A Review of Solar Wind Hybrid Power Generation System

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Abstract- Energy is essential for the economic, industrial growth and social development of any Country. The world is facing the many hurdles of power generation. The fossil energy sources are limited and needed to use properly and they also produce pollution. This power generated increases the greenhouse effect. The combined solar and wind power system can be more effective in order to generate more power throughout year. In the research paper the review is carried out on the different types of Solar and Wind associated Hybrid System for Power Generation.

Keywords: Solar Energy, Wind Energy, Hybrid Energy System

1. INTRODUCTION:

Energy is vital measure for the progress of a Nation and it has to be conserved in a most efficient manner. Not only the technology should be developed to produce energy in a most environment-friendly manner from all varieties of fuels but also enough importance should be given to conserve the energy resources in the most efficient way. Energy is the main factor responsible for both industrial and agricultural development. The use of renewable energy technology to meet the energy demands has been steadily increasing for the past few 10 years, however, the important drawbacks associated with renewable energy Thesystems are their incapacity to guarantee reliability and they are lean in nature. To import of the oil products constitutes a major drain on our foreign exchange reserve. Renewable sources are considered to be the better option to meet these challenges. It is obvious that the known resources of fossil fuels in the world are fast finishing. The importance of renewable energy sources was recognized in the early 20th century. During the past three decades, a significant effort has gone into the development, trial and induction of a variety of renewable energy technologies for the use in different sectors. Energy consumption has been growing rapidly in developing countries like India where, about 19% of the world's populationlive.

1.1 Solar PVEnergy:

Solar energy is a very huge, inexhaustible source of energy. The power from the sun falls on the earth is approximately 1.8 x 1010 MW, which is thousands of times more than the present rate of energy consumptionon earth. Solar energy could supply all the present and future energy needs of the world on a regular basis, which is one of the most promising renewable energy sources and it is an environmentally clean and free of cost source of energy that is available over almost all parts of the world [1]. The sun provides the basis for life on earth and sufficient energy to fulfill all our needs. The Photovoltaic (PV) is a technology which is used to convert direct sunlight into electrical energy. It has many advantages like, free from noise and due to absence of any type of moving parts, globallyfriendly operation, appropriate source for inaccessible applications.

Photovoltaic systems are obviouslyappropriate for inaccessible places where there is no grid power supply. Also universeprogrammes have proved the technical practicality of Photovoltaic system, because of its high performance andconsistency.

Photovoltaic power generation has an achievementwhich increased importance as renewable energy source due to its inherent advantages like absence of fuel costs, fuel supply difficult and system consistency with slight or no maintenance.Performance and reliability of Photovoltaic systems have been proven in a large variety of small and medium scale standalone application as well as MW grid connected power stations. The main problem for using multi MW scale photovoltaic system is the very high initial cost of the module raw material which is imported from other countries. The solar photovoltaic systems may be operated in several modes such as standalone system (off grid system) with storage battery and without battery storage mean on grid system. The advance use of solar energy is used as a hybrid and grid connected system in accordance with their a number ofapplications. The final objective of the solar Photovoltaic system design procedure is to obtain the size of the Photovoltaic array and the battery bank, which can deliver power to domestic as well as industrial energy requirement.

Solar panels were placed stationary. Therefore, readings were carried out in different time of day since the coming sunlight has different angles during the day. The input and output of MMPT, and function of control panel were studied for maximum output voltage of solar panels.

The solar PV energy can play the vital role in developing the human being and industrial growth is also dependent on his renewable solar energy.

Solar Energy is also called green energy on the earth which always support the environment.

1.2 WindEnergy:

The Wind turbines are used to convert the Wind Power into electrical energy. Electrical alternator inside the turbine converts the mechanical power into the electrical power. The Wind turbine systems are available ranging from 50W to 2-3 MW. The energy production by Wind turbines depends on the Wind speed acting on the turbine. Wind power is used to supply both energy production and consumption demand, and transmission lines in the rural areas. Wind turbine can be classify with respect to the physical features (dimensions, axes, number of blade), generated power and so on. Such as wind turbines with respect to axis structure: Horizontal rotor plane located turbines, turbines with Vertical or horizontal spinning directions with respect to the wind. The turbines with blade numbers: 3-blade, 2-blade and 1- blade turbines.

Wind energy is an important part of solution for world energy demand and pollution problems. With an average wind speed of 10m/sec, annual wind energy production is estimated almost60 million kWh, enough to supply 20,000 households with clean electricity.

In other words, the wind turbine avoids discharging to the environment 50,000 tone's of CO_2, 200 tone's of SO2 and 2,500 tone's of ash as a result of operating thermal Power plants in order to produce same amount of the Energy.
Wind has emerged as the most suitable solution as a renewable energysource in the immediate future.

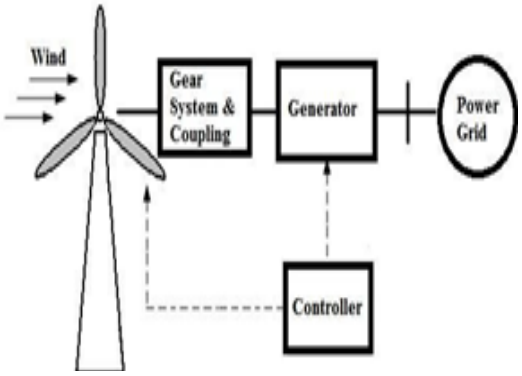

Fig 1.2 Wind Energy System

Technology for wind electricity generation has nearly developed. Wind energy output depends on wind velocity and swept area. However the energy output varies with the climatic conditions. In India, wind velocity depends on the monsoon circulations namely, the strong south-west summer monsoon commencing from June and the north-east winter monsoon commencing from October. General wind resource assessment comprising wind monitoring and wind mapping include complex terrain projects that were taken up in 1985 covering all the states and union territories of India. The projected conservative estimate of the potential is about 60,000 MW.

1.3 HybridSystem:

A system that brings together two sources of energy is called a hybrid system. The idea of having hybrid power stations is not new, but has gained popularity in recent years [1]. Hybrid energy stations have proven to be advantageous for decreasing the depletion rate of fossil fuels, as well as supplying energy to remote rural areas [3], without harming the environment.

At present-day, standalone solar Photovoltaic, wind systems; have been promoted around the world on a comparatively bigger scale. The independent systems cannot provide continuous source of energy, as they are seasonal. They depends on weather conditions. For example, standalone solar Photovoltaic energy system cannot provide reliable power during non-sunny days. The stand alone Wind energy system cannot satisfy constant load demands due to significant fluctuations in the magnitude of wind speeds from hour to hour throughout the year. Similarly, continuous supply of bio-diesel fuel is difficult because of low-Hybrid power system for the generation of power is the combination of wind, solar PV array, battery, inverter, controller. To satisfy the load demand PV array and wind turbine work together and that time battery is in state of charging mode[3]. In case one of the component, wind turbine or PV array not in the condition to fulfill the load demand, in that case battery bank release energy to synchronize the load requirement. Below the statement Fig 1.3 shows the block diagram of hybrid wind solar PV system. The Hybrid energy system gives the fluctuating output power. In this editorial Hybrid system consist of solar PV, wind turbine, fuel cell, dc-dc boost converter[4]. Continuous power flow for the stand alone loads cannot be guaranteed due to worst weather conditions. At this step fuel cell fulfill the load requirement for solar PV and wind turbine which gives the continuous power supply to the load. Power receiving from solar PV and wind turbine fluctuates, to eliminate power fluctuation efficient energy device fuel cell is used. Author approaches Matlab software to simulate the suggested Hybrid System model.

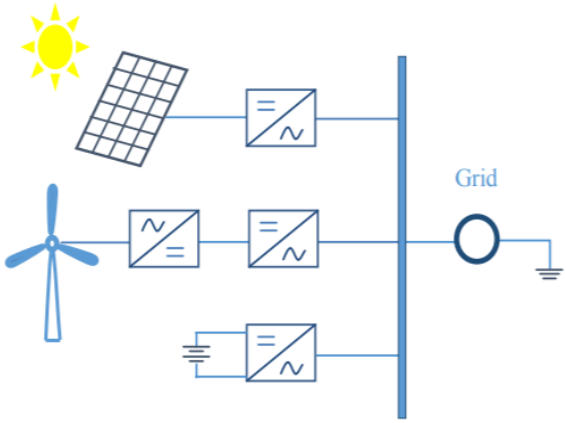

Fig.1.3 Hybrid Solar PV and Wind Energy System

Commercialization of bio-diesel generator fuel. Therefore the energy storage systems will be required for each of these systems in order to satisfy the power demands. Usually the storage system is expensive as well as maintenance required regularly and its size has to be minimized to make the renewable energy system cost effective. Integrated Hybrid Power system can therefore be used to reduce energy storage requirements.

Combined or Hybrid System is aarrangement of one primary energy system with one or more secondary energy systems for power supply. In photovoltaic hybrid system, PV system is the main source of energy and a variety of other energy sources namely bio-diesel generator, wind turbine generator and biomass gasifier can be combined as secondary energy systems.

