"ENERGY GENERATION USING SOLAR AND WIND TECHNOLOGY"

Asst. Prof. Reshma kadu
Department of Electrical Engineering, Wainganga College Nagpur

Mr. Akshata Surodkar
Department of Electrical Engineering
Wainganga College of Engineering

Ms. Dhanashree Dhomne
Department of Electrical Engineering
Wainganga College of Engineering

Ms. Saylee Mesharam
Department of Electrical Engineering
Wainganga College of Engineering

Ms. Deepali Khandait
Department of Electrical Engineering
Wainganga College of Engineering

Mr. AbhijeetYadav
Department of Electrical Engineering
Wainganga College of Engineering

Abstract

All the equipment we use in our daily lives, such as mobile phones, computers, induction cookers, washing machines, etc., needs electricity. Technological advances to increase the use of electrical and electronic equipment, which increases energy demand. Thus, to meet the load demand, different techniques are used to generate energy. Lately, in order to prevent pollution and conserve non-renewable energy resources such as coal, oil, etc., such as solar, wind, etc. renewable energy. They are to generate electricity. Renewable energy sources can also be combined. use it to generate electricity. It is called a hybrid energy system for generating energy. As a special case, we will discuss how a hybrid solar wind system works in this article.

1. INTRODUCTION

The hybrid solar and wind energy system is designed using solar panels and a small wind turbine generator to generate electricity. In general, these hybrid solar wind systems have low capacity. Typical capacities for generating energy from a hybrid solar wind system range from 1kW to 10 kW. Before discussing briefly the solar energy system and hybrid wind energy, it helps us to know the solar energy generation system and wind energy generation system.

The process of converting light (photons) into electricity (voltage) is called the solar effect (PV). Photovoltaic solar cells convert sunlight directly into electricity. They use a thin layer of semiconductor material that is loaded differently between the top and bottom layers. Semiconductor materials can be wrapped between sheets of glass or polymer resin. During the day, the electrons in the semiconductor material absorb photons from the house. It moves between the top and bottom surfaces of the semiconductor material. The movement of electrons creates a current called direct current (DC).

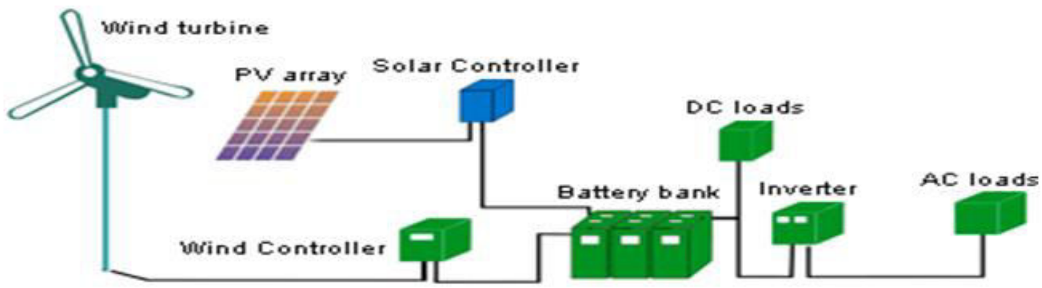

Fig no 1 Schematic Diagram for Installation of Solar and Wind Turbine

1.1. Basic Components of Solar Power

Key components include photovoltaic modules, battery and inverter. The most effective way to determine the capabilities of these components is to estimate the load to be delivered. The size of the battery bank required will depend on the storage required, the maximum discharge rate and the minimum temperature at which the batteries will be used [4]. When designing a solar installation, all of these factors must be taken into consideration when choosing the size of the battery.

Lead-acid batteries are the most common in photovoltaic systems because their initial cost is lower and they are also easily available almost anywhere in the world. Deep cycle batteries want to repeatedly discharge up to 80% of their capacity, so they are a good choice for power systems. The figure of a typical photovoltaic system is a schematic diagram.

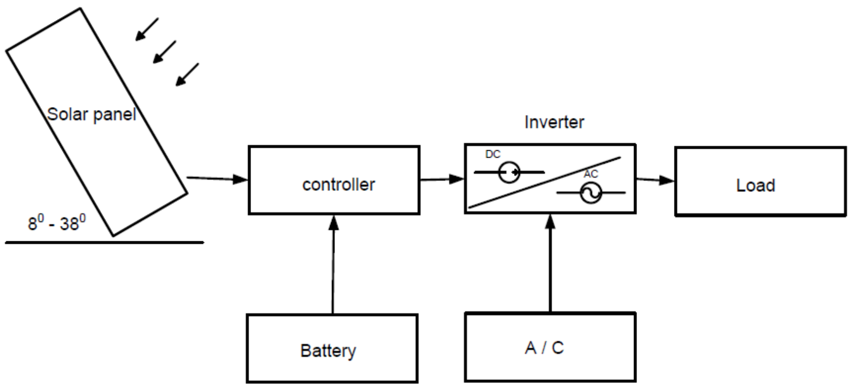

Fig. 2 Photovoltaic System

1.2 Photovoltaic (P.V) Solar Modules

A photovoltaic cell is also called a photocell or a photovoltaic cell. The most common photocell is made of silicon, one of the most abundant in the world, and is composed of sand. The solar module consists of several cells of the machine made into a climate zone. The solar system is a diode that allows it to generate electricity in the event of a collision and convert it into electricity The assembly of multiple modules will develop a series of cores whose structure has a light and physical connection. To determine the size of a photovoltaic module, it is necessary to predict the required power. Therefore, PV module levels are calculated in Wp as[5]:

Daily energy Consumption (1)

Isolation x efficiency

Where Isolation is in KWh/m2/day and the energy consumption is in watts or kilowatts

1.3 Batteries and Batteries Sizes of the Solar System

As mentioned above, the batteries in use for solar systems are the storage batteries, otherwise deep cycle motive type. Various storage are available for use in photovoltaic power system, The batteries are meant to provide backups and when the radiance are low especially in the night hours and cloudy weather. The battery to be used:

(a) must be able to withstand several charge and discharge cycle

(b) must be low self-discharge rate

(c) must be able to operate with the specified limits.

The battery capacities are dependent on several factors which includes age and temperature.

Batteries are rated in Ampere-hour (Ah) and the sizing depends on the required energy consumption. If the average value of the battery is known, and the average energy consumption per hour is determined. The battery capacity is determined by the equations 2a and 2b[3]

$BC = 2*f*W/V_{batt}$ (2a)

Where BC – Battery Capacity

f – Factor for reserve

W – Daily energy

Vbatt – System DC voltage

The Ah rating of the battery is calculated as[3]:

Daily energy Consumption (KW) (2b)

Battery rating in (Amp-hr) at a specified voltage

1.4 Solar Inverters

The Solar inverters are electrical device meant to perform the operation of converting D.C from array or battery to single or three phase A.C signals. For P.V Solar Systems, the inverters are incorporated with some inbuilt protective devices. These include[3]:

- