

## **Vertical Axis Highway Wind Mill Using Magnetic Levitation**

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**Abstract:** In current scenario the demand on electricity is much higher than that of its production. The main aim of our paper is to generate electricity by using pressure of wind created by the fast moving vehicle in highways. Wind power has sufficient potential to overcome the demand in energy sector. This demand can be overcome by using vertical axis highway windmill (VAHW). In India only 13.4% of renewable energy sources utilized, remaining energy is get wasted. The introducing a new unique method of VAHW, wind energy was effectively used. By using pressure of air which is much higher in the central part of highway, vertical blades of windmill will rotate. Generator will produce electricity by using rotation of blades. The use of magnetic levitation technique, the efficiency of the project is get improved because it reduces the frictional losses and increase the rotational speed. Maglev wind turbine is able to rotate at minimum wind speed i.e, at 1.5 m/s. Which is not possible in conventional one. So we can get better results and the utilization of wind energy is get increased.

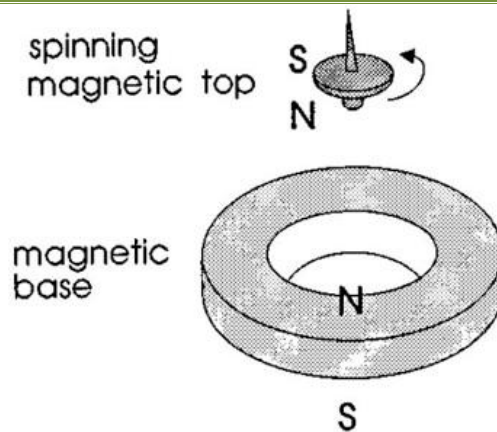
**Keywords:** Battery, Generator, Magnetic levitation, Renewable energy ,VAHW, Wind energy,

### **1. Introduction**

Energy plays the vital role in our day to day life. Without the energy there is every work is incomplete. There are two types of energy viz, Renewable energy and Non Renewable energy. Considering the future demand use of renewable energy is very important. As renewable energy is the clean source of energy[1]. In current scenario there are many more methods to produce energy. Some of them are eco friendly and some of them cause pollution. As conventional energy pollutes and causes harm to nature, the development of clean and renewable energy such as geothermal energy, biomass, solar and wind becomes very important to peoples life[7]. Wind energy contribute major part in conventional energy sector. The wind energy is a one of the rapidly increasing source of energy. The major issue with this technology is fluctuation in the source of wind. To overcome this issue maglev concept is used in this project[4]. Its main advantage is less friction and continuity of rotation at low speed of wind. The proposed design of wind mill is appropriate to infuse on highways. As it is suitable for all wind direction. Using the wind from fast moving vehicle, wind mill start rotating. This peerless technology is helpful for the generation of power.

### **2. Magnetic Levitation**

Magnetic levitation, maglev, magnetic suspension is method by which an object is suspended with no support other than magnetic fields[4]. It operates on the repulsion characteristics of permanent magnets. Magnetic force is used to counteract the effect of gravitational acceleration and any other acceleration. Using of pair of permanent magnets like Neodymium magnets and substantial support magnetic levitation can easily be experienced.



“Fig.1= Magnetic Levitation ”

### 3. Magnetic Levitation Wind Mill

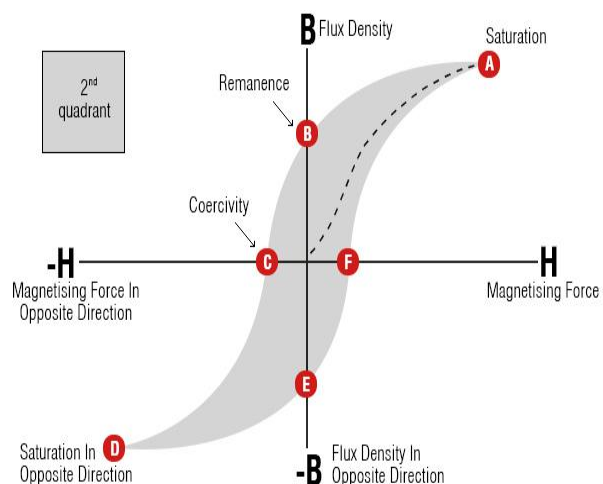
In this system the shaft of the vertical wind turbine consist of magnets that is one magnet is placed on shaft of the wind mill and other magnet is placed on the box of the supporting structure, such that they produce rotating repulsive force. Because the outer pole of the first magnet is same as that of inner pole of the second magnet which is fixed on supporting structure. This system does not require electricity to operate because no electromagnets are involved. The vertical axis wind concept for the wind turbine that is implemented as the power generation portion of this project certain uniqueness correspond to it.

### 4. Neodymium Magnets

Neodymium magnets are power full permanent magnets composed of the elements neodymium, boron and iron. It is developed in 1982 by General Motors and sumitomo special metals. This magnets are the strongest type of permanent magnet. It is also known as NdFeB, NIB or Neo magnets. It is most widely used type of rare earth magnet. This magnets have the highest known energy product for their mass. Neodymium magnets are graded according to their maximum energy product. Which relates to the magnetic flux output per unit volume. Neodymium magnets have higher remanance , much higher coercivity and lower curie temperature then other. It is alloyed terbium and dysprosium in order to preserve its magnetic properties at high temperature. One of the most appealing characteristics of neodymium magnets is their relatively low cost.[5]



“Fig. 2= Neodymium Magnets”



“Fig. 3Hysteresis Curve”

