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Design and Implementation of Solar-Wind Hybrid System Generation

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Abstract - *Hybrid Energy System by joining sun oriented photovoltaic and wind turbine as a little scale elective wellspring of electrical vitality at where customary age isn't viable. A straightforward PWM control method has been proposed for most extreme power point following from the photovoltaic exhibit and wind turbine under fluctuating climatic conditions without estimating the irradiance of the photovoltaic or the breeze speed. Portrayal of the proposed half and half framework alongside recreation results which discover its attainability are given to show the accessibility of the proposed framework in this project. In this undertaking, an independent sunlight-based breeze cross breed framework comprising of a photovoltaic (PV) exhibit, battery bank, wind turbine, and a three-stage lasting magnet synchronous generator (PMSG), two lift DC-DC converters.*

***Key Words*: WIND POWER, SOLAR POWER, BATTERY, MATLAB/SIMULINK.**

1.INTRODUCTION

Sustainable power Sources are those vitality sources which are not annihilated when their vitality is bridled. Human utilization of sustainable power source requires advancements that bridle common wonders, for example, daylight, wind, waves, water stream, and natural procedures, for example, anaerobic absorption, organic hydrogen creation and geothermal warmth. Among the previously mentioned wellsprings of vitality there has been a great deal of improvement in the innovation for bridling vitality from the Solar and wind Solar and wind vitality are non-deflectable, site subordinate, non-contaminating, and potential wellsprings of elective vitality alternatives. Numerous nations are seeking after the choice of wind vitality transformation frameworks; with an end goal to limit their reliance on fossil-based non-sustainable energizes. Additionally, by and by a great many photovoltaic (PV) arrangements exist around the world, giving capacity to little, remote, matrix free or remain solitary applications. For the two frameworks, varieties in meteorological conditions (sun-oriented light and normal yearly wind conditions) are vital. The execution of sun based, and wind vitality frameworks are emphatically reliant on the climatic conditions at the area. The power produced by a PV framework is exceedingly subject to climate conditions. For instance, amid overcast periods and around evening time, a PV framework would not produce any power. What's more, it is hard to store the power produced by a PV framework for some time later. To beat this issue, a PV framework can be coordinated with other substitute power sources as well as capacity frameworks, for example, electrolysis, hydrogen stockpiling tank, Fuel Cell frameworks. Joined breeze and heavenly bodies are winding up increasingly mainstream for stand– alone power age applications, because of advances in sustainable power source advances and resulting ascend in costs of oil-based commodities. The Economic parts of these advances show adequate guarantee to incorporate them in creating power age limit with respect to creating nations. Innovative work endeavors in sunlight based, wind, and other sustainable power source advances are required to keep improving their execution, setting up methods for precisely anticipating their yield and dependably incorporating them with other regular creating sources

1.1 Modeling the Solar (PV) System

A PV generator comprises of a get together of sun-based cells, associations, defensive parts, bolsters and so forth. Sun based cells are made of semiconductor materials (typically silicon), which are extraordinarily treated to frame an electric field, positive on one side (rear) and negative on the other (towards the sun). At that point sunlight-based vitality (photons) hits the sun-based cell, electrons are thumped free from the particles in the semiconductor material, making electron-gap sets. On the off chance that electrical conduits are, at that point assaulted to the positive and negative sides, framing an electrical circuit, the electrons are caught as electric flow (photocurrent) [4]. The model of the sun-oriented cell can be acknowledged by a proportional circuit that comprises of a flow source in parallel with a diode (Fig.1).

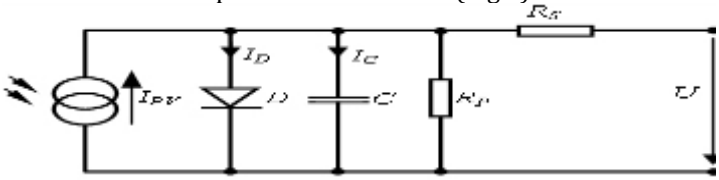


Figure 1 Equivalent circuit diagram of a solar cell

The p-n intersection has a specific exhaustion layer capacitance, which is regularly disregarded for

demonstrating sunlight-based cells. At expanded opposite voltage the exhaustion layer ends up more extensive, so the capacitance is decreased like extending the terminals of a plate capacitor. In this manner sunlight-based cells speak to variable capacitance whose greatness relies upon the present voltage. This impact is considered by the capacitor C situated in parallel to the diode Series opposition RS comprises of the contact obstruction of the links just as of the opposition of the semiconductor material itself. Parallel or shunt obstruction RP incorporates the "spillage flows" at the photovoltaic cell edges at which the perfect shunt response of the p-n intersection might be decreased. This is generally inside the kω area and subsequently has no impact on the current-voltage trademark [1]. The diode is the one which decides the present voltage normal for the cell. The yield of the present source is straightforwardly relative to the light falling on the cell. The open circuit voltage increments logarithmically as per the Shockley condition which portrays the association of flow and voltage in a sun powered cell [1].

