

### An analysis on Wind Power

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#### Abstract

This Wind energy being one of the fastest-growing electrical energy sources after solar energy. Wind turbines usually do not need any type of fuel, so there are no environmental risks or degradation from the any type of exploration, extraction, transport, processing of fuel. Among all renewable energy, wind power dominates as an effective, cost-effective alternative that encourages energy conservation and avoids the equitable use of fossil fuels, and other environmental impacts such as ozone depletion and millions of tons of greenhouse gas emissions Prevents global warming.

**Keywords:** Solar energy, wind energy, greenhouse effects, extraction, Renewable energy.

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#### Introduction

Wind power or wind energy is the use of wind to provide the mechanical power through wind turbines to turn electric generators and traditionally to do other work, like milling or pumping. Wind power is a sustainable and renewable energy, and has a much smaller impact on the environment compared to burning fossil fuels.

Types of wind energy conversion devices

Wind turbines are typically of types: the horizontal axis and the vertical axis. The horizontal axis grinder has its blades rotating on a axis parallel to the ground. Whereas the vertical axis grinder has its blades rotating on a vertical axis at the ground. There are many models for every, and every has its own benefits and disadvantages. However, as compared to the horizontal axis type, there are only a few vertical axis machines to be had for industrial purposes.

Horizontal axis wind mill or turbine:

It can be further divided into three types:

1. Dutch type grain grinding wind mills
2. Multi-blade water pumping windmills.
3. High speed propeller type windmills

**Dutch Windmill:** Man has been using Dutch type of windmills form a very long time. In fact the grain grinding windmills that were being widely used in Europe were mostly Dutch. These windmills were operated by wind driven tides. There were usually four blades bending at the corners of the plane of rotation. The air exhaled by the blade applied a force towards the winding. The blade was made of sails or wooden slate.

**Multi-blade Water Pumping Windmill**



Fig 1: Water pumping wind mill

Modern water pumping windmills have a large number of metallic blades operating on reciprocating pumps. Since the mill is placed directly above the water source, the criteria for site selection concern the availability of water and not the density of air. Therefore the mill is capable of being operated in very slow winds. A large number of blades are capable of delivering the significant amount of torque required to operate a centrifugal pump even at low wind speeds. Hence these are also called as fan mills. Since these windmills have to be installed at remote locations, as with most single units, reliability, rigidity and low cost are not the main criteria and skills. The blades are made of flat steel plates, which work in the tide of the wind. These are hinged to a metal ring which ensures structural strength, and the low speed of rotation adds to the reliability. The desired result is generally achieved by tail vane.

### **High speed propeller type wind machines**

The horizontal axis wind turbines used today to generate electricity are not based on thrust force. They mainly based on the aerodynamic force that develops after the flow of air around the blade of the aerodynamic design. Windmills operating on thrust force are usually less efficient. So all the modern wind turbine blades are designed based on aerofoil section.

Vertical axis wind turbines:

There are two type of different designs

1. The savonius rotor
2. The darrieus rotor

### **The savonius rotor**

Saunius rotor is a very popular vertical axis device that works perfectly due to the wind force. The main tool is to cut the cylinder vertically into two parts. The vertical tree has two types of parts connected by two opposite sides. When air enters the structure, two split surfaces - one convex and one concave - are combined on two surfaces with separate deflection forces, which gives the rotating torque. By providing some overlap between the drums, the torque can be increased.

