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Wind-Solar Hybrid Power Generating System,The Renewable Power Tree

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Abstract -In recent days, world is facing the problem of energy crisis. The demand for energy is increasing with the advancement in technology. Since the conventional energy sources are decreasing day by day, it's time for us to shift the focus from conventional to non-conventional energy sources to produce electricity. The proposed methodologyaims at producing tomorrow's sustainable energy from nature. In which the design and simulation of hybrid power generating system has been explained. Wind-solar hybrid power generating system is simulated using proteus software.

***Key Words*:**vertical Axis wind turbine, savonius turbine, hybrid power system, proteus software

1. INTRODUCTION

Wind-solar hybrid power generating system, The renewable power tree is a method of generating electricity from nature. As the name says it is a hybrid plant. This harnesses energy from both wind and sunlight. This type of resource is much desirable to use because often a resource renews so fast that it will have regenerated by the time we used it up.

In this project the number of mini turbines referred to as leaves are placed in the form of tree. On each turbine solar panels are placed. Here the number ofgeneratorused are equal to the number of turbines. Both the energy sources have greater availability in all areas.This system can be installed anywhere, there is no need to find special location to install the system.

2. PROPOSED METHODOLOGY

Whenwind blows, the pressure of the wind falls on the turbine blades. Fig 1. Shows the hybrid model .The kinetic energy of the wind is converted into rotational energy using the turbine. Solar panels are placed on the turbines. Maximum power point tracking is a technique used commonly with wind turbines and photovoltaic solar systems to maximize power extraction under all conditions. Fig 2. Shows the simulation circuit of hybrid model using proteus software. This turbine is coupled with the generator through gear box.Gear mechanism is used to increase the RPM. This rotational energy is converted into electrical energy by generator on the principle of Faraday's law of electromagnetic induction.

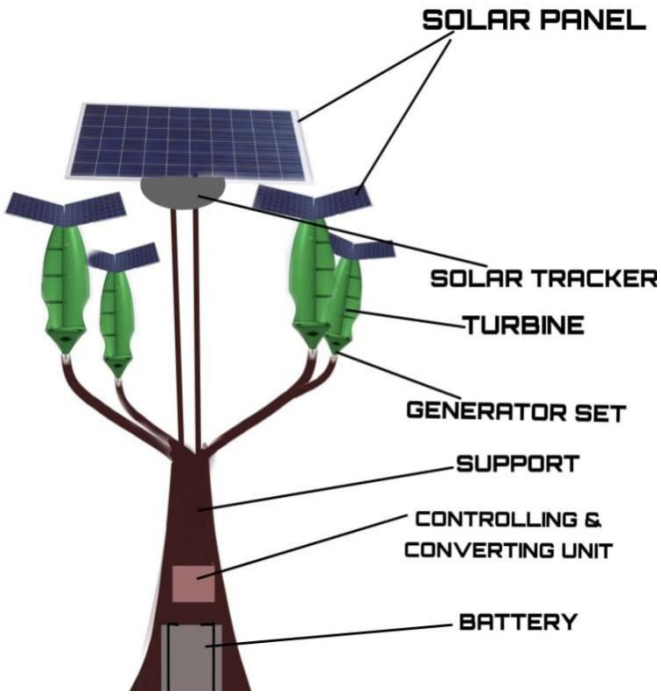

Fig 1: Shows the module of Wind-Solar Hybrid Power Generating System

2.1 Wind turbine:

A wind turbine or a wind energy converter converts the kinetic energy of the wind into electrical energy using the generator. Wind energy provides a clean energy with no greenhouse gases. There are generally two types of turbines, namely horizontal Axis wind turbine (HAWT) and vertical Axis wind turbine (VAWT). HAWT have the ability to collect maximum amount of wind energy and they utilize aerodynamic blades, positioned either upwind or downwind. This type is aimed at generating electricity from a wind with high speed. Whereas VAWT is installed in area with low wind speed. Darries,Savoniusand Giromill type of turbine constitute vertical Axis wind turbine. In this project,thesavoniusturbine,a simplest turbine is used., it is drag type device consisting of two or three curved blades. Number of wind turbines which are considered as leaves are installed in the form of tree. All the turbines are connected to the gear mechanism.

