Greater Changhua Offshore Windfarm 1 & 2a challenges and solutions - first large-scale OWF in Taiwan

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ABSTRACT

As the first large-scale offshore wind farm (OWF) in Taiwan, Changhua 0102a project (CHW0102a) aims to deliver approx. 900 MW of renewable energy ashore. This paper covers certain key challenges and solutions developed within the HV cable scope, e.g. onshore & offshore export, array circuits, during the development and execution of this ground-breaking project in the Asian market.

A special focus is given to the onshore export cable circuit routing & installation design due to an extremely congested 50m cable corridor commonly shared by many developers.

KEYWORDS

HV Array/ Export Cables, Termite resistant jacket, Computational Fluid Dynamics (CFD), HV Cable Culvert, Forced ventilation, Earth Potential Rise, Safety, Indirect earthing, Offshore resonant voltage test.

INTRODUCTION

With the vision to create a world that runs entirely on green energy, Ørsted is constructing the 900 MW CHW0102a Offshore Windfarm in Taiwan Water, which generates more than double the previously installed total offshore wind production in Taiwan. Once fully commissioned in 2023, it can power approximately 1 million domestic households.

Located 35 - 60 km from the coast of Changhua County, CHW0102a comprises 111 nos. 8.4 MW Wind Turbines (333 piles for jacket foundations) interconnected through 66 kV array cables (total ~179 km) and transmits the green energy ashore through three independent 230 kV export cables systems (total ~150 km).

Fig. 1: Location of CHW0102a project

This paper will describe some of the key challenges experienced and associated solutions developed within the HV cable scope along the project journey.

ONSHORE EXPORT CABLE SYSTEM

Entering new markets globally to install OWF can mean new local constraints. Common practice in Taiwan for onshore installation of HV cables is either HV ductbank or culverts due to earthquake concerns (e.g. approx. 40.000 events registered per year). Since ductbank installations could not meet the thermal requirements, a bespoke culvert installation was selected. To implement a sustainable cost-efficient culvert solution, complex CFD simulations of cable culvert installation were carried out considering continuous loads and future adjacent HV Cable systems.

The design considers a high availability (~99%) requirement in an environment with around 1000/year sensitive earthquakes that could initiate liquefaction conditions, an outdoor maximum air average daily temperatures ~34.3°C, and a max. ambient culvert air temperature of 40°C to allow O&M inspections of the ~3.5 km underground culvert. The cable has max. 90°C normal operating temperature.

Culvert Solution

Earth Potential Rise (EPR) and Electrical Magnetic Field (EMF) studies [1] became a central challenge, due to high risk of mutual influence from parallel project circuits and adjacent developer cable systems (Fig. 2 and Fig. 3).

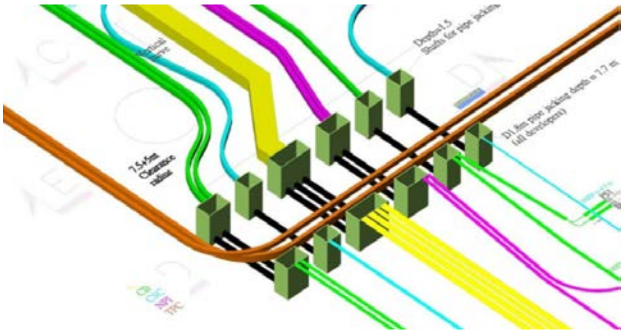

Fig. 2: Congested cable corridor & crossings

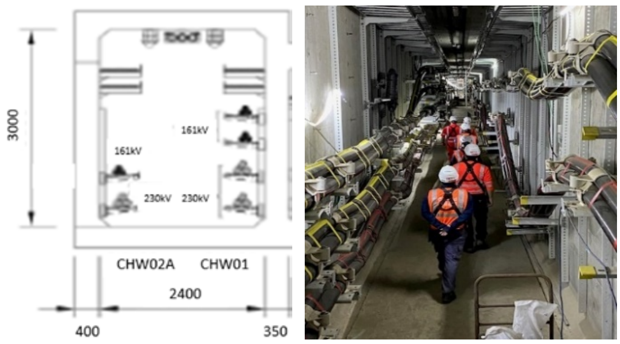

Fig. 3: CHW0102a culvert layout

Although not explicitly shown in Fig. 3, the culvert design also contains a second chamber neighbouring the CHW0102a one, which is reserved for the 230 kV export cable systems and 345 kV grid connection cable systems of the following Changhua 2204 OWF (CHW2204) (920MW, 2025 energization target). All HV onshore export cables have termite resistant design.