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Wind Energy-An Alternative Energy Source for Future

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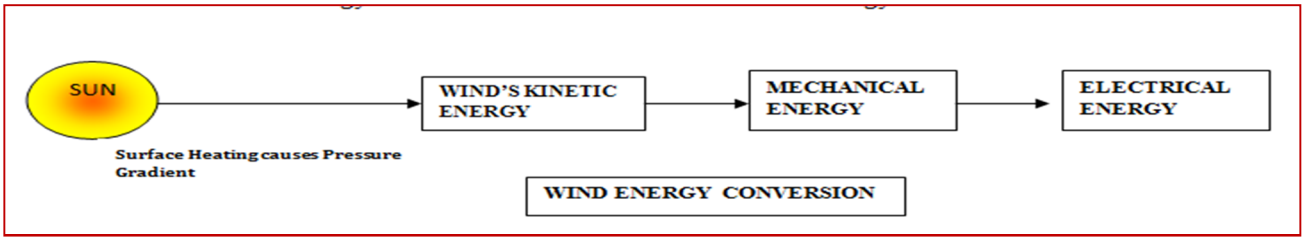
Abstract: - The purpose of this paper is to provide the real information about Wind Energy, which is energy source of non-conventional type. The nature and behavior of wind is also explained here which is the important factor to decide the wind turbine performance. The other factors like physical locality condition and geographical features of site also decide wind speed. The Power in wind is directly related to wind speed, the power increases with increase in wind speed. A wind mill is a device which is used to extract useful mechanical power from wind, but it's a varying power source so it must be connected to some other energy provider or grid in order to maintain power supply continuity to meet consumer loads vary time to time as per requirement.

I. INTRODUCTION

The differential heating and pressure difference causes motion of air and air in motion is known as wind. This wind can be further utilized for power generation. There is regular circulation of wind from the poles towards equators, it takes place as air heated by space rises and then replaced by air of lower temperature which creates convection current. In all total, in northern hemisphere wind circulates from north to south. So heating of earth plays important role for wind and its circulation. Wind is also affected by certain forces like Coriolis force caused by rotation of earth which adds some extra wind component and friction between air in motion and earth surface also retards the flow of air. During day time, the air flows from the water bodies to the surface of land as rate of land heating is faster and the whole process gets reversed during night time. As wind is in motion, it has kinetic energy which can be harnessed by some suitable device. It has been analyzed that, about two percent of solar radiation absorbed by the earth is converted into kinetic energy and its thirty percent is available in troposphere. The kinetic energy of wind is first converted to mechanical energy then it can be converted into electrical energy.



II. WIND POWER FUNDAMENTALS

The wind is directly depends upon below three factors flowing through particular area

A. Volume of air (V)
B. Velocity of air (v)
C. Density of air. (ρ)

Mass flow rate is the product of density and volume flux and mass flux is the rate of change of mass with time and it is equivalent to

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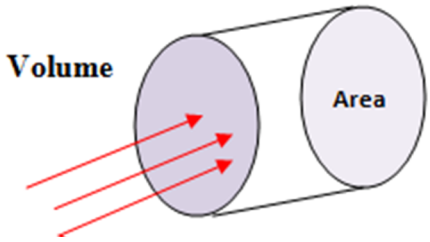
mass flow rate.