1.2 Components of Hybrid System

(1) Photovoltaic: - Photovoltaic cells are made of semi-conducting materials and the most commonly used material is silicon. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity.

(2) Wind turbine: - wind turbines use wind to generate electricity. When the wind blows, the combination of lift and drag forces on turbine blades causes the rotor to spin, and the turning shaft spins a generator to generate electricity.

(3) Inverter: - An inverter is a circuit for converting direct current (DC) to alternating Current (AC), which acts as the interface between the PV arrays and load

(4) Converter: - Converter is circuit that convert variable DC supply into controlled DC Supply

(5) Battery: - the function of batteries is to store the energy when generation is more than load demand and supply the energy to the load when load demand is higher than generation.

(6) Permanent magnet synchronous generator: -They are commonly used to convert the mechanical power output of turbine into electrical power. In the rotating assembly of the PMSG the rotor contains the magnet, and the stator is the stationary armature that is electrically connected to a load.

2. Optimization

Due to that solar and wind power is intermittent and unpredictable in nature, higher penetration of their types in existing power system could cause and create high technical challenges especially to weak grids or stand-alone systems without proper and enough storage capacity. By integrating the two renewable resources into an optimum combination, the impact of the variable nature of solar and wind resources can be partially resolved and the overall system becomes more reliable and economical to run. This paper provides a review of challenges and opportunities / solutions of hybrid solar PV and wind energy integration systems. Voltage and frequency fluctuation, and harmonics are major power quality issues for both grid-connected and stand-alone systems with bigger impact in case of weak grid. This can be resolved to a large extent by having proper design, advanced fast response control facilities, and good optimization of the hybrid systems. The paper gives a review of the main research work reported in the literature regarding optimal sizing design, power electronics topologies and control. The paper presents a review of the state of the art of both grid-connected and stand-alone hybrid solar and wind systems.

Power quality

Intermittent energy from solar and wind has a huge impact on loads security since those loads have no connection with grid. So, any shortfall in power generation from those sources may leave the connected loads without power supply. Voltage fluctuation, frequency fluctuation and harmonics are major power quality issues. The voltage fluctuation because of irradiation changes could make the PV system unstable which will have an impact on the overall reliability of the hybrid stand-alone solar PV and wind system. The same thing is applicable with respects to variations in wind speed which affects the performance of the wind system and ultimately the overall hybrid system. Accurate forecasting and scheduling systems can minimize the impacts. The frequency stability of a generator should be considered based on load requirements and whether the generator is connected to AC loads with critical power frequency requirements or not. High frequency fluctuations can be suppressed by using storage devices such as electrolytic double layer capacitor [64]. An experimental investigation was carried out in [123] to assess the wind impacts on PV module. The mean pressure magnitude on the PV module was measured for both cases; under smooth wind exposure and open terrain wind exposure where the magnitude was smaller in the latter case.

WORKING

The figure below illustrates the solar and wind hybrid systems consists of photo voltaic array, wind turbine, aero wind generator, solar controller, wind controller, battery

banks, inverter and loads. Firstly, numbers of photo voltaic panels are connected in series or in parallel by which together in produces DC output incident radiance. Along with the photo voltaic panels wind turbine is also connected to the DC output which in turns rotates and generates the power. Now the aero wind generator which is one of the main components of the system which converts kinetic energy of wind into electrical energy and then converter is used to convert it into mechanical energy. Solar and wind controller are basically used as the safety values which indirectly look into the battery backup levels. Batteries are one of the crucial parts of the systems. It depends on us how many batteries should we use for storing the energy. Next comes the inverter which converts the DC output power into AC power. "Recent researches in the field of renewable resources shows that the solar and wind hybrid power generations system can work with increased output and increased practically" (Dixet, V. and Bhatia, J.S. 2013 p.40). Thus, from above statement we can say that although if wind speeds are low, we can obtain the output from sun rays. Thus, we can generate energy in rural areas where there is considerable amount of energy were solar rays are available in abundant quantity