A : Calculation of the wind energy

The power generated by the wind energy is given by,

Power= (density of air*swept area*velocity cube)/2

P_w= (1/2)*f*(Aw)(V)³

Where, P=power in watts

f=air density in kilogram per cubic metre

A_w= swept area in square metre

V= wind speed in metre per second

B:Swift area

The blade Swift area can be calculated as

Swift area= 2RL

Where,R= radius of the rotor in metre

L= length of the wind blade in metre

C : Power Co-efficient

The power coefficient is the percentage of power reversed by wind turbine through Swift area of turbine blades. This value varies between 0.1-0.6.

Cp= 0.245 (from standard power coefficient)

2.2 Solar panel:

Solar energy is most affordable, renewable energy source. Solar panel consists of photovoltaic cells which converts solar energy into electrical energy. The major advantage of solar panel is that they can be used wherever it is required and maintenance cost is less. The only problem with this system is that it cannot produce energy in poor weather condition. In order to extract the maximum power, solar tracker is used. Solar tracker is a device that orientsthe payload i.esolar panel towards the sun.

Calculation for solar energy

To determine the size of PV modules, the required energy consumption must be estimated.

The power is connected as

P_s= Ins(t) * A_s * eff(pv)

Where,

Ins(t) = isolation at time t(kw/m²)

A_s= area of singles PV panel (m²)

Eff(pv)= overall efficiency of PV panels and DC-DC converter

Overall efficiency is given by,

Eff(pv) = H* PR

Where, H= annual average solar radiation on the panels.

PR= performance ratio.

The addition of the power obtained from the solar panel and wind turbine gives the total power generated.

Mathematically, it can be represented as

$P_t= N_w *P_w+N_s*P_s$

Where, $P_t$is the total power generated

$P_w$is the power generated by the wind turbine

$P_s$is the power generated by the solar panel

$N_w$is the total number of wind turbine

N_s is the total number of solar panels

2.3 Charge controller:

Charge controller is mainly employed to control the source to limit the electric current that flow to the system.This prevents overcharging and protect the system against overvoltage.

2.4 Batteries:

The energy obtained from the solar and wind source are stored in batteries. The type and the capacity of the battery depends on the size of the solar and the wind system. The main parameter for thechoice of battery is that charger leakage should be low. The number of the batteries can be connected in series or parallel to increase or decrease the capacity.

2.5 Inverter:

Most Of the electrical appliances require AC for their operation. Hence it is necessary to convert the DC power output of batteries to AC power.

3. RESULT & DISCUSSION

The wind-solar hybrid power generating system is simulated using proteus 8 software. The proteus design suite is a proprietary software tool suite used for electronic design automation. The figure below shows the simulation circuit for wind-solar hybrid power generating system.

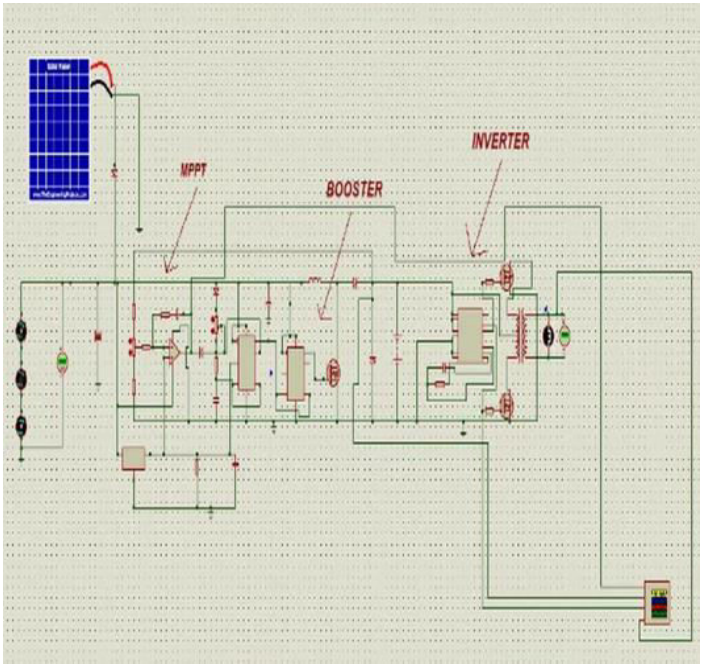

Fig 2: Proteus simulation model ofWind-Solar hybrid power generating system

In the circuit, 6Volts solar panel and three wind turbines each of 2voltsis selected. These wind fans are connected in parallel with solar cells. The output from the sources are connected to comparator. The comparator used here is LM358. This is basically a high gain op-amp with a wide range of power output.

