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Wind - An Efficient, Safe and Economic Global Energy Resource with Zero Effect

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Abstract*-Energy is a valuable input in all sectors of any country's economy. Today most of the countries draw its energy need using a variety of sources. Out of all these sources wind energy is an efficient and economically viable energy resource which is safe and has no side effects on the environment. Attempts are being made to develop low cost wind mills which can be used for generation of electricity and irrigation purposes. Therefore this paper presents various causes and remedies so that the usage of wind turbine can be assured as safe and free from causing any sort of harmful impact on the surroundings as well as the environment.*

Keywords: Wind Aero Generator, Wind utilization, Safety systems, Zero effect

INTRODUCTION

Wind is basically the result of motion of air. This motion of the air takes place because of the pressure difference. Convective circulation is globally one of the primary force causing winds. The solar energy irradiating the earth also is one of the main causes of wind. Therefore, wind energy is also considered as a part of solar technology.

Wind energy is one of America's greatest natural resources. In India the interest in the windmills was shown in last fifties and early sixties. Farm windmills are still being produced and used, though in reduced numbers. They are best suited to mill grain and lift water for land drainage and watering cattle. There is also growing interest in generating heat from the wind for space and water heating and for glass houses but the potential market in much smaller than for electricity generation.

The modern wind mill consists of two or three blades rotating at high speeds along a horizontal axis which is then installed on the tower.Along this horizontal axis, a turbine is attached to the generator.

I. WIND ENERGY COLLECTOR

A Windmill is suitable equipment used for wind energy conversion. This is a very useful device used for converting the kinetic energy of wind's motion into mechanical energy that is transmitted by the shaft. A generator is used for further converting it into electrical energy thereby generating electricity. The term wind mill which originally implied a mill for grinding grain becomes an obvious misnomer when applied to electric power generation. The term is still widely used however, aero generators avoids the difficulty.

II. Classification Of Wind Turbine Generators

Aerogenerators or wind turbine generators of Wind Energy Conversion System are generally classified in the following way which can be seen as:

Fig (1) Classification of Wind Aero generators

HORIZONTAL AXIS WIND TURBINE

- This wind turbine design is very much common.
- The rotational axis of blade ismade parallel to the ground and also to wind flow.
- Some of them operate in an upwind mode having its blades in upward direction of the tower.
- In that situation, then a tail vane is usually used to keep the blades in such a way that they face the wind.
- All the remaining designs operate in downwindmode, so that the wind crosses the tower prior to strikingtheblades.
- Some wind turbines that are too large use a motor-driven mechanism, which turns the machine as a response to the direction of the wind sensor that is mounted on the tower.
- Horizontal axis wind mills are aero-turbine mills that are too common having35% efficiency and farm mills have an efficiency of 15%...

VERTICAL AXIS WIND TURBINE

- These turbines are less common compared to horizontal axis wind turbine.
- The basic reason for this is that they do not make the use of greater wind speeds at elevations above the ground.
- Darrieus are the basic vertical axis design which consists of curved blades and has an efficiency of about 35%, the Giromill, consists of straight blades, and has an efficiency of about 35%, and the Savonius mainly uses scoops to catch the wind and the efficiency of this is about 30%.
- A vertical axis wind turbine may not be in the direction of wind.
- The generator and the transmission can be installed at ground level which allows easy service and provides light weight and lower cost.
- These are not as much efficient for collecting energy from the wind as in the case of horizontal axis wind turbine.

CYCLO-GYRO WIND MILL

- This type of wind mill has a very much high efficiency of 60%.
- However, this is not too stable and is sensitive to wind direction.
- It is also very much difficult to build.

