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DESIGN AND FABRICATION OF DOMESTIC WIND TURBINE

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ABSTRACT
The continuous increase in demand of electricity makes it necessary for everyone to have its availability and also during power cut-off. For this, people are moving towards the renewable energy sources. Because of its reversibility, the process ishighly demanding. Wind is one of the most important renewable energy which drags and sparks the houses because of non-conventional energy sources. Since wind produces power in a cubic relation with the wind speed, people conscience towards the wind sources has increased and also it is free of cost and doesn't emit any greenhouse gases. In this study, we elucidate the wind energy for power generation at domestic level of use at optimum rate so that people will be benefited through its use.

INTRODUCTION
Wind is a viable alternative, as it is virtually endless resource. The phenomenal thing of wind is that it produces the power in cube of wind speed i.e. as the wind speed increases, power available increases cubically. The second most important factor after wind itself is the sweep area of the wind turbine which determines the energy production.

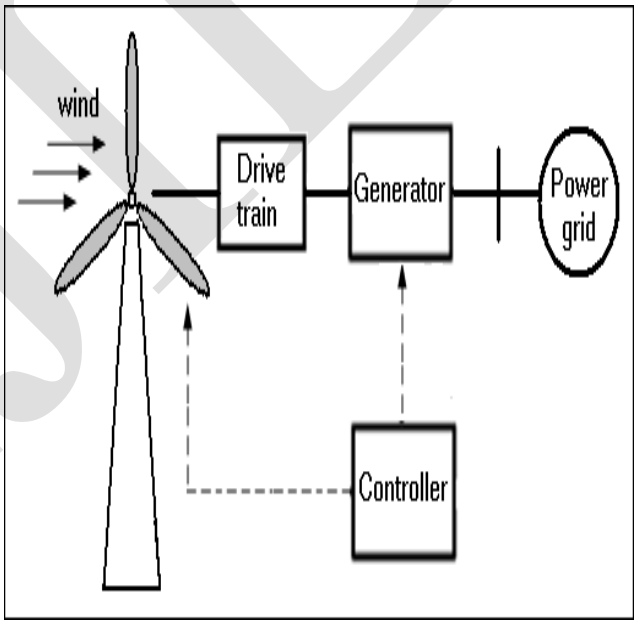


Fig.1 simple block diagram of wind turbine

Wind turbine constitute of two core type as Horizontal Axis Wind Turbine (HAWT) and Vertical Axis Wind Turbine (VAWT). The Horizontal Axis Wind Turbine is most commonly used and efficient with analogy to Vertical Axis Wind Turbine. For household power generation, Horizontal Axis with three blades is efficient. Perhaps this resource fulfills the environment economically with great satisfaction.

BACKGROUND AND PURPOSE OF STUDY

Because of depleting fossil fuels, the potential of the world is to establish a system of non-conventional energy sources as economical to everyone at optimum rate. Many researchers have found the application of these renewable resources in a determined way and given a thesis from their level of perception which are as follows:

Through the next several decades, renewable energy technologies, thanks to their continually improving performance and cost, and growing recognition of their environmental, economic and social values, will grow increasingly competitive with traditional energy technologies, so that by the middle of the 21st century, renewable energy, in its various forms, should be supplying half of the world's energy needs.[1]

The energy available for conversion mainly depends on the wind speed and the swept area of the turbine. A 1kW @ 11m/s, 1meter diameter wind turbine is designed with the support of software. The wind turbine blades power and efficiency has been measured at different tip-speed-ratios by using software tool.[2]

Wind energy is available without any cost and it does not emit any greenhouse gases. This makes it a great source of energy production for any developing state. The field of wind energy has tremendous scope for innovation, translating to real world applications and tremendous economic opportunity. It is crucially important for India, as the economy continues to evolve, and we must ensure every Indian has access to different opportunities, decent jobs and environment friendly livelihood. For that we will need greater resources. Clean, sustainable, renewable - and equally important, domestic sources of energy are essential to fulfill the potential of India in the coming years and it is certain that wind energy will play a major part in shaping India's future. Wind power has emerged as the biggest source of renewable energy in the world.[3]

From the above scenario, we come to know that to develop a wind turbine with people economy and environmental aspect so that they are benefited by the wind resource at optimum rate.

PRINCIPLE OF OPERATION

Wind turbines work by converting the kinetic energy in the wind first into rotational kinetic energy in the turbine and then electrical energy that can be supplied.[2]

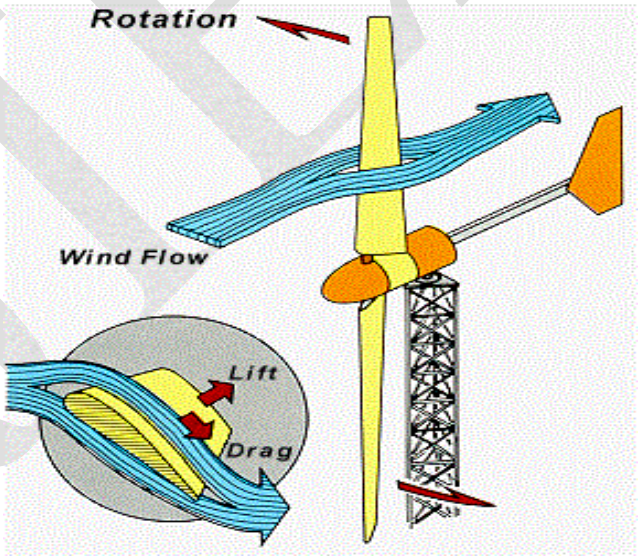
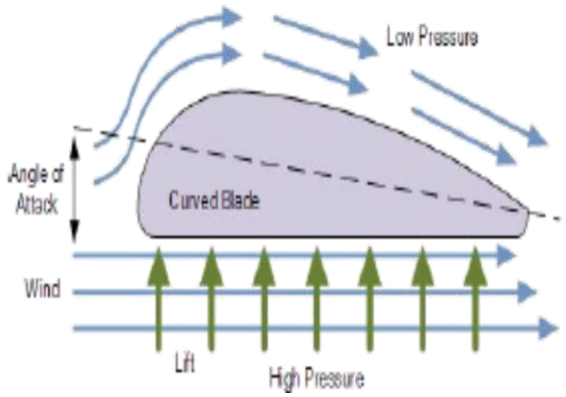


