

# Hybrid Solar and Wind Power Generation with Grid interconnection for Power Quality Improvement

*Mr. Abhsihek Gothe*

*PG Student*

*Department of Electrical Engineering*

*Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur*

*Mr. Radharaman Shaha*

*Assistant Professor*

*Department of Electrical Engineering*

*Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur*

**Abstract**— Power framework is truly outstanding and future one framework. In this framework, there is wind framework with nearby planetary group and diesel generator framework, which is capacity in one spot that is stockpiles (Batteries) and yield, gives age sources, small turbines framework utilized in crossover, implies association with battery, diesel-generator and photovoltaic framework. The breeze is a wellspring of free-energy, which has been utilized since old time. It is utilized of wind stream through wind turbine to give the mechanical capacity to transform into electrical force this framework for utilized by far off and off-network framework likewise, that wonder called crossover power framework. In some cases this mixture power framework otherwise called Green Energy. Blend of at least two sustainable power sources is more compelling than single. This is called as mixture framework. 'Crossover' signifies consolidate environmentally friendly power sources advancements. This innovations yield gives electric flexibly gets at home, on-network etc. Many mixture framework sources, which worked off-matrix framework, not associated with an appropriated framework from this framework, we put away the energy power stream in batteries. A blend of at least two sustainable power sources is more successful than a solitary is brought regarding cost, proficiency and dependability. Energy is the most significant factor for both modern and gribusiness advancement of any nation.

**Keywords :** hybrid, Green Energy

## I INTRODUCTION

A few sustainable sources have experienced a decent improvement in the most recent many years. Along these lines, their mix would clearly give a decent uninterrupted force framework. Distinctive sustainable generators would supplement one another. Notwithstanding, a ton of prerequisites must be viewed as first. It is critical to see all the elements that impact its conduct, all together

to bamboozle it. The most significant variables are area, time and client needs (power). Area partners data about atmosphere, fuel sources accessibility and climate conditions. This data is critical to choose what sort of sustainable generators can be picked [1]. Again the quickly expanding expenses of electrical cable expansions and petroleum

derivative, joined with the craving to decrease carbon dioxide discharges pushed the advancement of half and half force framework appropriate for far off areas. Crossover power frameworks are intended for the age and utilization of electrical force. They are autonomous of a huge, brought together power network and join more than one sort of intensity source. They may go in size from generally huge island lattices to singular family unit power supplies. As a rule a cross breed framework may contain substituting current (AC) diesel generators, an AC appropriation framework, a DC conveyance framework, loads, sustainable force sources, energy stockpiling, power converters, rotational converters, coupled diesel framework, dump loads, load the executives choices or an administrative control framework

The non-conventional energy such as solar photovoltaic system and wind turbine are natural resources and provides sustainable green energy . Its advancement is quite exciting but the technical challenges on integrating wind and PV system is noticeable. In order to meet the energy demand the wind and PV system is combined. The wind turbine converts wind energy into electrical energy by generating AC output voltage whereas the PV array converts light energy into electrical energy by generating DC output voltage . Solar and wind energy system are commonly used Renewable energy sources (RES) to supply power . The wind and PV system are integrated to meet the energy demand. The output power of wind and PV output power is controlled using power conditioners. It is stored in batteries. The excess power is utilized by the grid. When the load demand goes high, the power is drawn from the battery and even from the grid to run the wind turbine. The Power electronic equipment's are interlinked with PV and wind energy system either to convert or control or transfer the power.

In the entire stream of power system the power quality is the key factor. Power quality should be maintained in generating, transmitting and distribution sector, to increase the efficiency, performance and life of the system Thus it is required majorly in renewable energy system such as wind and PV system too. Power quality refers to maintain the rated

magnitude and frequency near the rated current and voltage of a power system

In the present scenario, energy resources are being used at alarmingly high rate. High penetration of renewable energy resources in the existing micro grid is the dire need to fulfill increasing load demand while considering the alarming situation of global warming and higher emissions. The project introduces the hybrid power generation by the use of PV and wind energy system. The hybrid power generation is basically for improving the power quality. The power generated is stored in batteries which can be converted into A.C. by means of inverter and is fed to AC load. The surplus power is fed to the grid. For improving power quality, multilevel inverter is used as controller

