Abstract — In this study, a new approach of optimum and Economical sizing of a Hybrid PV-Wind energy system is presenting in order to assist the Projector to take into contemplation, both of the economic and ecological aspects. This context presents the varied optimization techniques to circumvention the hybrid PV-wind Modal. The hybrid Modal implies the photovoltaic panels and wind turbines. Fuzzy logic Based Optimization techniques are employ to minimize the formulated substantial function, i.e. total cost which add the initial costs, yearly substitution cost, yearly labourer’s cost and sustenance costs with condue value of the proposed hybrid Modal. It also exhibit the rehearsed and spectacle comparison between the modal with fuzzy and without fuzzy techniques for eminent sizing of spurious PV/Wind energy modal. One computer program and one Matlab model are designed, using MATLAB code to formulate the optimization issue by numerating the colligation of the objective task. Finally, the optimal annotation is achieved by fuzzy logic optimization method. Dynamic modelling, management and simulation have a glance at in the PV/wind electric technology system is dead in MATLAB/Simulink application. The simulation results obtained via various load things and precise analysis of this attached simulation model are given.

Keywords: Hybrid PV/Wind Generation System, Fuzzy Logic Controller Power Quality, MPPT, Matlab/Simulink.

I. INTRODUCTION

The world demand for electric energy is constantly rising and conventional energy resources are withdrawing and are even exposed to be useless. The recent change in the environmental conditions such as global warming and rapid increase the demand for electricity led to a need for a new source of energy that is cheaper and sustainable with less carbon emissions. For these reasons, the need for alternative energy sources has become essential and solar energy in particular has proved to be a very capable alternative because of its avail talent and pollution-free nature. With high economic growth rates and over seventeen per cent of the earth’s inhabitant, India is an evincive subscriber of energy estate. Notwithstanding the global financial emergency, India’s energy consumption continues to sustain. India liquidates it’s at most energy in Residential, commercial and agricultural motives in collation to China, Japan, and Russia. [1]

Exercise of renewable energy is becoming comprehensively helpful from the environmental concern because the conservation and depletion of fossil fuel. Wind power and Solar power (PV) installations are being increasingly adopted in several applications, such as distributed power generation, stand-alone or connected to the power system. The up growth of wind and solar (PV) power generation systems has raised the most hopeful calculations. Still, each of the renewable energy sources has its personal flaws. For example, wind and solar power are highly subordinate on environment condition. For illustration, it is not possible to depend on PV technology as a regular source of power during all the day or hours or in different light situations.

To overcome from these kind of problem we can use various alternative energy sources that are available in nature and have been proposed, [2]-[3]. This technique has the two types of energy source to accumulate each other in a sense. Multiple-source of hybrid alternative energy systems (with proper control) have great efficiency to provide good quality and more authentic power to customers than a system based on a single resource can do. That by why, hybrid energy systems have grain worldwide research notice. However, a major issue in using a PV source is to tackle its non-linear output characteristics, which changes with temperature and solar irradiation.

The objective of this paper is to propose a hybrid PV/Wind power system model. In this model all important parameters can be changed and influence the performance of the power
The proposed model consists of a Power Electronic Controller DC/DC and AC/DC conversion and PWM inverter with fuzzy logic controller and a wind energy conversion system, and PV arrays. After obtaining the model, different control strategies (fuzzy logic controller) are studied and an appropriate controller has been designed. At the end, the performance of proposed controller of hybrid system has been evaluated.

2. HYBRID PV/WIND SYSTEM SIMULATION

The hybrid power generation systems are the power generation systems that are established by parallel connection of two or more traditional or renewable power generation systems. The hybrid power generation systems are the best solution methods to meet the electric energy needs of mini networks and small settlements far from energy generation and distribution centres. The wind-solar hybrid power generation system is the most commonly used system [4,5]. The hybrid power system enables to overcome the limitations in wind and photovoltaic resources since their performance characteristics depends upon the unfavourable changes in environmental conditions. It is probable to endorse that hybrid stand-alone electricity generation systems are usually more reliable and less costly than systems that depend on a single source of energy. On other hand one environmental condition can make one type of RES more profitable than other. For example, Photovoltaic (PV) system is ideal for locations having more solar illumination levels and Wind power system is ideal for locations having better wind flow conditions.

