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Design and Fabrication of Wind Operated "INVELOX"

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Abstract - *A new concept in wind power harnessing is described which significantly outperforms traditional wind turbines of the same diameter and aerodynamic characteristics under the same wind conditions and it delivers significantly higher output, at reduced cost. Its first innovative feature is the elimination of tower-mounted turbines. These large, mechanically complex turbines, and the enormous towers used to hoist them into the sky, are the hallmark of today's wind power industry. They are also expensive, unwieldy, inefficient, and hazardous to people and wildlife. The second innovative feature of INVELOX is that it captures wind flow through an omnidirectional intake and thereby there is no need for a passive or active yaw control.*

Key Words: Turbine generator, Venturi, Funnel, Omnidirectional, Diffuser, etc.

1. INTRODUCTION

Wind energy systems have been harvesting energy from the wind for centuries, from early wind mills used for grinding grains and pumping water to the present day large scale electricity generating wind turbines. Early use of wind energy for sailing ships in the Nile River was dated to 5000 B.C.Recorded history, the pneumatics of Hero of Alexandria by (Marie Boas Hall, 1971) explains the first use of wind energy (Manwell et al., 2009)clearly described the existence of first wind mill from Hero of Alexandria. Wind mills were in the use by Persians between 500 and 900 B.C., later this was spread to surrounding areas in the Middle East and to the European nations. European wind mills made their first recorded appearance with advanced design incorporating top rotor blades and yaw mechanism that is seen in modern wind turbines. Initially in the 18th century, wind mills were meant for mechanical power, later the development of electrical generators in 19thcentury gave a great approach in using wind for electricity generation. In the 20th century, technological advancement in wind power conversion led to the development of modern wind turbine systems used primarily on large scale for generating electricity. Today's Most common design of wind turbine systems is horizontal axis wind turbine (HAWT) having a turbine generator on the top of tower of height 80 m.

1.1 Problem Identification

Conventional wind energy systems are of giant structures having a turbine generator on the top of tower at a height of 80 metres with control mechanisms like yaw control and pitch control, with this modern wind energy systems, exploitation of wind energy at low wind speeds is not possible, operation and maintenance and yaw control are difficult. In other fact, environmental problems related to disturbance in signals and birds life are considerably high. With conventional wind turbine there is also problem with changing of rotor direction as per wind direction, transportation of massive structures and installation at specific site.

1.2 Scope

In order to make wind power an acceptable mainstream in electrical energy generation industry, an advance approach, with disruptive features, needs to be developed.

Such a disruptive approach and way of thinking, with no naturally, will generate huge resistance and opposition from current experts in the industry. A recently developed technology, Invelox (increased velocity), has shown good results. Invelox is simply a wind capturing and delivery system.

2. LITRATURE REVIEW

Literature review is an assignment of previous task done by some authors, scientists, engineers and collection of information and/or data from research paper published in journal to progress our task.

[1] Daryoush Allaei, David Tarnowski, Yiannis Andreopoulos(2015)

In the present work we provided a theoretical background explaining the operation of INVELOX and its performance with three wind turbines installed in the Venturi section. It has been shown that the extraction of energy depends on the increased mass flow rate through the system controlled by the omnidirectional intake and the external flow which sets up the back pressure.

[2] Nallapaneni Manoj Kumar, M. S. P Subathra (2014)

Results obtained from subsonic wind tunnel testing showed that FBWHES performs better in conversion of wind energy to electrical energy. FBWHES is also suitable for exploiting the wind energy at low wind regime areas as it is incorporated with venturi effect before the turbine section. FBWHES can offer solutions for many problem that are associated with tower mounted modern wind energy systems. Smoke test that is carried out in the subsonic wind tunnel gave the clear view of air flow visualization into the nested funnel.With this it is concluded that FBWHES will generate more power than the modern wind energy systems under similar wind turbine swept area and wind velocities by eliminating the yaw control. In this paper, the concept of INVELOX and its outer look is taken for implementing an experimental setup for demonstrating the performance based on the resources available in Karunya University. The main objective of this paper is to design a Solid Works 3-D model and to fabricate FBWEHS.

[3] Vinay C D, S S Desai, P S Kulkarni

Grid independence study is performed for symmetric configuration of INVELOX i.e. for 4 guide blade configuration with blade angle 45deg. Blade angle is defined as the angle between the reference guide blade (one of the 4 blades) and the wind flow direction. The speed ratio obtained is 1.84, mass flow rate is 39.5 Kg/s and average velocity at the Venturi is 12.31 m/s. So the result matches with very minimal error. It becomes wrong to conclude results at this point because this system has to be tested for all the blade angles i.e. omnidirectional property and for various speeds.

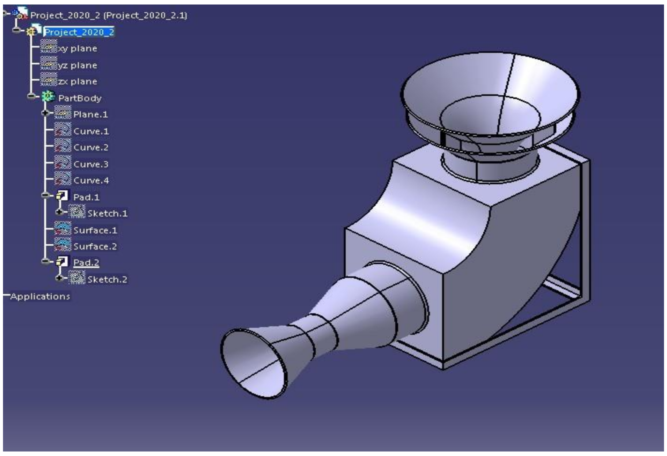
[4] Patel SnehalNarendrabhai, Dr. T.S.Desmukh

This paper aims that the present work an attempt has been made to numerically simulate analyze the performance of an Invelox with a turbine. Initially the flow through a simple Inveloxwas simulated and the results validated with the developer's results. The developed Invelox model was then analyzed with inclusion of a wind turbine to achieve a wind speed of 11.90 m/s at venturi section giving a speed ratio of 1.72. Comparison between Invelox wind turbine system and a traditional wind turbine was also attempted under similar conditions. Results indicate that the Invelox system can generate about 6 to 8 times more energy than the traditional wind turbine with the same size of turbine. The performance of Invelox system was analyzed with wind flows from 8 different directions (0˚, 45˚, 90˚, 135˚, 180˚, 225˚, 270˚, 315˚, 360˚) with respect to turbine axis. It is observed that higher speed ratios are achieved in all case expect 135˚ and 225˚ angles. Highest wind speed ratio of 2.014 is achieved in case of 45˚ and 315˚ angles. In the present work, the dimensions of Invelox were taken to be same as that used by the developers. The model consists of a double nested cone with 360° wind intake capability. The top cone is the guide directing wind into the lower cone. The top cone has a diameter of 12.192 m and height of 12.203 m. The lower cone has 2 different size of diameter at the top and bottom, which are 12.192 m and 3.048 m respectively. Distance between two cones is 6.096 m.

3. DESIGN SPECIFICATION

Blade diameter **=** 1.5-2 m
Rated free stream wind speed = 3 m/s
Rated power = 1500 w
Voltage = 50 v
Rated load Current = 30 amp.
Generator = 3 PHASE
Tower height = 18-20 m

4. 3D Model of INVELOX



5.ADVANTAGES

1. Reduced Land Use

Thanks to its smaller size and its high performance, an INVELOX wind farm uses only a fraction of the land area usually required for the operation of traditional wind farms. INVELOX is designed in such a way that it is less influenced by the vortex and wake effects that are caused by the large turbine blades rotation. These aerodynamic effects imposeturbine spacing constraints on traditional wind farms, and causes them to take up much more space. INVELOX doesn't face the same challenges as it has no rotating blades on the top the tower. On average, for a 100 MW project, INVELOX wind farms will use on average 90% less land than traditional wind farms. On the other hand, while the traditional wind turbines can only produce about 100 MW within 2,500 acres of land, an INVELOX wind power plan can generate about 1,400 MW on a similar surface.

2. Impact on Birds

Traditional wind farms represent a risk to birds due to collision with the rotating blades, interferences with migrations, and reduction or loss of habitat. INVELOX, thanks to the absence of rotating blades and its smaller land use, contributes to significantly reduce the negative impact on birds.

6. INVELOX WIND MILL SETUP

7.APPLICATIONS

It can be used for a broad range of applications including:

- It is suitable to use in residential area like residential societies, schools and colleges as it requires less space to install.
- This wind mill is also suitable to generate the power for any industries from small scale to large scale.

8. CONCLUSIONS

From the literature review, we come to know that, omnidirectional Multiple wind turbine INVELOX System can capture. Wind from all direction. In Multiple wind turbines INVELOX System, We can placed more than one in the Venturi section For more power harness.

After reviewing all research paper, I found that the extracted wind power P can increase by increasing the mass flow rate or total pressure drop across the turbine. From the comparison of the both system, outlet velocity of the Modified multiple wind turbine INVELOX system is higher than Existing multiple wind turbine INVELOX system.

9. ACKNOWLEDGEMENT

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10. REFERENCES

[1] INVELOX with multiple wind turbine generator systems.
[2] Design and Wind Tunnel Testing of Funnel Based Wind Energy Harvesting System.
[3] INVELOX Wind Turbine Power Curve Modeling based on Field Data in Manjil, IRAN.
[4] A Ducted Horizontal Wind Turbine for Efficient Generation
[5] Numerical Simulation of Flow through Invelox Wind Turbine System
[6] CFD ANALYSIS ON INVELOX, A NEW CONCEPT IN WIND POWER
[7] Design Modification & Analysis for Venturi Section of INVELOX System to Maximize Power using Multiple Wind Turbine
[8] INVELOX: Description of a new concept in wind power and its performance evaluation
[9] Design and Wind Tunnel Testing of Funnel Based Wind Energy Harvesting System.
[10] Jithin m, Ramakrishnan Hegde., Innovative wind energy generation by Invelox, 19th April 2015,Cochin, India, ISBN:978-93-82702-98-6.
[11] Daryoush Allaei, Yiannis Andreopoulos., Invelox: Description of a new concept in wind power and its performance evaluation, Energy xxx (2014) 1-9.
[12] Dr. Daryoush Allaei, Prof. Yiannis Andreopoulos., Invelox: A new concept in wind energy harvesting, ASME 2013 7th international conference on energy sustainability and 11th ASME fuel cell science, engineering and technology conference ES-Fuel cell 2013 July 14-19, 2013, Minneapolis, MN, USA.
[13] Ramesh Singh., ME677: Laser material processing, Laser cutting.
[14] www.support@weldability.com/ an introduction to MIG welding
[15] http://www.cascom.army.mil/ordnance