Hybrid Power Generation System Using Wind and Solar Energy

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Abstract - In today's world, due to the growing demands of technology and rise in population, there has been a tremendous pressure on the electricity demands. The world needs to find alternative sources of energy. Hence renewable sources are being considered to meet the growing demands of energy. This paper proposes a unique standalone hybrid power generation system, applying advanced power control techniques fed by four power sources are wind power, solar power, storage battery and diesel engine generator , and which is not connected to a commercial power system. This electrical power can utilize for various purpose. Generation of electricity will be takes place at affordable cost. This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance.

Keywords - Electricity, Hybrid, Solar, Power, Wind.

I. INTRODUCTION

most other countries is blessed with large amount of sunshine all the year with an average sun power of 490W/m^2/day. Solar charged battery systems provide power supply for complete 24hours a day irrespective of bad weather. Moreso, power failures or power fluctuations due to service part of repair as the case may be is nonexistent.

II. WIND ENERGY

Wind is a natural phenomenon related to the movement of air masses caused primarily by the differential solar heating of the earth's surface. Seasonal variations in the energy received from the sun affect the strength and direction of the wind. The wind turbine captures the winds kinetic energy in a rotor consisting of two or more blades mechanically coupled to an electrical generator. The turbine is mounted on a tall tower to enhance the energy capture. Solar energy and wind energy have been deemed clean, inexhaustible, unlimited, and environmental friendly. Such characteristics have attracted the energy sector to use renewable energy sources on a larger scale. However, all renewable energy sources have drawbacks. Wind and solar sources is dependent on unpredictable factors such as weather and climatic conditions. Due to both sources, complementary nature, some of these problems can be overcome the weaknesses of one with the strengths of the other. This brings us to the hybrid solar-wind power plant concept. Hybrid energy stations have proven to be advantageous for decreasing the depletion rate of fossil fuels, as well as supplying energy to remote rural areas, without harming the environment.

The main objective of this paper is to assess the feasibility and economic viability of utilizing hybrid Solar– Wind–battery based standalone power supply systems to meet the load requirements.

III. SOLAR ENERGY

IV. HYBRID ENERGY SYSTEM

The Word hybrid means something which is made by the combination of more than one element. In energy system the electricity can be generated by more than one source at a time like Wind, solar, biomass etc. There are various modules to generate hybrid energy like wind-solar hybrid, Solar-diesel, Wind- hydro and Wind–diesel. Among the above hybrid energy generation module the wind-Solar hybrid module are more important because it is abundant in nature and it is very much environment friendly.

Hybrid energy generation is more important because the wind not floe continuously and sun radiation is only present approx. 8 to 10 hours in a day. So for continuous power it is important to hybridize the solar and wind power with the storage batteries. The hybridization in India has large prospect because over 75 % of Indian household face the problem like power cut specially in summer Solar energy is energy from the Sun. It is renewable, inexhaustible and environmental pollution free. Nigeria, like.

V.BLOCK DIAGRAM OF HYBRID WIND SOLAR ENERGYSYSTEM

The block diagram of the hybrid power generation system using wind and solar power includes the following blocks.

1. Solar panel
2. Wind turbine
3. Charge controller
4. Battery bank
5. Inverter

SOLAR PANEL

Solar panel is use to convert solar radiation to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron proton system of the material, creating charge carriers that are separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.

WIND TURBINE

Wind turbine is that system which extracts energy from wind by rotation of the blades of the wind turbine. Basically wind turbine has two types one is vertical and another is horizontal. As the wind speed increases power generation is also increases. The power generated 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.

CHARGE CONTROLLER

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

BATTERY BANK

We have to choose battery bank size per the load requirement so that it should fulfill 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 increase in battery bank size we need to connect cell in series so that we can get the larger battery bank size.

INVERTER

We have to choose greater rating inverter than the desired rating .The pure sign wave inverter is recommended in other to prolong the lifespan of the inverter. Inverter is need to convert DC power into AC power. As our load working on the AC supply so we need to convert DC power. The input voltage Output voltage and frequency, and overall power handling depends on the design of the specific device or the circuitry. The inverter does not produce any power. The power is provided by the DC source

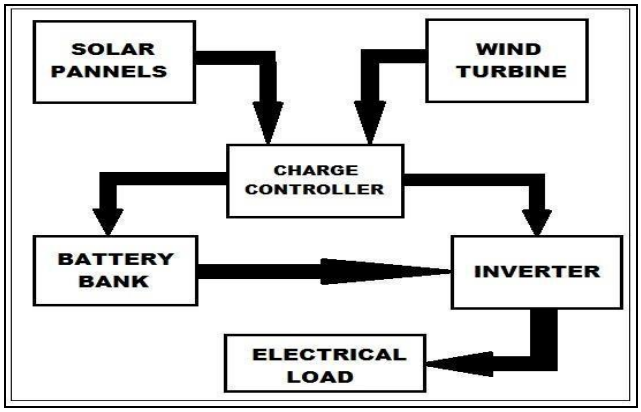


Fig.1 Block diagram of Hybrid energy system

VI. SIMULATION MODEL OF WIND SOLAR HYBRID SYSTEM

Simulation of the hybrid wind and PV system is shown in Figure. 1.3 which was done in MATLAB/SIMULINK environment. In Hybrid Wind-PV System, PV system acts as a main source. In Wind Energy conversion system, wind speed is varied continuously. PV and Wind systems are connected in parallel and the across this parallel combination, more than 30 V battery is connected which is in charging mode. If voltage across this parallel combination is

less than 30 V, battery is in discharging mode. If battery is only present in the circuit, percentage semi-oxide concentration linearly decreases and battery voltage rapidly decreases.

