

## Development of Dynamic Cable System for FUYAO Floating Offshore Wind Farm

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### ABSTRACT

This paper describes a dynamic submarine cable system with 65m water depth, which is the power transmission system of the deep sea floating offshore wind farm (FUYAO). Attention is focused on the design, development and qualification of the 35kV dynamic cable and its main components. In particular, a vertical full-scale fatigue test machine was designed, built as well as first applied for dynamic cable in China.

### KEYWORDS

Floating Offshore Wind Platform, Dynamic Cable, Water retardant XLPE, Accessory; Qualification tests

### INTRODUCTION

With the onshore and offshore fixed wind farm tending to be saturated, floating wind farm comes into sight. Dynamic submarine cable, as the connection between floating wind turbine and static submarine cable, is the key equipment to realize offshore wind energy transmission [1].

In this paper, the development and qualification process of the dynamic cable and its main components applied in FUYAO floating offshore wind farm are focused on. Moreover, some urgent issues need to be solved in dynamic cable technology are put forward, for instance, studying the long-term water tree and fatigue aging characteristics of water tree retardant XLPE (TR-XLPE), optimizing cable line design according to cable operating conditions, developing fatigue lifetime estimation simulation method, researching special accessories of dynamic cable system, exploring joint technology for dynamic-static cable connection, and improving standard about fatigue test and relevant specifications before and after installation.

### FUYAO PROJECT OVERVIEW

This paper describes a 35kV dynamic submarine cable system with 65m water depth, which has been installed on the 6.2MW floating wind turbine generation facility named FUYAO, located 15km from the coast and tested in Luodousha sea area.

The principle of connection for FUYAO offshore wind farm demonstration is shown in Fig.1, which has been connected to the existing fixed wind turbine in Wailuo wind farm by submarine cable over a total distance of 26 km and under a nominal voltage of 35kV. The connection with transmission submarine cable has been done at the end of 2022.

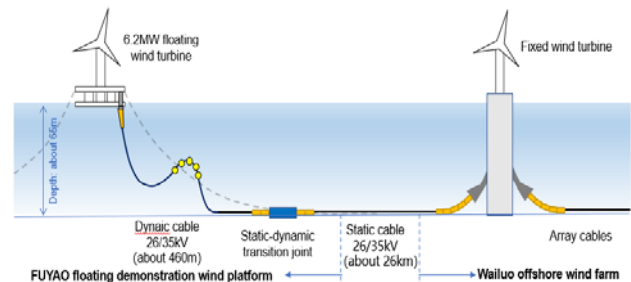


Fig. 1: Principle of connection for floating wind farm

## DEVELOPMENT OF THE DYNAMIC CABLE SYSTEM

### Fundamental Design

Compared with static submarine cables, dynamic cable is usually subjected to movements of the floating structure, swell and sea currents. Therefore, mechanical damage, fatigue in particular, is one of the most common causes of dynamic cable failure.

Due to the rapid flow velocity in the operation sea area (2.5m/s under operating conditions and 3.5m/s under extreme condition), four layers of galvanized steel wire were selected to increase the fatigue life of dynamic submarine cables.

Moreover, TR-XLPE were applied for insulation of dynamic cable with the "wet" design. Several different dynamic cable structures are described and presented in the next section.

A conceptual layout of the dynamic cable system is shown in Fig. 2.

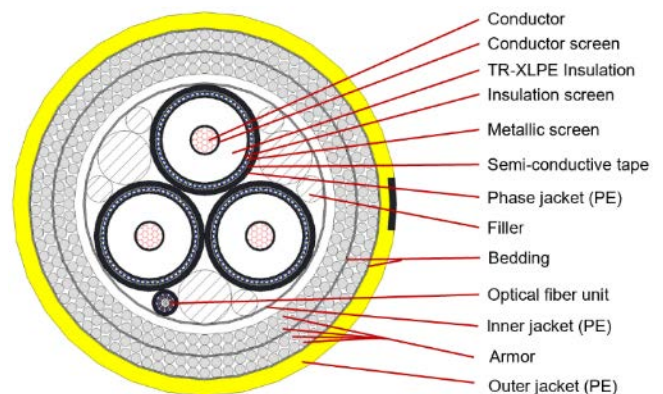


Fig. 2 Structure of 35kV dynamic cable