The output of the comparator is fed to the converter. Depending on the requirement any type of converter can be used.Generally there are two topologies. Non isolated type which includes buck, boost and buck boost converter andisolated type includes fly back, push pull, forward,half bridge and full bridge .Here ,for the simulation buck boost converter is used. This converter consists of buck converter to step down and boost converter to step up the output voltage.

In any DC-DC converter or chopperit includes semiconductor as a switch like IGBT's, MOSFET's , thyristor etc. In this project MOSFET is used as a switch as it has the capability to operate at high voltage. The switching of MOSFET is controlled by PWM 555 timer IC. Generally to generate pwm withoutmicrocontroller,IC'S like opamp, timer, pulse generator are used. And here 555 timer IC is used.

Timer provides time delay. It is a multivibrator circuit which operates in monostable mode and generates a non-sinusoidal wave. In the PWM, the main parameter is the duty cycle. It can be varied by variable resistor r3 as in the circuit. The buck boost converter depends on the source output. when source output is high ,the timer reduces the duty cycle and this will reduce the on time of MOSFET , thus reducing the output. Similarly when source output is low it increases the output.

Performance of a hybrid system that utilized both solar and wind energy as renewable sources is experimentally investigated using the proteussoftware. The advantage of maximizing the power output and keep a continuous source of power supply were proved. During excessive power generation load can be fed directly but when the generation is less even then through the battery electrical supply is fed to the load. As the wind speed is not constant the output of the generator will be varying frequently. So the buck-boost converter is used which regulates the output of the generator and charges the battery.DC loads are supplied directly from battery and inverter are used for supplying AC loads. Fig 3. Shows the output waveform of the simulation.. Finally, the data and results were recorded form wind-solar hybrid power generation tree.

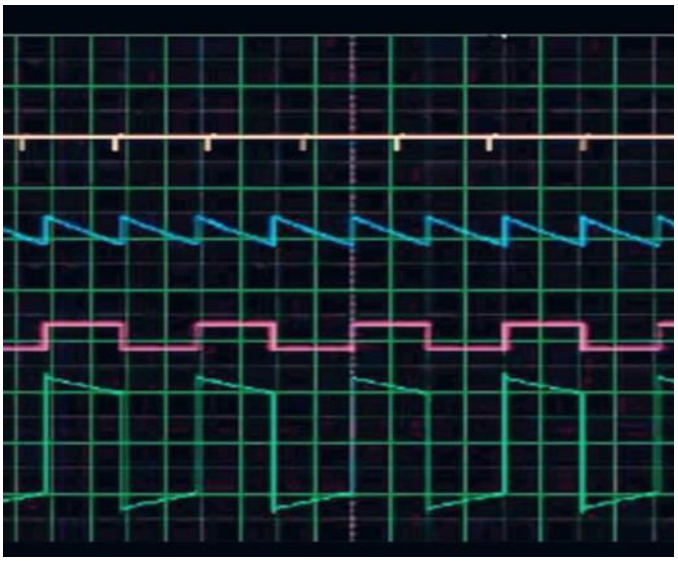

Fig 3: Shows the output waveform

4. CONCLUSION

Wind-solar hybrid power generating system is one of the convenient and effective solution for providing electricity as compared to non-renewable energy resources. Both the source are available free of cost and they do not even pollute the environment. Another important reason to why this system is that, it can be installed in the place where it is needed, thus reducing the losses that were produced during long transmissions. If this system is installed, this becomes a boon to mankind and it helps to solve the problem of energy crisis in the world.

REFERENCES

1. MagediMohM.saad,NarozelawatiAsmuim,"comparison of horizontal Axis wind turbine and vertical Axis wind turbine" in IOSR journal of engineering. Volume 04, issue 08 (August 2014).
2. S.Tullis, S.Zida, "performance testing of small vertical Axis wind turbine" in Researchgate, article-june 2007.
3. Obaidullahlodin,Nitin,Satya...,"modelling and simulation of wind solar hybrid system using matlab /simulink", IJITEE.
4. "Ms. Aher M.H. *1, Ms. Avhad R.V. Ms. Chaudhari S.A. Prof. Pawar S.D. InternationalJournalof Advance EngineeringandResearch Development Amodern method of generating electricity by smart wind tree *Volume5, Issue05,May-2018"*
5. "Shekhanabi BChalageri, AkashMDeshpande,ManjunathSBanad, AnoopSPavateProf.SujataEresimi, International Journal of Advanced Research in Science, Engineering and Technology, Generation of electricity by wind tree Vol.4,Issue5 ,May 2017"