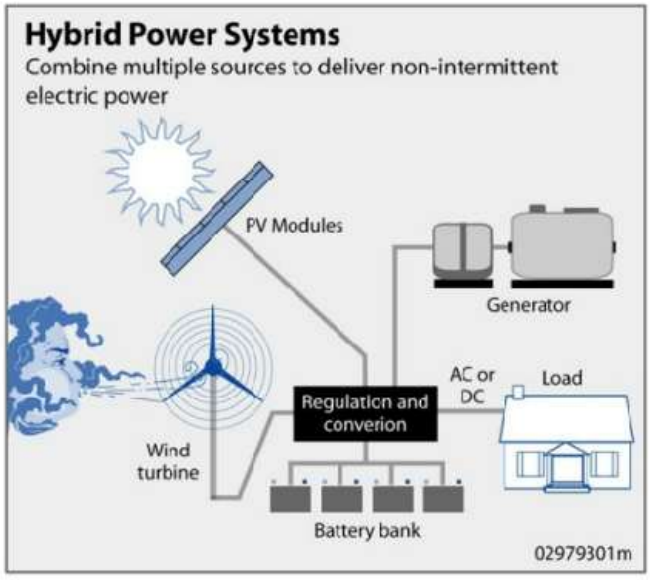
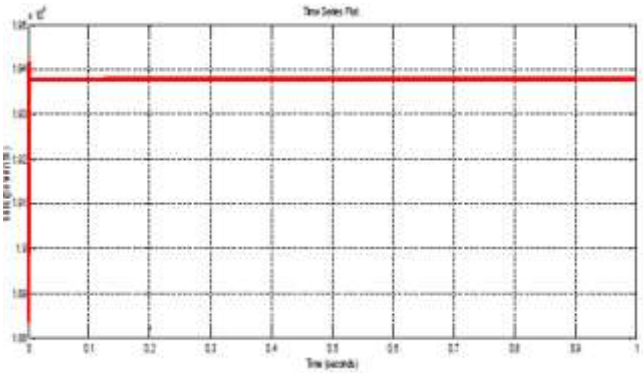
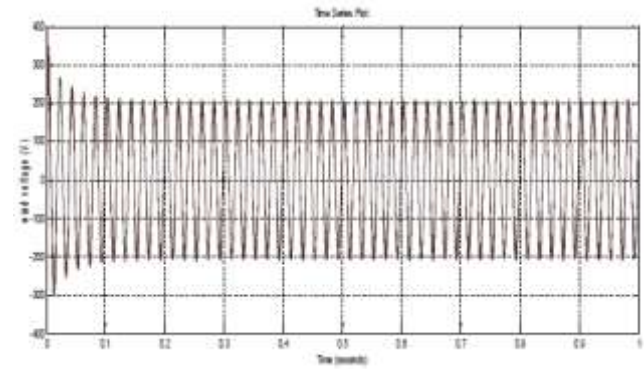


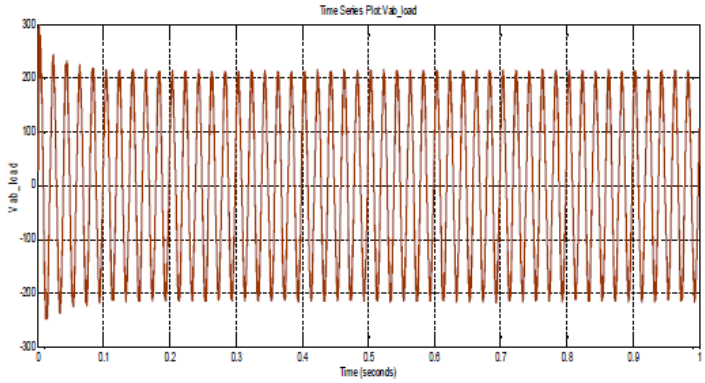
Fig -2 overall System Concepts

RESULTS

For the simulation, the data solar irradiance, temperature and wind speed are used. The three data will be the input of the PV and Wind energy generation system. Figures shown below show the waveform of the output of the solar and wind energy generation system.







CONCLUSION

In this project we describe a renewable energy hybrid generation system combining solar photovoltaic and variable speed wind turbine. In rural or remote sites, the proposed renewable base stand-alone solar-wind hybrid system is most suitable solution. These solutions for this proposed system are available throughout the year.

REFERENCES

1) Dorin Bica, Cristian Dragoç Dumitru, Adrian, "Isolated hybrid solar–wind-hydro renewable energy systems." Scientific bulletin of the Petru Maior University of the Targu Mures Vol.7 (XXIV), No.2 2010 ISSN 1841-9267

2) Basker Vairamohan, "State of Charge Estimation of Batteries." A thesis presented for the Master of Science Degree, The University of Tennessee,

Knoxville.

3) M. N. Mansouri Ecole, M. Mansouri Ecole, M.F.Mimouni Ecole, "modeling and c o n t r o l energy management of a hybrid system associated a continuous load and coupled with the electrical network." International journal of sciences and techniques of automatic control and computer engineering IJ-STA Vol. 2 No.2 pp 722-727 Dec. 2008.

4) Shishir Kumar Pradhan, "Modeling and Simulation of PV array with boost converter: An open Loop Study" A thesis presented for the Bachelor of Technology Degree Department of Electrical Engineering National Institute of Technology Rourkela.

5) Jinhong Jeon, "Development of A Grid Connected wind/PV/BESS Hybrid Distributed Generation System." 19th International Conference on Electricity Distribution Vienna 21-24 May 2007 paper 0539

6) Shalikram Dewangan, "stability enhancement of a wind energy embedded distribution system" A thesis presented for the Master of Engineering Degree Department of Electrical Engineering SSCET Junwani Bhilai

7) G.D. Rai, "A book of Non-conventional energy sources"