The main blocks in the above simulink diagram are Wind turbine block , Squirrel cage Induction Generator block, PV model block, MPPT block, DC/DC converter block, Battery model and discrete PWM generator block. The Wind turbine with optimum power control and pitch angle control act as prime mover for induction generator. The external inputs to the turbine are wind speed and rotor speed. Optimum power is obtained from the Power-Speed characteristics and it depends upon the speed of the turbine. Rotor side converter is controlled by vector control and its main objectives are active and reactive power flow control and maximum power point tracking. The grid side converter (Front End converter) main objective is to regulate the DC link capacitor voltage and this converter controls the power flow between the DC bus and the AC side.

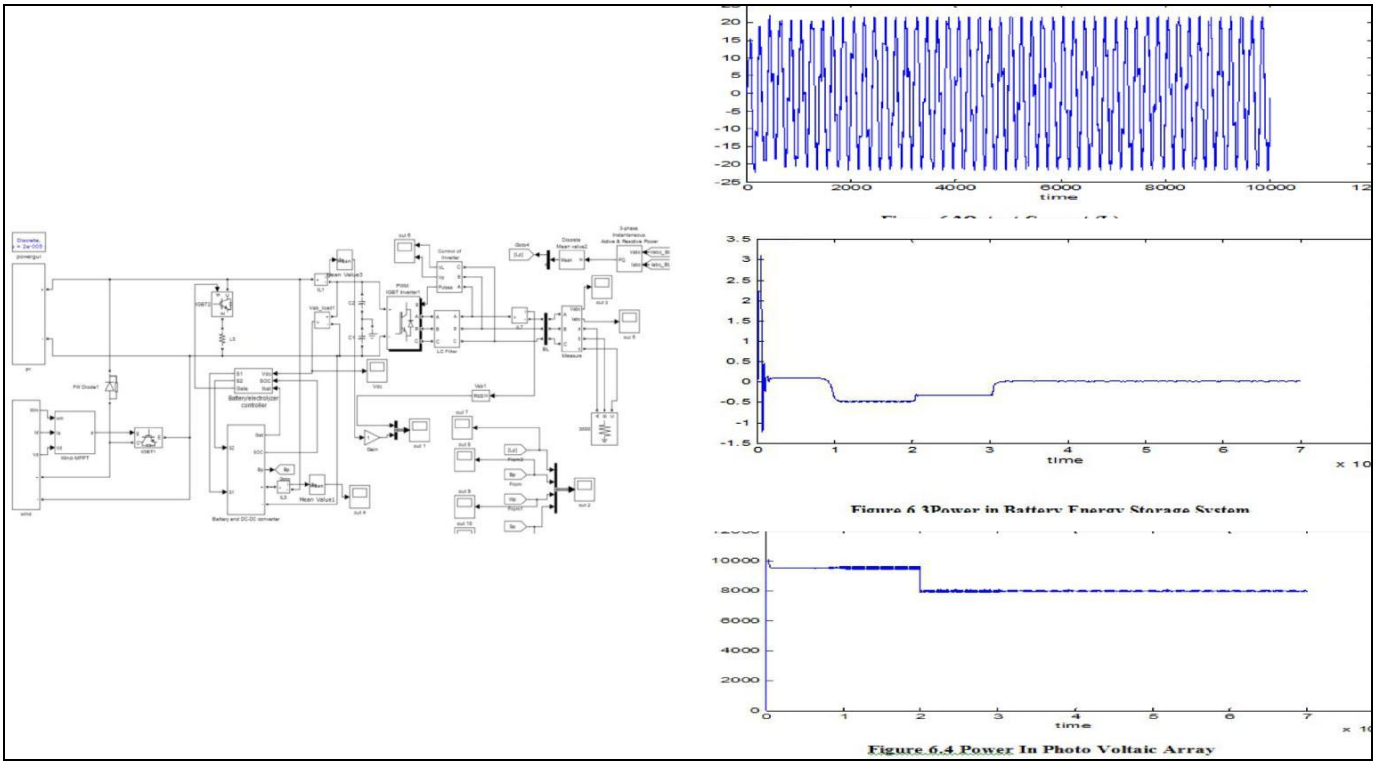
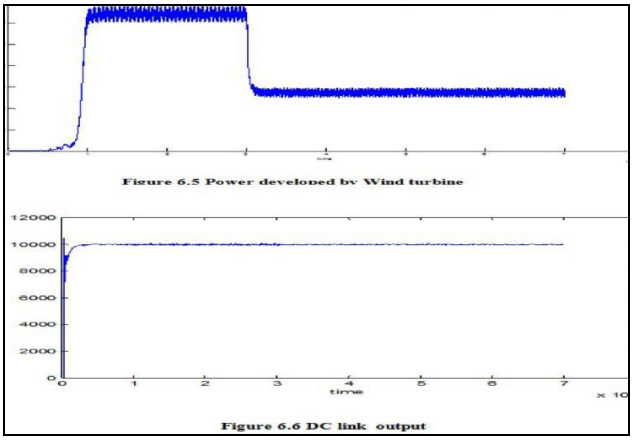
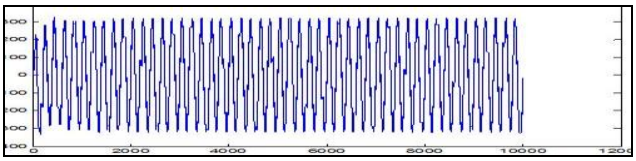


Figure 1.3 Simulation diagram of Hybrid wind and PV system



VII. RESULTS

The results of the dynamic performance, which validates the efficient MPPT of PV generation system when the irradiance changes dramatically are presented. The output voltage is shown in Figure.



VII. CONCLUSION

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it good, reliable and affordable solution for electricity generation.

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