Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 05, May -2018

A MODERN METHOD OF GENERATING ELECTRICITY BY SMART WIND TREE

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Abstract- *"Energy can neither be created nor be destroyed but it can transferred from one form to another form". The man made tree are made from plastic material, Aluminium or GI sheet. The artificial tree is constructed in such way that the several leaf shaped aeroleaves are placed in the form of tree called wind tree. The plastic leaves or GI sheet (which serve as turbine blades) are painted green its look like a normal leaf but it placed in vertically manner. Wind Tree uses tiny blades housed in the aero leaves to generate power from wind energy. The power generation does not depend on wind direction. In this system we have used tree shaped structure leaf shaped mini turbines called aero leaves. These turbines are of savonius type turbine and it will catch the wind from all directions. When the wind blows, the leaf turbines rotate and quietly produce the energy. As the rotation of the turbine take placed it induces emf in generator. It concludes that, the power generated from wind tree is environmental friendly, it does not generate any type of green house gases, mainly it generates power with least noise and it can be installed at different locations.*

Keywords-- *Vertical axis wind turbine, Savonius type, Aeroleaves*

INTRODUCTION

Wind energy is the fastest growing source of clean energy worldwide. This is partly due to the increase in price of fossil fuels. Wind is a natural resource and can be harnessed as an alternative energy. Wind energy is a good choice to supplement for fossil energy demands. Other than that, wind energy is a clean, abundant and can reduce the global warming problem due to the excessiveness of conventional combustion with air assisted processes. Renewable and sustainable energy research has attracted much attention with the increasing gap between the demands and supply of fuel in recent years.
Energy: Energy is the capacity of a physical system to perform work.

Classification of energy

It is broadly classified into

1. Conventional energy is in practice for long duration of time and well established technology is available to tap and use them,

e.g. Coal, oil, natural gas, hydro power, nuclear power etc.

2. Non-conventional energy source can be used with advantage for power generation as well as other applications in a large Number of locations and situations. These energy sources cannot be easily stored and used conveniently. Eg. Solar, wind, Tidal and geothermal etc.

Based upon nature, energy sources are classified as

1. Renewable energy sources are inexhaustible and are renewed by nature itself. Solar, wind, tidal, hydro and biomass are few examples.
2. Non-renewable energy sources are exhaustible within a definite period of time depending upon its usage. Fossil fuels (coal, Oil, gas) and nuclear fuels are few examples.

As the demand for renewable energy grows, the use of small wind turbines is increasingly attractive. In this project wind is used for generation of electricity. Wind energy is a source of renewable power which is available in atmosphere at free of cost and comes from all directions. Wind power plants can make a significant contribution to the regional electricity supply diversification. Wind energy system transforms the kinetic energy of the wind into electrical energy that can be used for

practical use. Wind electric turbines are employed to generate electricity. There are two basic designs of wind electric turbine, Horizontal axis wind turbine and Vertical axis wind turbine. Vertical axis wind turbine can further classified into two types Darrieus type and Savonius type. Darrieus type rotor wind mill needs much less surface area. It is shaped like an egg beater and has two or three blades shaped like aero foils. Savonius turbine is S-shaped if viewed from top. This turbine turns relatively slow, but yields high torque.

In this project we use Savonius type vertical axis wind turbine and these turbines are catch the wind coming from all 360 degrees, and even some turbines are powered when the wind blows from top to bottom. Because of this versatility, vertical axis wind turbines are thought to be ideal for installations where wind conditions are not consistent, or due to public ordinances the turbine cannot be placed high enough to benefit from steady wind. Wind tree is designed as same as tree and it works silently. It is small in height and also the sizes of blades are small. And this wind tree consists of Aero leaves that houses tiny blades which can generate electricity even in the slightest wind speed.

OBJECTIVE807964

- The main objective of this project is that incorporation of more renewable energy to the power system.
- Design of a new model of generation of electricity using the wind energy generated by the wind tree.
- The goal of this project is to generate the power at low wind speed by using the vertical axis wind turbine. The savonius type vertical axis wind turbine generates a power at relatively low wind speed as compare to horizontal axis wind turbine.
- The main objective of this project is gaining power from wind. Therefore, this project is green Source of energy and has no effect on the life of earth. These wind energy turbines are small and can produce up to 300 watts.
- Learn about wind energy and different ways of convert it to a useful power.
- Learn the different between Vertical Axis Wind Turbines (VAWT) & Horizontal Axis Wind Turbines (HAWT).
- Learn the impact of energy & our rules as engineering students to provide alternatives.

