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WIND TURBINE

Sahil S. Kasawar[1], Mayur V. Pullakwar[2], Abhilash Kasbe[3]

[1]*Sahil S. Kasawar, Civil Engineering, JDIET, Yavatmal, Maharashtra, India,* ***kasawarsahil81@gmail.com***
[2]*Mayur V. Pullakwar, Civil Engineering, JDIT, Yavatmal, Maharashtra, India,* ***mpullakwar@gmail.com***
[3]*Abhilash Kasbe, Civil Engineering, JDIT, Yavatmal, Maharashtra, India,* ***abhilashkasbe321@gmail.com***

Abstract

Wind Energy is an indirect form of solar energy which can be used continuously unlike solar energy. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. Wind flow patterns are modified by the earth terrain, bodies of water, and vegetative cover. This wind flow, or motion energy, when harvested by modern wind turbines, can be used to generate electricity. In this project we have mainly focused on how to generate Electricity from wind energy for House hold purpose.

Index Terms: *Wind Energy, Solar Energy, Earth, Wind Turbines.*

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1. INTRODUCTION

The terms "wind energy" or "wind power" describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity to power homes, businesses, schools, and the like.

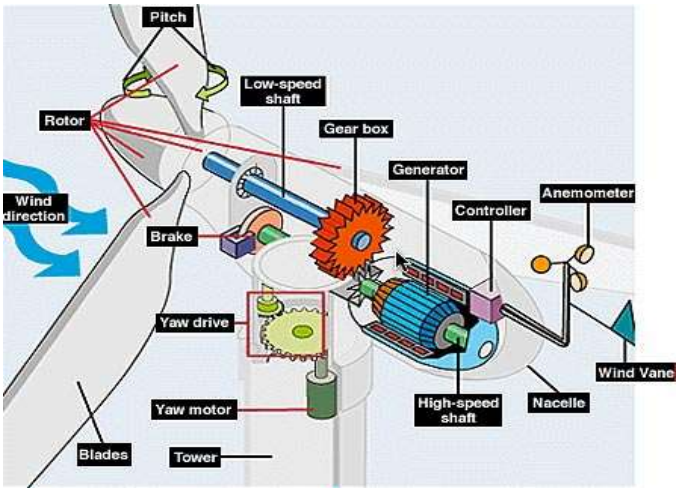


Fig-1: Symmetric Overview of Wind Turbine

The wind power generation India was started in 1994-95 with installed capacity of 230MW. The installed power generator capacity up to September 2006 was 6018MW out of which 1080MW was installed in the year2006 itself therefore, we find that wind power generation in India is growing at rapid rate.

Wind turbines, like aircraft propeller blades, turn in the moving air and power an electric generator that supplies an electric current. Simply stated, a wind turbine is the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. Below given Figure.1. is the simple structure of Wind Turbine.

1.1 How do you convert wind into Electricity??

The rotor blade on a wind turbine catches the kinetic energy in the wind and transfers it via a rotor shaft to the generator. The wing blades can be rotated and adjusted to the wind direction and strength, for maximum utilization of energy. When the rotor spins, the power is transferred via the drive shaft and gearbox. Then, the generator converts the kinetic energy from the turbine into electrical energy. The electricity is sent to the substation, where it is converted and then transported out on the net. Wind speed must be at least 10 feet per second for a typical wind turbine (2.3 MW) power generation. The maximum effect is achieved when the wind speed is 34-47 knots (gale). At 48-63 knots (storm) turn the turbine off to avoid damage to machine parts.Wind turbines are usually collected in parks that vary in size. Wind

farms in the US generate 41,400 MW in electricity. Power is transferred from the turbines to a central transformer via cables that are buried in the road network in the wind farm. From there the flow goes on the regional power grid.

The wind energy potential is about 3600 TW (equivalent of about two hundred times of the worldwide energy consumption). We have just begun tapping into this source. Wind turbines for home use are being produced on mass scale and cost competitive prices. New wind turbines are being researched as we speech, providing better efficiency. The future of wind energy looks promising.