2. LITERATUREREVIEW:

The different researches were carried out on the Solar and Wind Power Generation. The utilization of renewable energy required system. The literature carried out with categorization of the different power system stand alone and Hybrid power system asfollows:

AbhayaSwarup[1] developed a model for energy management of PV based energy system. This model has been mainly proposed to raise the public awareness and education levels of solar systems in an interesting and amusingmode. The results show that the difficulties with PV systems were not due to PV array and instead it was due to the performance of the battery components.

Martina [2] have discussed about multilevel converters that are effectively used to connect single- phase grid with Solar Photovoltaic systems. An overview of dissimilarmulti level topologies and the suitability for single-phase grid connected Photovoltaic systems has also beenpresented.

VivekKapil[3] have developed an Artificial Neural Network (ANN) model for designing PV systems for remote areas and presented the stimulus of various parameters on the design of PV systems. The results of ANN model showed a variation of 6% as compared to other models with more consistency and accuracy. The application of solar power is varied and the opportunity of PV systems being employed even in domestic applications appears to bebright.
The use of PV System is increasing day by day in all the field where energy is required to do the work.

Bhattacharaya[4] developed a simplified design methodology and commercial appraisal of a Solar PV system.

In this model the PV array and battery bank size for a standalone PV system were estimated. Also a cost evaluation of the standalone PV system with a PV diesel hybrid system was presented. The results show that the hybrid systems were cost effective than standalone systems for a given location.

KshitijKaushik [5] developed a knowledge based model for the design of standalone solar photovoltaic system. This approach combined both the site and array characteristics as a single parameter, referred to as an equivalent unit array output.

Hamid Marafia [6] studied the feasibility of photovoltaic technology for power generation and presented comparative economic analysis of power generation with a conventional gas turbine. The results indicate that the solar photovoltaic systems are not economical as compared with a conventional gas turbine. However, it was concluded that PV systems could become economical when the system cost reduces to below $2.50 per peak Watt with conversion efficiency above20%.

MohanlalKolhe[7] has analyzed the financial viability of a standalone solar photovoltaic system with the most likely conventional alternative system i.e. a diesel powered system for the energy demand through sensitivity analysis of life cycle cost computation. The analysis has been carried out for the powerrequirement for different key parameters, such as discount rate, diesel fuel cost, diesel system lifetime, fuel escalation rate, solar isolation, PV Also PV array cost and reliability. The result showed that the PV powered systems could be a cost effective option at aeveryday energy demand up to 16 kWh even under uncomplimentarycommercial conditions.

UshaBajpai[8] developed a model to improve the size of PV panel and battery in a Standalone Photovoltaic powered system. Optimization of PV system was done based on the cell area, efficiency, cell power and array inclination. Hence this type of standalone PV power system can be more reliable, viable and acceptable. Similar work was also carried out by Philip (2003) on the studies of system design, installation and performance of a standalone wind-diesel power supply systems for remote applications. The result shows that the system performance was satisfactory.
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R. A. Gupta, R. Kumar, and A. K. Bansal, "BBO-based on small autonomous hybrid power system Optimization incorporating the wind speed and solar radiation forecasting" Renewable and Sustainable Energy Reviews. AydoganOzdamar [9] have studied and presented a case study on the Wind Energy utilization in a house in Izmir, Turkey. The developed model determines the number of batteries needed for permanent energy supply, for each wind turbine taking into account of the economic aspects. It was found that the wind battery hybrid system was not economical in the areas of low wind potential.

Kanat A. Baigarin[10] have discussed about the potential of wind energy resources available in middle Asia. The equations used for determining the distribution of the wind energy output, energy density, energy price and effectiveness have been discussed indetail.

Suresh H. [11] have developed a model to investigate the best sitting of wind turbine generators based on site and wind turbine type. The procedure of analysis was based on the accurate assessment of wind power potential of various sites. The analytical computation of annual and monthly capacity factors has been carried out by using the statistical model employing cubic mean cube root of wind speeds. A judicious choice of potential sites and wind turbine generator systems can be made using the model proposed.

Wen-jei Yang [12] adopted the same principle for determining the power generation by a wind machine and discussed about the utilization of excess wind power for hydrogen storage and subsequent secondary power generation. Rogers (2002) studied experimentally the design requirements for a medium sized wind turbine for remote and Hybrid Power systems. Also, the operational problems of installing medium and large sized wind turbines at remote locations have beenaddressed.

