Design and Fabrication of Twister Turbine for Power Generation

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Abstract- **Wind turbine is a device which converts kinetic energy from the wind into electrical power. Wind turbines generate electricity through asynchronous machines that are directly connected with the electricity grid. Twister wind turbine blades have high strain energy because it has less Young's modulus and density compared to vertical wind mill. Due to light weight and non-corrosiveness in nature the life and durability is high. A material is made by combining standard materials. They are combined in such a way that the resulting passes superior properties which are not available with single constituted material. Material plays an important role in automobile industry, aerospace application because of its exotic properties like high strength, erosive resistance and light weight.**

I. INTRODUCTION

Twister turbine is generally associated with mass power production, but it is developed a wind turbine that can harness the tremendous power of these storms and turn it into useful energy. Twister turbine an extremely durable, eggbeater-shaped device that can not only withstand the awesome forces generated from wind, storm etc it can convert all that power into useable energy. The Twister turbine differs from conventional turbines in two important ways. It works on an omni directional axis that allows the machine to survive unpredictable wind patterns, and the speed of the blades can be adjusted to ensure they don't spin out of control during a storm. A functional prototype was installed and the next big step is to test the device under high-wind conditions. It's not immediately clear where all the incoming energy will be channeled, whether it is sent straight to the grid

II. SPECIATION OF TWISTER TURBINE COMPONENTS

Going through a case study we found. At the time, Atsushi Shimizu was working as an engineer at a major electronics manufacturer. The nuclear-power accident shocked him to his core, and he remembers feeling a sense of crisis not only for Japan but also for the energy infrastructure of the world. Shimizu's answer was a breakthrough generator design: one that could transform the destructive winds of a typhoon into usable energy. This idea launched his company, Challenger, and planed a prototype for a propeller-free wind turbine. Challenger President and CEO Atsushi Shimizu

"Propeller-based turbines were invented in Europe," Shimizu says. "While they have gotten bigger and bigger, just like dinosaurs, their basic form hasn't changed much. And while there is enormous potential to generate electricity from wind in Japan, erratic wind patterns and destructive typhoons have really held back the spread of wind generation here. Given the circumstances, I felt there was room for innovation."

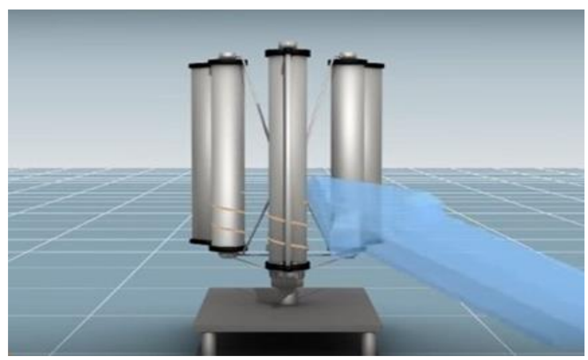
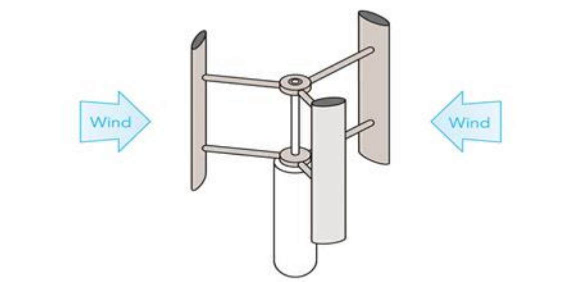
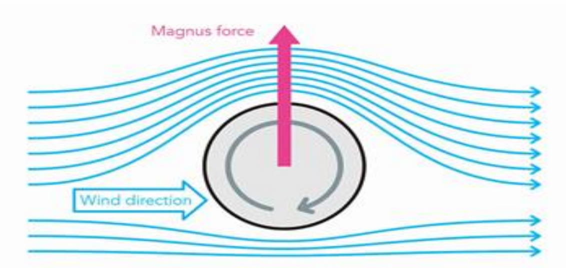


Fig 1. Twister Turbines

2.1 Developing a Big Idea

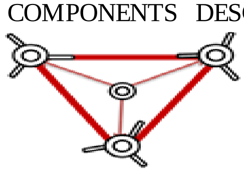
Soon after the 2011 disaster, Shimizu began poring over literature and patents surrounding wind generation. Using this research, we proposed a novel design in which a vertical-axis generator applies the Magnus effect a phenomenon in which a cylinder rotating in a flow of air or water experiences a pulling force perpendicular to that flow. A curveball pitch in baseball or the arc of a soccer ball during a free kick gives a sense of how this phenomenon affects spinning bodies. We conducted the first experiments at home using MS shaft poles, with an electric fan as his wind source. And, we found the basis solution to wind-generation woes.