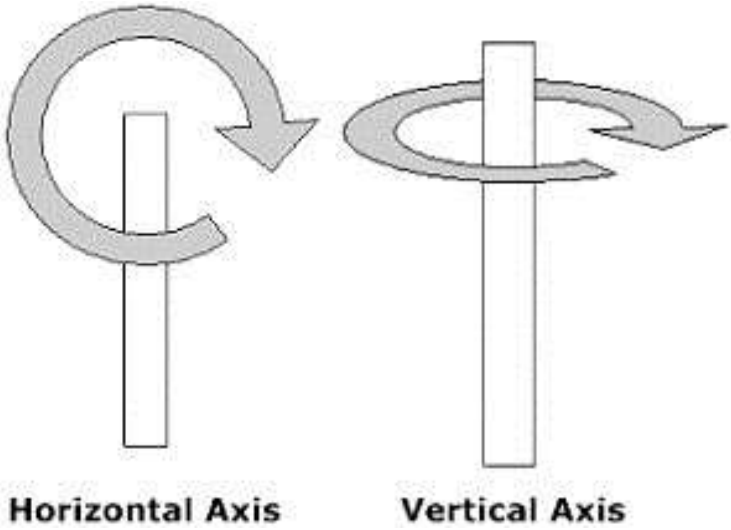

Fig (2) Horizontal and Vertical axis wind turbine

III. GENERATING SYSTEMS

The basic components of a wind electric conversion system are shown in figure .Aero turbines convert wind energy into rotary mechanical energy. There is a type of mechanical interface which consists of a step up gear as well as a very suitable coupling that is used to transmit the energy to the electrical generator. Then furtherthe output of this generator is being connected to the system grid or to the load. The controller senses the direction of the wind, speed of the wind, generator power output and other necessary performance quantities of the system and initiates appropriate control signals to take corrective actions. The system should be prevented from the excessive rise of temperature of the generator, electrical faults and extra wind conditions.

The choice of an electrical generator and the control method to be employed (if any) can be decided by the considerations of the following three factors:

- The basis of operation *i.e.* either constant tip speed or constant tip speed ratio.
- The wind power rating of the turbine.
- The type of load demand *e.g.* battery connection.

Wind power ratings can be divided into three convenient grouping, small to 1KW, medium to 50KW, and large 200KW to megawatt frame size.

The electrical control strategy employed for any particular scheme can be designed to effect control of the generator, the power transmission or the load.

Several schemes for electric generation have been developed. These schemes can be broadly classified into three main categories:

- System of constant frequency -Constant speed
- System of constant frequency variable speed
- system of variable frequency Variable speed

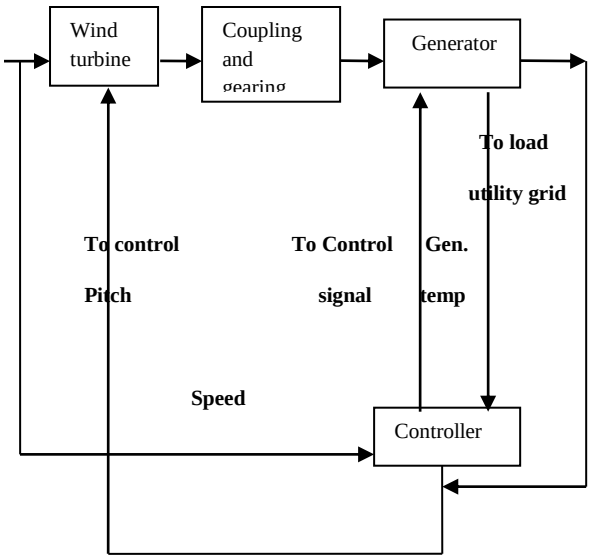

Fig. (3) Components of Wind Electric system

IV. WIND ENERGY UTILISATION

Initial wind energy is in the form of rotary, translation, or oscillatory mechanical motion. This mechanical motion can be used to pump water or can be converted to electricity, heat, or fuel. The most effective uses of wind energy are those that use energy derived directly from the wind, without any further processing, conversion, orstorage. Some important applications are as follows:

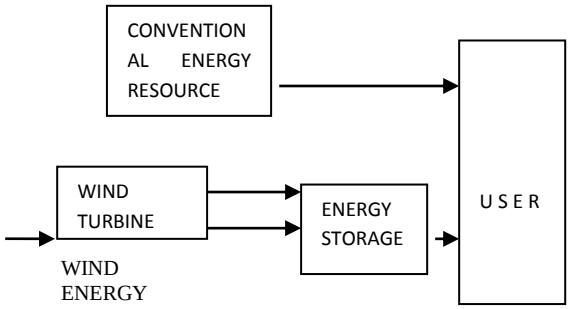

Fig (4) utilization of wind energy

- **USED FOR PUMPING**

Large numbers of wind mills are being used for water pumping. One of the main uses of wind turbine is as wind pump. These can be used for water supply and irrigation purposes. Wind mills used for irrigation purpose are generally built by farmers as method of low- cost mechanization. Irrigation designs are generally unsuitable for bewater supplyapplications, which may require heads 10-100m high. But water supply pumps are sometimes used for irrigation purpose.