The customary fuel sources are restricted and have contamination to the climate. Consequently more consideration has been paid to the usage of sustainable power sources, for example, wind energy, power device and sun based energy and so on Wind energy is the quickest developing and most encouraging sustainable power source. During most recent twenty years, the high infiltration of wind turbines in the force framework has been firmly identified with the progression of the breeze turbine innovation and the method of how to control. Doubly-took care of acceptance machines are getting expanding consideration for wind energy transformation framework during such circumstance

Wind turbine is arranged into two general sorts: 1.Horizontal pivot and 2.Vertical hub. The restrictions on the extraction of energy from the breeze incorporate the reasonable size of wind machines, their thickness, erosion misfortunes in the pivoting hardware and efficiencies of transformation from rotational energy to electrical energy. A windmill chips away at the rule of changing dynamic energy of the breeze over to rotational mechanical energy. In further developed model the rotational energy is changed over into power [7]. Wind turbines convert the motor energy present in the breeze into mechanical energy by methods for delivering force. Since the energy contained by the breeze is as active energy, its extent relies upon the air thickness and the breeze speed.

## II LITERATURE REVIEW

01. Habib Ur Rahman Habib, Shaorong Wang, Muhammad Tajamul Aziz, "PV-Wind- Battery Based Standalone Microgrid System with MPPT for Green and Sustainable Future", 2019 IEEE [01]. The paper explains the Simulink model for hybrid power generation using different power electronics devices.

02. Amr Ahmed A. Radwan and Yasser Abdel-Rady I. Mohamed, "Grid-Connected Wind- Photovoltaic Cogeneration Using Back-to-Back Voltage Source Converters", IEEE Transactions on Sustainable Energy, 2019 [02]. This paper introduces a new topology, yet simple and efficient, for a grid-connected wind-photovoltaic (PV) cogeneration system. A permanent magnet synchronous generator-based full-scale wind turbine is interfaced to the utility-grid via back-to-back (BtB) voltage-source converters (VSCs).

03. Adhiya N N, Nayana G S Nair, Silindas C, Remanikant S, "Hybrid power generation using dual axis solar tracking system and wind energy system", International Journal of Advance Research,

Ideas and Innovations in Technology, Volume 4, Issue 3, pp 2381-2384, 2018[03]. The paper presents the methodology of producing hybrid power using dual axis solar tracking system and wind energy system, along with the use of microcontroller.

04. Pooja Patel, Dr. Vijay Bhuria, "Power Quality Issues in Grid Integrated Solar and Wind Hybrid System: A Review", International Journal of Engineering Development and Research, Volume 6, Issue 3, pp 505-509, 2018[04]. The paper explains the various power quality issues and the techniques to overcome these problems by the use of hybrid power generation with grid interconnection.

05. Ravikumar S and Dr. H Vennila, "Hybrid Wind Solar System for Efficient Power Generation", International Conference on Electronics, Communication and Aerospace Technology, 2017 IEEE[05]. This paper proposes a new solution for improved voltage stability with quality power output. In this system voltage out from wind energy conversion system(WECS) and Photo voltaic panels are given to separate DC DC converters, independently controlled and connected to a common DC bus and from there it is inverted. In the proposed controller the voltage stability is obtained by applying adaptive Honey Bee Optimization (HBO) algorithm along with a PI controller. The implementation of the proposed method is done by using Simulink platform.

06. Lalit Yashwant Bacchav and Dr. Asha Gaikwad, "MATLAB Implementation of Standalone Hybrid Wind-Solar Power Generation with and Without Dump Power Control", International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017), pp 3069-3073, 2017 IEEE [06]. In this paper unique approach for standalone hybrid model power generation system is been developed using MATLAB simulink. While implementing this technique advance power control technique which used a four power sources, solar, wind, diesel generator and storage battery is demonstrated which is generally not use in commercial power system Serious efforts has been put while completing this project for active, reactive and dump power control.

