

Design, Simulation and Control of Solar Wind Hybrid Renewable Power System

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ABSTRACT: As far as the growing demand of energy is increased we have not to rely fully on the fossil fuel as it produced harmful gasses which affects our environment and fossil fuel extend day by day renewable energy is generally inexhaustible and can be completely used over and over again. A combination of one or more renewable sources of energy is an important while considering hybrid system. In this paper we will be focusing more on hybrid concept i.e. solar PV with wind combination and we will see various aspects of integration design and optimization control system, energy constraints storage and environmental impact efficiency and overall factors will be shown.

KEYWORDS: Hybrid, fossil fuel, Solar PV, Wind, Energy Efficiency.

I. INTRODUCTION

Feasibility study on optimizing hybrid system by the combination of the solar PV with wind for uninterrupted power supply with concept on resource management and economic constraints has played an important role as far as increase in the demand of the power is concerned. Solar and wind energy system are the most important source of energy which has become a popular concept none a days with this view it is proposed in the study the present states of development of these energy system. A properly designed hybrid renewable energy system that combines two or more renewable energy sources with battery back-up increase the reliability of the system in the stand alone concept Micro grid systems have the ability to provide reliable and improve power quality. There are two major types of smart grid in the absence the main grid i.e. DC micro grid And AC micro grid. In Ac micro grid the energy source and the ability to regulate voltage and frequency can all mate the burden for conventional generating unit. In DC micro grid such problem does not exist however the issue of voltage handling is needed to be draft with it. This paper deals with the generation of the electricity by using two sources of renewable energy by without damaging the nature's balance.

1.1 HYBRID ENERGY:

Hybrid system is basically combination of two systems to give power to the load. In other word we can say that energy system with renewable sources is good reliable, low cost, low maintenance, low emission system. In the proposed system solar and wind energy used for generating power.

1.2 SOLAR ENERGY:

Solar energy is the energy which is get by irradiation on of the sun. It has low maintenance. It is pollution free only problem with the solar energy is that it does not produce energy more efficiently in bad weather condition.

1.3 WIND ENERGY:

Wind energy is the energy which is extracted from the wind for this we need wind mill. But energy produced by wind is very moderate and fully control fulfils the demand of the load by itself. The major disadvantage of using independent renewable energy resources is that the unavailability of the power all the time for overcomes these we have used the combination of the both solar PV and wind. This will load to the continuity of generation and make the system more reliable.

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1.4 DESIGN OF HYBRID ENERGY SYSTEM:

To design hybrid system we need some data/parameter as follow:

A. Data required for PV system

- I. Annual means daily change on the sun rays.
- II. MPPT (Maximum Power Point Tracking) angle.
- III. Solar radiance horizontal (KWH/M2/Day)

B. Data required for wind system

Mean annual wind speed (m/sec).

Here much wind power can be generated from turbine.

II. RELATED WORK

The Block diagram of proposed system is shown in Fig.1. When a direct connection is carried out between the source and load, the output of PV module is seldom maximum and the operating point is not optimal. To overcome this problem it is necessary to add an adaption device, an MPPT controller with a converter between source and load. The Pulse width (PWM) generator is required to maintain the switching mechanism because only when the desired output of current is attained then only the battery should be allowed to charge.

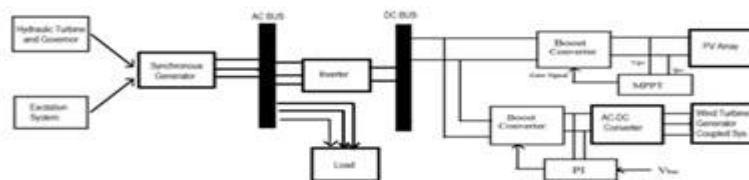


Fig.1: Block Diagram Of Proposed Work

The aim in designing Maximum power point controller is to find the voltage and current at which a Photovoltaic array operates to obtain maximum power under the given temperature and irradiance. Practically we have multiple local maxima, but overall there should be only one true MPP (Maximum power point. To find the optimal point and improve the efficiency of energy conversion we have done a controller design and verified its performance on the MPPT algorithms. The solar energy absorbed by the photovoltaic panel does not always generate a fixed output so a regulator should be connected before charging the battery. A voltage regulator is designed to automatically maintain a constant voltage level.