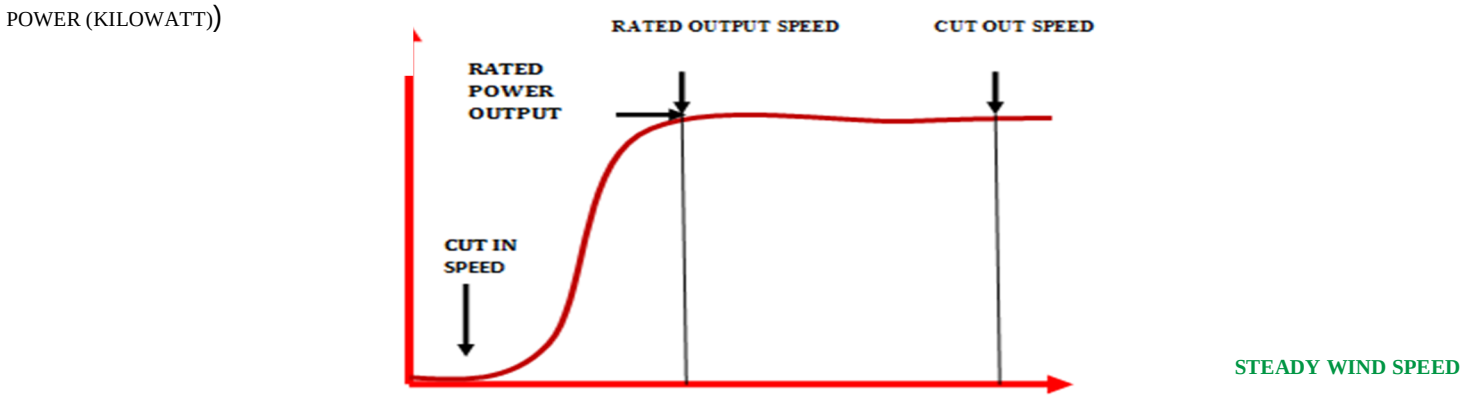


So, mass flux = ρ x **A** x **v**. The kinetic energy per unit time provides power. Here A is the area swept by the rotor.

$P = \frac{1}{2} \times \frac{dm}{dt} \times v^2$

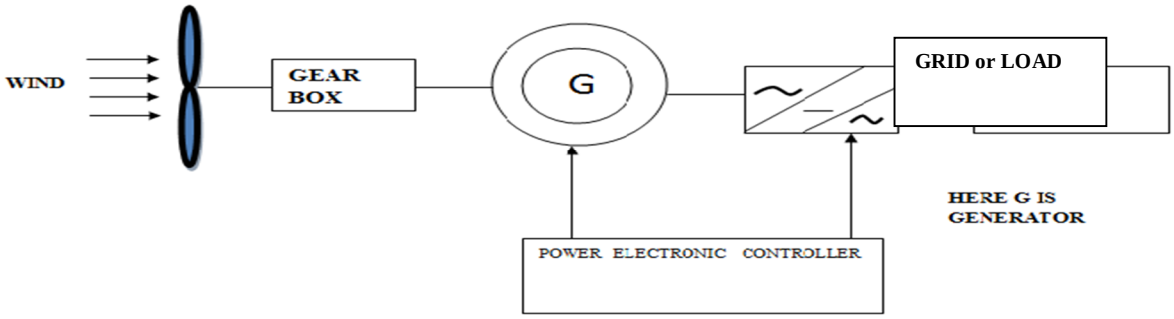
Hence, Power $= \frac{1}{2} \times \rho \times A \times v^3$

Capacity Factor: The capacity factor is the ratio of average output to the peak output. It depends upon the nature of wind turbine and geographical land characteristics. The graph below represents the Power versus Steady wind speed curve.



III. WIND ENERGY CONVERSION SYSTEM

The main components of Wind Energy Conversion System are shown in figure below:



The energy from wind can be harnessed with the help of wind energy conversion system.The aeroturbine converts the energy in wind into mechanical energy first. Then fine tuning with proper pitch control is required. A mechanical gear system of step up type

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transfers the mechanical energy to the electrical generator. The electrical ouput is either fed to load or grid.In above process a special control i.e. Yaw control is required, here the blades of turbine rotates in only one direction irrespective to the direction of wind. The main use of controller is to sense wind velocity, direction of wind as well as torques at various points followed by generator temperature.It also provides fine matching between input and output of a wind turbine.The ac-dc-ac convertor switches power time to time as per requirement.The wind energy conversion system is further classified as follows:-

On Roational Basis:-Horizontal Axis WECS:-The areoturbine used here is placed in such a way that the blades face towards wind all the time and the rotation takes place in horizontal axis.

SOURCE:- http://www.sterlingcodifiers.com/

Vertically Axis WECS:-In this machine the rotation takes place in vertical direction and the blades are also vertically placed.

On Power Output Basis

Small Scale:- upto 2 Kilo Watt

Medium Scale:- 2-100 Kilo Watt

Large Scale:- 100 Kilo Watt and above.

On Speed Basis

Constant Speed with pitch blades of variable type.

Constant Speed with little deviation with pitch blades of fixed type.

Variable Speed with blades of fixed pitch.

IV. ADVANTAGES OF WECS

A. It is a non conventional energy source which is renewable in nature.
B. Pollution free hence ecofriendly in nature.
C. On small scale requirement where rating is limited to few kilowatts it is convenient and less costly as compared to any other renewable energy source.
D. No problem of waste handling.

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V. DISADVANTAGES OF WECS

A. Wind energy is variable in nature.
B. Wind energy is non-continuous type of energy so its storage is must.
C. The operation of windmill creates noise which can be listen from several kilometers.
D. Huge area is required for plantation of wind mill.
E. Its not reliable because it requires frequent maintenance.
F. Initial setup cost is very high.

VI. APPLICATIONS

A. Generation of Electricity
B. Pumping Purpose
C. Heating Purpose
D. Energy Storage Application.

VII. SUMMARY

Wind energy is non conventional energy and after the oil crisis of 1973 the development in the field of wind energy system increased with new ideas and innovations.Due to this 50 GW was recorded in the year 2014 for global wind power. Although the intial setup cost is very high but after 30 years when people will face fossil fuel crisis, the renewable sources will be the only option. Research works are being carried out to reduce size of wind turbine system with maximum ouput power also with silent operation. So, In coming years the wind energy sources are going to the best option among all non conventional energy sources.

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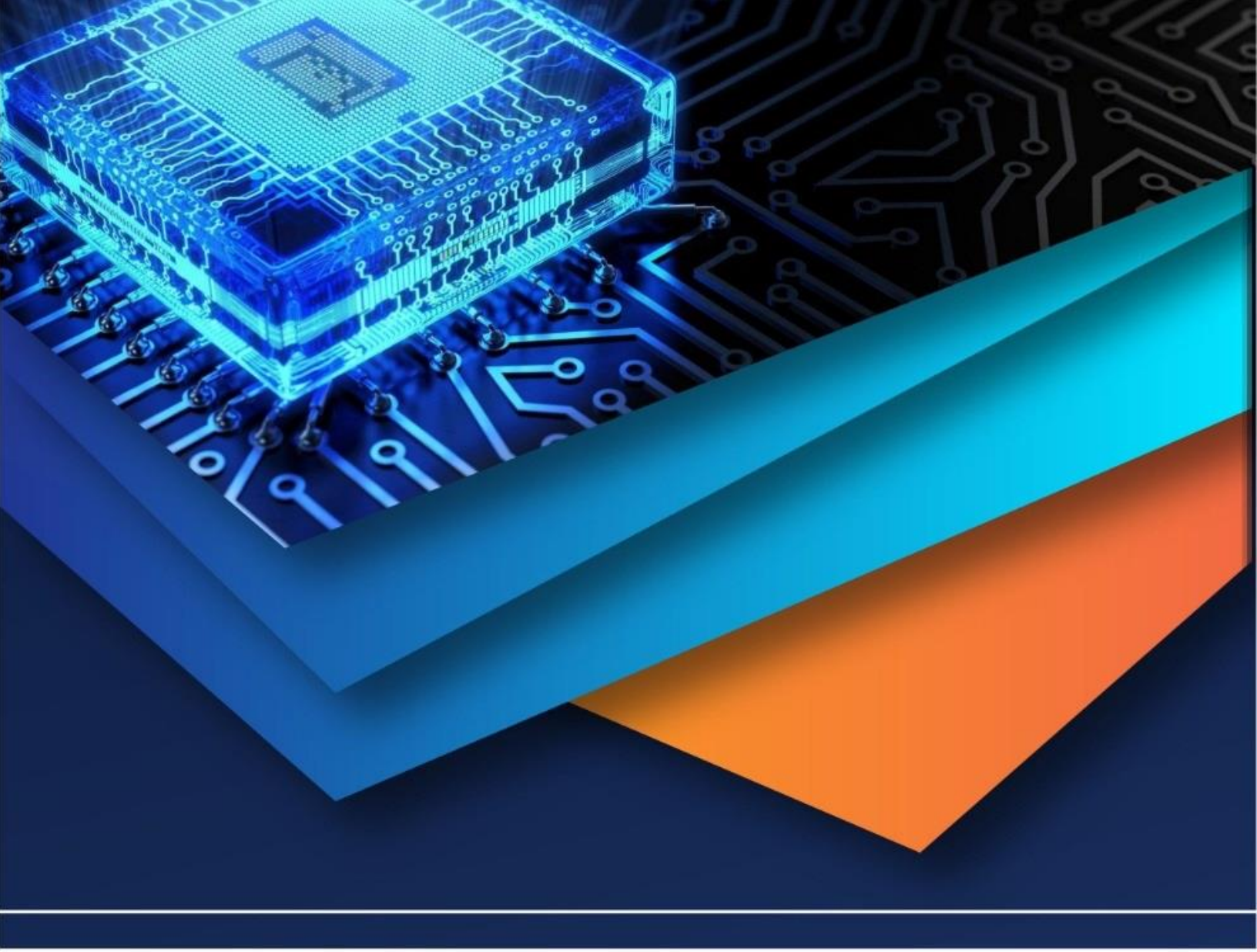

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