## 5. Component Designing and Consideration

**5.1 Shape of blades** – Wind mill blade is a important part of whole assembly. Efficiency of wind mill will be increased by using by the appropriate and proper design of blades. In the selection shape of blade Darrieus model is designed by the French aeronautical engineer, Geoges Darrieus. The blades consisting eggbeater is best example of Darrieus Model. Two or three of them bend into a C- shape on the shaft. Further more the Finnish engineer Sigurd Savonius invented savonius model, the functioning of this model is depends on drag forces. There are various types of blades are present such as,

- Flat, unmodified blade surface.
- Wing shape.
- Both edges tapered to a thin line.
- Both edges leading blades.
- C- shape blades.[6]

**5.2 Designing of blades** – Considering the aerodynamic concept that, “ The forces and velocities cutting in a turbine, the resultant velocity vector is given by,

$$W = U + (-W * r)$$

Where

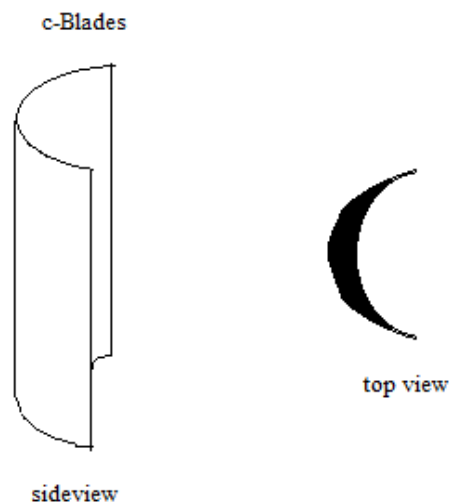
U=Undistributed upstream velocity

(-W\*r)=velocity vector advancing blade.

We used C- shaped blades in project. The c-shaped blade design is suitable for vertical axis highway wind mill. The maximum energy transformation is given and maximum air pressure is collected by the inner circular and concave shape[7].

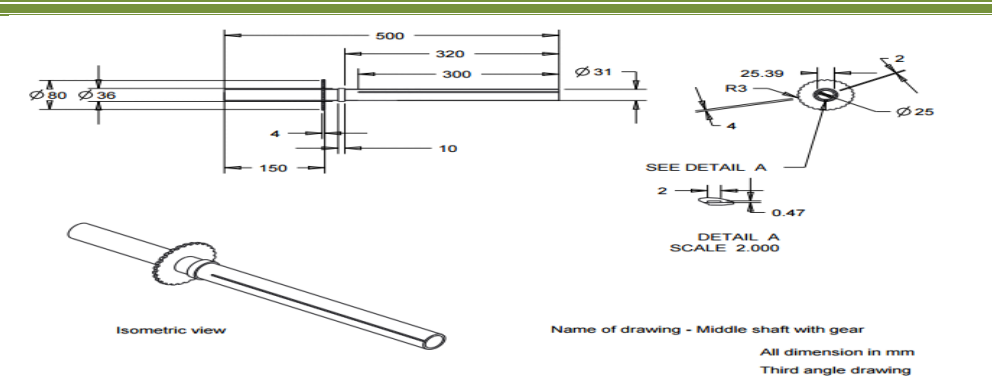


“Fig.4 = Actual View of Blades”



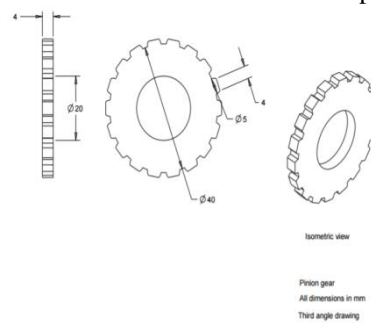
“Fig.5 = Isometric View”

**5.3 Shaft** – The shaft is a part on which blades are placed, is most important part. The shaft used is made of pvc material having 25mm outer diameter and 500mm length. The shaft material to hold and withstand the total air pressure and weight of blades also.



“Fig.6 = Isometric View of Shaft”

**5.4 Gear and pinion** - In this prototype model we have used gear and pinion mechanism to increase the RPM of the motor shaft and to increase its RPM that makes it to generate more power. Gear is used which is of 100 tooth and pinion is of 40 tooth both are made up of plastic material reduce the weight of model.



“Fig.7 = Isometric View”



“Fig.8 = Actual View of Gear and Pinion”

**5.5 Battery** – For the application like street light, battery is used which stores the generated power. There are various type of batteries are available. As the lead acid battery have low cost, simple charging process and no maintenance that is maintenance free hence we have used it.



“Fig.9 = Battery”

## 6. Advantages of Vahw Over Conventional

- 6.1 They can produce electricity in any wind direction.
- 6.2 Strong supporting tower is not needed because generator and other components are placed on ground.
- 6.3 Low production cost as compared to horizontal axis wind turbine.
- 6.4 There is no need of yaw mechanism.
- 6.5 Easy installation as compares to conventional one.
- 6.6 Easy to transport from one place to another
- 6.7 Low maintenance cost.
- 6.8 It does not cause harm to human and birds because of low height and low speed compared to conventional.

## **7. Prototype Model**



“Fig.10 = Prototype Model”

## **8. Conclusion**

This vertical axis highway wind mill give an idea about the new way of power generation and also about the new wind mill technology. The proposed VAHW is designed for the highest possible efficiency. The power generation using VAHW is eco friendly and due to its simple construction and low maintenance cost, VAHW can be effectively used. Power generation in this technology is almost an continues one. By using this technology all the highways can be lightened without use of non renewable energy.

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