- **USED FOR HEATING**

Wind -powered pumps canturbulencescan be used to save fuel and electricity by compressing the working fluid in heat pumps for heating applications. This can be done by the churning water or other fluids, or by the use of centrifugal or other types of pumps along with restristictive orifices which produces heat from friction as the working fluid flows through them. Wind energy can be used for low temperature heating i.e. up to 175degree C. It is useful for:-
(a)Inorganic chemicalsproduction which include chlorine, borax, bromine, potassium,caustic soda chloride,and sodium metal.
(b) Organic chemicals production like synthetic perfumes, rubber making chemicals, alcohols & solvents etc.
(c) Processing of textiles, hot air for curling and finishing of the textiles.

- **USED FOR ELECTRICITY GENERATION**

Wind power is used in many centralized applications for driving synchronous generators. The energy is directly fed into power networks through step up transformers. It is also used for generating dc electrical power that can be used for dc applications or space heaters like resistance heaters, or can be stored in batteries and then inverted for used by a.c. loads.

V. WORLDWIDE USAGE OF WIND ENERGY

There is more and more usage of wind energy in the world. Here is a diagram forecasting the worldwide installed capacity in Gigawatts.

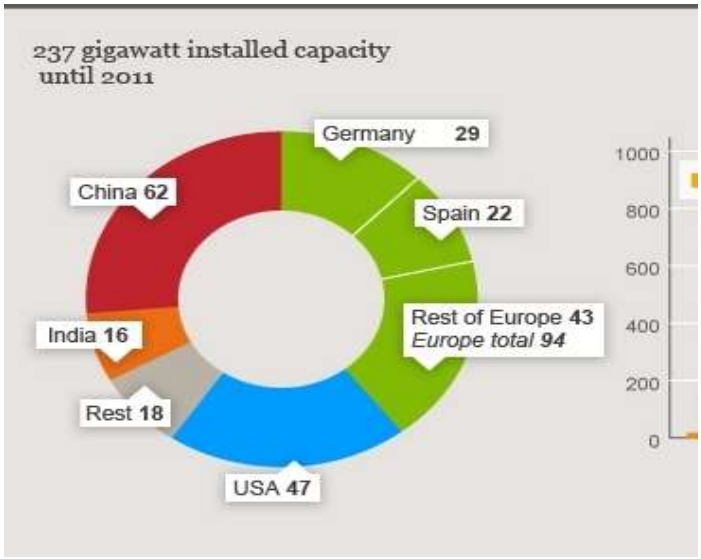

Fig (5) Usage of wind energy all over the world.

VI. SAFETY ASSURANCE WITH WIND TURBINE

Safety systems of wind turbines comprise the following features:

(i) ***Velocity of wind****:* it is measured and controlled by computer in two ways. First gusts of wind are registered and if they are too strong the turbine is stopped.

(ii) ***Lightning the rods****:* the three blades and the mill or wind turbine cap are protected from lighting by these rods going from tip of each blade to ground.

(iii) ***The computer****:* the wind turbine is controlled by a computer which monitors the most important gauging instruments and compares the results.

(iv) ***Revolution counters****:* to prevent the rotor from racing 2 revolution counters have been mounted on the shaft. These operate quite independently and activate the emergency stop if revolutions of turbine exceed 24rpm which is maximum.

(v) ***Emergency stop****:* if a situation arises which calls for wind turbine to be stopped immediately, the emergency stop is used. The wind turbine will stop in few seconds by feathering the blades directly into the wind.

(vi) ***The parachutes****:* each blade tip has a parachute, which is activated if the rpm exceeds 28. An iron plumb bob, otherwise held in place by a magnet, is released from the blade trip, the centrifugal force exceeding the of magnet pulling outside the parachute.

VII. ZERO EFFECT ASSURANCE WITH WIND TURBINE

There are various environmental impacts of wind turbine. Here are some remedies which make the operation of wind turbine entirely risk free.

(i) ***Electromagnetic interference:***

Interference with TV and other electromagnetic communication systems is a possibility with wind turbines as it is with other tall structures.

Remedies

Interference can be overcome by dispensing with aerial and sending TV signals by cable in areas that would otherwise be affected.

(ii) ***Noise***

The noise produced by wind farms falls into two categories. The first type is a mechanical noise from the gear box, generating equipment and linkages and the second type of aerodynamic in nature produced by the movement of turbine blades.

Remedies

Revolving blades generate noise which can be heard in the immediate vicinity of the installation, but noise does not travel too far.

(iii) ***Visual effects***

Megawatts power generating wind turbines are massive structures which would be quite visible over wide areas in some locations.

