Study of Hybrid Solar-Wind Power Plant System Using MATLAB

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Abstract- *currently a day's electricity is most required facility for the creature. All the traditional energy resources are depleting day by day. Therefore we've got to shift from standard to non-conventional energy resources. During this the mixture of two energy resources is takes place i.e. wind and alternative energy. This method reviles the property energy resources while not damaging the character. We are able to offer uninterrupted power by victimisation hybrid energy system. Primarily this method involves the mixing of two energy system which will offer continuous power. Star panels are used for changing alternative energy and wind turbines are used for changing wind energy into electricity. This power will utilize for numerous purpose. Generation of electricity are going to be takes place at reasonable value. This paper deals with the generation of electricity by victimisation two sources mix that ends up in generate electricity with reasonable value while not damaging the character balance.*

Index Terms- Electricity, Hybrid, Solar, Power, Wind.

I.INTRODUCTION

Electricity is most required for our day to day life. There are two ways that of electricity generation either by standard energy resources or by non-conventional energy resources. Current demand will increase in word therefore to meet demand we've got to get current. currently a day's current is generated by the traditional energy resources like coal, diesel, and nuclear etc. the most downside of those sources is that it produces waste like ash in coal power station, nuclear waste in atomic energy plant and taking care of this wastage is extremely pricey. And it conjointly damages he nature. The nuclear waste is extremely harmful to human being conjointly. The Standard energy resources are depleting day by day. Presently it'll be utterly vanishes from the earth therefore we have a tendency to have to notice another means to get electricity. The new supply ought to be reliable, pollution free and economical. The non-conventional energy resources ought to be sensible energy resources for the traditional energy resources. There are several non-conventional energy resources like geothermic, tidal, wind, solar etc. the periodic event energy has drawbacks love it will solely enforced on ocean shores. Whereas Heat energy wants terribly laser step to extract heat from the earth. Star and wind are simply accessible altogether condition. The non-conventional energy resources like star, wind are often sensible various Supply. Alternative energy has downside that it couldn't manufacture current in rainy and cloudy season therefore we'd like to beat this downside can we are able to use two energy resources in order that anyone of supply fails alternative supply will keep generating the

electricity and in decent weather condition we can use both sources combine.

II.HYBRID ENERGY SYSTEM

Hybrid energy system is the mixture of two energy sources for giving power to the load. In forward term it can distinct as "Energy system which is fabricated or designed to extract power by using two energy sources is called as the hybrid energy system." Hybrid energy system has decent reliability, efficiency, less emission, and lower cost.

In this projected system solar and wind power is used for generating power. Solar and wind has noble advantages than other than any other non-conventional energy sources. Both the energy bases have greater availability in all areas. It needs lower cost. There is no necessity to find special location to install this system.

A. Solar Energy

Solar energy is that energy which is gets by the radiation of the sun. Solar energy is current on the earth continuously and in abundant manner. Solar energy is freely available. It doesn't create any gases that mean it is pollution free. It is affordable in cost. It has low maintenance cost. Only problem with solar energy plant ,it cannot produce energy in bad weather condition. But it has superior efficiency than other energy sources. It only need initial investment. It has extended life span and has lower emission.

B. Wind Energy

Wind energy is the vitality which is extracted from wind. For extraction we use wind mill. It is renewable energy sources. The wind energy wants less cost for generation of electricity. Maintenance cost is too less for wind energy system. Wind energy is present for 24 hours of the day. It has less emission. Initial cost is also less of the system. Generation of electricity from wind is depend upon the speed of wind flowing.

The major drawbacks of using independent renewable energy resources are that unavailability of power for all time. For overwhelming this we use solar and wind energy together. So that any one source of power fails other will take care of the generation. In this projected system we can use both sources combine. Another way is that we can use any one source and keep another source as a stand by unit. The main drawbacks of this system are that it needs high initial cost. Except that it is dependable, it has less emission. Maintenance cost is less. Life span of this system is more. Efficiency is more. A

main benefit of this system is that it gives continuous power supply.

III.DESIGN OF HYBRID ENERGY SYSTEM

For scheming of the hybrid energy system we need to find the data as follows

A. Data required for Solar System:

1. Annual mean daily duration of Sunshine hours
2. Daily Solar Radiation horizontal (KWH/m2/day)

B. Data required for Wind System:

1. Mean Annual Hourly Wind Speed (m/sec)
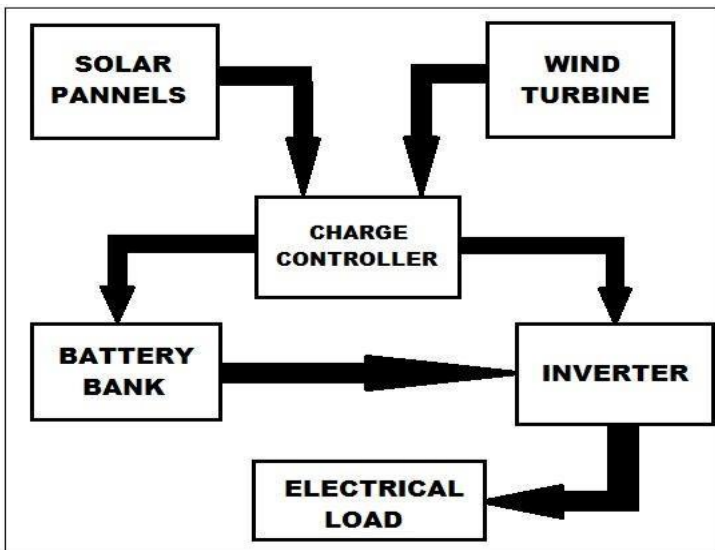2. Wind Power that can be produced from the wind turbine

