

Construction Environment Characteristics and Structural Solutions of Wind Turbine Foundation for Offshore Wind Farm in China

Zhongmin Lu

Shanghai Investigation, Design & Research Institute
Shanghai, China

ABSTRACT

The paper presents the proposed structural solutions and the applicable conditions of the wind turbine foundation available to offshore wind farm, and the approaches to perform the analysis of typical technical issues like the foundation structure, erosion to surrounding seabed, bearing capacity of pile foundation etc and corresponding handling measures for the offshore wind farm in China. The above outcomes are concluded through study on the construction environment conditions concerning the marine hydrology, meteorology, topography and geology; and the situation of force on structure of the wind turbine foundation for offshore wind farm in China. They are worth to recommend as a reference for the construction of the wind turbine foundation of offshore wind farm in the future.

KEY WORDS: Offshore wind farm; construction condition; foundation solution; structural analysis.

PREFACE

Wind energy has caught the attention of various countries in the world. Wind power is a recycle and everlasting applicable energy from nature, characterized by its advantages such as huge storage, wide distribution, pollution free etc. With the elevated technologies for development and the cost drop of wind power generation, it has turned out to be one of power generation forms in the new energy field and compared with other forms it enjoys most favorable condition to develop on large scale and promote for commercial orientation.

China has long coastal lines and is very rich in offshore wind energy resources. The coastal areas are with developed economy and under vast power demand, and the smart grid has been planned and constructed. The space for power grid market and the power grid will then support the scale development of offshore wind power and make its prospects to grow abroad. The development of offshore wind power has been brought very much to the attention in China. Since 2007, pilot WTG units in the capacity of 1.5 MW, 2.0 MW, 2.5 MW, 3.0 MW, 3.6 MW and 5 MW have been built in Shanghai municipality, Jiangsu, and Fujian provinces etc. As the first offshore wind farm in China was completed in August 2010 – Shanghai Donghai Bridge Offshore Wind

Farm and its second phase wind farm is planned to built further, including Lingang Offshore Wind Farm, Jiangsu Binhai and Sheyang offshore wind farms etc. The construction of offshore wind farms is at a beginning stage in China. A great deal of study and research has been done in the pilot wind farms and model wind farms built. The study concerns wind resources in wind farm, planning and siting, voltage step-up method, type of wind turbine foundation, construction of wind turbine foundation and erection of WTG etc., which help us accumulate experience in the planning, design and construction of offshore wind farm.

SPECIFIC FEATURES OF CONSTRUCTION CONDITIONS OF OFFSHORE WIND FARMS IN CHINA

Chinese coastal line extends from Yalujiang river mouth of Liaoning province to Beilun river mouth of Guangxi province, extending 18 thousand km long and including total island coastal length of 32 thousand km. The coast northward from Hangzhou Bay is staggered distribution of mountains and hills and plains. Flat coast is in the majority. The southeastern coast southward from Hangzhou Bay is mountainous and hilly land, in which with small pieces of estuarial plain.

Meteorological Conditions

The coastal areas from north to south are classified into warm temperature zone, subtropical zone and tropical monsoon zone. In winter period, temperature differs greatly between northern regions and southern regions, with the average temperature difference in the coldest month being up to higher than 20 °C. However, in summer period, the temperature difference is not high.

Due to the influence from warm and wet air currents, rainfall is relatively abundant. However, the rainfall varies in the distribution of regions and duration. It is generally less and less from south to north and mostly concentrates in summer period. And raining season is longer in southern regions than northern regions.

China Meteorological Administration carries out long-term observation on the typhoon impact in coastal area. The statistics analysis of 50-year occurrence period maximum wind speed (10 min) at the height of 70 m ~ 80 m in coastal area is shown in Table 1. It indicates that the