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Review On Venturi Windmill

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ABSATRACT

Recent developments are carried out to enhance the performance of horizontal axis wind turbines. In these developments a low pressure region was created behind the wind turbine blades enclosed by diffuser or shroud. In this paper the venturi effect was used to concentrate the air flow to the turbine blades with convergent section, which increases the velocity at turbine blades and low pressure region created behind the blades by divergent section, whereas turbine was mounted at the throat section. The aim of the project is to reflect an idea of wind power plant in the urban areas where wind velocity is low. The increased velocity of wind resulted in significant improvement in the kinetic energy hence power output of turbine. The power available from wind is proportional to the cubed of the wind speed. This project looks at increasing the speed of the wind by means of passive devices like venturi tube and making the speed of the wind inside the system constant by means of a built in small wind tunnel. By doing this the efficiency of the wind turbine would be greatly increased and if we can maintain the wind speed constant the power output would be constant over time. The final outcome of this project is to build a wind power generation station which is small i.e. it could he installed in a house and could be integrated with the current wind turbine ventilation system. It is a challenging project but if successful, it will minimize the current disadvantages of wind turbines and open new gates for development in this regard.

1. INTRODUCTION

Wind energy conversion systems have existed for more than 3000 years. Since the appearance of the ancient Persian wind mills 3000 years ago, many different types of windmills have been invented. Initially, wind energy was used to induce a function, such as moving boats using sail, cooling houses by circulating outside air, running machinery in farms, and even small production facilities. In late 1800s and early 1900s, conversion of wind energy to electrical power marked a turning point for the wind power generation industry. Due to energy crises and changes in the political and social climates, wind turbines started to rapidly spread across the globe in the last three decades. [2]

However, wind power is far from reaching its full potential. Manufacturers have incrementally improved conventional wind in the last two decades e but the greatest energy output gains have come from building turbines with ever-larger blades, perched on ever-taller towers, built at ever increasing expense and with ever increasing areas of land required. As the size and height of turbines and towers increase, often reaching beyond 100 m e wide enough to allow one or two 747 aircrafts to fit within the sweep area of the blades e the cost of wind-generated power continues to exceed the cost of power generated by hydropower plants, coal and natural gas.

Turbines are often subjected to excessive downtime, and failure and repair costs are high. Moreover, complaints of harm to wildlife continue to plague the industry, as do complaints of harm to human health from high-decibel low-frequency sound waves from wind turbines, propeller noise and flickering of light through rotating turbines. The visual nuisances of large wind farms are another cause of complaints. Conversion of wind power to electrical energy is controlled by the free stream wind speed and blade shape, orientation and radius. Because of these design parameters, the tower height and blade sizes in conventional systems have grown to sizes that are considered excessive. In terms of manufacturing, logistics, installation and maintenance challenges and costs, the heights of the towers and size of the blades are reaching to very challenging limits.[4]

Innovators across the globe have developed approaches showing promise for certain applications. For example, airborne units have been developed with turbines at 300e500 m above the ground.

A variety of single and multiple array ducted turbines have also been developed. The single-ducted turbines have been shown to be effective and economical for small wind applications. Attempts have been made to scale up the single ducted turbines for utility scale applications. However, due to size, and the required speed increase, they have been proven to be uneconomical. Even though an array of ducted turbines can generate more electrical energy, they suffer from complexity in actual implementation at utility scale. Attempts have been made to scale up the single ducted turbines for utility scale applications. However, due to size, and the required speed increase, they have been proven to be uneconomical. Even though an array of ducted turbines can generate more electrical energy, they suffer from complexity in actual implementation at utility scale. Attempts have been made to scale up the single ducted turbines for utility scale applications. However, due to size, and the required speed increase, they have been proven to be uneconomical. Even though an array of ducted turbines can generate more electrical energy, they suffer from complexity in actual implementation at utility scale

As a result, the industry has remained on the same track e using turbines mounted on the top of towers e for almost a century A recently developed technology, INVELOX (increased velocity), has shown promise. The patented INVELOX is simply a wind capturing and delivery system that allows more engineering control than ever before. While conventional wind turbines use massive turbine-generator systems mounted on top of a tower, INVELOX, by contrast, funnels wind energy to ground based generators. Instead of snatching bits of energy from the wind as it passes through the blades of a rotor, the INVELOX technology captures wind with a funnel and directs it through a tapering passageway that passively and naturally accelerates its flow.[1]