The best power that the panel can put out to charge the battery. The design of the simulation model of the proposed system is carried in simulink environment and it requires a physical to real time interface circuit for connecting the panel output as the input to controller circuit. The Pulse width modulation technique is employed in the controller design to achieve the output at highly varying switching speeds. The solar chargers use technology similar to other high quality battery chargers. When a battery reaches the regulation set point the PWM algorithm slowly reduces the charging current to return maximum amount of energy to the battery in the shortest time, that result in achieving a higher charging efficiency.

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III. METHODOLOGY

1. To develop the MATLAB Simulink model of the overall Solar PV-Wind Hydro hybrid system.
2. To develop the control logic for inverter to convert DC power obtained from solar PV-Wind (AC-DC) to AC active power and to generate reactive power within the inverter.
3. To develop the control logic for hydro unit to generate deficit amount of active power and reactive power required for the load.
- 4 Study and investigate different papers, articles, research works and reports related to hybrid system including renewable resources and hydro power plant.
5. Learn and practice various Simulink models in MATLAB software so to familiarize in the particular tools and techniques required for the report simulation and modeling.
6. Investigate and learn about the PV solar grid system in detail and prepare its Simulink model for the final simulation.
7. Investigate and learn about the Wind power system in detail and prepare its Simulink model for the final simulation.
8. Prepare the mathematical and Simulink model of the inverter with modifications as per requirement for the project.
9. Model the inverter for reactive power fulfilment of the system.
10. Develop a Simulink model for isolated hydro generating unit using synchronous generator.
11. Set up a complete plan and control mechanism for automatic operation of the overall system and Simulink model of the proposed system in MATLAB simulation.

IV. MATLAB SIMULINK MODEL & RESULTS

The system consists of the power-stage and control module. In Figure 2, the DC link is presented by a battery. The voltage level of the DC link of a PV system is stable. In the topology shown by Figure the voltage level of the solar panel is related to the voltage level of the DC link and the duty-ratio of the switching signal. Assuming that the voltage level of the DC link is constant, the perturbation in duty-ratio of the switching signal (G_s) will cause a variation in the voltage level of the solar panel so that the operation point of the solar panel could shift. The key of the MPPT algorithm is to figure out the appropriate value for the duty-ratio, which can lead the solar panel to achieve its maximum power point [1]. It is worthwhile to note that the PV DC-DC boost system can be generally modelled by the Figure The system consists of the power-stage and control module. In Figure 2, the DC link is presented by a battery.

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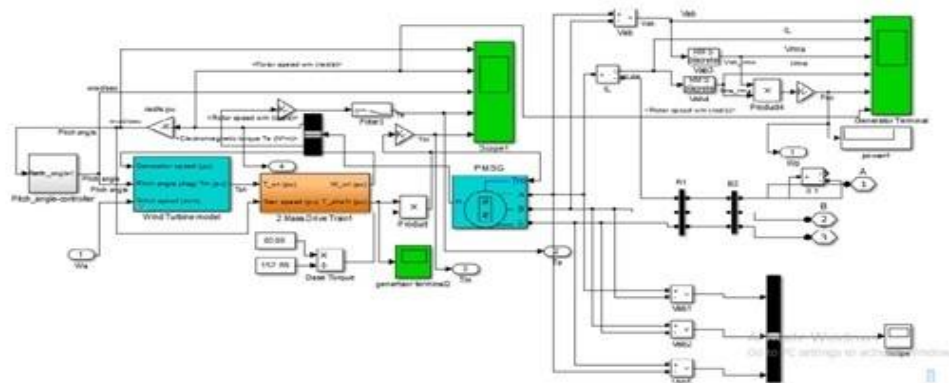


Fig. 2: MATLAB model for improving efficiency of the system

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V. CONCLUSION

Hybrid power generation system is get effective concept to meet the demand of the power. It has the greater efficiency. It is highly safe for the environment as it doesn't produce any emission of harmful waste product like conventional energy.

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