In hybrid power systems, a number of renewable energy generators and storage components are combined to meet the energy demand of the power system. It mainly includes PV generators and wind generators, the others sources of electrical energy can also be added to meet the energy demand. It is essential to know the energy demand and the resources available at that site before developing a hybrid power system. The energy planners must study the availability of solar energy, wind, and other potential resources at that site. This will help them to design what kind of hybrid power system will be suitable to meet the demand. Hybrid power system implies the three platforms:

1. The power generation stage,
2. Converter / controller platform
3. The distribution platform.

A. Simulation of Proposed Hybrid System

Dynamic modelling of the hybrid power generation system in conformity with its behaviour in real time was realized by using the Sim Power Systems in the Matlab/Simulink program. The overall Simulink model describes the Simulation diagram of the hybrid system in which PV system, wind energy system are connected through a power electronic controller in which it perform DC to DC transformation and AC to DC transformation and it is fed in to the PWM inverter for AC conversion and the system is connected to the grid and the loads.

![Fig 1 General view of Hybrid PV-Solar generation System.](image1)

![Fig 2 Proposed Block Diagram of Hybrid Generation System.](image2)
B. Solar Power Generation Based on MPPT.

Solar panels have a nonlinear VI characteristic, with a distant maximum power point (MPP), which depends on the environmental factors, such as temperature and irradiation. In order to continuously harvest maximal power from the solar panels, they have to operate at their MPP in spite of the indispensable variance in the environment. This is why the controllers of all solar power electronic converters commission by some method for maximum power point tracking (MPPT). Over the last few decades many MPPT techniques have been professed. The first aim of this perusal is to study and analyse them. The three algorithms that where found most useful for large and medium size photovoltaic (PV) applications are perturb and observe (P&O), incremental conductance and fuzzy logic control (FLC). These were compared and tested dynamically according a recently issued standard. Several modifications to the P&O and the Incremental Conductance algorithms are proposed, which overcome their poor performance when the irradiation changes continuously because a typical solar panel converts only 30 to 40 per cent of the incident solar irradiation into Electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel. According to Maximum Power Transfer theorem, the power output of a circuit is maximal when the Thevenin impedance of the circuit (source impedance) matches with the load impedance. Hence our problem of tracking the maximum power point reduces to an impedance matching problem. If the source side we are using a boost convertor connected to a solar panel in order to enhance the output voltage so that it can be used for different applications. By changing the duty cycle of the converter appropriately we can match the source impedance with that of the load impedance. For renewable especially In a PV system, a solar cells singly can generate power of 1 to 2 watt [6]. The solar cell is modelled by one diode model [7].The PV modules are knitted in series and parallel to take the form a PV array in order to give rise to relevant magnitude of power. Thus a PV system prepared by using a PV array, Maximum Power Point Tracking, convertors, The competence and credibility of the PV cell specially bank on the command tactics of the MPPT with converter. The solar PV cell power generation cannot actuate at Maximum power point (MPP) without duly control logic in the MPPT. If the MPP is not trailed by the controller the power losses will take place in the system and in spite of solar PV cell power availability, the output voltage of the hybrid PV-Wind system will not pathos to the desired value [8]. The output voltage of the PV cells power generation is absolutely low as proportion with the desired operating scale.

C. Wind Power Generation System (WES).

For RES especially the variable speed wind energy conversion systems, Permanent Magnet Synchronous generator (PMSG) is gaining popularity. PMSG have a loss-free rotor, and the power losses are confined to the stator winding and stator core [9]. A gearless construction of wind conversion system represents an efficient and reliable wind power conversion system. The wind turbines change kinetic energy from wind into the form of electric energy. The generated electric energy changes proportionally depending on the speed of wind. For wind side selection is a very important for ample uses of the wind turbine, many component are important for wind system. One of the most important component for the wind speed a particular place which must be continuous and advanced. Besides, altitude that slowdown air flow must not be discarding throughout the turbine. The easy operation of a wind turbine is as follows; when the air hits on the turbine blades, it causes their twist and so does mill attached to them. In small power wind turbines, this mill is basically...
attached freely to the generator and in big power wind turbines to the generator mostly by means of gear box. Generators change this mechanical energy into the form of electric energy. In the case of low power wind turbines, generally permanent magnet generators are useful, in the second case of high power turbines, synchronous or asynchronous generators are useful [10]. The wind turbines are mostly offered with 2 or 3 wings. In this study, the PMSG wind turbine used WPGS is with 3 wings. In the wind turbine, exclusive explication of mechanical enginery and connection explaining dynamic performance of the device is explained the element in previous annihilation. Within that we have a look at extinguished reason for gaining the dynamic behaviour of the wind energy generation system in real time, Simulation modal and program are created inside the Matlab and practiced is give in fig no 4.