Bhave A.G [13] studied the techno-economic feasibility of installing solar photovoltaic-wind hybrid system. This system uses electrical storage by lead acid battery and auxiliary power from AC mains. The result from the above study showed that 82% of the energy demand was satisfied by the Solar Photovoltaic Wind Hybrid System. But it was cost effective, only when the system cost was considerably reduced or the current electricity cost raised to a much higher level.

Habib M.A. et al [14] have developed a model for optimizing the size of a Hybrid Photovoltaic Wind Energy system. The procedure was applied for thesizing and

The proposed model of solar wind hybrid system designed to produce a constant load of 5 kW in the Dhahran area, Saudi Arabia. The analysis indicates that a Hybrid system power output can be optimized to suit specific applications with variable or constant power loads.

Francois Giraud [15] analyzed a model for design of Wind–Photovoltaic system with battery storage for grid connected rooftop system. The system was designed to meet a typical load demand for a given loss of power supply possibility. The various parameters like system reliability, power quality, loss of supply and effects of the randomness of the wind and the solar radiation on systems design have been studied. The results showed that the wind and solar PV systems were complementary to each other and resulted in improved reliability of thesystem.

Rajesh Karki [16] established a simulation method for photovoltaic and wind energy utilization in small isolated power systems based on reliability/cost implications. This simulation method provides objective indicators to help system planners decide upon suitable installation sites, operating polices selection of energy types, sizes and mixes in capability expansion. In this model, cost and reliability are the main parameters to be considered as it has a significant impact on thedesign.
CelikA.N.[17] developed a novel optimization technique for techno-economic analysis for autonomous small scale Photovoltaic Wind Hybrid Energy system. An optimum combination of the Hybrid Photovoltaic Wind Energy System could provide higher system performance than either of the single system. It was shown that the magnitude of the battery storage capacity has important influence on the system performance of a single PV and wind system.

Yang H.X.et al [18] have suggested an optimization technique following the Loss of Power Supply Probability model for a Hybrid PV-wind system taking into account the reliability of the system. They demonstrated the utility of their model through a case study of a Hybrid unit for a telecommunication system.

Celik A.N [19] has made a techno-economic analysis and optimization of a PV-wind hybrid system and reported a comparative study against a standalone solar and wind system for the same conditions of load, isolation and wind velocities. In the previous studies design was based on the worst month, which resulted in a costly and non-optimal system in terms of techno- economics. An alternative method was applied in thework by incorporating a third energy source into the system instead of increasing the hardware sizes excessively for the worst month which facilitated a techno-economically more optimum system.

BitterlinI.F.[20] developed a model for a reliable wind/PV/storage power system for remote radio base station, which explores the current practicalities of PV- wind hybrid power generation solution for the cellular phone base station. It is concluded that the application of PV is not technically or commercially viable for this application because a large capacity of PV modules and batteries are essential. Also it is concluded that Wind Power Generation is technically viable and has some practical possibilities being integrated with the radio pole. The longer-term intermittence of the wind, demands a back-up power supply best provided by a diesel generator. The battery will minimize the start/run demand on the diesel engine, which in turn will minimize the required size of the battery storage capacity.

Tina Getal [21] developed a probabilistic model based on the closed form solution approach to convolute long term performance of a Hybrid Solar Wind Power System for both standalone and grid applications. For estimating the energy performance of Hybrid System, the consistency analysis is performed by the use of the energy index of reliability. The model enables the study of range periods from one year to one hour, thus allowing the inclusion of time value of energy as appropriate in economical assessment. The model is validated by an illustrious numerical example and the results are compared to those resulting from the time domain simulation. A statistical approach alternative to a time step simulation is used for the evaluation of long-term average performance of a Hybrid Solar PV and Wind Energy system.

3. CONCLUSION:

This paper provide review of the different Hybrid Power system techniques. This methods are very useful for the next generation students and researcher who are interested to make study in the Hybrid Power system analysis using different simulation software's. Hybrid Power system that exclusively axis on the intermittent renewable energy sources will generate a swing output voltage that leads to damage the machines that operate on steady supply. Hybrid Power system are mainly advantageous power system which required for continuous reliability of power supply.

The utilization of renewable resources is greatly demanding in the world. The world facing the difficulty of global scarcity of electricity and pollution can be easily overcome with renewable energies. The presented paper is based on the different researches on the utilization of the natural resources like Solar and Wind Energy. The combination of Solar and Wind Hybrid System is also presented in the paper. Overall the aim of the research study to utilized the presented literature for developing the proposed researchwork.

After reviewing the Hybrid Solar PV and Wind Energy system based paper, it is clear that in future stand alone any energy system can not fulfill the energy demand of any field or area like industrial as well as domestic energy demand.

So we have to select any hybrid energy system for energy requirement.

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