Fig1. Block diagram of Hybrid energy generation system

Beyond figure shows the block diagram of the hybrid power generation system using wind and solar power. This block diagram includes following blocks.

I. Solar panel

II. Wind turbine

III. Charge controller

a. Battery bank

b. PWM Inverter

IV. Maximum power point tracking technique (MPPT)

1-Solar panel

Solar board is use to convert solar radiation to the electrical energy. The physical of PV cell is very alike to that of the classical diode with a PN junction formed by semiconductor material. When the junction engrosses light, the energy of absorbed photon is transferred to the electron-

proton system of the material, creating charge exports that are separated at the junction. The charge transporters in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an

external circuit. Solar board is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar board are the medium to convert solar power into the electrical power.

2-Wind turbine

Wind turbine is that system which excerpts energy from wind by rotation of the blades of the wind turbine. The wind turbine has two types vertical and horizontal. As the wind speed rises power generation is also increases. The power produced from wind is not continuous its fluctuating. For obtain the non-fluctuating power we have to store in battery and then provide it to the load.

3-Charge controller

Charge controller has basic function is that it control the source which is to be active or inactive. It concurrently charge battery and also gives power to the load. The controller has over-charge protection, short-circuit protection, pole confusion protection and automatic dump-load function. It also the resolve is that it should vary the power as per the load demand. It add the both the power so that the load demand can Fullfill and once power is not generating it should abstract power from battery and give it to the load.

a. Battery Bank

We have to choose battery bank size per the load requirement so that it should fullfill the requirement of load for calculating the battery bank size we need to find following data

1. Find total daily use in watt-hour (Wh).
2. Find total back up time of the battery

For rise in battery bank size we need to connect cell in series so that we can get the larger battery bank size.

b. PWM Inverter

The inverter desires to convert dc power into ac energy. As our load working on the ac deliver so we want to convert dc electricity. The input, output voltage and frequency, and average strength coping with depends on the design of the precise device or the circuitry [11]. The inverter is fed from the buck-improve converter. The O/P of the inverter is shown in fig.7.As according to the requirement of the burden. The pwm switching is accomplished within the inverter to get the preferred output.

The output of the above system is shown in "Fig.2" which contains the output voltage and output current.
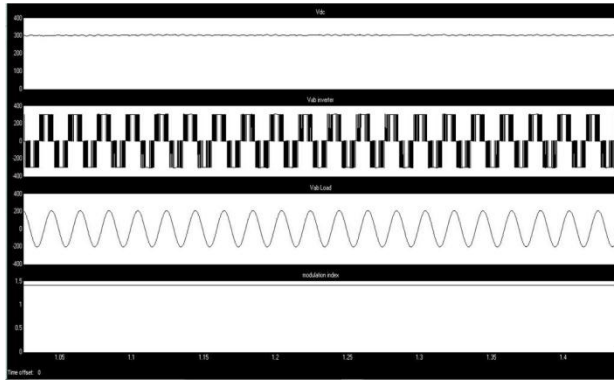

Fig2.The output waveform of PWM Inverter.

iv.   Maximum Power Point Tracking Technique

To bring operation point at or MPP, we need MPPT the algorithm used ,mine the peak power by controlling converters duty ration(D),in this study a buck-boost converters has been used. [10].

IV.PROPOSED CALCULATION

The total power produced by this system may be given as the addition of the power generated by the solar PV panel and power generated by the wind turbine.

Mathematically it can be represented as,

$$P_{Total} = N_W * P_w + N_S * P_S$$

Where,

P_T is the total power generated

P_W is the power generated by wind turbines

P_S is the power generated by solar panels

N_W is the no of wind turbine

N_S is the no of solar panels used

A.   Calculations for wind energy

The power generated by wind energy is given by, Power = (density of air * swept area * velocity cubed)/2

$$P_W = ½. ρ (A_W) (V)^3$$

Where,

P is power in watts (W)

ρ is the air thickness in kilograms per cubic meter (kg/m^3)

A_W is the cleaned area by air in square meters (m^2) V is the wind speed in meters per second (m/s).

B.   Calculations for solar energy

Tofind the size of PV modules, the required energy consumption must be estimated. Therefore, the power is calculated as

$$P_S = Inst (t) * A_S*Eff(pv)$$

Where,

Inst (t) = isolation at time t (kw/ m^2)

A_S = area of single PV panel (m^2)

Effe.pv = overall efficiency of the PV panels and dc/dc converters.