This stream of wind energy then drives a generator that is installed safely and economically at ground or sub-ground levels. In this paper, both computational and test results measured from a fielded unit are reported. The performance of the system was validated by recent measured field data. It has been shown that the increase in wind speed was maintained even when a turbine was installed inside INVELOX and thereby the daily energy production was significantly improved. This measured data is shown to be consistent with that obtained through laboratory and wind tunnel tests, and full-scale computational fluid dynamics models.

2. LITERATURE REVIEW

Gives brief study on stages of energy. Over the centuries, energy has been supplied by wood, coke, coal, oil and natural gas, as well as by uranium (nuclear energy). All these energy sources are limited and at the same time these energy sources create pollution problems. This has led to the focus on a sustainable energy supply, which implies optimized use of energy, minimized pollution. That is why wind energy is prominent and it is the solution to the global energy problem. The wind energy is generated by using wind turbines. The turbine blades plays very important role in the wind turbines. The efficiency of the wind turbine depends on the material of the blade, shape of the blade and angle of the blade. So, the material of the turbine blade plays a vital role in the wind turbines. The material of the blade should possess the high stiffness, low density and long fatigue life. The main objective of our topic is to discuss the different materials as candidates for turbine blades and to select the best material for turbine blades by using one of the MADM (Multiple Attribute Decision Making) approach with fuzzy linguistic variables. He concluded that the efficiency of the wind turbine depends on the material of the blade, shape of the blade and angle of the blade. So, the material of the turbine blade plays a vital role in the wind turbines. The material of the blade should possess the high stiffness, low density and long fatigue life.

3. OBJECTIVES

- Using physics principles, explore ways to increase wind speed, thus making possible to harness wind power even in low wind speed areas.
- To determine the overall system efficiency and if possible increasing the efficiency of this system by using a custom built wind tunnel attachment into this system.
- To predict the overall output power by this system.
- To predict if the overall system has better efficiency than the currently available systems or to develop educational suggestions for integrating such a system into the current wind turbine industry.

4. COMOPONENTS OF VENTURI WINDMILL

4.1 Conversion Section

That is smaller the area greater the velocity and vice versa. To capture large amount of air the input sections should be made very large and apart from capturing air the input section is doing no work. Now, if the input section is made similar to a turbine which is rotated by atmospheric wind and the entire structure allows the horizontal moving wind to be directed into vertical venturi tube resulting in compact system size and a generator could be attached with the turbines to generate some electrical power.

Fig. 01

Length = (Li) = 100 cm
Diameter = (DI) = 55 cm
Diameter = (D2) = 20 cm
Material = Mild Steel sheet.

4.2 Throat Section

The conversion part is followed by the throat section. Conversion part and throat part are joined together by welding process. Throat section gives a provision to high velocity air to perform work on rotor by rotating the fan and leaves the section smoothly. Throat section has uniform diameter over the length and made up of mild steel iron sheet as shown in figure 02. This section mainly focuses on generating power by using the higher velocity wind. As the power generation is directly proportional to the cubed of the wind velocity a higher power output is expected. However, the size of the wind turbine should be reduced to handle the higher velocity wind. It will make the overall system smaller and compact. Hence, the idea of generating considerable amount of power required for a single house seems to be achievable with this project.

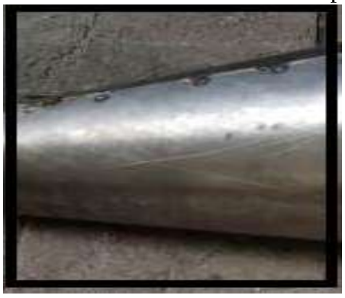

Fig. 02

Length = (L1) = 25 cm
Diameter = (D1) = 26 cm
Diameter = (D2) = 23 cm
Material = Mild Steel sheet.