07. Akshay B. Zade, Asha Gaikwad, Prachi M. Jeevane and Ganesh Lohote, "Hybrid Solar and Wind Power Generation with Grid Interconnection System for Improving Power Quality", 1st IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems, pp 1-6, July 2016[07]. The paper presents the simulation and hardware of analysis of hybrid solar and wind energy system for the improvement of various power quality issues such as sag, swell, source voltage, source current, percentage of THD. The simulation analysis shows the use of seven level inverter as a controller for power quality improvement. The results have been discussed in the paper by developing the prototype model for single phase supply.

08. R.Karthick, S.Manoharan, "GRID INTERCONNECTION OF HYBRID POWER SYSTEM WITH POWER QUALITY IMPROVEMENT FEATURES", International Journal of Advanced Engineering Technology, Vol. VII, Issue I, pp 121-124, Jan- March 2016[08]. The research paper discusses the simulation analysis of hybrid power generation by using unified control strategy for power quality improvement. The unified control strategy is to deal with the issues caused by the nonlinear local load.

09. Varun Kumar, A.S. Pandey, S.K. Sinha, "Grid Integration and Power Quality Issues of Wind and Solar Energy System: A Review", International Conference on Emerging Trends in Electrical, Electronics and Sustainable Energy Systems, pp 71-80, 2016 IEEE [09]. This paper presents a review on grid Integration and power quality issues associated with the integration of renewable energy systems in to grid and Role of power electronic devices and Flexible AC Transmission Systems related to these Issues. It also discusses recent trends in power electronics for the integration of wind and photovoltaic (PV) power generators.

10. Radharaman Shaha, Dr. D. P. Kothari and Dr. V. S. Chandrakar, "Optimization of Renewable Energy Sources for Hybrid Power Generation", 2016 Biennial International Conference on Power and Energy Systems: Towards Sustainable Energy (PESTSE), 2016 IEEE [10]. This paper gives the detailed insights about the optimization techniques for different non renewable energy sources for hybrid power generation. The paper also discusses the cost functions for the given system. This is analysed with the help of MATLAB simulations.

### III CONCEPT

The (HPGS) ideal (or conceivable) setup relies upon three fundamental elements: energy asset (ordinary and additionally sustainable), requested burden, and the cost (working consumption and capital use) [8]. The principle issue which face power age utilizing a crossover power framework is the variety in inexhaustible assets (wind speed and sun based radiation) and the variety in load interest. Along these lines, the lion's share worry in the plan of the crossover power framework that utilizes environmentally friendly power sources is the most ideal selection of segments for the framework that can fulfill the heap need and monetarily pregnancy.

In view of the parts working cost, fuel, work and transportation, upkeep and exceptionally alluring to evaluate the most savvy scaling, everything being equal, to meet pinnacle loads. The framework size enhancement of crossover power framework needs to decrease the net present expenses while satisfying need as solid and practical. In this work the PC reproduction model has been created to improve cross breed power age framework which uses photovoltaic modules (PV), wind turbines (WT), PEM energy units (FC), electrolyzer (EL) and hydrogen tank (HT) as the energy stockpiling. The primary motivation behind this task is to consider the chance of interbreeding sustainable power sources through the plan and advancement of the half breed PV/WT/FC framework utilized dependent on the ideal PC plan. So as to use in the conservative and proficient manner sustainable power assets, it is imperative to enhance the size of framework segments. The ideal framework segments sizes can assist with guaranteeing least speculation cost with the completely utilization of the framework parts. In such cases the half breed framework can work in the ideal conditions as far as the venture just as far as the energy framework dependability prerequisites. Sun based and wind energy

frameworks are sustainable power frameworks assets, with and without the lattice association broadly utilized among the most evolved ones. The estimating device decides the ideal size of the framework parts. In half breed energy power frameworks around 35% of the complete energy is lost due to the non-ideal size of the framework [9]. The ideal designs can be found by utilizing the PC reenactment. The Matlab reenactment has been utilized so as to get the ideal design and the spans of the framework segments..