Overall efficiency is given by,

$$Eff(pv)= H * PR$$

Where,

H = Yearly average solar radiation on tilted panels.

PR = Performance ratio, coefficient for losses.

C.   Cost

The overall cost of the solar-wind hybrid energy system is depend upon the total no of wind turbines used and total no of solar panels used. Therefore the total cost is given as follows

Total cost= (No. of Wind Turbine * Cost of single Wind Turbine)

+ (No. of Solar Panels * Cost of single Solar Panel)

+ (No. of Batteries used in Battery Bank * Cost of single Battery)

$$C_T = (N_W * C_{WT}) + (N_S * C_{SP}) + (N_B * C_B)$$

Where,

C_T is the total cost in Rs

$C_{WindTurbine}$ is the cost of single wind turbine in **Rs** C_{SP} is the cost of single solar panel in **Rs** C_B is the Cost of single Battery in Rs

N_W is the number of wind turbine used N_S is the number of solar panels used

$N_{Batt.}$is the number of Batteries used in Battery Bank**.**

Solar-wind hybrid energy systems needs only initial investment. It will vie well in generation with the conventional energy sources. When determined for a lifetime of reduced or avoided utility costs. The price of the system depends on the system chosen, wind resource on the site, electric costs in the area, and the battery bank required. price of the Wind-Solar Hybrid system is to be minimized. For minimize the price of the system we need to increase the use of non -conventional energy sources..

V.MODEL OF HYBRID ENERGY SYSTEM AND RESULT

The complete system strategy of hybrid energy system is simulated using SIMULINK. Fig. 3 shows the simulation diagram for a hybrid system with solar and wind systems.
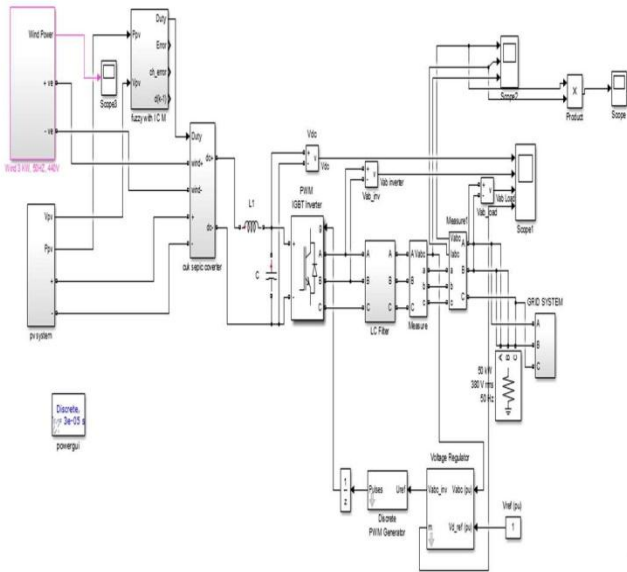
Fig.3.MATLAB model for Hybrid Generation

VI. SIMULATION AND RESULT

The waveforms investigates of the complete machine are seen in fig. 10. The dc outputs of Buck-boost converter are exposed. The outputs of the PWM inverter are depicted in fig.2
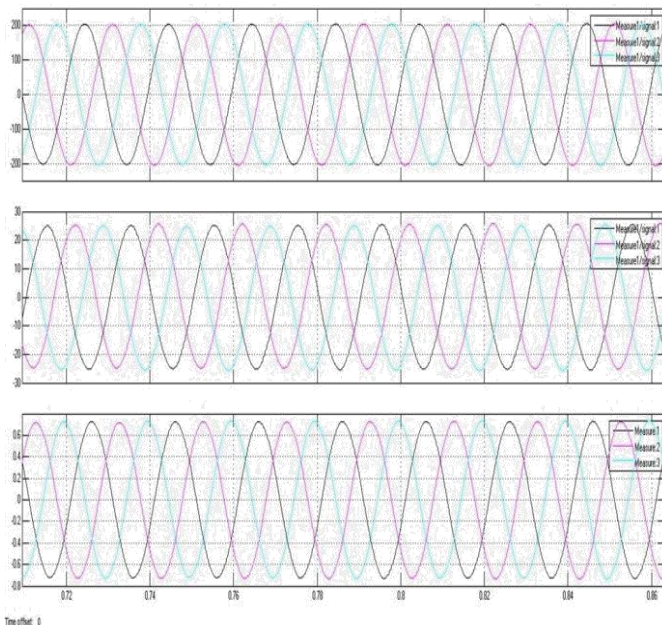

Fig.4.The output waveform of Generating System

VII. CONCLUSION

In This paper we have done a hybrid renewable power conversion system. The sun and wind power sources most broadly used as renewable power resources. It is able to provide to foreign places wherein the authorities is not able to reach. In order that the strength may be applied where it generated so that it will lessen the transmission fatalities and

price. Ordinary it's miles smarter and really green way for pollutants- free electricity generation.

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