4.3 Fan

The rotor is like a heart of the system. It has main function in the system. It coverts kinetic energy of wind into mechanical energy. The fan is mounted in throat section on the shaft of generator. The fan (rotor) is made up of plastic fibre having three blades on its hub as shown in figure 03.

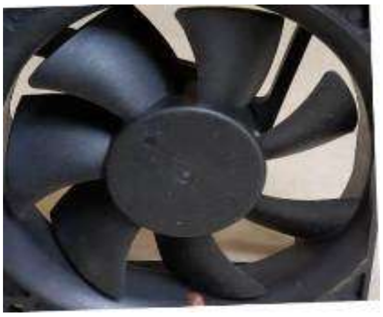

Fig.03

Blade type = Aerofoil Shape Type
Number of blade = 7
Material = fibre
Swept area = 8.63 cm`

4.4 Generator

Generator is the electric devices which converts mechanical energy into electrical energy. They are basically of two type one is alternating current generator and another is direct current generator. The generator work on the principle that when a conductor placed in magnetic field, cuts the magnetic field emf is generated. We used here direct current generator also called as dynamo as shown in figure 04

The reason behind using direct current generator is it requires less revolution to generate electrical energy also direct current can be stored in battery.

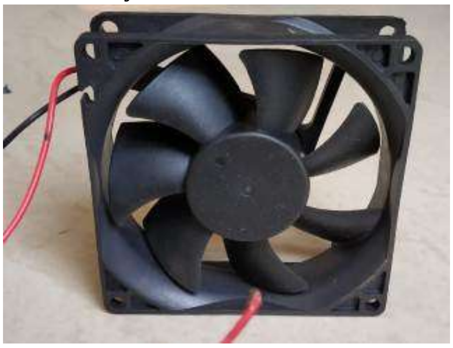

Fig.04

Generator type = Direct Current   Maximum Voltage Output = 6 volt   Rpm = 1500

4.5 Electrical Output

An LED strip light (also known as an LED tape or ribbon light) is a flexible circuit board populated by surface mounted light-emitting diodes (SMD LEDs) as shown in figure 05 and other components that usually comes with an adhesive backing. Traditionally, strip lights had been used solely in accent lighting, backlighting, task lighting, and decorative lighting applications. Increased luminous efficacy and higher-power SMDs have allowed LED strip lights to be used in applications such as high brightness task lighting, fluorescent and halogen lighting fixture replacements, indirect lighting applications, Ultra Violet inspection during manufacturing processes, set and costume design, and even growing plants.

Strip lights are designed for both indoor and outdoor use depending on whether they are water resistant. Since the strip is flexible and can be divided at any point between LEDs, it is extremely versatile and can be used in a number of installations. Outside of traditional lighting, strip lighting is extensively used in DIY projects or lighted clothing. The ability to power strip lights off of a USB device or battery pack makes them extremely portable. Examples include computer lighting, costume lights, toys, workspace lighting, monitor and display ambient lighting, and alcove lighting.

Fig. 05

Output type = LED Lights Output Current = 20 mA Output Voltage = 6 Volts.

6. REFERENCE

1. A research paper by A. R. Dehghani on A new design of wind tower for passive ventilation in buildings to reduce energy consumption in windy regions
2. A research paper by Daryoush Allaei on INVELOX: Description of a new concept in wind power and its performance evaluation
3. A research paper by Nallapaneni Manoj Kumar on Design and Wind Tunnel Testing of Funnel Based Wind Energy Harvesting System
4. A research paper by Qiyue Song on Design, Fabrication, and Testing of a New Small Wind Turbine Blade.
5. Wind Turbine Blade Design Peter J. Schubel * and Richard J. Crossley Faculty of Engineering, Division of Materials, Mechanics and Structures, University of Nottingham,University Park, Nottingham NG7 2RD, UK
6. John D., Anderson Jr. Fundamentals of aerodynamics. McGraw-Hills Inc; 1991. ISBN: 0-07-001679-8.
7. US Dept. of Energy-EERE. History of wind energy. Energy .gov/ eere/ wind/ history-wind-energy.
8. L. Chen, F. L. Ponta, L. I. Lago. Perspectives on innovative concepts in wind-power generation. Energy for Sustainable Development 2011; 15: 398-410.