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Fabrication of Helical Blade Vertical Axis Wind Turbine

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ABSTRACT

In an exertion to discover arrangements for worldwide vitality emergency, an examination on a helical vertical blade wind turbine was conducted with the thought of renewables and vitality effectiveness. This experiment was carried out in two steps: the realization of the explanatory calculation of a helical wind turbine control yield which at that point educated the plan and development of the rotor edges. The extend especially pointed to address its utilize as the power supply for private properties or any other places with less perfect economy conditions. The uncomplicated and profoundly open instrument utilizing fundamental materials is to allow individuals to have a reasonable alternative on their possess power production.

Keywords– Helical wind turbine, Blade design, Electricity supply

I. INTRODUCTION

Wind energy could be a clean and limitless energy source broadly utilized as a working liquid for wind ranches for centuries. Be that as it may, it is utilized as an impression of power supply starting in advanced time due to the rise of natural concerns and fuel assets issues. The worldwide request for feasible and renewable vitality has made the need to inquire about and the advancement of modern innovation. Thus, wind energy has been the centre of the industry and has impressively developed its utilization but fair in a large-scale generation. Later, for a long time, the critical build of more proficient, bigger and expensive horizontal hub wind turbines (HAWT) showed up to make inland and seaward wind-turbine fields. This thinking points to creating power on a lower scale by employing a little wind turbine in small arrange to produce a house-hold power supply and construct a cost-effective and open turbine for individuals who require an elective choice to cover their claim power request.This report presents the rotor edge plan, turbine development and the comes about of the experimentation of a helical vertical hub wind turbine These turbines come with a number of particular preferences over the flat ones, and those advantages make this kind of turbine distant better.
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II. ANALYTICAL CALCULATION

According to India's air density, d=1.225 kg/m3 and the turbine and generator efficiencies which are about 0.4 and 0.9 respectably, Wind velocity, v = 6.11 m/s

Sweep area A = $2\pi rh + 2\pi r^2$

$= 2\pi * 0.4 * 1 + 2\pi * 0.4^2$

$= 3.51\ m^2$

$$p = \frac{\frac{1}{2}(1.225\ kg/m^3)(3.51\ m^2)(6.11\ m/s^3)(0.4)(0.9)}{1000}$$

$$= 0.177\ kW/h$$

III. BLADE DESIGN

A 3D sketch of the blade design was done on a solid edge.First, the sketch was divided into five parts. Each part had a different twist angle from the top to the base, reaching 180°. The edge structure is based on semicircles which donate the distance across each segment. Such diameters alter as are inexact to edge centre. The structure is symmetrical from the centre to the close but with inverse heading. Once the structure was set up, the blade surface was made by the hurled surface apparatus utilizing splines to portray the edge border. The base has a 0.4 m diameter and a height of 1 m. The top and bottom are separated by one diameter with respect to the axis. The surface was elaborated by glass fibre. A light-weight, strong, and easy-to-work-with material. The turbine has two identical twist blades with a 180° torsion. Both blades are placed facing away from each other to have 360° of sweep area to then be assembled on a 1.5 m steel shaft. The blades collected were carried out by holding the close of each blade on the shaft, base and top of each edge at the same extremes as the other but in inverse headings.

IV. MANUFACTURE

Based on the 3D sketches, an carboard sheet mould for the blades was developed. The mould was used to make glass fibre reinforced plastic (GFRP) and make the blades. For 1 litre of polyester resin, add 15 ml of cobalt. Mix this material thoroughly, being careful to mix the bottom and sides, and not just the middle of the container, using a paint stick. Lay C. S. mat 300 E-B on and spread the resin mixture over it with a disposable paint brush. Work the mat and resin completely until it is covered uniformly. Repeat applying mat and resin until the finished project is as thick as we want.Fibre glass was rolled to make twisting on the shaft easier. Then the blades were set on the shaft, which has two arms where the extremes of each blade were introduced and clamped. The other side of each blade was turned around the shaft and riveted to it, giving the final twist to the rotor. The rotor was set on a bearing to reduce friction and bear high axial loads.

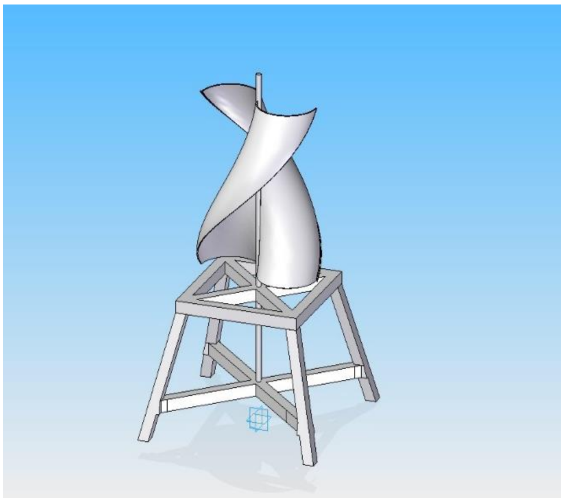

Fig: 3D image of Wind Mill

V. CONCLUSION

A helical vertical pivot wind turbine was built with the reason of covering the power supply for a family with a normal utilization of roughly 1550.52 kW/h per year. A helical vertical pivot wind turbine was built with the reason of covering the power supply for a house-hold with negligible utilization. It was decided that the helical wind turbine may well be a practical elective choice for its use to create cost-competitive vitality. Wind control could be a clean and limitless source of renewable vitality, which has experienced sensational development within the final decade. Considering the included benefits, such as the construction and upkeep costs, turbine estimate and operation necessities, this rotor instrument may be a versatile arrangement, which has a noteworthy extension potential to address the current renewable vitality requests.

