

Vortex Bladeless Wind Power Generation

¹Vadghule Rishikesh, ²Maknor Akshay

^{1,2}Student, B.E., Mechanical, Sinhgad College of Engineering, Pune, Maharashtra, India

Abstract - Bladeless Wind Power Generation uses a radically new approach to capturing wind energy. The device captures the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the wind bypasses over a propylene sheet structure, the energy will be transferred to the spring which will exert the force in the down ward direction. These forces are acted on the piezo sensors which are mounted below the spring. Naturally, the design of such device is completely different from a traditional turbine. Instead of the usual tower, nacelle and blades, the device has a fixed mast, a propylene sheet and piezo sensors. This puts the technology at the very low range of capital intensity for such projects; it also makes it highly competitive not only against generations of alternative or renewable energy, but even compared to conventional technologies.

I. INTRODUCTION

Today India is on the path of becoming the super power in the entire world. This means that India is at uppermost position in the list of a developing country. India is at uppermost level in terms of an economic condition. Hence energy requirement is increase day by day. Hence for fulfilling the requirement of this energy, coal cannot be the primary source of energy. This is because coal is depleting very fast. Due to that coal will exhaust within some -day. So, it's needed to find out another source of energy. Hence the next choice is solar power. But due to its lower concentration per unit area, it is very costly. India is having fifth largest installed wind power capacity in the world.[1] But for the generation of an energy with the help of wind as a source speed of a wind should be high, but speed of a wind is not at high speed at each location. The place at which speed of a wind is high those places are limited. Windmills should be safe, simple and affordable. Hence another great option for the generation of energy is bladeless wind turbine. The Bladeless Windmill is such a concept which works on the phenomenon of vortex shedding to capture the energy produced. Generally, all the structure is producing such that which must produce low vibration. But when bladeless wind turbine is considered, generation of a vibration is most importance. Here entire generation of energy depends upon the vibration created in the structure. As the vibration produced in the structure with the help of that vibration kinetic energy is created, that kinetic energy is converted in to the electrical energy. Nowadays wind power has become most usable source of energy from last decade. For increasing the amount of energy generation, the turbine should be more efficient. But even though the industry saw a record 6,730 billion global investment in 2014, turbine growth may be reaching its limits [2]. It is found that bladeless turbine is more efficient as compared to the conventional wind turbine. The cost of an energy creation by bladeless wind turbine is 40 percent less as compared to conventional wind mill turbine. But the conventional wind turbine is more costly as compared to the bladeless wind turbine because it includes the transportation cost of and blades and other bulky components. Today's wind turbines are also incredibly top heavy. Generators and gearboxes sitting on support towers 100 meters off the ground can weigh more than 100 8 tons. As the weight and height of turbines increase, the materials costs of wider, stronger support towers, as well as the cost of maintaining components housed so far from the ground, are cutting into the efficiency benefits of larger turbines. The alternative energy industry has repeatedly tried to solve these issues to no avail. But this latest entry promises a radically different type of wind turbine: a bladeless wind turbine. The design of a turbine should be such that which will avoid wear and tear.

II. METHODOLOGY

Idea emerged in 2002 when David Yáñez, the co-founder of a vortex bladeless startup company, saw a video of the Tacoma Narrows Bridge disaster and led him to the idea of a bladeless wind turbine is new technology which seeks to overcome issues related to traditional wind turbines such as maintenance, amortization, noise, environmental impact, logistics, and visual aspects. bladeless windmills run on the principle that when wind is allowed to strike the column mast, it tends to vibrate and this vibrational energy is further converted to mechanical (crank shaft) or electrical energy (direct connection to alternator). When the wind impinges on the projected surface area of the mast from one specified direction, stream lines of the wind tend to depart and get sheared. Further passage results into the formation of wind currents called vortices or eddies. When they are strong enough to overcome the internal resistance offered by the mechanism (crank shaft or direct linear alternator), the mast vibrates due to spring connected at outside surface of the mast. Then spring is connected to the foundation seat. Connecting rod is

bound to transmit this vibration to the crank. Crank shaft can be connected to a generator further. We can also connect the lower end of the mast with the linear alternator directly. Obviously, we can use a rectifier circuit to transform this A.C. current to D.C. current and charge a battery or connect it the load.

