor-made” systems and “semi-mature” technologies will lead thorough risk-oriented analysis and elaborated repair preparedness.

Risks and chances are provided at the same time:

- Possibility to compare different cable system suppliers, at performance, technologies, QA/QC etc.;
- Building a pooling strategy of the spare parts and compatibility research;
- Resource exploring for QA/QC globally;
- Standardizing the products and system modules;
- Challenges for cable engineering and facing repeated quality problems (systematic failure);
- Building of the benchmark for EHVDC cable systems for operation and maintenance (RPP and SLA);
- Investigating the behaviour in a meshed grid with overhead lines and cable systems etc.

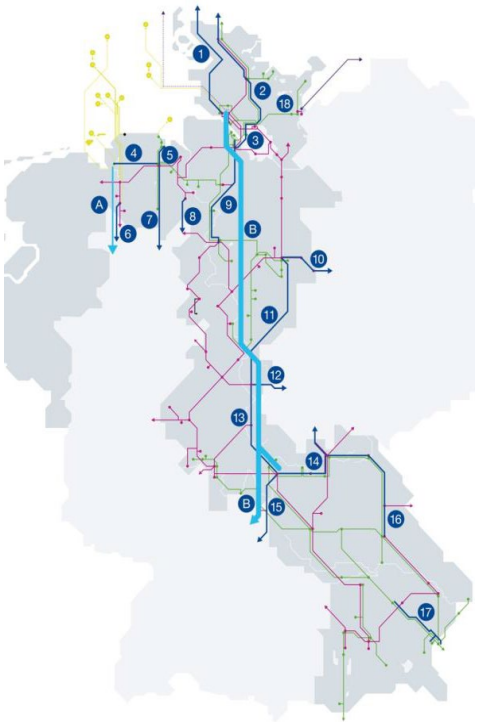

Figure 1 Overview of German TenneT cabling projects

PROJECTS FROM OFFSHORE TO ONSHORE

The installation and laying of submarine cables need more investment and are more complicated compared to land cables. The costs for the laying and installation of submarine cables will be 1.5 to 2 times higher than the cost of the cable itself. From an engineering point of view, the planning of the underground cable systems is more challenging, based on the following facts: