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Research Paper

Engineering

# Optimization of Off-Grid Hybrid Solar-Wind Power Flow System To Obtain Maximum Power Generation

**Aditi Tripathi** Kalinga University, Naya Raipur

**Lumesh Kumar Sahu** (Assistant Professor), Kalinga University, Naya Raipur

**ABSTRACT** *Electricity is the need of society. To provide electricity for household use to each family in each locality including remote villages of each state a very efficient power generation unit is required. Conventionally electricity was generated using only solar systems. It will be more efficient way if we use hybrid methods of power generation. Two individual DC-DC boost converters are used to control the power flow to the load. A simple and cost effective control with DC-DC converter is used for maximum power point tracking (MPPT) and hence maximum power is extracted from the o turbine and the photo voltaic array. This paper proposes a hybrid energy conversion system combing photovoltaic and wind turbine as a small-scale alternative source of electrical energy.*

**KEYWORDS : Hybrid energy system, PV power generation, Cost effective design, Green energy.**

## I. Introduction

Currently, obtaining reliable and cost effective power solutions for the household use especially for minimum needs like house light, for recharging mobile, for TV use in rural and remote areas is a very challenging problem. Alternative energy resources, such as solar energy and wind energy, have attracted energy sectors to generate power on a large scale. A drawback, common to wind and solar options, is their unpredictable nature and dependence on weather and climatic changes. Fortunately, the problems can be partially overcome by integrating the two resources in a proper combination to form a hybrid system, using the strengths of one source to overcome the weakness of the other. However, the complexity, brought about by using of two different resources together, makes the hybrid systems more difficult to analysis. Good compensation characters are usually found between solar energy and wind energy. This necessitate an optimal design model for designing hybrid solar–wind systems employing battery banks for calculating the system optimum configurations and ensuring that the annualized cost of the systems is minimized. The five decision variables included in the optimization process are the PV module number, PV module slope angle, wind turbine number, wind turbine installation height and battery capacity. The proposed method has been applied to design a hybrid system to supply power .The research and project monitoring results of the hybrid project were reported, good complementary characteristics between the solar and wind energy were found, and the hybrid system turned out to be able to perform very well as expected throughout the year with the battery over-discharge situations seldom occurred.

## II. Material and Methodology

An alternative multi-input rectifier structure is proposed for the hybrid wind/solar energy system. The proposed block diagram, a fusion of the cuk and SEPIC converters, is shown in figure 1, where one of the inputs is connected to the output of the PV array, and the other input to the output of a generator. The fusion of the two converters output is combined and it is given to the rectifier block.

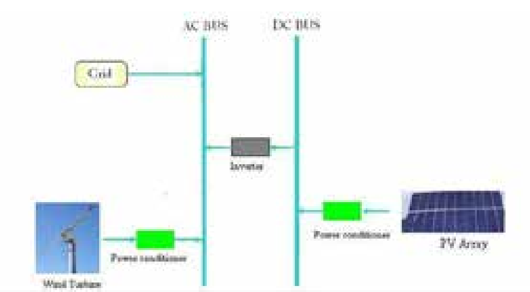


**Figure: 1 Basic structure of the hybrid solar wind system**

The rectified AC voltage is given to the load. This configuration block diagram shown, allows each converter to operate normally, individually, in the event of one source being unavailable.

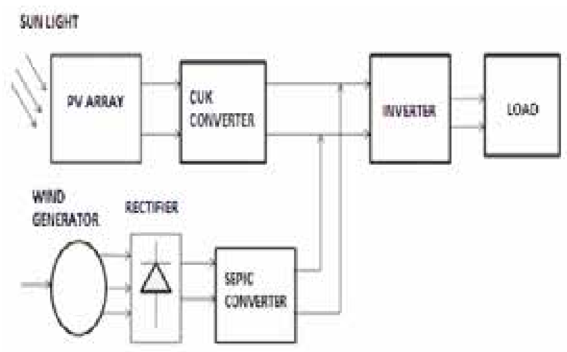


**Figure: 2 Block diagram of the hybrid system**

The PV-cell-manufacturing process is energy intensive. Every square centimeter of cell area consumes more than a kWh before it faces the sun and produces the first kWh of energy. However, the energy consumption during manufacturing is steadily declining with continuous implementation of new production processes.