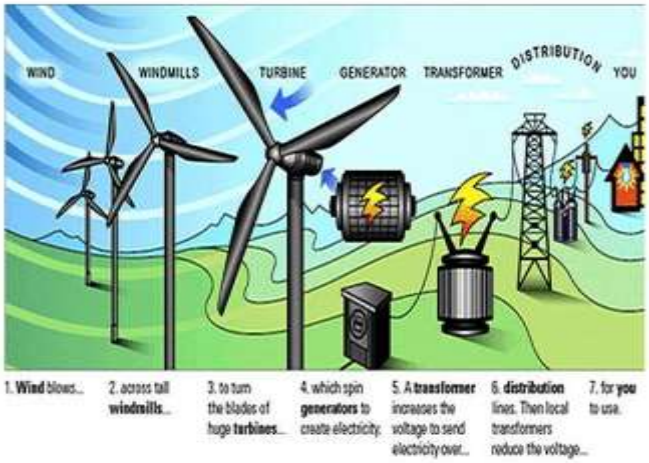


Fig-2: Wind Energy System

2. Wind Energy at Home

A wind electric system is made up of a wind turbine mounted on a tower to provide better access to stronger winds. In addition to the turbine and tower, small wind electric systems also require balance-of-system components.

Fig-3: Wind Energy at Home

- **Turbines:**

Most small wind turbines manufactured today are horizontal-axis, upwind machines that have two or three blades. These blades are usually made of a composite material, such as fiber glass. The turbine's frame is the structure onto which the rotor, generator, and tail are attached. The amount of energy a turbine will produce is determined primarily by the diameter of its rotor. The diameter of the rotor defines its "swept area", or the quantity of wind intercepted by the turbine. The tail keeps the turbine facing into the wind.

- **Towers:**

Because wind speeds increase with height, a small wind turbine is mounted on a tower. In general, the higher the tower, the more power the wind system can produce. Relatively small investments in increased tower height can yield very high rates of return in power production. For instance, to raise a 10-kilowatt generator from a 60-foot tower height to a 100-foot tower involves a 10% increase in overall system cost, but it can produce 25% more power. Most turbine manufacturers provide wind energy system packages that include towers. There are two basic types of towers, self-supporting (free-standing) and guyed. There are also tilt down versions of guyed towers. Most home wind power systems use a guyed tower, which are the least expensive and are easier to install than self-supporting towers. However, because the guy radius must be one-half to three-quarters of the tower height, guyed towers require enough space to accommodate them.

While tilt-down towers are more expensive, they offer the consumer an easy way to perform maintenance on smaller light-weight turbines, usually 10 kilowatt or less. Tilt-down towers can also be lowered to the ground during hazardous weather such as hurricanes. Aluminium towers are prone to cracking and should be avoided.

- **Balance of System Components:**

The balance-of-system parts you'll need for a small wind electric system – those in addition to the wind turbine and the tower – will depend on your application. For example, the parts required for a water pumping system will be much different from what you need for a residential application.

The balance-of-system parts required will also depend on whether your system is grid-connected, stand-alone, or hybrid. Most manufacturers can provide you with a system package that includes all the parts you need for your particular application. For a residential grid-connected application, the balance of- system parts may include the following:

• Controller
• Storage batteries
• An inverter (power conditioning unit)
• Wiring
• Electrical disconnect switch Grounding system Foundation for the tower.

Below given is the specification of the Wind Turbine used in Home:

Table.1: Specification of Home Wind Turbine

Rated Power (W)	5000
Maximum output power (W)	7500
Battery Bank Voltage (VDC)	240
Cut in Wind Speed (m/sec)	2.5
Rated Wind Speed (m/sec)	10
Working Wind Speed (m/sec)	3-25
Survival Wind Speed (m/sec)	50
Generator Efficiency	>0.8
Wind Energy Utilizing Ratio (Cp)	0.4
Generator Type	Permanent Magnet Alternator
Generator Weight (kg)	147
Blade material quality	GRP/3
Blade Diameter (m)	Ø 6.4
Over Speed Control	Yaw + Electromagnet Brake / Hydraulic Brake(Optional)
Shutting Down Method	Manual +Automatic

2.1 What is the state wise installed capacity in India?

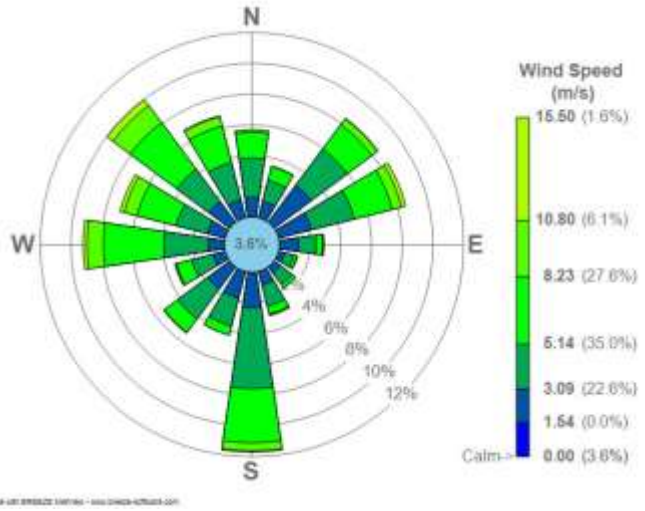
Up to 31.3.2011 a total capacity of 14156MW has been installed, as per following break-up.

