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SOLAR AND WIND BASED HYBRID ENERGY SYSTEM USING MODELING AND SIMULATION

[1]C P SUDHAKAR, [2]Dr. K VENKATA SUBBAIAH, [3]BHUMIREDDY RAVINDRAREDDY, [4]GUGLOTH VIDYA, [5]KONYALA ARAVIND, [6]MANAPURAM SAIPRIYA, [7]MOHMMAD ABDUL SIRAJ

[1]Assistant Professor, Dept. Of EEE, DRK INSTITUTE OF SCIENCE & TECHNOLOGY, Hyderabad,

[2]Professor & Principal, Dept. Of CSE, DRK INSTITUTE OF SCIENCE & TECHNOLOGY, Hyderabad,

[3]Assistant Professor & HOD, Dept. Of MECH, DRK INSTITUTE OF SCIENCE & TECHNOLOGY, Hyderabad,

[4,5,6,7]BTech Student, Dept. Of EEE, DRK INSTITUTE OF SCIENCE & TECHNOLOGY, Hyderabad

Abstract: This article is a simulation, designing and modeling of a hybrid power generation system based on nonconventional (renewable) solar photovoltaic and wind turbine energy reliable sources. The primary premeditated system is the solar electric generator, consisting of six models and series connected to each other, based on predicted-P&O and connected to a MPPT controller and DC/AC converter, system is associated with PMSG (permanent magnet synchronous generator). The main purpose of this article is to interconnect systems to generate maximum power for single auxiliary phase loading, as well as the solar PV generator and systems of wind turbines for simulation with execution use of Simulink / MATLAB. The results of this simulation indicate that the hybrid power system is planned for stability, reliability, efficiency and model. Solar PV generator and wind turbine from the use of a renewable energy source (for maximum voltage generation). The solar photovoltaic module executable in MATLAB / Simulink captures five parameters, series parameters and shunt resistance are an inverse photovoltaic saturation flow and an ideal factor.

Keywords: Solar power, Wind power, Micro hydro power, Hybrid energy systems, power generation.

I. INTRODUCTION

In electricity systems renewable energy sources are playing a significant and fundamental role, and utilization of photovoltaic solar energy is rising exceptionally day by day. Photovoltaic panels and electrical inverters are used to generate solar power. In nature, the output power generated. By the photovoltaic panels is discontinuous and varies depending on the level of irradiancy,

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temperature, aging of the panels, various orientations etc [1]. In several implementations, particularly in rural areas, a solar photovoltaic system is more cost effective and environmentally friendly. This work develops and reveals the fundamental combination of the photovoltaic array as well as examines the substantially different outputs characteristics of the solar photovoltaic array under different conditions along with variations in temp, changes in irradiance and various internal resistances to illustrate the different impacts of the parallel and the series solar PV array. The article discusses the model of a photovoltaic cell on the basis of equation of Shockley diode in MATLAB[2]. A comparison was also discussed between double and single diode models of the cell of solar photovoltaic's. This work has generally designed the feature model of a photovoltaic cell with inverters and filters. The hybrid electric system integrates of two or more non-conventional energy sources. There are certain benefits; it is more efficient than separate productivity, cost, mobility and reliability of energy sources. Moreover, it is mostly a few financial and environmental benefits, but also achievable with up and down production costs.

II. LITERATURE SURVEY

For our project we are surveying some reports and references which are helping us to make it easy and simplest and they are as follows S. Jain, and V. Agarwal, "An Integrated Hybrid Power Supply for Distributed Generation Applications Fed by Nonconventional Energy Sources," in these chapter a review of the literature is suggested about the modern techniques use in a hybrid power generation, its control and monitoring. Also introduce to the equipment's for controlling the hybrid power generation [1]. A. O. Ciuca, I. B. Istrate, and M. Scripcariu, "Hybrid Power-Application for Tourism in Isolated Areas," in these chapter a review of the literature is suggested about the regulatory changes has brought increasing opportunities for distributed power generation at small scale for meeting the requirements of a single house, a community, a commercial activity in an efficient way close to the point of demand than main grid connected to a large centralized power plant [2]. Non-conventional energy sources by smt. C. K. Rai, in these chapter a review of the literature is taken about how the actual hybrid power plant is being constructed in large scale, as it is very easy to set up a hybrid power plant [3]. Ahmed et al., "Power Fluctuations Suppression of Stand-Alone Hybrid Generation Combining Solar Photovoltaic/Wind Turbine and Fuel

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Cell Systems, Energy Conversion," in these chapter a review of the literature is taken about a hybrid system model that included fuel cell generation along with wind and solar power. The fuel cell system was used as a backup resource, where as the main energy sources were the solar and wind systems. Results demonstrate that the system is reliable and can supply high-quality power to the load, even in the absence of wind and sun [4]. Deshmukh and Deshmukh, "Modeling of hybrid Renewable Energy Systems", Renewable and Sustainable Energy Reviews, in these chapter a review of the literature is discussed about methods of modeling and designing hybrid renewable energy systems, and also issues involved in increasing the penetration of such systems [5]. Yang et al., "Weather data And probability analysis Of hybrid photovoltaic-wind power generation systems" in these chapter a review of the literature is taken about the development of a hybrid wind/solar system which are used to calculate optimized combinations of PV module, wind turbine design of a hybrid power generation system, with the objective of maximizing power, while minimizing cost [6, 7]. Tina et al., "Hybrid solar/wind power system probabilistic modelling for long-term performance assessment", in these chapter a review of the literature is taken about assessed the long-term performance of a hybrid wind/solar power system for both standalone and grid-dependent applications by using a probabilistic approach to model the uncertain nature of the load and resources [8].

i. Principle operation

When sunlight is irradiated, a photovoltaic cell generates current and the pair of electron holes is generated, while photovoltaic cell equipment absorbs photons with an energy that exceeds the material's band gap. These generate dphotons are carriers that remove this cell's internal electrical fields and help to the current when the external circuitis linked to the cell.

ii. Photovoltaic cell corresponding circuits

Two types of diodes and established equivalent circuit shown in Figure 1 & 2 can represent a photovoltaic cell.

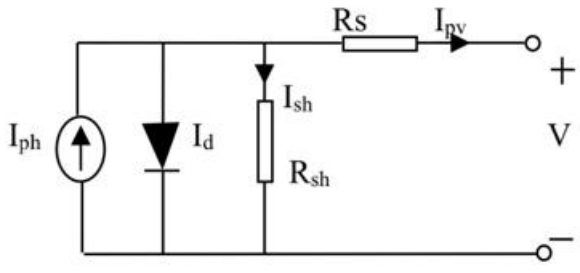

Fig.1. Circuit of single diode

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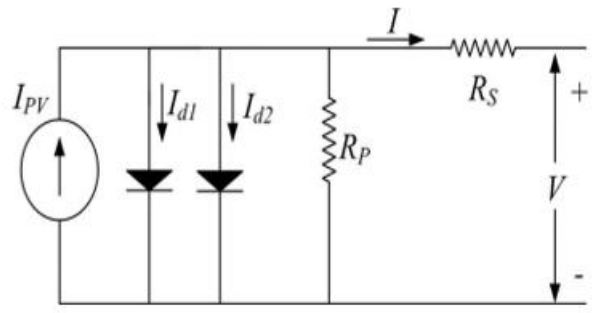

Fig.2 Circuit of double diode

Whenever sun light irradiated to photovoltaics' cell, it generates direct current that varies widely sequentially with photovoltaic radiation, and the model could be enhanced by adding shunt resistance (RP) and series (Rs) effects. Rsis initiated here to take into account internal losses and voltage drops due to current flow and Rp reflects the leakage of current to the surface whenever diodes are reversed.

iii. Comparison of double and single diodes models

Any double diode model reflects the impact of free electron and pair of photons recombination. However, it actually increases the number of equations, and also unspecified parameters, attempting to make simulations slight, complex, but greater precise than the single - diode model. Mathematical errors are less in the single in view of mathematical calculations and the number of iterations.

iv. Photovoltaic Cell

The photovoltaic cell is one of the semiconductor devices that absorbing and converting the photon energy that approaches energy from sunlight radiation. In the perfect photovoltaic cell model, it is extremely complex to determine the parameter associated with cell temp and Which rises the response time of the process. On the contrary, steady state oscillation around the MPP is produced by enlargement the size of perturbation.

The radiation intensity such as ILG, IOS, Rsh, and Rs. Manufacturers of photovoltaic's arrays give various observational conceptual parameters including current of shortcircuit ISC, voltage of open circuit VOC, max voltage point Vm, max power point current Im, and max power point Pm

$$I = I_{PV} - I_{d1} - I_{d2} - \frac{V + IR_s}{R_p}$$

Whereas Rp and Rs are the parallel and series resistance, correspondingly.Althoughthe diodes thermal voltage is VT. The created current by lights is (IPV)

$$I_{PV} = (I_{PV-STC} + K_I(\mathrm{T} - T_{STC}))\frac{G}{G_{STC}}$$

IP V_STC is computed in the standard test condition (STC), i.e., irradiance G = 1000 W/m2 and temperature T = 298 K (25◦C).

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Variable KI is frequently delivered by the constructor, which is coefficient of the ISC. Diode's saturation current.

$$I_{d1} = I_{d2} = \frac{I_{SC-STC} + K_1(T - T_{STC})}{\exp((V_{OC-STC} + K_V(T - T_{STC}))/V_T) - 1}$$

.

In (3), ISC_STCis the short circuit current and VOC_STC is the open circuit voltage in standard test condition (STC). The voltage's temperature factor is denoted by Variable KV.

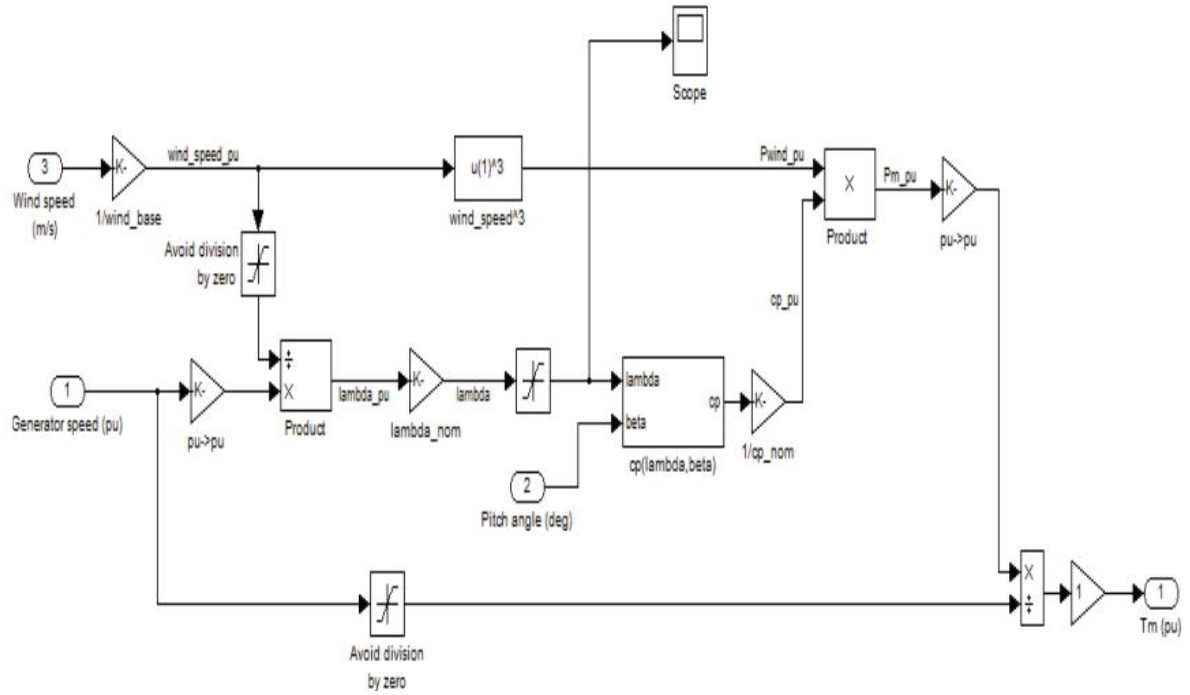

Fig.3 Simulink model of wind turbine

III. HYBRID POWER GENERATION SYSTEM

Hybrid energy system is the combination of two energy sources for giving power to the load. In other words, it can be defined as an Energy system which is fabricated or designed to extract power by using two energy sources is called the hybrid energy system. Hybrid energy systems have good reliability, efficiency, less emission, and lower cost. In this proposed system solar and wind power is used for generating power. Solar and wind have good advantages over other non-conventional energy sources. Both the energy sources have greater availability in all areas. It needs lower cost. There is no need to find a special location to install this system. There is a growing need for energy throughout the world. This insatiable demand is being driven from an ever-expanding growth from the middle class of people in emerging economies looking to avail themselves of conveniences and tools

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that are normally taken for granted. Additionally, the worldwide explosion of technologies of all types, including personal electronics, mobile devices, and (quality of life) conveniences, place a greater demand or strain on traditional grid or utility supplied energy sources. Hybrid systems that use renewable energy sources, such as solar and wind resources, may be feasible and an alternative to supply electricity to remote or isolated areas from the national grid and help in reducing the use of fossil fuels, dependence on costly fuel, and reduce the emission of greenhouse gases. As we know that sun is available in the day only, energy is not available during night from sun whereas wind energy is available throughout the day and its capacity increases in the nights. Here when sun is not available wind energy comes to play and vice-versa. Thus, hybrid power plants are more useful than individual ones and therefore they are extensively used nowadays. Additionally, the worldwide explosion of technologies of all types, including personal electronics, mobile devices, and (quality of life) conveniences, place a greater demand or strain on traditional grid or utility supplied energy sources.

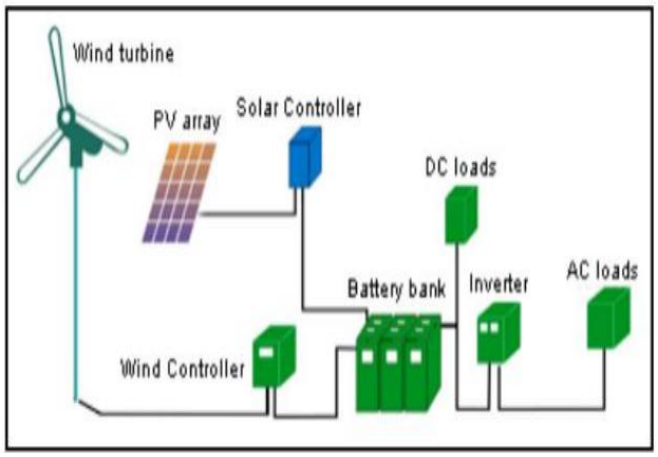

Fig. 4 Hybrid System

Grid Connected Hybrid power system simulation and modelling. Perhaps the hybrid power system, which consists of two non-conventional energy sources, the combination of solar photovoltaic and wind turbine system and providing single phase AC load.

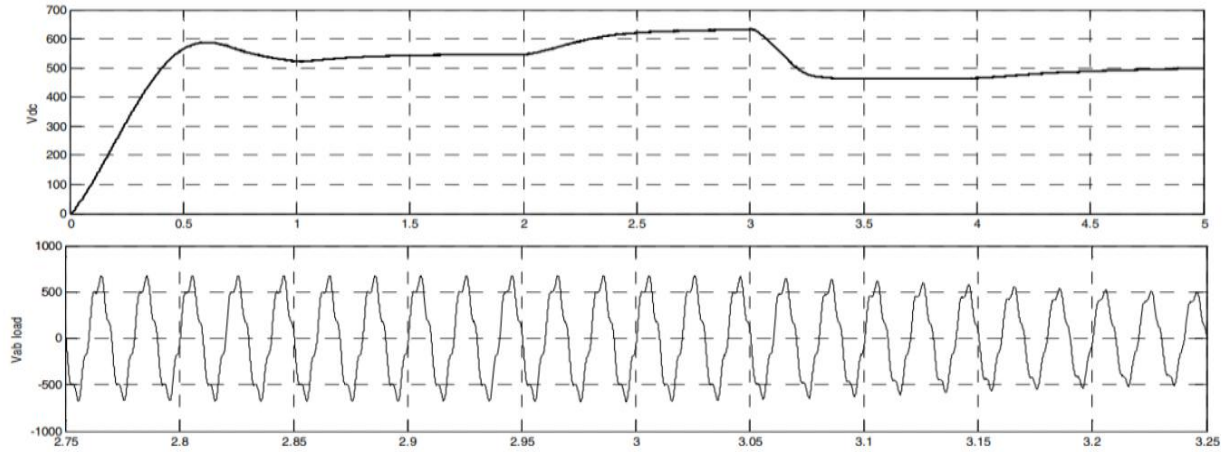

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Fig.5 Output for both wind speed and solar

The above figure represents the voltage waveform of wind turbine and solar photovoltaic system based on the predictive -P&O MPPT technique.

IV. CONCLUSION

The objective of this article is the integration of wind turbine system with solar photovoltaics' system to demonstrate the efficiency, reliability, and maximum power generation of a hybrid power system. Then each system was premeditated and modelled unaccompanied and subsequently joined to compare the voltage and power variation use of Simulink / MATLAB. In fact, the effects of the simulation actually demonstrate the efficiency of the planned hybrid power system, in order to generate maximum power for moist summer weather in various countries trying to use renewable energy. Recently, the power generation of average lightness and wind velocity are valuable and beneficial. The solar cell's performance depends mainly on climate conditions. Entire field tests to monitor solar cell performance are highly costly. A comprehensive simulation study can accumulate resources and time, however. All these concerns are covered by the solar photovoltaic's model implemented using MATLAB /Simulink. The Simulink execution of the solar photovoltaic model has five parameters in the description.

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