## III. Results and outcomes

A simulink model has been prepared using Simulink/ MATLAB and simulated for hybrid solar-wind system. The results obtained are as follows

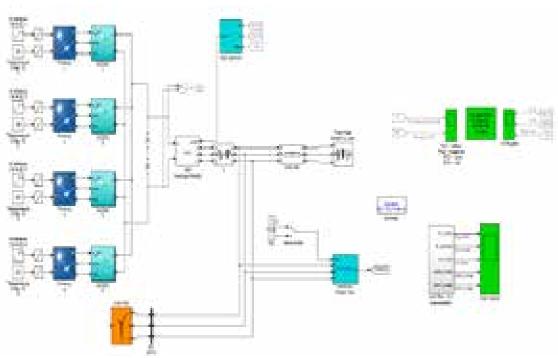

**Figure: 2 Simulink model of the hybrid system**

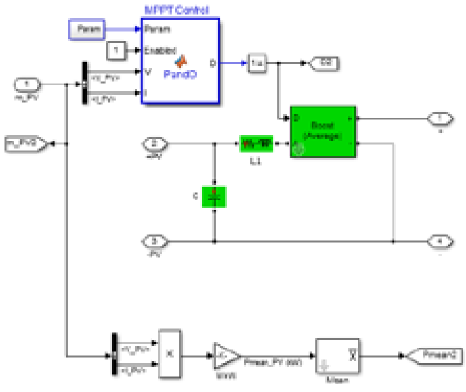

**Figure: 3 MPPT Control of Solar Array**

From the simulation results it is observed that the variations in output power are more in PV system because the voltage across PV module is changing rapidly whereas the variations in output power in wind energy conversion system is less because the voltage across wind system is almost constant and the battery voltage decreases exponentially and the battery current increases exponentially.

After designing and implementing of proposed method with Optimization of hybrid Solar-Wind power there is higher efficiency of system, precise power control, power quality improvement in generation from PV system and Wind generator and short-circuit protection.

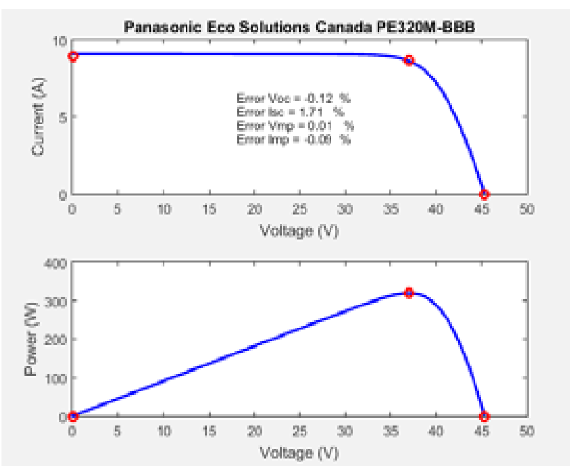


**Figure:4- Module Used for PV array**

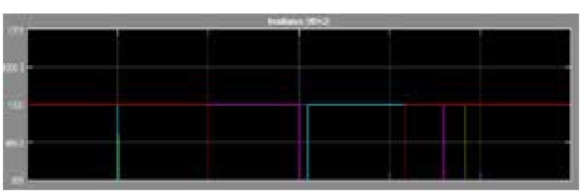

**Figure 5:- Irradiance of PV array**

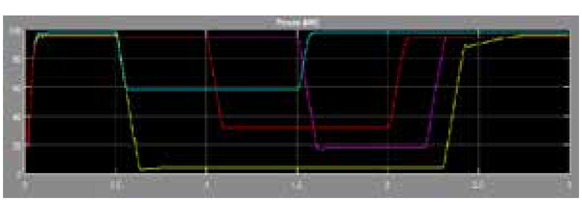

**Figure 6:- Pmean of PV array**

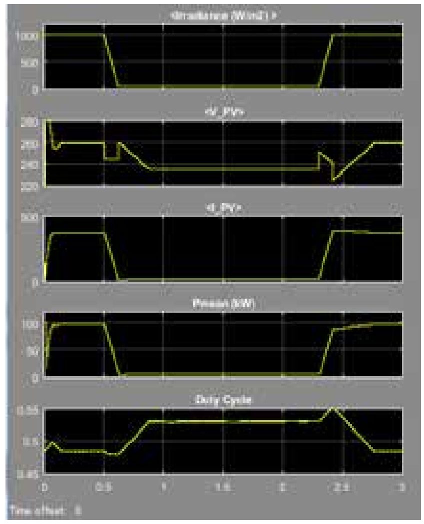

**Figure 7:- Output Parameters of PV array**

## IV. Conclusion

A generalized PV model which is representative of the all PV cell, module, and array has been developed in MATLAB/SIMULINK .The proposed model takes sunlight irradiance and cell temperature as input parameters and outputs the I-V and P-V characteristics under various conditions. This model has also been designed in the form of Simulink block libraries. The masked icon makes the block model more user-friendly and a dialog box lets the users easily configure the PV model. This paper describes renewable energy hybrid Wind-PV with battery energy storage system. In Hybrid Wind-PV System, PV system acts as a main source. A simple and cost effective maximum power point tracking technique is proposed for the photovoltaic and wind turbine without measuring the environmental conditions. This is based on controlling the photovoltaic terminal voltage or current according to the open circuit voltage or short circuit current and the control relationship between the turbine speed and the dc-link voltage is obtained using simple calculations. A complete description of the hybrid system has been presented along with its detailed simulation results which ascertain its feasibility. The power fluctuation of the hybrid system is less dependent on the environmental conditions as compared to the power generated of individual PV and WG systems.

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