METHODOLOGY

Methodology

Wind turbine design parameters are as follows
1. Swept area-: The blade swept area can be calculated as
Swept area= 2RL
R= radius of the rotor in meter
L= length of the wind blades in meter
R=14cm
L=12cm
S= 2*(14*10-2)*(12*12-2)
S=0.0336m2
2. Power -: Power available from wind for vertical axis wind turbine
Pw=1/2 ρSVo3
VO =velocity of the wind (m/s)…… (6m/s)
ρ =air density (kg/m3)……. (1.125kg/m3)
=1/2*1.125*(6)3*0.0336
Pw = 4.44528
3. Power coefficient-: The power coefficient is the percentage of power received by the wind turbine

through the swept area of the turbine blades.
CP = Tangential speed / actual speed
CP = 0.245 (24.57 from standard power coefficient)

SYSTEM DESIGN

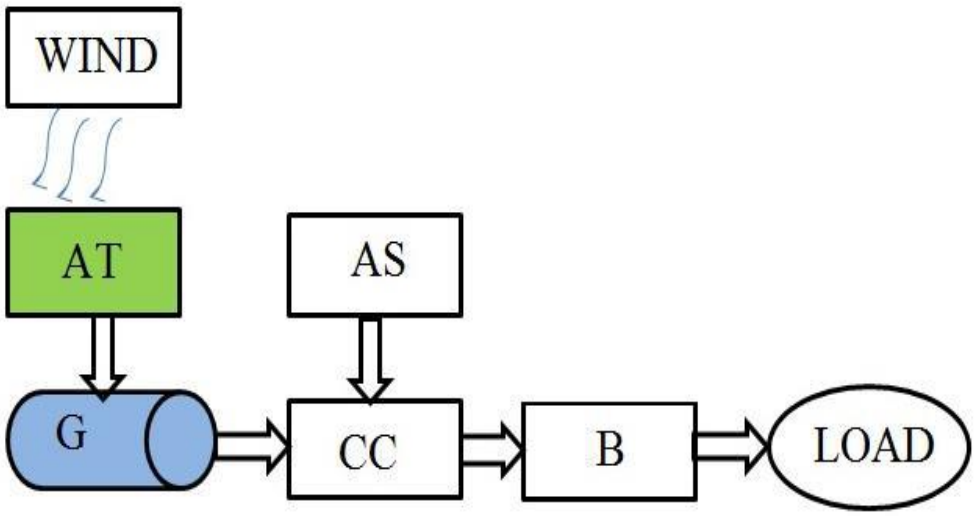

FIG.1-: BLOCK DIA.OF WIND SYSTEM

Schematic diagram of the wind tree system is shown in fig.1. In this concept wind energy is used to generate electricity with the help of Aeroleaves. Wind is available in the atmosphere at free of cost it is clean and sustainable fuel source, it does not create emissions and it will never run out as it is constantly replenished by energy from the sun. The Aeroleaves are made of fiber and molded into specified shape based on the requirement. The aeroleaves shape like leaf but are placed in vertically and painted green colour. The „AT‟ represents aeroleaf turbine. The „G‟ represents generator. We are using the generator which will be equal to the number of Aeroleaves. This model mainly works on the principle of "Faradays law of electromagnetic induction‟, which states that "Whenever a conductor is placed in a varying magnetic field (Or conductor is moved in a magnetic field) an EMF gets induced in the conductor". An EMF is induced due to the relative motion between the rotating armature and magnetic field due to field coil. Each aeroleaves along with generators are connected in series, so the generated voltage will get added. This resulted output is given to the battery and stored it and then it is used to drive the load.
The shapes of the blades are aerofoil type due to that the scoops experiences less drag when moving against the wind than when moving with the wind. For the generation of electricity from the designed, we chose a dynamo which is capacity 12V.
After the generator we use „CC‟ represents charge controller. The charge controller is there to prevent damage to the batteries. If the batteries are near to full charge, but the wind is blowing strongly, the charging current needs to be reduced to prevent damage to the battery. The 1 Amp diode bridge rectifier is used. The charge controller will divert some power from the generator away from the battery and into a dump load. The „AS‟ represents auxiliary supply which is used in case of stoppage of the system. The „B‟ represents battery which is used for storage purpose. Finally we are using it for practical purpose.
The kinetic energy of the wind is converted into rotational energy using vertical axis wind turbine which is either coupled directly or through gear. Rotational energy from the turbine is converted into electrical energy by the permanent magnet synchronous generator whose output is fed to an IGBT based chopper. Since the wind speed is not constant, the output of the generator will be varying frequently. Chopper regulates the output of the generator and charges the battery. Stored energy in the battery can be used to light LED based street lights using an LED driver circuit.