A Simulink diagram of the wind power generation system featured via Mat lab/Simulink software is given. In the wind electricity ages machine imply the chief compounds consisting of permanent magnetic synchronous generator, synchronized condenser, variable pace wind turbine, load, frequency control unit, sell off load, ammeter and voltmeter. Because the equations and formulations related to dynamic modelling of the synchronous generator and synchronized condenser that construct the wind electricity generation system will take a large place in this look at, they are no longer given here. Within the Matlab software, modelling of the permanent magnet synchronous generator wind turbine (PMSG), ac/dc transformation, dc/dc transformation, pitch angle, wind speed with fuzzy logic algorithm are shown in figure no 6.
D. Simulation and Implementation of Fuzzy Logic Controller in Wind System.

In proposed model, The wind system manufacturing device implies of easy additives consisting of wind turbine, permanent magnetic synchronous generator (PMSG), ac/dc diode rectifier, dc/dc converter with fuzzy logic algorithm, variable velocity wind turbine, load, frequency manipulate unit, unload-load, ammeter and voltmeter. The elaborated simulated model of the wind power production system given in Figure 6 above is shown in Figure 7 below. In this wind power production system, variations in frequency, output voltage and drawn power curves of the system are obtained individually by means of the simulation. Give credit to the controller (fuzzy Logic) which is placed into an operation on variations in electrical proportion of the wind energy generating model in such loading situation. Amplitude of the voltage received from the model should be within accepted limits whatever the electric electricity production system is used. It’s well-known that frequency of the device in significant importance. The machine frequency of electricity production stations is tried to be store in 50Hz fee. To gain high substantial amount of power, the values of frequency and voltage should be kept in the desired range. Best result can be achieved of electricity, when we proposed to solicit degree via the unsolicited harmonic currents and voltages to low level. By using that we think about the condition of the wind power manufacturing system will function with the network, the frequency and voltage price is well-adjusted consecutive with the frequency and voltage values of the load.

3. Result and Discussion

In the simulation study, The overall Simulink model describes the Simulation diagram of the hybrid system in which PV system, wind energy system are connected through a power electronic controller in which it perform DC to DC transformation and AC to DC transformation and it is fed in to the PWM inverter for AC conversion and the system is connected to the grid and the loads. Here d-axis and q-axis voltages are taken as inputs to the FLC to get the desired d-q axis voltage then it is used to produce gate signals to the PWM inverter in which the voltage regulation can be done. While loads are fed by conventional MPPT and available wind then place with Fuzzy Logic controller to controlled Hybrid PV-WPGS, voltage at load ends, load current, voltage frequency at load ends, the generation of power through PV-WPGS, by using MPPT and PMSG of wind turbine with fuzzy logic and then the result obtained in Matlab simulation. In this study, the performance of the proposed power system can be evaluated. Based on the description in the previous section, three control strategies (fuzzy logic controller) can be selected for the hybrid power system. For this part, the purpose of the control strategy is:

1. Setting the output voltage at a determined value by controlling the time duration of the power which is related to the PV arrays.
2. Extracting maximum power from the WEC system by controlling through Fuzzy Logic controller.
3. Fuzzy Logic is wont to get electrical output prices of Hybrid PV-WPGS in fascinating quality and value.

There the overall system efficiency, reliability and performance of the system can be improved by using the MPPT and PMSG with wind turbine is developed by FLC.

4. Conclusion

The perusal work has been done totally in MATLAB environment in order to test the system behaviour before actually implementing it. The simulation of Hybrid PV-Wind for optimal and economical designing for efficiently use of Hybrid system in versatile phase such as economical and environment, ways for friendly use of renewable source of energy. In this paper, hybrid PV/Wind power system was too simulated. The proposed system consisted of three important components which are PV arrays, WEC system, and power electronic converter and PWM inverter. Different applicable control strategies (fuzzy logic controller) for the design of the proposed system would be studied. Two important factors for designing the controller are extracting maximum power from power sources, and regulating the output voltage are the key point of this paper. The FLC controller can be plays an important role in the hybrid system to improve the performance and reliability of the system.

5. Reference