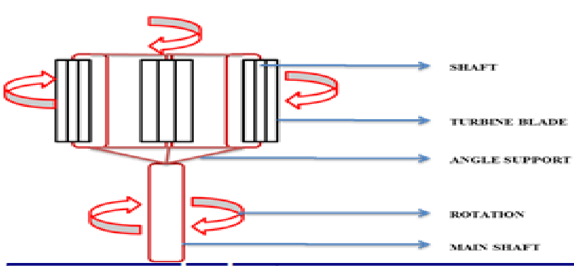




While ordinary wind turbines use propellers, our generator is mounted with three vertical rotating columns. The unique shape of this turbine allows rotation-speed control even in typhoon conditions for continuous generation of electricity. This design also resolves common issues facing propeller-based turbines, such as bird collisions and low-frequency noise from turbine rotation.

2.2 COMPONENTS DESCRIPTION





Max Stress	400-560 n/mm^2
Yield Stress	300-440 n/mm^2 Min
0.2% Proof Stress	280-420 n/mm^2 Min
Elongation	10-14% Min

2.3 Roller

In metalworking, rolling is a metal forming process in which metal stock is passed through one or more pairs of rolls to reduce the thickness and to make the thickness uniform.

2.4 Turbine

A turbine blade is the individual component which makes up the turbine section of a gas turbine or steam turbine. The blades are responsible for extracting energy from the high temperature, high pressure gas produced by the combustor.

2.5 Generator

In electricity generation, a generator is a device that converts motive power into electrical power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks. The first electromagnetic generator, the Faraday disk, was built in 1831 by British scientist Michael Faraday. Generators provide nearly all of the power for electric power grids

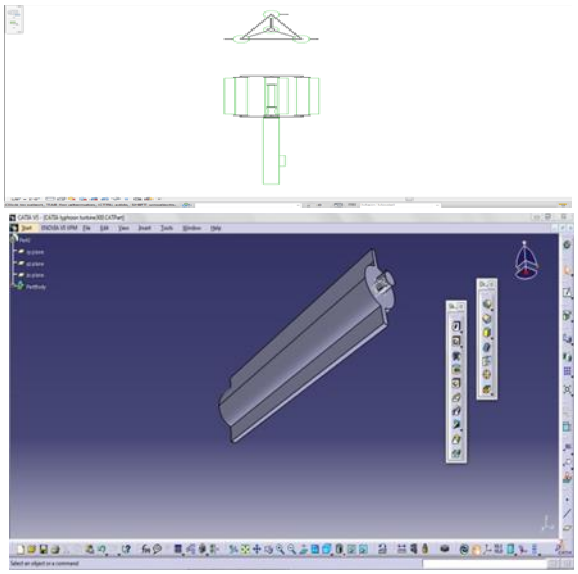
III.WORKING PRINCIPLE OF TWISTER TURBINE

The main principle of operation of a transformer is mutual inductance between setup which is linked by a common magnetic flux through main shaft. A basic transformer consists of two coils that are electrically separate and inductive, but are magnetically linked through a path of reluctance. A mutual electro-motive force is induced in the transformer from the alternating flux that is set up in the laminated core, due to the coil that is connected to a source of alternating voltage. Most of the alternating flux developed by this coil is linked with the other coil and thus produces the mutual induced electro-motive force.

IV.DESIGN AND CALCULATIONS

4.1 DESIGN

Parameter Utilized Roller height = 600mm, Roller Dia = 100mm, Turbine height = 600mm, Turbine Width = 75 mm, Main shaft Height = 750mm,Main shaft Dia = 120 mm

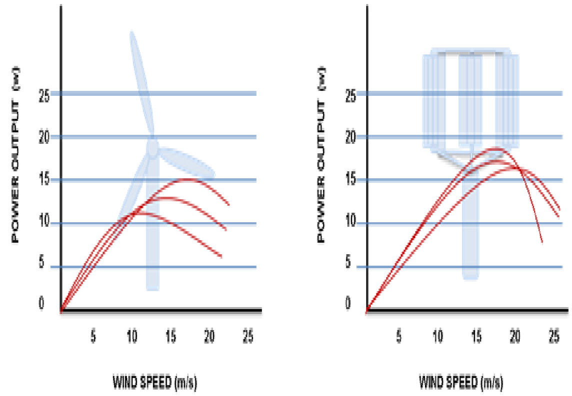


3D DESIGN TWISTER TURBINE

4.2 CALCULATIONS Power PAV = ½ ρAv3 Where ρ = density (1.2 kg/m),A = d * h, v = design wind speed ,Cp = Co-efficient of performance ,Cp = P turbine / P Av,Where P turbine = ½ cp Av3 , cp < 0.593,Generally cp limits ramous from 0.15 to 0.35 + (small turbine to large turbine),Selection of number of blades, Blades = odd number, Odd number à smooth, Even number à vibrate, Standard number of blade must be > 2