Fig.2 Principle of wind turbine aerodynamic lift [4]

BLADE DESIGN FOR WIND TURBINE

Generally, wind turbine blades are shaped to generate the maximum power from the wind at the minimum construction cost. But wind turbine blade manufacturers are always looking to develop a more efficient blade design. Constant improvements in the design of wind blades have produced new wind turbine designs which are more compact, quieter and are capable of generating more ower from less wind. Its believed that by slightly curving the turbine blade, p they're able to capture 5 – 10 percent more wind energy and operate more efficiently in areas that have typically lower wind speeds.



In conclusion, a wind turbines rotor blade length determines how much wind power can be captured as they rotate around a central hub and the aerodynamic performance of wind turbine blades is very different between a flat blade and a curved blade. Flat blades are cheap and easy to make but have high drag forces making them slow and inefficient. To increase the wind turbine blade efficiency, the rotor blades need to have an aerodynamic profile to create lift and rotate the turbine but curved aerofoil type blades are more difficult to make but offer better performance and higher rotational speeds making them ideal for electrical energy generation. (5)

FUNDAMENTAL EQUATION & CALCULATION OF WIND POWER

– Wind Power depends on:
• Amount of air (volume)
• Speed of air (velocity)
• Mass of air (density) flowing through the area of interest (flux)

KINETIC ENERGY DEFINITION:

K.E.
– Power is KE per unit time:
• **P**
– **Mass flow rate**
(density * volume flux):
• $dm/dt = \rho * A * v$
– Thus:
• $\mathbf{P = ½ * \rho * A * v^3}$
Where, Power ~ cube of velocity
Power ~ air density and Power ~ rotor swept area $A= \pi r^2$

$P = ½ * \rho * A * v^3$
$= ½*1.2*78.5*0.0929*4^3$
= 280.03776 W
Where, swept diameter= 1.68 m^2

FABRICATION OF WIND TURBINE

The fabrication of wind turbine for domestic purpose should meet the people economy and be made with cost effective and reliable materials. Here is the step-wise procedure to make domestic wind turbine at the home:

MATERIALS &EQUIPMENTS USED

- PVC pipe
- M.S. shaft for tower

- Tin sheet for deflector
- 70mm diameter hub for supporting rotor
- Nut, Bolts & Washers
- Bearings

Fig.4 Horizontal axis wind turbine and Deflector

Fig.5 Vertical axis wind turbine

STEPWISE PROCEDURE

1. Cut the PVC pipe according to your blade profile and give perfect shape to it.
2. Make the hub as per the design and machine (drill) the holes for holding the blades of the turbine.
3. Turn the shaft to design length and diameter and support it on hub.
4. Cut the tin sheet for making deflector as per the design in such a way that they rotate in all the directions.
5. Tight the hub and turbine blades with the aid of nuts and bolts.
6. Make the tower of required height and weld the deflector with tower such that it act as integrated part.
7. Support the tower in bearing so that it can rotate as per wind direction (where the flow of wind is more).
8. And finally, weld the whole wind turbine assembly to the frame.

CONCLUSION

Wind power is one of the fastest-growing energy sources in the world. This free green energy can be very easily produced from naturally resources that are available on our planet for free, and the best part about it is that they are plentiful. Some estimates say it is possible to generate 200kWh to 720 kWh of electricity per month, depending on wind capacity. As per the knowledge of researcher, wind turbine having efficiency 59% will give the best performance. Finally as a consequence, because of cubic relation of power with wind speed we can generate the power using wind domain in a effective, reliable, and efficient way at optimum rate.

REFERENCES

1) Vishak Mourya, Sushant Khare, Shirish Bajpai *Future scope of wind energy in India, Undergraduate student and Asst. professor, Electronics & Telecommunication Engg. Dept., Integral University, U.P. India, Volume 10, Issue 1 Ver. 2, (Jan – Feb 2015), PP 79-83.*

2) Asis Sarkar, Dhiren Kumar Behera *Wind turbine blade efficiency and power calculation with analogy electrical energy,National institute of Technology, Agarthala, Tripura state, India, Dept. of mechanical Engg., I.G.I.T. SARANG, ODISHA, INDIA, Volume2, Issue2, February 2012.*

3) N R Deshmukh and S J Deshmukh, *Development of modified wind turbine: A past review, Vol. 2, No. 3, July 2013.*

4) *http://www.google.co.in/search?q=wind+turbine&site=webhp&prmd=inv&source=Inms&tbm=isch&sa=X&ved=0ahukEwjizJmWuJfSAhXIRo8KHSj3CnkQ_AUIBygB#tbm=isch&q=principle+of+operation+of+wind+turbine&imgrc=uia_Vi6EpiyM2M*

5) *Wind turbine blade design, Flat or Curved, http://www.alternative-energy-tutorials.com/energy-articles/wind-turbine-blade-design.html, Accessed on Jan 2017.*