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台灣西北部離岸風機下部結構重量研析

Study of the weights for offshore wind turbine generator sub-structures in northwestern Taiwan

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摘要

依據經濟部能源局於台灣西部沿海所規劃之離岸風機潛力場址，其水深範圍約略介於 20~50 公尺，若參考歐洲經驗，風機下部結構型式主要以單樁式基礎(monopile-type foundations)和套筒式基礎(jacket-type foundations)為主。於技術層面考量下，一般會先評估各類基礎型式之最大單元結構重量，以確保有足夠的技術能量進行製造、運輸及安裝等工作。由於台灣遭受颱風與地震的侵襲，且於風能優勢的條件下將伴隨較大的常態波浪，所以無論就極限界限狀態(ultimate limit state, ULS)或疲勞界限狀態(fatigue limit state, FLS)等檢核條件，相較於一般的國際經驗會需要更厚與更大尺寸的結構元件。

為探求台灣西北部海域風機下部結構重量，茲針對單樁式基礎與套筒式基礎，初步選擇單一處風場位置作為海氣象與土壤條件參數的參考，並以通用的 7 MW 風機參數作為上部荷載的輸入值，結構檢核包含極限界限狀態、疲勞界限狀態與使用界限狀態(serviceability limit state)等項目，期望此重量評估成果可作為發展風機下部結構所需製造、運輸及安裝等技術能量的初步參考。

關鍵詞：離岸風機下部結構、離岸風機基礎設計。

Abstract

Based on the plan of offshore potential wind farms in western Taiwan issued by Bureau of Energy, Ministry of Economic Affairs, the range of water depths is about 20 ~ 50 m, where the monopile-type and jacket-type foundations are considered as general wind turbine generator(WTG) sub-structures in Europe. In terms of techniques, the heaviest unit of any type sub-structure will be confirmed to ensure enough capacity for manufacture, transportation and installation. Because of Taiwan suffering from typhoons, earthquakes and larger normal waves result from advantageous winds, the thicker and larger structural elements than international experience will be necessary to overcome the code checks of ultimate limit state(ULS) and fatigue limit state(FLS).

In order to assess the weights of offshore WTG sub-structures in northwestern Taiwan, the parameters of sea states from one site and the interface loads of a 7 MW wind turbine from general assumptions will be used. Both monopile-type and jacket-type foundations will be considered, and besides the ULS and FLS, the serviceability limit state(SLS) will also be checked. It is expected that the results of this study would be preliminary references for developing technical capacities of manufacturing, transporting and installing WTG sub-structures.

Keywords: offshore wind turbine generator sub-structure, offshore wind turbine generator foundation design.