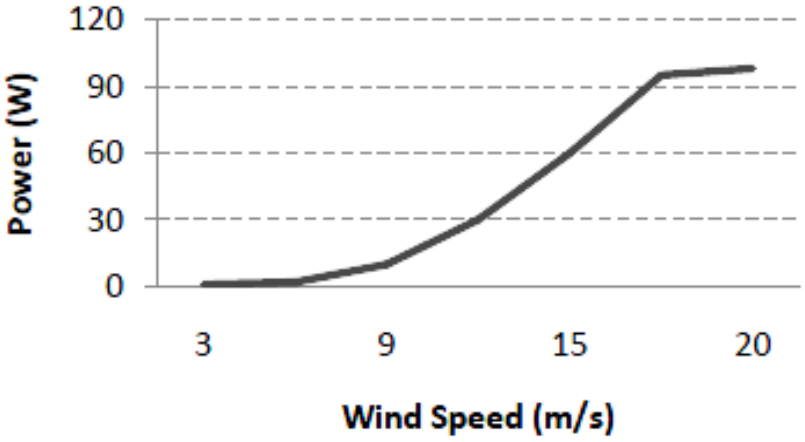

FIG.2 POWER CURVE OF WIND SYSTEM

Fig.2 represents the power curve of wind tree system. Power Curve indicates the generation of power per aeroleaf depending on the wind velocity. If the wind speed increases the generation will also increase, basically the aeroleaf actuates with the wind speed of 7Kmph. If the wind speed becomes 12m/s then the aeroleaf produces 30Watt of energy and when the wind speed is 18m/s, each aeroleaf will generate up to 100Watt and becomes the saturation level because peak capacity of an aeroleaf is 100Watt.

RESULTS

The project conclusion was that the turbine has proved to be self-starting under low wind speed.

Wind speed m/sec	Volts
0	-0.0091
1.19	0.0766
3.07	0.2223
5.18	0.3826
7.3	0.5371
8.81	0.6601
9.71	0.7381
10.68	0.8162

ADVANTAGES

1. Easy installation as compare to horizontal axis wind turbine.

2. Wind tree works silently with least noise and hence these can be installed everywhere.

3. As wind tree is located near to the consumer premises transmission cost will be very less.

4. They can produce electricity in any wind directions.

5. No emission of greenhouse gases.

6. They can be installing in urban areas.

7. Low risk for human and birds because blades moves at relatively low speed.

DISADVANTAGES

1. Vertical axis wind turbine is not able to produce more electricity from a given amount of wind.

2. Vertical axis wind turbines are not widely used because horizontal axis wind turbine dominates the majority of the wind industry.

FUTURE SCOPE

Wind energy available in atmosphere at free of cost. Wind power is an affordable, efficient and abundant source of domestic electricity. It does not emit any greenhouse gases. As everyone knows importance of wind energy then it will be constructed at every residential sector. This system will be constructed where the flow of wind is more or where there is more amount of wind is available like near to railway yard, middle of the road etc. This will be constructed at roof of the home.

CONCLUSION

From this paper our conclusion is that Wind tree works silently with least noise. Wind energy available at free of cost and it does not emit any green house gases, The power generated is not constant but it is a small step to produce energy from wind tree it is not just alternative but effective use of wasted energy.
From the observations as turbine weight is low, increased high power can be generated. It is a small level power generation but if it is used in proper way then we can generate larger amount of power. As day by day power consumption increases but electric crisis occur. So the minor needs of electricity such as street lights can be generated from wind tree. Instead of wasting kinetic energy of wind the minor needs can be met by converting kinetic energy to electrical energy.

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