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62_Suitability Study of Foundations for On-shore and Off-Shore Wind Turbine

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This is to certify that Dr./Mr./Ms. **Arbaz Kazi** has presented / participated / contributed for a **FLP** length paper with the title **Suitability Study of Foundations for On-shore and Off-shore Wind Turbine - A State of the Art** in the **International Conference on Advances in Mechanical & Civil Engineering (IC-AMCE 2023)** organized during February, 24th & 25th, 2023 at Thakur College of Engineering and Technology, Kandivali (E), Mumbai.

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Suitability Study of Foundations for On-shore and Off-shore Wind Turbine – A State of the Art

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***Abstract*— In order to meet the expanding energy needs, wind turbines are essential in the production of sustainable and clean energy. Due to the fact that wind energy is more affordable and environmentally friendly, many nations have made significant advancements in the development of large-capacity wind turbines. With the usage of larger towers, the power generation capacity of wind turbines has grown steadily throughout the course of each year. The weights on the foundation grow as the tower height rises, making the foundation much larger. The geotechnical design of foundations for taller wind turbines has also grown difficult, posing particular difficulties in certain locations. The purpose of this paper is to provide a concise overview of the various wind turbine models that are currently available, as well as their competency for the Indian market and the suitability of the various foundation types offered for both off-shore and on-shore wind turbine foundation design.**

Keywords— Energy, Foundations, Off-shore, On-shore, Wind turbines, Sustainable.

I. Introduction

Onshore and offshore wind farms are both viable sources of energy. 90% of the total power generated in Europe comes from the numerous offshore windmill projects that are now in operation. In order to generate wind-based electric energy, wind turbines are frequently used. As we progress toward a decarbonized future, the power sector all around world is undergoing a fundamental upheaval. According to COP26 in November 2021, 151 nations made decarbonization commitments and ambitions to attain carbon neutrality by 2050 and limit global warming to 1.5°C [1]. With the power sector expected to be responsible for 25% of GHG emissions in 2020, the shift is being significantly accelerated by the adoption of renewable electricity, broad electrification, energy conservation, and other initiatives. Since power generation accounts for the majority of India's emissions—about 56% of all emissions—the scenario for GHG emissions in India follows the worldwide trend. With national power demand estimated to expand at a 6% CAGR from 1,276 TWh in 2021 to 2,172 TWh by 2030 [1], India must prepare for decarbonisation of the power sector to accomplish its transition targets. In order to fulfil India's growing demand and sector-wide decarbonization requirements, Renewable Energy continues to be the primary axis of energy supply planning. A suitable foundation is essential for ensuring the stability of wind turbines. The distribution and transfer of loads to deep earth is the main purpose of a wind turbine's foundation. The forces operating horizontally and vertically on the turbine's base are caused by self-weight and wind, respectively. Typically, wind turbine tower heights range from 40 to 130 metres [2]. As wind turbine tower height rises, wind speed increases as well. A great moment is produced at the base of the foundation by the wind pressure exerted on the tower of wind turbine. So, this paper will help to understand the different widely used models and the foundation suitable according to the model.

II. Site Details Considerations

The location of a wind farm is crucial to its overall effectiveness. The intensity of the wind, the access of the site, the existence of electric transmission, and the cost of power in the region are additional factors that affect where to build a wind farm. Faster winds often provide more energy than slow winds do on average, making the construction of wind farms economically attractive. Stronger, more complex and costly turbines are required since there is an extensive damage in the absence of powerful gusts and severe turbulence. Average wind power and speed are not inversely related. This makes the ideal wind condition strong, consistent breezes with minimum turbulence that come from a single straight path [3]. Mountain passes are ideal places