

REVIEW ON WIND-SOLAR HYBRID POWER SYSTEM

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ABSTRACT: *The demand for electricity power is increasing day by day, which cannot be met with the satisfied level without non-renewable energy resource. Renewable energy sources such as wind, solar are universal and ecological. These renewable energy sources are best options to fulfill the world energy demand, but unpredictable due to natural conditions. The use of the hybrid solar and wind renewable energy system like will be the best option for the utilization these available resources. The objective of this research paper is to study the various aspects of hybrid solar and wind system. The application and different theories related to the development of hybrid also discussed in this paper.*

Keywords: *Solar energy, Hybrid system, Wind energy*

1. INTRODUCTION

For development of any country energy plays an important role. It is very essential part of growth & economy of country. Our primary source of generating energy is from coal, oil and natural gas. As we all know that energy is needed for industrial, agriculture, commercial and domestic purpose. World's energy demand is increasing day by day. There are many sources of generating energy from coal, fossil fuels, oil and other gases [3]. But all these sources are harmful to the environment so that there are limitations of using these sources and they are limited. Due to global warming and pollution in environment we need clean energy source. In today's world all focus is on Eco green energy, means generating energy without harming environment. In that case we have option of renewable energy sources like solar, wind, small hydro & biomass, bio-fuel etc. Renewable energy is having very much potential to achieve energy demand. But there are also some difficulties occur to use these energy sources, many research is going on to improve the efficiency of renewable energy source. Because main aim is to conserve the natural resources, make system to avoid global warming & carbon emission. Generating energy from renewable source instead of coal or fossil fuel will be cost effective to the country. If we use this renewable source to generate energy it is predicted that it will reduce CO₂ emission [9]. As mentioned above there are many renewable energy sources but wind & solar energy is most prominent. Because if we talk about renewable energy source the first thought is about wind- solar, it is well known source of energy and widely distributed everywhere. Single source of energy such as wind & PV is not totally reliable due to climate change or sunshine in night hours or rainy season and wind speed variation [1].

Normally wind & solar energy are separately used to generate power but both are having some losses. Like our environment is changes every day the climate changes affect these systems, solar radiations are not consistent and wind speed varies every time so it affect the

system & its performance. Whatever cost require for installing single system it will reduced up to some extent in this combine hybrid system. So instead of using single system, if we combine these two it will help each other to overcome losses. Like when sunshine hour's solar PV system will generate electricity and wind turbine system will extract energy from wind source. When wind conditions are not strong enough to produce power that time its have backup to fulfill load demand & that will generate from the solar system. For more convenience of hybrid wind-solar system many researcher have used different combinations to make system more reliable. They used combination of wind-solar and other sources like diesel/wind/PV, wind/diesel, and PV/diesel hybrid system [12].

There are some basic steps which have to follow for design and planning of hybrid system.

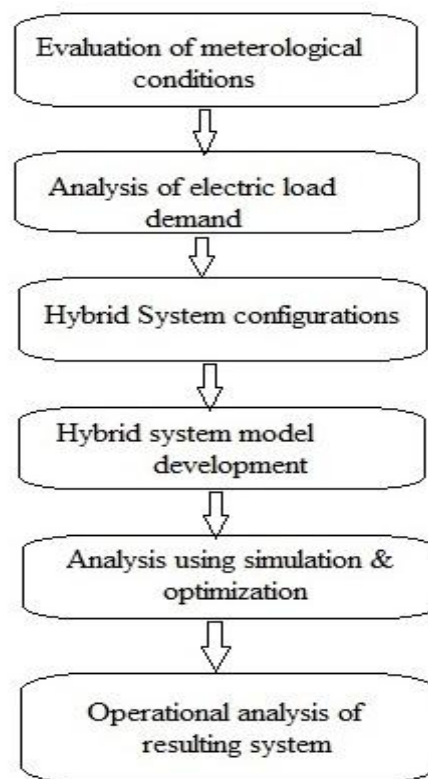


Fig.1. Basic steps for design & planning of hybrid system

2. HYBRID WIND-SOLAR POWER SYSTEM

This system is combination of wind energy and solar energy, used to generate power from each other. Hybrid system is having advantage than system those which are totally depend on single source of energy. Researchers have very tough task to maximize the total energy output from the system with lower cost & reliability [8]. Generally wind-solar hybrid power system consists of wind turbines, photovoltaic array, controller and storage battery. Wind

turbines is used to convert wind energy into mechanical energy and then into electric energy. Whatever electric energy is generating from this system is alternate & unstable. So some controlling units or inverters are used to make it continuous and store into battery. This energy utilize for domestic purpose or other. Photovoltaic array having solar panels through series or parallel, converts solar energy into electrical energy. This energy is in DC form, it is stored in battery and controller supply power for AC or DC loads. This system having high daily electricity generation capacity, low fabrication cost, maintenance is low and has other advantages also [13].