Remedies

Variety characteristics like rotating speed, colour pattern, and the reflectance of blade materials can be adjusted to modify the visual effects of wind turbines involving the land in which they come.

(iv) ***Bird life***

Tall structures represent a potential collision hazard to bird life. However, studies indicate that majority of migrating birds either fly at much higher altitudes or take the avoiding action.

Remedies

It is more likely to affect the birds more and to be more of a problem with smaller faster turning machines rather than very large rotors which exists with wind turbine.

(v) ***Risk of Injury***

The possibility of mishap is perhaps of greater concern to the public. The most serious failure from the safety point of view is the detachment of blade, or blade fragment which could be thrown a considerable distance and could damage people or property.

Remedies

A reliable control system to identify the fault situation rapidly and braking system to bring the rotor safety to rest could be the measures adopted to prevent such failures.

Regular inspection and greater safeguards against over speeding should minimize the hazard.

Most wind machines will be in rural areas which make it less likely that anyone would be injured or killed by flying debris if there were an accident.

VIII. CONCLUSION

In the developing scenario all countries are financially and economically competitive with respect to the use of their resources. It must be clear that the countries must use such type of energy resources which are safe, efficient and in turn do not cause any harmful impact on the environment. It is suggested that the resources should be used in such a way keeping in mind that they should be of low cost, highly efficient, easily available, safe during operation and does not have hazardous impact on the surroundings and environment. Therefore, wind energy is one of such type of efficient resource which maintains zero effect on environment. So this energy resource must be highly used by all the countries of the world.

REFERENCES

[1] Bin Wu, Yangquan Lang, Navid Zargari, Samir kouro (2011), "Power conversion and control of wind energy system", first edition august (IEEE Press)

[2] EL-Helw, H.M. and Tennakoon, S.B. (2008), "Evaluation of the suitability of a fixed speed wind turbine for large scale wind farms considering the new UK grid code", Renewable Energy, vol. 33, pp.1-12.

[3] Grainger, S.J. and Stevenson, W.D, Jr. (1994), "Power System Analysis", Book, McGraw-Hill, Inc.

[4] Mohan, N., Undeland, T. and Robbins, W. (1989), "power electronics converters, application and design", Book, John wily And Sons, Inc

[5] S.Jockel (2006) New Gearless wind turbines in the 1.5MW class, in European wind energy conference and exhibition, EWEC

[6] Mittal, R., Sandu, K.S. and Jain, D.K. (2009), "Isolated Operation of Variable Speed Driven PMSG for Wind Energy Conversion System", IACSIT International Journal of Engineering and Technology, Vol. 1, No.3, August, pp 1793-8236

[7] R.Venktesh, *Technological possibilities for efficient utilization of wind energy* NPSC 2002, Vol.1, pp.9-14 IISc. Bangalore India

[8] T.Thringer, *Grid friendly connecting of constant speed wind turbines using external resistors* IEEE Trans. On Energy Conversion Vol.17 pp.537-42 Dec 2002.

[9].E.Hau (2006) Wind Turbines: Fundamentals, Technologies, Application, Economics, 2nd edition, Springer.

[10] I.J.Nagrath & D.P. Kothari, *Power System Engg.* TMH, 1994

[11] R.Krishnan etal, *Control in Power electronics* Academic press, 2002

[12] Wind energy fundamentals, resource analysis &economics –Sathyajith Mathew (Springer 2006)

[13]. On Netz (2006) High and Extra High voltage

[14] Modeling of GE wind turbine generators for grid studies 2009 by K. Clark, N. M.Millar

[15] Apoorva Srivastava, Rakesh Sharma, Virendra Kr. Maurya (2015),"Performance Analysis of SCIG Coupled with Wind Turbine with and Without Fault", IJAERD International Journal of Advance Engineering and Research Development, Vol.2, Issue 1, January, pp (75-82)

[16] Rekha Parashar, Shashikant (2015),"Performance Analysis of Doubly Fed Induction Generator Based Wind Turbine under Faulty and RLC Load Conditions", IJEST International Journal of Engineering Science and Technology, Vol.7, No.2, February, pp (62-70)

[17] Apoorva Srivastava, Rakesh Sharma, Virendra Kr. Maurya (2015),"Performance Analysis of SCIG Coupled with Wind Turbine with and Without Fault using RLC Load, IJERGS International Journal of Engineering Research and General Science , Vol.3, Issue 1, Jan-Feb, pp (837-843)