## IV OBJECTIVES

In this design stage, the system's configuration is synthesized, i.e. which types of generation technologies will be allocated and integrated to build a hybrid system. This is very crucial aspect in the design, since there are usually many alternative possibilities related to which individual components will be included in a hybrid energy system [standalone and hybrid wind]. For a given hybrid energy system, this design stage would be to determine:

- The type of renewable energy system to be included.
- The number and capacity of renewable energy units to be installed.
- Whether a back-up unit, such as diesel generator, fuel cell etc. would be included in the system.
- Whether energy storage would be integrated into the system.
- Whether the system is stand-alone or grid connected. The selection of the technology depends on the availability of renewable resources for particular site where the system is to be installed in which the local weather conditions play an important role for taking decision. Based on the weather statistics (hourly data), a feasibility study for different possible combinations of renewable sources is studied using optimization techniques to get the optimum configuration. Then the number and size of the selected components is optimized in order to get an economical, efficient, and reliable system

### IV.1 PROTOTYPE

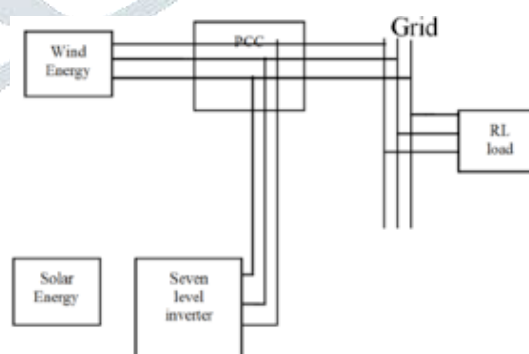


Fig IV.1. Hybrid System

The proposed scheme in the project consists of wind energy which is directly connected to the grid. The solar energy is connected to the grid through multilevel inverter. Multilevel



inverter is used with solar energy as output of solar energy is dc. This dc is to be converted into ac before connecting to the grid; hence multilevel inverter is connected to solar energy. Multilevel inverter also acts as controller for reducing Total Harmonic Distortion (THD) at Point of Common Coupling. Multilevel inverters are beneficial for this purpose as they reduce total harmonic distortion (THD) from the system. Multilevel inverter is use for improving efficiency of waveform by reducing switches. RL load is connected to the grid. Boost converter is used to increase the power received from solar panel hence MPPT technique is not used in the proposed project. The simulation model is studied without controller and then with controller and the results of proposed system without and with controller are studied.

## V RESEARCH METHODOLOGY/PLANNING OF WORK

In case one of the component, wind turbine or PV array not in the Continuous power flow for the stand alone loads cannot be guaranteed due to worst weather condition. At this stage fuel cell fulfill the load requirement for solar PV and wind turbine which gives the continuous power supply to the load. Power getting from solar PV and wind turbine fluctuates, to eliminate power fluctuation efficient energy device fuel cell is used. Author approaches PSIM software to simulate the proposed hybridsystem model. Author develops the integration of photovoltaic(PV), fuel cell and ultra capacitor(UC) system for continuous power supply[5]. Whenever PV system cannot fulfill the load requirement at that time fuel cell comes into action. If the load demand increases above the limit of fuel cell in that case ultra capacitor bank fulfill the load requirement. In this fuel cell uses long term and short term storage batteries and this model simulate by using MATLAB software. Maximum electricity comes from wind which clears that wind is superior than solar at the site. But both are alone cannot fulfill load requirement. According to review of this article optimized solar PV-battery-wind hybrid system is more cost effective than wind alone, solar PV alone system Providing pre-charging to allow load impedance testing before switch on and two stage charging to limit inrush currents Providing means of access for charging individual cells

1. To study the basic concepts of hybrid power generation using PV and wind energy systems.
2. Finding the problems from conventional system by surveying literature.
3. Analysis of the proposed methodology.
4. Study of the control strategies

## VI CONCLUSION

This paper provides review of the different hybrid power system techniques. This methods are very useful for the nextgeneration students and researcher who are interested to make study in the hybrid power system analysis using different simulation softwares. Hybrid power system that exclusively pivot on the intermittent renewable energy sources will generate a swing output voltage that leads to damage the machines that operate on stable supply. Hybrid power system are most advantageous power system which required for continuous reliability of power supply..

## VII REFERENCES

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