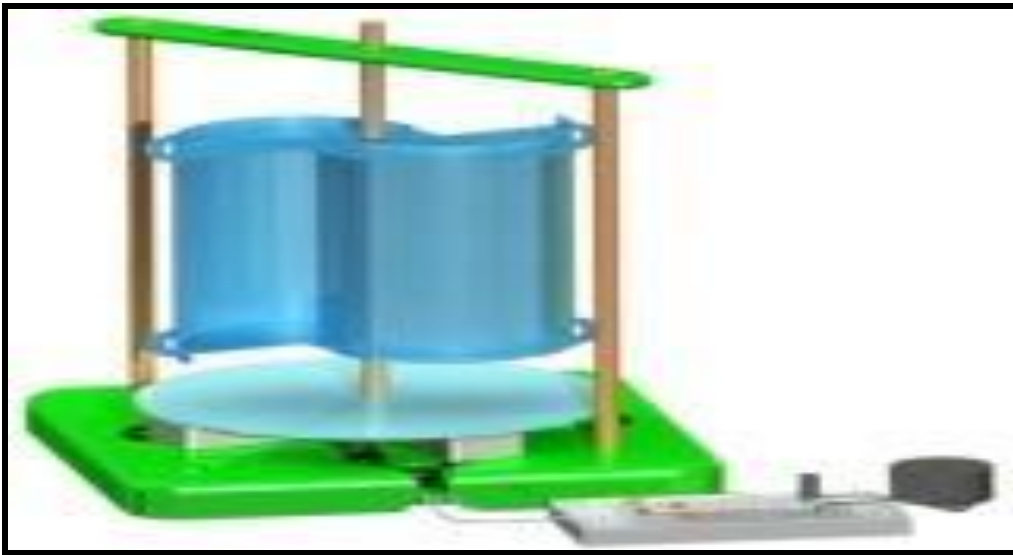


Fig 2: Savonius motor

### The darrieus wind turbine

Darius Rother's specialty is that his work is not at all clear from his appearance. Two or more flexible blades are attached to a vertical column. Blades are sections of the pneumatic winding coil almost parallel with the parabolic shape here. The torque is zero when the rotor is stopped. The positive pair develops when it is already turned on. This means that such a rotor has no torque and must be operated using external means.



### Giromill

Jerome is identical to Darius but the blades here are straight, which simplifies the construction process. However, this leads to the development of the centrifugal force in the blade to produce stress, and thus an attempt to bend it. The blade must be strong enough in the transverse direction to withstand this pressure. As a result, the vertical well cannot be

protected by glaciers, and therefore when exposed to strong winds, the base section must be strong enough to maintain it vertically. It is also called the H-type grinder due to its shape.

### **Main Components of a wind-mill**

**Rotor:** A part of a wind turbine that collects energy from the wind is called a rotor, which usually consists of two or more wood, fiberglass or metal blades that move along an axis (horizontal) at a rate determined by wind speed and the size of the blade. Or vertical). The blades are attached to the hub, which in turn are connected to the main bay.

**Lift Design:** The lifting blade design uses the same principle that allows airplanes and birds to fly. The blade is basically an aerial photograph or some type of wing. As air flows through the blade, the wind speed and pressure difference is created between the upper and lower surfaces of the blade. The pressure on the underside is high and this blade is used to "lift it". When the blades are installed on a central axis such as the wind turbine rotor, the elevator is translated at a rotating speed. The wind turbines driven by the elevators have a much higher rotational speed than the clouds type, and are therefore suitable for generating electricity. The following figure gives an idea of the principle of drag and drop.

**Tip Speed Ratio:** The ratio of the wind speed to the blade rotating speed at the maximum speed. The higher the ratio, the higher the rotational rate of the spin speed when the turbines spin at a certain wind speed by about 10, while the drag ratio was about 1. The type of elevator works effectively to soften the air on the slide. To avoid turbulence, the distance between the blades should be wide enough so that the blade does not go through the annoying and weak air flow that the blade has previously left. Due to this requirement, most wind turbines only have one or three blades on the rotor.

**Generator:** The generator is used to convert blades into energy into electricity. This includes spools of wires that have been woven into a magnetic field to generate electricity. The size of the generator depends on the length of the wind turbine blades, as more energy is captured by longer blades, since alternating current generators are generally equipped with a suitable voltage and a constant frequency of 240 volts to produce 50 energy cycles, even without wind speed fluctuations. DC motors are used in battery charging applications and for managing DC applications and devices. It can be used to generate alternating current using transformers, which convert direct current into alternating current.

**Transmission:** The wind turbine rotor speed is generally between 40 and 400 r / min depending on the model and wind speed. Generators usually require 1,200 to 1,800 rpm. As a result, most wind turbines require a gearbox to increase the number of generator rotations to the speed required to generate efficiency. There are a few current direct wind turbines that have a direct connection between the rotor and the generator. They are called direct driving systems. Without transportation, complexity and required maintenance are greatly reduced.

**Tower:** The tower where the wind turbines are placed not only raises the wind turbines so the blades can easily clean the ground, but it can also reach stronger winds at higher altitudes. The largest wind turbines are usually placed on towers between 40 and 70 meters in height. Small air system towers are usually "manual" designs. This means that there are people anchored to the ground on three or four sides of the tower to stand up. These towers cost less than free-standing towers, but they require more space for people to lay cables. Some of these towers are built with turbines. This not only simplifies installation, but also maintenance. Large wind turbines can be installed on lattice towers, tubular towers or inclined towers with cable.

