Design and development of bladeless windmill

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Abstract- *As the regions with high wind speed are limited, the installation of conventional windmill is limited. Windmills that would provide safe, quite, simple, affordable and work on lesser wind speeds are need of the hour. The Bladeless Windmill is such a concept which works on the phenomenon of vortex shedding to capture the energy produced. Generally, structures are designed to minimize vortex induced vibrations in order to minimize mechanical failures. But here, we try to increase the vibrations in order to convert vortex induced vibrations into electricity. Naturally, the design of such device is completely different from a traditional turbine. Instead of the usual tower, nacelle and blades, our device has a fixed mast, a power generator and a hollow, lightweight and semi-rigid fiberglass cylinder on top. 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.*

Keywords- Bladeless windmill, vortex shedding, non conventional technology, lightweight, vibrations

I. INTRODUCTION

In these days non renewable energy sources are gone to the depth of earth, so we can obviously produce energy by renewable energy sources. Wind energy has become a legitimate source of energy over the past few decades. The construction of bladeless windmill is quiet simple. The conical mast is pivoted vertically with the help of cylindrical rod which is held within roller bearing in such a way that it vibrate in one direction only. The portion below pivot is covered with help of metal sheet. The upper part of mast flutters in wind while crank shaft is connected to lower part. This is a wind generator without blades. The main advantage of this underlies the absorption of energy through the vortices of a rigid member similar to an effect of aerodynamics. We are going to generate electricity by using the bladeless windmill. This wind mill will have no blades. It will generate electricity by using oscillation due to wind.

1.1 Problem Statement

Looking at the current scenario of power generation. Wind power has become a legitimate source of energy over the past few decades as larger, more efficient turbine designs have produced ever-increasing amounts of power. But even though the industry saw a record 6,730 billion global investment in 2014, turbine growth may be reaching its limits. Bladeless turbines will generate electricity for 40 percent lesser in cost compared with conventional wind turbines. In conventional wind power generation transportation is increasingly challenging because of the size of the components: individual blades and tower sections often require specialized trucks and straight, wide roads. 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 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 cylinder that oscillates or vibrates, has become the most promising power generation source.

1.2 Objective

This is a wind generator without blades. Instead of capturing energy via the rotational motion of a turbine the Vortex takes advantage of what's known as vortices an aerodynamic effect that occurs when wind breaks against a solid structure. By this project, we are going to generate electricity by using the bladeless windmill. This wind mill will eliminate blades. It will generate electricity by using oscillation occurring due to wind. It works on principle of electromagnetic induction or vibrations. Here, electricity can be generated by using generator.. The advantages over our present ones are: there are less gears, bolts or mechanical moving parts so they are cheaper to manufacture and maintain. It would cost less than the conventional turbine with its major costs for the blades and support system. The main objectives of this project is as follows, to increase the efficiency of wind power generation, produce clean energy to meet the increasing demands, make the

wind energy economical and efficient & to reduce pollution and global warming.

1.3 Methodology

The main principle behind bladeless wind generator is the conversion of linear oscillation of mast to rotational motion. As the mast is subjected to wind energy, it tends to oscillate due to the vortices formed around the structure of the mast, which can be converted to rotational force to generate electricity. In the bladeless wind system configuration, the mast is fixed with the frame with respect to the frame. Energy is obtained by continuously oscillation of the mast. The mast utilizes wind power to pull the threads along with the rack attached to the pinion which drive the shaft which intern rotates the alternator to generate power. During the oscillation of the mast, the mast tries to oscillate in any direction depending on the wind direction. The rib structure at the top of the mast is attached with six threads to absorb the energy from the wind. Each set of the thread arrangement of the rib structure corresponds to one teeth on the shaft which is driven by the rack which is pulled by the thread. The arrangement of the threads on the mast is such that the power is generated on all direction of oscillation of the mast. Each of the threads is joined with the rack which drives the pinion attached to the shaft to generate the maximum amount of power. After the maximum oscillation on one side is reached, the mast returns to its initial position and then continues the oscillation on the other side where in the other arrangement of the rack and pinion drives the shaft hence providing the continues movement of the shaft. Such operation has been developed and tested through numerical simulations, considering a quite accurate model, which takes into account the aerodynamic characteristics of the mast and the strength of the threads, and employing self-tuning magnetic coupling system to maximize the net generated energy. So that it can operate in a wider range of wind speeds and also withstand the high wind velocities. This system allows maximizing the oscillation amplitudes when wind intensifies. When the wind strikes the mast, it starts to oscillate due to the vortices formed around the structure and nylon rod placed at the bottom of the mast. The energy absorbed by the nylon rod during the oscillation of the mast contributes to the increase in the amplitude of the oscillations. The shaft driven by the rack and pinion arrangement rotates in both direction. Due to rotation of pinion generator produces emf continuously.

II. LITERATURE REVIEW

This paper deals with the study of the vortex induced vibrations for harvesting energy in which the various methods of the wind power harvesting are discussed. The various phenomenon and concepts that are used in the wind power harvesting. Also the various problems which are related with the conventional wind power harvesting are discussed. The possible solution of using a piezoelectric material in the oscillation wind power harvesting type model is also discussed. [1]

This paper deals with the study of the bladeless wind power generation in which various aspects of bladeless wind power generation. In this paper the other type of thread attached mast model is discussed. The history of the bladeless wind power generation is also discussed. The various applications of the bladeless windmill and its future is discussed. [2]

This paper deals with the study of the influence of the taper ratio on vortex-induced vibration of tapered cylinders in which a series of tests are conducted and the effect of the various taper ratios is studied. For linearly tapered cylinders wider range of locking ranges were observed as compared to the uniform cylinders. The tests are carried out on small taper ratios. [3]

III. DESIGN OF BLADELESS WINDMILL

Fig. Actual Design of Bladeless Windmill

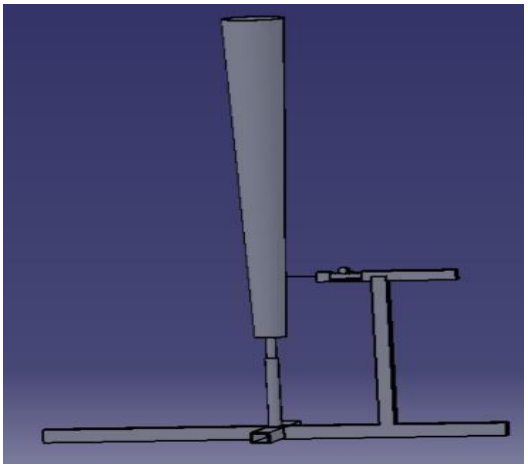

Fig. CAD Model

3.1 Components of bladeless windmill

A. Rain forced glass fiber sheet

This type of sheet made up of polymer matrix reinforced with fibers. The fibers used are glass. Glass reinforced polymers and strongest and most resistive to deforming forces when the polymer fibers are parallel to the forces being exerted. The plastic matrix may be a thermoset polymer matrix—most often based on thermosetting polymers such as epoxy, polyester resin, or vinyl ester—or a thermoplastic. Cheaper and more flexible than carbon fiber, it is stronger than many metals by weight, and can be molded into complex shapes. Sheet is folded in cylindrical shape and used as mast in model.

Sr. No.	Na-me	Hei -ght	Wei ght	Generation Capacity	Tentative Price	Capabilities
1.	Vortex Atlantis	10 feet (3m)	10Kg	100 Watts	17294.50	Lightings and electronics items
2	Vortex Mini	42 feet (13m)	100 Kg.	4 Kilo watts	34589.00	A Village
3	Vortex Grand	490 feet (150 m)	100 ton	1 Mega watts	86,47, 250.00	400 House holds

B. Mild Steel frame

Mild steel has a high resistance to breakage. Mild steel, as opposed to higher carbon steels, is quite malleable, even when cold. This means it has high tensile and impact strength. Square pipes are used to manufacture the frame and welded by arc welding.

C. Rack and Pinion

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. Plastic rack and pinion used to minimize the weight of model.

D. 12v generator

Generator is used for converting mechanical energy into electrical energy. 12v generator is attached to the pinion which will rotate due to reciprocating motion of the rack attached to the fiber glass frame mast.

E. Nylon Rod

Nylon rod is particularly good at resisting wear and abrasion and is suited to machining. It has a high mechanical strength and good sliding properties. It is also stiff and has a good creep stability and is resistant to many oils and chemicals. The light weight glass fiber mast is connected to nylon rod which is attached to mild steel frame for stability.

F. Aluminum rivet

A rivet is a permanent mechanical fastener. Aluminum rivets are used for riveting the glass fiber sheet in cylindrical shape. Aluminum rivets are light weight and have high strength in vibrations. These are permanent type of fastener. After fastening it expands more than other materials.

G. LED light

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

IV. RESULT

Basically there will be three main Prototypes to hit the Market.

1. Vortex Atlantis (Micro power generation)
2. Vortex Mini (Domestic
3. or industrial generation Near to consumption point)
4. Vortex Grand(Large scale power generation)

V. CONCLUSION

Bladeless wind powered harvesting is convenient, requires less investment and also less area than the convenient wind powered harvesting. The highly efficient energy is generated through the bladeless windmill. As the wind speed required is very low the future of the wind power harvesting is very much depend upon bladeless windmill concept. The device produces renewable clean energy which will provide alternate option for exhausting non-renewable energy sources in future.

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