Table.2: State-Wise Capacity Rate

State	Capacity (MW)
Tamil Nadu	5904
Maharashtra	2317
Gujarat	2176
Karnataka	1727
Rajasthan	1525
Madhya Pradesh	276
Andhra Pradesh	192
Kerala	35
Others	4
Total	14156

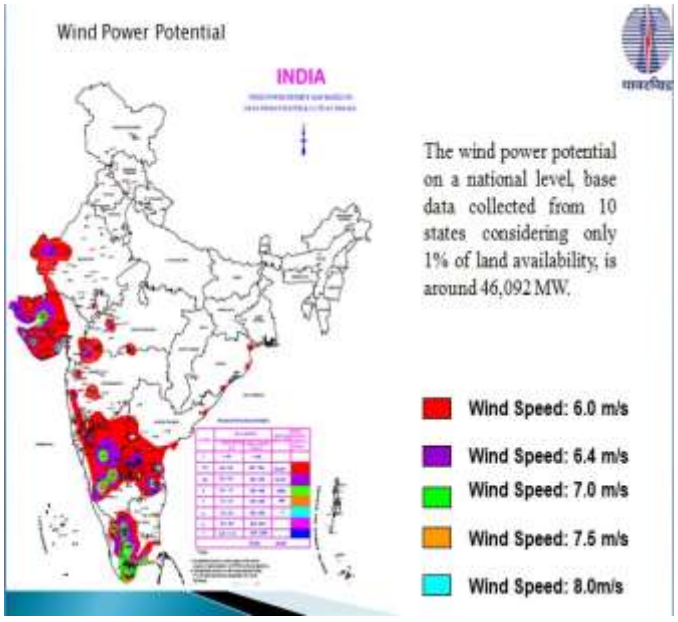
2.2 WIND ROSE

A **wind rose** is a graphic tool used by meteorologists to give a succinct view of how wind speed and direction are typically distributed at a particular location. Historically, wind roses were predecessors of the compass rose (found on charts), as there was no differentiation between a cardinal direction and the wind which blew from such a direction. Using a polar coordinate system of gridding, the frequency of winds over a time period is plotted by wind direction, with color bands showing wind speed ranges. The direction of the longest spoke shows the wind direction with the greatest frequency.



2.3 What is the state wise installed capacity in India?

Wind power installable potential of the country has been estimated with reference to Indian Wind Atlas and institute measurement. On a conservative consideration, a fraction of 2% land availability for all states except Himalayan states, North eastern states and Andaman Nicobar Islands has been assumed for energy estimation. In Himalayan states, North eastern states and Andaman & Nicobar Islands, it is assumed as 0.5%. However the potential would change as per the real land availability in each state. The installable wind power potential is calculated for each wind power density range by assuming 9MW could be installed per square kilometre area.



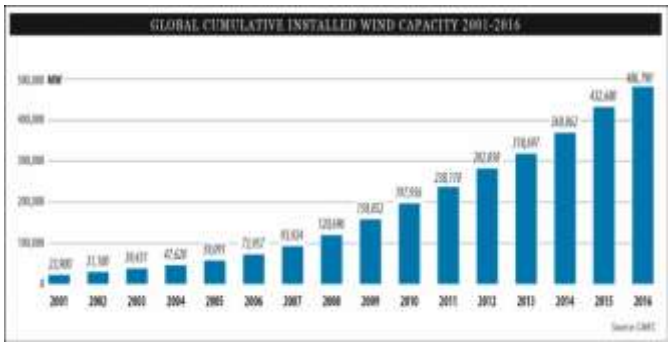


Fig - 4: Cumulative Capacity of Wind

3. CONCLUSION

The new mantra of the 21st century is sustainable development, which means that the local population should be able to absorb the development of a country or region. The people should be financially, mentally and physically able to support the improvement in the quality of their lives. We want the entire population to have access to uninterrupted supply of electricity. This puts a huge burden on the limited fossil fuel resources. The benefits of using wind power over other resources lies in its minimum operational cost. Depending on field of applications, various schemes can be adopted to get optimum output. Various option of storage facility makes it versatile source of energy. Modern turbines are totally controlled by computers that are totally safe. Since wind is clean source of energy, the power conversion does not pose any environmental hazard.

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