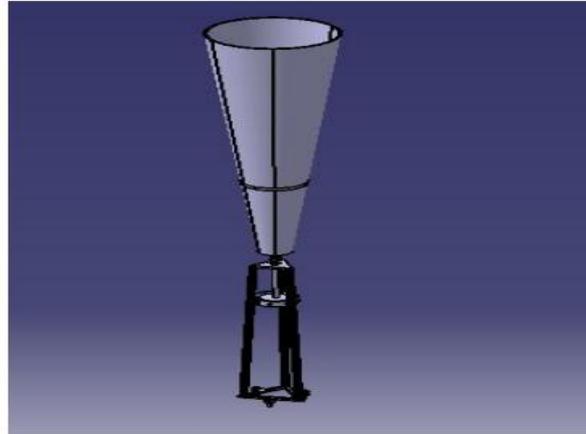


Figure 1: Model of Vorted Bladeless Turbine

$$A_p = (\pi/2) * (D_{max} + D_{min}) * L$$

$$R_t = \text{Taper Ratio} = L / (D_{max} + D_{min})$$

Reynolds Number distinguishes the flow of fluid as Laminar or turbulent. So, we are targeting Re values $300 < Re < 3 * 10^5$,

This is for better frequency of vibration. (From graph) Now for Reynold number to be $300 < Re < 3 * 10^5$, Strouhal Number should be 0.2 or 0.198 (from graph)

$$St = 0.198$$

Now all the parameters are known except Mean diameter (D). To find mean diameter, we have to do trial and error. By comparing our value of D with L/D ratio of other such Experiment.

Let's fix length as L=2m total length so from precious research paper and past study we take L/D=10

$$\text{Now, } 2000/D = 10$$

$$D_{max} = 200\text{mm}$$

From different Research paper, it found that taper ratio lies between 14-19 so selecting 16 as a taper ratio $r = 16$

III. RESULTS AND CONCLUSION

Tapping the wind for renewable energy using new approaches is gaining momentum in the recent years. The purpose of this paper is to provide some fundamental results on the bladeless wind system and serve as stepping stones for the future development of bladeless wind power generation system. The forces that is beneficial or useful to generate power in bladeless are different from those in conventional horizontal axial wind turbines. Our device captures the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architect for ages. As the wind bypasses the fixed structure, its flow changes and generate cyclic pattern of vortices. As the wind energy is powerful and consistent, the usage of conventional wind turbine for utilizing the wind energy in lesser area and cost is most possible. Hence bladeless wind energy helps us to achieve these criteria. This project has three main advantages: 1) Utilizing less area. 2) Generation of high power. 3) Economical.

REFERENCES

- [1] Design of Machine elements By V.B. Bhandari.
- [2] Design of Machine structure By Sharma & Agrawal.
- [3] https://www.youtube.com/watch?v=2_5K4kmnsL4, Power Generation by Bladeless Windmill Abhilash Khairkar¹, Prof. Saurabh Bobde², Prof. Saurabh Bobde³, Gaurao Gohate⁴, Department of Mechanical Engineering, DBACER Nagpur
- [4] <https://www.indiegogo.com/projects/vortex-bladeless-a-wind-generator-without-blades--3#/>
- [5] <http://ijsetr.org/wpcontent/uploads/2015/04/IJSETR-VOL-4-ISSUE-4-710-714.pdf>
- [6] www.ijserd.com/articles/IJSRDV4I31605.pdf
- [7] https://en.wikipedia.org/wiki/Vortex_Bladeless
- [8] IJIRST –International Journal for Innovative Research in Science & Technology| Volume 2 | Issue 11|april'16

AUTHORS BIOGRAPHY



Vadghule Rishikesh, Student, B.E., Mechanical, Sinhgad College of Engineering, Pune, Maharashtra, India



Maknor Akshay, Student, B.E., Mechanical, Sinhgad College of Engineering, Pune, Maharashtra, India

Citation of this Article:

Vadghule Rishikesh, Maknor Akshay, "Vortex Bladeless Wind Power Generation" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 11, pp 38-40, November 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.511006>
