



Fabrication and Experimental analysis of Vortex Wind Turbine

Mr. C. H. Joseph Sundar*, M. Tech
Asst. prof, Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
*Corresponding author: joseph.me@srit.ac.in

V.Lakshmi Narayana Reddy
Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
204g1a0339@srit.ac.in

B. Narasimhappa
Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
204g1a0351@srit.ac.in

G. Divya
Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
204g1a0326@srit.ac.in

P. Karthikeya
Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
204g1a0334@srit.ac.in

T. Anusha
Dept of Mechanical Engineering
Srinivasa Ramanujan Institute of Technology
Anantapur, India
204g1a0307@srit.ac.in

Abstract: Vortex – Bladeless is a Spanish SME whose objective is to develop a new concept of wind turbine without blades called vortex or vorticity turbine. In current scenario, the uses of electricity increases widely and on other side will be scarcity of fossil fuels. As these fossil fuels depleted there will overcome by the use of renewable resources to produce electricity. Air is most valuable energy source, today we currently use wind turbine with having blades to produce energy but these are very costlier and having many disadvantages like maintenance cost, Capital cost, noisy and very dangerous to birds. As a result we attempted to make electricity with the use of wind energy by using Vortex wind turbine. The concept of bladeless windmill works on the theory of vortex shedding effect. Vortex windmills are the wind generators that generates electricity with minimum or less moving parts. It generates the electric current by using vibrations produced due the wind. Hence electricity generated by using the electromagnetic effect. The main aim of this project is to save birds, reduce the weight of turbine, to avoid the blades manufacturing and produce electricity with less moving parts.

KEYWORDS: Vortex Wind Turbine, Electromagnetic Effect, Vortex Shedding, Circular Magnets, VIV Principle.

INTRODUCTION

As the world develops, human resources are being exploited. This exploitation will likely lead to a deficiency of natural mineral resources in the future. Renewable energy sources like light, wind, water, and biomass could be the best options instead of fossil fuels. Wind could be one of the cheapest and most sustainable sources since it is abundant. Looking at this, wind turbines generate sustainable, clean energy from the wind. With HAWTs and VAWTs, transportation is increasingly challenging because of the large component size. Their large size can also endanger birds. Additionally, they are very expensive. The latest modification is a technological leap forward and revolution in wind energy - Vortex Bladeless Turbines. These turbines work via the principle of vortex shedding and provide a more efficient, cost-effective, and eco-friendly way to produce energy. Bladeless turbines can generate electricity for 40% less cost than bladed wind turbines. The Literature survey on the development of solar grass cutter is presented below.

Wind power is a renewable energy source that is consistently available throughout the year. It can be harnessed to provide electricity to rural areas that face frequent power outages lasting up to 12 hours daily. However, traditional wind turbines with rotary components require regular maintenance, impacting their efficiency. Additionally, these turbines can disturb wildlife with noise and are not suitable for residential areas due to geographical constraints. The development of a bladeless vortex wind turbine specifically designed for low wind conditions in Indian rural areas aims to address these issues. This innovative turbine offers a 40 percent cost reduction compared to traditional rotary blade turbines and operates on the VIV principle, where movement of a magnet or coil of wire generates electrical current. [1]. Saurav Bobde and Sameer Jadha et al.

Nowadays, the depletion of non-renewable energy sources has led to the need for utilizing renewable energy sources to produce energy. Traditional blade wind turbines, although effective in generating energy, come with high costs and various disadvantages such as capital, maintenance, running costs, friction loss, as well as posing risks to birds and creating noise pollution. Therefore, there is a necessity to explore cost-effective and safe alternatives to conventional windmills. The concept of bladeless windmills operates on the principle of vortex shedding effect. Vortex bladeless windmills are wind-powered generators that produce electricity with minimal moving parts, utilizing the oscillation or vibrations caused by the wind. This technology is based on the working principle of vortex-induced vibrations (VIV), where electricity is generated through a linear alternator or piezoelectric material. Typically, structures are engineered to reduce vortex-induced vibrations (VIV) to prevent mechanical failures. However, in this project, we aim to enhance vortex-induced vibrations (VIV) by maximizing the deflection of bladeless windmills in order to generate electricity through an experimental and geometrical approach. [2]. Akshay Agarwal and Subhasis Sarkar et al.

METHODOLOGY AND MATERIALS

S. No	Components	Images	Description
1.	Aluminium Sheet		The structure is lightweight of aluminium sheet. The part that oscillates in the centre is the conical-shaped part. The oscillations will be more pronounced with the smaller weight.
2.	Springs		Four helical springs, with one end fastened to the circular disc and the other to the device's foundation. They are used to give the mast both vibratory and constraint motion.

3.	Winding Coil		<p>A winding coil used in bladeless windmills serves as a crucial component in generating electricity through a unique mechanism. Unlike traditional wind turbines with rotating blades, bladeless windmills harness wind energy using oscillation and resonance principles. The winding coil, typically made of copper wire, is attached to the base of the windmill structure. As the wind passes through the windmill, it creates oscillations in the structure, causing the attached coil to move within a magnetic field, thereby inducing an electric current. This current is then captured and converted into usable electricity.</p>
4.	Circular Magnets		<p>Magnets used in vortex wind turbines exhibit strong magnetic properties, ensuring efficient energy conversion and reliable operation over time. The magnets' magnetic field strength contributes to the turbine's overall power generation capability, enhancing its performance and output capacity.</p>

WORKING PRINCIPLE:

Whirlwinds are drawn to the structure and, depending on the wind speed, develop at specific frequencies. The energy detected occurs when the vortex's frequency and the structure's frequency match. This system operates using the same principles as an electromagnet or alternator. The oscillations' response to air vortices moves a number of magnets in the joint close to its base, producing electricity. These magnets are then used to power an alternator, which increases the oscillations' frequency and converts the motion into useful electricity.



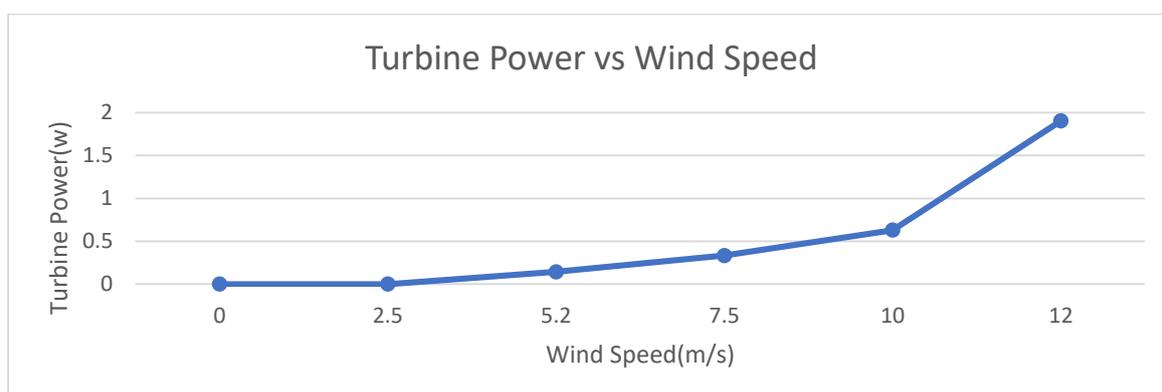
Fig1: Vortex Wind Turbine

RESULTS AND DISCUSSION

TURBINE POWER: Turbine power refers to the amount of electrical energy that is generated by a wind turbine through the conversion of kinetic energy of wind into mechanical energy, which is then converted into electrical energy.

For the observations that are taken during experimentation for various wind speeds the turbine power are calculated by using (2). The resulted values are:

Wind Speed (m/s)	Turbine Power (w)
0	0
2.5	0
5.2	0.144
7.5	0.334
10	0.63
12	1.902



OBSERVATIONS RECORDED DURING EXPERIMENTATION

Wind speed (m/s)	Current (A)	Volts (V)
0	0	0
2.5	0	0
5.2	0.08	1.8
7.5	0.15	2.2
10	0.20	3.2
12	0.28	3.9

6. ADVANTAGES.

- There are no moving parts in contact with one another in the wind generator, so there is no need for lubrication and less wear and tear.
- Compared to traditional wind, the design's complete elimination of mechanical components subject to friction-related wear and tear is expected to result in a 53% reduction in maintenance costs.
- They are not a threat to birds flying around them.
- It cuts the foundation in half at the bottom.

7. APPLICATIONS

- Bladeless energy for Agriculture
- Industries
- Schools
- Off grid power for rail Signaling

III. CONCLUSION

After conducting the experimental analysis on the vortex wind turbine produces 300 to 400 watt per day at 5 m/s. The project will cater to the increasing energy demands of the community while utilizing minimal land area. It is suitable for installing at medium and high altitudes. The methods employed in bladeless turbines to generate electricity differ from those used in traditional direct shaft wind turbines. It can be installed in various settings where there is sufficient wind flow. This power generation system is beneficial for both individuals and small-scale residential industries. Challenges related to profitability and small-scale manufacturing in remote areas are being addressed by upgraded wind turbines, which aim to enhance cost-effectiveness and eliminate unnecessary components. Bladeless scroll wind turbines, on the other hand, are not as popular. However, the compact design of bladeless turbines enables efficient power generation.

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V. REFERENCES

1. Int MAT Journals - "Design and Analysis of Vortex Bladeless Windmill for Composite Material" by Onkar and Amol B Gaikwad.
2. International Journal for Innovative Research in Science & Technology - "Study of Vortex Induced Vibrations for Harvesting Energy" by Saurav Bobde and Sameer Jadha.
3. Research paper on - "Bladeless windmills based on the principle of vibration" by Akshay Agarwal and Subhasis Sarkar.
4. International research journal of Engineering and Technology – “Design, Analysis and Prototype of Vortex Bladeless wind turbine” by Balakrishnan S P, Arun R and, Vinoth Babu N.
5. International research journal of Engineering and Technology – “ Design and Fabrication of Bladeless Wind Power Generation” by N. Sai Charan and A. Sai Vasudev