4.3 Twister Turbine D = 60 mm, H =1200mm,T=70mm,H = 1200mm Area = 72000 mm2 = 0.072 m2Let Cp= 0.25 (medium size)PAv = ½ x ρAv3 = ½ x (11)3 x 0.072 x 1.20 x 3= 172.49 Watt Note: PAv= Power available in Twister Turbine= ½ Cp Av3ρ= ½ x 0.25 x (0.072 + 0.084) x (11)3 x 1.20 x 3 =94.5 Watt
Cp = η =Performance=P_turbine/P_Av =94.5/172.49=0.55 = 55%

4.4 Vertical lD =60 mm, H = 1200 mm, Area= 72000 mm2=0.072 m2,Let Cp= 0.25 (medium size),PAv= ½ x ρAv3 = ½ x (11)3 x 0.072 x 1.20 = 57.49 Watt Note: PAv= Power available in Twister turbine=½ Cp Av3ρ= ½ x 0.25 x 0.084 x (11)3 x 1.20=16.77 WattCp = η=Performance= P_turbine/P_Av = (16.77)/57.29=0.299 = 30%



Representation Power Output

V.ADVANTAGES

1. The wind is free and with modern technology it can be captured efficiently.
2. Once the wind turbine is built the energy it produces does not cause greenhouse gases or other pollutants.
3. Although wind turbines can be very tall each takes up only a small plot of land. This means that the land below can still be used. This is especially the case in agricultural areas as farming can still continue.
4. Many people find wind farms an interesting feature of the landscape.
5. Remote areas that are not connected to the electricity power grid can use wind turbines to produce their own supply.
6. Wind turbines have a role to play in both the developed and third world.
7. Wind turbines are available in a range of sizes which means a vast range of people and businesses can use them. Single households to small towns and villages can make good use of range of wind turbines available today.

VI.CONCLUSION

Our work and the results obtained so far are very encouraging and reinforce the conviction that vertical axis wind energy conversion systems are practical and potentially very contributive to the production of clean renewable electricity from the wind even under less than ideal sitting conditions. It is hoped that they may be constructed used high-strength, low-weight materials for deployment in more developed nations and settings or with recyclable materials and local skills in less developed countries. The Involute wind turbine designed is ideal to be located at the highways medians to generate electricity, powered by wind. The heavy vehicle traffic gives it an advantage for more wind opportunity. With the idea of putting it on highway medians, it will power up street lights and or commercial use. In most cities, highways are a faster route for everyday commute with different places and in need of constant lighting makes this an efficient way to produce electrical energy.

REFERENCE

[1] P. L. N. V. Aashrith, Ch.Vikranth, Int. Journal of Engineering Research and Applications, VOL 2, Design and Fabrication of Savonious Wind Mill,
[2] Matthijs Langelaar, Gil Ho Yoon, Sham Gurav, Yoon Young Kim and Fred van Keulen Feasibility Assessment and Capacity Building for Wind Energy Development in Cambodia, Philippines and Vietnam, Design of Wind Turbines in Typhoon area
[3] Takeshi Ishihara, Atsushi Yamaguchi, Keiji Takahara, Takehiro Mekaru, and Shinich Matsuura, Institute of Engineering Innovation, School of Engineering, The University of Tokyo An Analysis of Damaged Wind Turbines
[4] Peter, C., Sheets, B. and Tablar, S. (2008): Emerging Technologies in the Wind Turbine Market, The Palace Hotel, San Francisco, CA. 19-20 November 2008.
[5] Manwell, J.F., McGowan, J.G. and Rogers, A.L. (2009): Wind Energy Explained UK, John Wiley & Son Ltd.
[6] Akwa, J.V., Junior, G.A.S. and Petry, A.P. (2012): Discussion on the Verification of the Overlap Ratio Influence on Performance Coefficients of a Savonius Wind Rotor Using Computational Fluid Dynamics. Renewable Energy, Vol.38,