A Novel Approach for Integration of Solar-Wind Energy System Using MPPT Algorithm

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***Abstract*-Amongst all the renewable resources, wind and solar are the most popular resources due to its ease of availability and its easy conversion into electricity. Each renewable resource uses DC/DC boost converter separately with MPPT control to generate power. The main objective of this work to meet out the power demand is reduced, the increase the additional load. In a hybrid systems, extracting a huge amount of energy from the wind and solar are possible by using MPPT technique. Many MPPT methods, like Perturb and Observe method, is the most popularly for its easy implementation and simple structure. In the proposed method, the concept behind this method is that observation of output power and its perturbation by changing the current or the voltage of hybrid operation. Maximum power point tracking accurately tracks the maximum power in a hybrid system using P&O method. The effectiveness of proposed MPPT algorithm done and implemented using MATLAB/SIMULINK.**

***Keywords*- Photovoltaic systems, maximum power point tracking (MPPT), Perturb-and- observe (P&O), wind energy conversion system (WECS) and Boost converter**

I. INTRODUCTION

Nature is filled with lots of natural fuel reserves. On continuous usage, these resources are getting reduced in quantity. Also, when fossil fuels are burnt to produce the energy they emit carbon dioxide which is a major cause of global warming, so it's mandatory to alteration of renewable energy sources. Among those other alternative sources, PV and Wind power are best alternatives among other renewable resource.

Solar and wind energy is the most important energy resource. Since it is clean, pollution-free and inexhaustible. Solar photovoltaic generation systems have two inherent major problems. The first is low conversion efficiency.

Second is a presence of highly nonlinear i-v characteristics. Further, due to a mismatch between the operating point and Maximum Power Point (MPP) of the solar cells. In order to extract the maximum amount of energy, the PV system must be capable of tracking solar panel unique maximum power point that varies with irradiance and temperature.

For maximum energy extraction, the speed of the wind turbine is the optimum tip-speed ratio is maintained constant. A maximum power point tracking (MPPT) algorithm is developed. It extracts maximum power from the wind turbine for wind speeds from the cut into rate, by generating a suitable reference voltage to the dc-dc converter. A separate controller generates the reference current for the inverter in such a way that the dc link voltage is maintained constant.

The main objective of such algorithm is to achieve faster and accurate tracking performance. A simple control method to tracks the maximum power from the wind/solar energy source to achieve much higher generating capacity power. Many MPPT methods, Perturb and Observe method is most popularly used for its easy implementation and simple structure.

The proposed system aims to integrated solar and wind energy in Perturb and observe method by using MATLAB/SIMULINK.

II. SCOPE

Now a day more important is hybrid energy generation because solar radiation is only present approximately 8 to 10 hours in a day and wind, not flow continuously. 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, especially in summer.

The main scope of this project is to reduce the load demand in order to increase power in both solar and wind. MPPT method by using additional load to be integrated.

III. LITERATURE SURVEY

Individual photovoltaic (PV) or wind energy system, do not generate utilizable energy for a large portion of the time system. The hybrid design is an important power generation method all over the world. Maximum Power Point Tracking is a technique used commonly with wind turbines and photovoltaic (PV) solar systems to maximize power extraction under all conditions. It is used for controlling the Direct Current (DC) to DC boost converter. Boost converter working in continuous conduction mode (CCM) is unremitting part of the converter is model by differential equations and state

space models, while the switching actions are recently more accurately model by state charts[1,2]. Boosting the DC voltage to a sufficient level using the converter, and obtaining pure AC voltage from the inverter, are the keys to realize the above targets. Availability of energy source depends on load can be connected by two sources. The inherent nature of these two converters eliminates the need for separate input filters. The operations of these fused converters are compared with the separate parallel operation of the Cuk and SEPIC converters [3]. Normally wind energy system to produced maximum power extraction. It is consist of the rectifier, boost converter, permanent magnet synchronous machine (PMSM), inverter and a microcontroller send a command to the dc/ dc converter [4].The DC-DC converter can work in wide range of specifications and track the maximum power point on a different generator in series operation. The turbine capture the wind energy and the permanent-magnet synchronous generator (PMSG) transforms the captured mechanical power to electrical power which is associated with the wind speed and pitch angle. Concurrently, the DC-DC converter controls the power to regulator maximizes the generator power [5, 6]. Tip Speed Radio is maintained constantly at its optimal value, this ensures that the energy extracted is in its maximum operating point too. Therefore, this method finds to force the energy conversion system to work at this point continuously by comparing it with the actual value and feeding this difference to the controller[7].Small-scale wind energy system change DC current the perturbing variable. The algorithm detects sudden wind speed changes indirectly through the dc-link voltage slope. The two method can change the speed of fluctuation condition to be under perturbing and observe (P&O) mode with adaptive step size [8, 9].Battery storage is designed to supply continuous power and to provide the deficit power .when the combined wind and photovoltaic sources cannot meet the net load demand [10]. This paper aims to reduced load demand in order to integrate additional load by using MPPT P&O method.

IV. EXISTING BLOCK DIAGRAM

The hybrid design is an important power generation method all over the world. Solar energy relatively less polluted and maintenance free. But it is not produced constant power, in order to improve performance by using MPPT Algorithm.

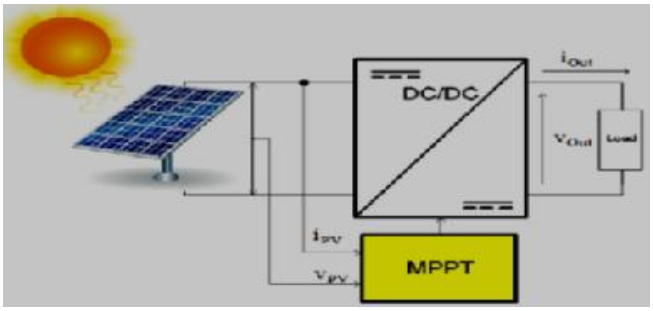

Fig 1. Basic Solar plant diagram

Solar energy relatively less polluted and maintenance free. But it is not produced constant power, in order to improve performance by using MPPT Algorithm.

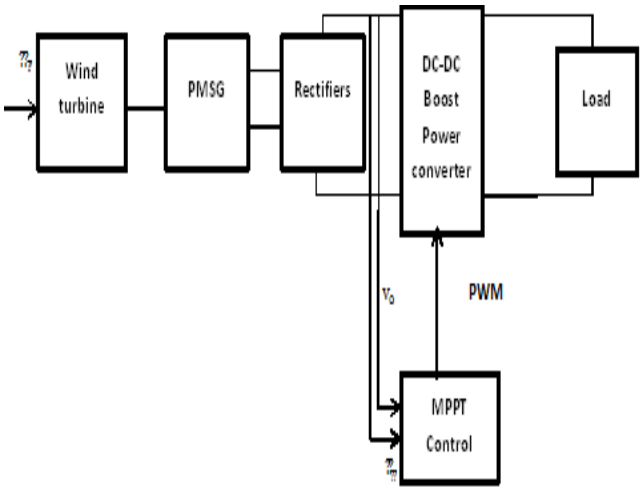

Fig 2. Wind plant diagram

The wind energy can be control by the DC-voltage from PMSG to work at maximum power point and realize the series buck-boost converter. As such, many MPPT methods have been introduced and numerous variants of each method have been proposed to overcome specific disadvantages. Problem identification for this paper is Switch does not contain a closed loop, Power demand cannot be compensated to load and Performance of Maximum Power Point Tracking accurately continuous update via simulation and lab testing is needed.

V. PROPOSED BLOCK DIAGRAM

Hybrid renewable energy system Utilizes two or more energy sources, usually solar, wind and battery power. The proposed system uses the combination of solar and wind system for both day and operation. Solar can achieve the highest efficiency in sunny days. Where the wind system can perform both day and night operation without any restriction of climate. In order to achieve the highest efficiency for renewable energy systems in a whole day, hybrid solar wind turbine system is one of optimum solution to generate the energy in anytime and all-weather Conditions. The main advantage of solar and wind power production is used together, the reliability of the system is enhanced.when a source is lacking in meeting the load demands, the other energy source can compensate the shortage. Additionally, we can use battery resource. In the proposed system, integrated solar, wind and battery power to reduce the load demand by using MPPT algorithm P & O technique.

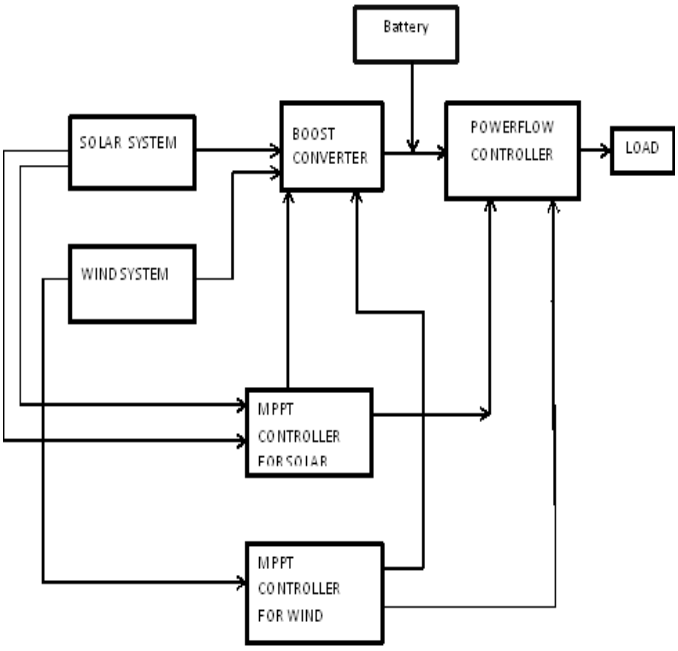

Fig 3. Basic block diagram

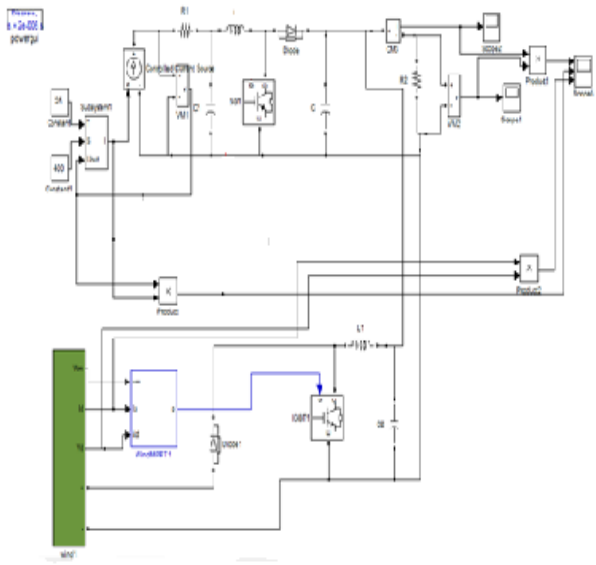

Fig 4. Simulation model for hybrid solar-wind

Solar and wind energy source separately current flow through current control source and voltage measurement. This block is used for analysis of maximum power available from the source. IMPP and VMPP are input to the boost converter. The change in duty cycle is necessary to control the output voltage. The switch is used to run simulation under real data or any specific data. The Plot of theoretical instantaneous maximum power from solar panel and wind, a power that can be transferred from the source under boost converter and the maximum power that cannot be extracted.to overcome the problem by using MPPT method.

VI. MPPT TECHNIQUE

There exists a single point in a power-voltage curve called maximum power point (MPP) at which maximum output power of PV and wind system can be collected. PV panel ray flow through MPPT controller is connected to boost converter and power flow controller to operate PV system MPPT at all operating condition. Wind system is directly connected to MPPT controller is connected to boost converter and power flow converter to operate wind system at MPPT all operating condition. Separation MPPT algorithm estimates the MPP and forces the PV system and wind to operate at that estimated MPP with the help of a converter to providing appropriate duty signal to it. The MPPT algorithm is needed to be efficient one because its performance is directly related to the power conversion efficiency of the entire PV system and wind system by using perturb and observation.