## Operating Characteristics of wind mills

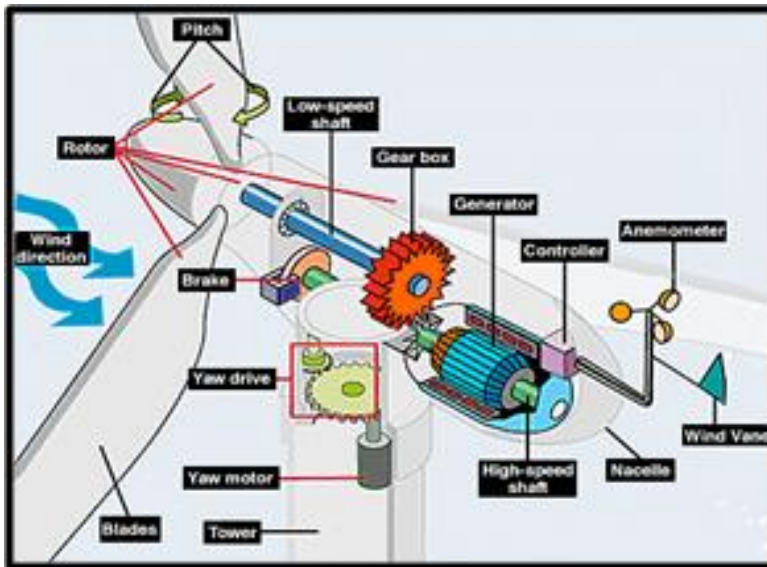


Fig. 4: Interior design of a wind mill

All wind machines share certain operating characteristics, such as cut-in, rated and cut-out wind speeds.

### 1. Cut-in Speed:

Cut-in speed is the minimum wind speed at which the blades will turn and generate usable power. This wind speed is typically between 10 and 16 kmph.

### 2. Rated Speed:

The rated speed is the minimum wind speed at which the wind turbine will generate its designated rated power. For most machines, the rated speed is 40 to 55 kph. At wind speeds between the cut-in and rated, the power output from the wind turbine increases as the wind increases. The output of most machines is above the rated speed. Most manufacturers provide a graph called "power curves" that shows how its wind turbine output changes with wind speed.

### 3. Cut-out Speed:

At very high wind speeds, most wind turbines typically power on and off at 72 to 120 km / h. The wind speed at which it stops is called the cut-out speed. Having a cut-out speed is a safety feature that protects wind turbines from damage. Shutting down can be one of several ways. In some machines an automatic brake is activated by an air speed sensor. Some machines "pitch" the blade to disperse the air. Still others use a flag flap mounted on a blade or hub that is automatically activated by high rotor RPM, or mechanically activated by a spring loaded device that turns the device into lateral airflow. Normal wind turbine operation usually begins to actually return the air to a safe level.

### 4. Betz Limit:

The theoretical maximum amount of energy in the wind which can be collected by a turbine's rotor is approximately around 59%. This value is known as the Betz limit. If the blades are 100% efficient, a wind turbine will not work because the wind stops completely, dissipating all its power. In practice, the collection efficiency of the rotor does not exceed

59%. The more common efficiency is 35% to 45%. A complete wind power system with rotors, transmissions, generators, storage and other equipment that provides the right efficiency for all will provide between 10% and 30% of the original energy available in the air.

### **High Potential of Wind Energy**

Solar energy falling to Earth produces a large amount of movement in the atmosphere, which is recommended for local changes for several reasons. The wind is caused by the rotation of the Earth and the atmosphere heated by the sun. In the equatorial region, the air is warmer than the air warmer and begins to rise and cold air circulates in the poles. In the tropics, the upward winds move north and south. Differential ocean temperatures cause small changes in airflow. The nature of the area also greatly affects winds, hills and valleys, which range from more local obstacles such as buildings and trees.

Wind force is proportional to wind speed or cubic speed.

Wind energy use can play an important role in the region's energy mix. In rural areas, the windmill has been used for centuries for grains and pumped water. Wind energy is renewable and not harmful to the environment. Its feature is used locally for applications in rural and remote areas. Wind power generators can be used as a standalone power source and aim to increase the power supply to the grid. In densely populated areas, decentralized electricity production will support local industries, especially seasonal agricultural industries.

### **Review**

A full assessment of surrounding environment is to be considered for any wind energy project. The following is required before the project implementation.

1. Land use analysis: helps in assessing the changes in land use pattern for setting up wind energy stations.
2. Ecological and Environmental Assessment: Impact on Flora and Fauna.
3. Visual and landscape assessment: a map is prepared showing those areas from which the wind turbines may be seen; more sophisticated techniques of visual assessment may be appropriate for larger projects.
4. Noise assessment: to ensure the wind farm will not create any nuisance at local dwellings.
5. Hydrological assessment: the impact of the proposed project on watercourses.
6. Economic effects on local economy: includes an estimate of the number of permanent and temporary jobs, which may be created.
7. Mitigating measures: ways in which any adverse environmental impact may be minimized.

### **Conclusion**

In this review paper , we can say that wind powered plants can creating wind energy is probably the solution to our energy needs. It has great potential and thus easy to manage. All we need to do is build a turbine and everything else is very much easy going. With just 1 turbine we can deliver electricity to more than 200 homes. Each wind turbine usually lasts for more than 20-25 years. As long as there is wind, wind turbines can strengthen the wind to create energy. Wind power right now only makes up a small percentage of the electricity produced around the globe.

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