VI. REFERENCES

[1]. Arturo Reza, Guilibaldo Tolentino and Miguel Toledo, Construction of a helical vertical axis wind turbine for electricity supply, “Computer-Aided Design and Applications”, Published online: 01 Sep 2015.

[2]. Dowon Han, Young Gun Heo, Nak Joon Choi , Sang Hyun Nam , Kyoung Ho Choi and Kyung Chun Kim, “Design, Fabrication, and Performance Test of a 100-W Helical-Blade Vertical-Axis Wind Turbine at Low Tip-Speed Ratio”, Published: 11 June 2018.

[3]. Kyung Chun Kim, Hoseong Ji, B. Yang, Qian Cheng, Xiaolan Liu, Ho Seong, Ji Kyung Chun Kim and Bo Yang, “Aerodynamic Analysis of a Helical Vertical Axis Wind Turbine”Article in Energies DOI: 10.3390/en10040575, Published: 22 April 2017.

[4]. R. Karthikeyan, A. Gokul Karthik, Design, “Fabrication and Performance Test of Helical-Blade Vertical-Axis Wind Turbine at Low Tip Speed Ratio”,International Journal of Scientific Engineering and Research (IJSER) Volume 6 Issue 11, November 2018.

[5]. Abel Arredondo-Galeana and Feargal Brennan, Floating Offshore Vertical Axis Wind Turbines: Opportunities, Challenges and Way Forward, Issue 30 November 2021.

[6]. Vemuluri Prathik, Udith Kumar Narayanan and Pankaj Kumar, Design Analysis of Vertical Axis Wind Turbine Blade Using Biomimicry, Journal of Modern Mechanical Engineering and Technology, Vol. 8, Issue 7 september 2021.

[7]. Luca Salvadori , Annalisa Di Bernardino , Giorgio Querzoli and Simone Ferrari , Novel automatic method for urban canyon parametrization needed by turbulence numerical simulations for wind energy potential assessment,Issue 3 August 2021.

[8]. Unnikrishnan Divakaran, Ajith Ramesh, Akram Mohammad and Ratna Kishore Velamati, "Effect of Helix Angle on the Performance of Helical Vertical Axis Wind Turbine", Issue 12 January 2021.

[9]. E Jr. J Golloy and J Honra, Performance Evaluation of a Forward Swept Blade for Vertical Axis Wind Turbine through CFD Simulation, "Performance Evaluation of a Forward Swept Blade for Vertical Axis Wind Turbine through CFD Simulation ", OP Conf. Series: Earth and Environmental Science 897, 012002 Issue 2021.

[10]. Hawwa Kadum, Sasha Friedman, Elizabeth H. Camp, Raúl Bayoan Cal, Journal of Wind Engineering & Industrial Aerodynamics, "Development and scaling of a vertical axis wind turbine wake", Journal of Wind Engineering & Industrial Aerodynamics 174 ,Issue 3 January 2018.

[11]. Ying Wang,Sheng Shen, Gaohui Li, Diangui Huang and Zhongquan Zheng, Investigation on Aerodynamic Performance of Vertical 2 Axis Wind Turbine with Different Series Airfoil Shapes, Renewable energy an international journal, ISSN 0960-1481 vol.120, Issue 18 February 2018.

[12]. S.M.H. Karimian, Abolfazl Abdolahifar, Performance investigation of a new Darrius Vertical Axis Wind Turbine, Energy the international journal ISSN 0360-5442, Issue 13 November 2019.

[13]. A review on the historical development of the lift-type vertical axis wind turbine: from onshore to offshore floating application, Issue ,30 January 2020.

[14]. Victor Kouloumpis, Robert Adam Sobolewski and Xiaoyu Yan, Performance and life cycle assessment of a small-scale vertical axis wind turbine, Journal of Cleaner Production, Issue 07 February 2020.

[15]. Zhengshun Cheng, Kai Wang, Muk Chen Ong, Assessment of performance enhancement of a semi-submersible vertical axis wind turbine with an optimized Darrieus rotor, Issue March 12, 2018.

[16]. Jack Durkacz, Sheikh Islam, Ryan Chan, Ethan Fong, Hamish Gillies, Aditya Karnik, Thomas Mullan, "CFD modelling and prototype testing of a Vertical Axis Wind Turbines in planetary cluster formation", 6th International Conference on Advances on Clean Energy Research, Issue April 17, 2021.