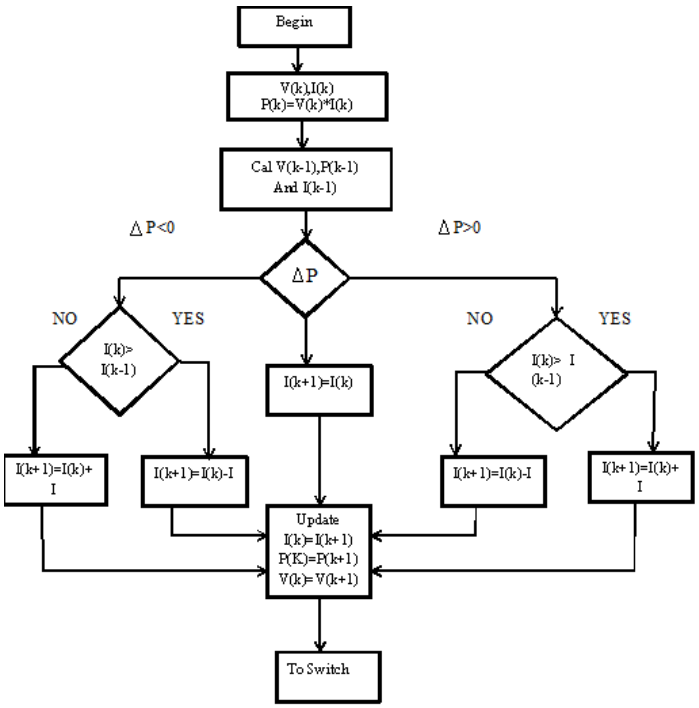

Fig 5. Flowchart

VII. SIMULATION OUTPUT

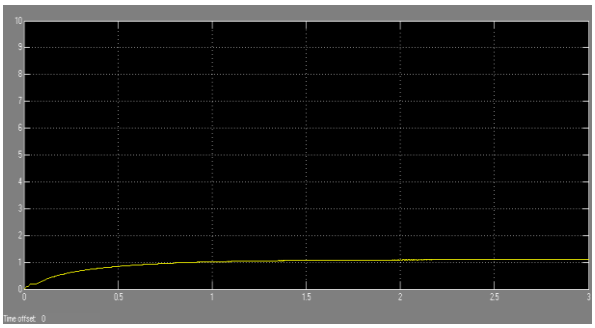

Fig 6.I –V characteristics

Hybrid system output current can vary time and magnitude, stable output reaches 1.

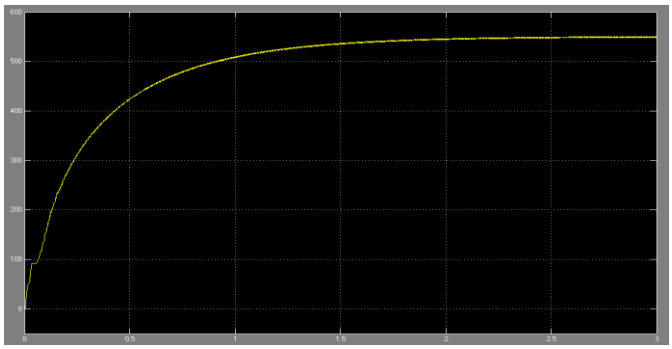

Fig 6.2 P-V characteristics

Hybrid system output power can vary time and magnitude, stable output is reaches 550.

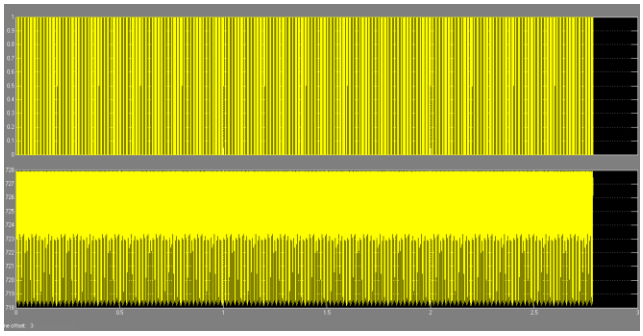

Fig 6.3Simulation result of P&O Algorithm

Output power and output voltage after maximum power the maximum power which is approximately 26.3 volts. From fig 5.3 we can see the maximum power which is approximately 200 watts can be tracked point tracking are manifested. As we observe from the fig 6.3, maximum power is achieved at voltage 26.3 volts, we can see we are able to track the output voltage where we can get.

VII. CONCLUSION

Solar and wind system are simulated and effect of environmental conditions has been studied. Maximum power point tracking techniques extract the maximum output power of the PV systems at certain weather conditions to maximize its efficiency. When combining both solar and wind, the efficiency is much more increased than the usual method. This hybrid system is supported to give maximum output power under all condition to meet the load demand. This system is more reliable and thus it reduces load demand for integrated hybrid system technology. Various algorithms are compared and final hardware is implemented.

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