3. REQUIREMENTS OF WIND-SOLAR HYBRID POWER SYSTEM

To develop this system & to investigate performance, modeling and mathematical calculations have to develop. Different models of hybrid system have covered in literature. Following are the components from review of literatures:-

- 3.1 Meteorological data: - Meteorological analysis of the location has to be made for optimization process. It is important for total utilization of PV/Wind sources. Measuring solar and wind resources data is main input of the hybrid system. That all data should be measured hourly, daily and as per weather or climate change.
- 3.2 Load Demand: - It is necessary part of system to design & analyze. To find out the exact load demand it is very complicated and difficult to decide. Load variation for different seasons is not predictable, so system have to design for nearer or more than load demand to full fill requirements.
- 3.3 System Configuration: - By studying all data like solar radiation, wind speed and load demand proper selection of equipments have to be made. But sizing of system will be according to the environmental conditions. Because producing power from solar-wind is depend upon the location which is to be selected.

4. LITERATURE STUDY ON THE HRES SYSTEM

The utilization of hybrid solar wind is necessity for the development of the country. The different researches were carried out on the development and performance assessment of the solar and wind hybrid system. Makbul A.M. Ramli [2] et.al, presented case study model on the hybrid solar and wind system on the techno-economic energy analysis for in Saudi Arabia. The study is carried out for economic production for the electric using the hybrid system; the different parameters are taken into consideration for economic production. Vikas Khare [3] et.al, presented the review on the HRES. The presented research concentrated on the different issues related with HRES such as optimum sizing, feasibility analysis, modeling, control aspects and reliability. Binayak Bhandari [4] et.al, in this paper author differentiates power produced from both the photovoltaic (pv) and wind turbine base on weather conditions. They found that by using storage system for backup we can improve the system and make it more convenient.

According to that they apply various optimization techniques for hybrid system & make component specifications according to that. Again they focus on the present scenario of environmental crises. Renu Sharma [5] et.al, this paper main focus is on rural development in India by using separate hybrid system. They study combinations of hybrid system for generating power. By calculating load demand for rural villages, load is divided into phase on that basis further analysis is done. Getachew Bekele [6] et.al, design the hybrid wind and photovoltaic power generation system for the Ethiopian remote area. The research studies design the system for basic electrification requirement. The data for the study collected from national agency. The simulation of that hybrid system is analyzed by using the HOMER software. The results of the study concluded with satisfied working of the system and the shortage of electricity is covered up to 20%. Y.M.Irwan [7] et.al, Asserted the new techniques in Perlis Malaysia for hybrid power generation. The power generation from the wind is used for cooling of the PV module. The combination of Savinius and Darrieus is used with PV module. The new approach for hybrid system design can improve the performance. Mohammed Gwani [8] et.al, this system is used for energy generation using hybrid solar-wind but this is combination of vertical axis wind turbine with omni directional guide vanes (ODGV). Author design ODGV to get maximum power output from wind energy which works on venturi effect. By using this combination in hybrid system, they successfully improved power output of the system. Power generated from this system used for lightning street lights and other appliances. Prabhakant [9] et.al, Developed the optimized techniques for hybrid solar and wind power generation in remote areas. This presented study associated with saving of coal and carbon production during the power generation. Yahia Bouzelata [10] et.al, Explored about the optimal design and performance in the hybrid solar and wind energy system. The Doubly fed induction generator used for generation of electricity with WECS. The results of the study concluded that the used power electronics for electricity generation improved the power quality. Palash Jain [11] et.al, Discussed on the performance prediction and fundamental of small scale VAWT for blade pitching during variable amplitude. The different design issues were studied and concluded that the maximum from turbine is due wide ranges of wind speed and tip speed ratio and amplitude of blade pitching varied with wind speed and tip speed ratio. Sunanda Sinha [12] et.al, presented the prospects for installation of micro wind and PV hybrid system in the Western Himalayas region. The analysis of the hybrid system is carried out on the basis data available from NASA and ANN predicted data, measured data for Hamirpur and estimated data for eleven locations of Himachal Pradesh.

5. CONCLUSION

The use of solar-wind hybrid renewable energy system is ever-increasing day by day and has shown incredible development in last few decades for electricity production all over the world. By using this development of new technologies and researches in the field of solar wind hybrid renewable energy system, a new difficulty arises, which become much more easily solved with new techniques. The presented review paper reported the different techniques and ideas about the HRES and its energy utilization.

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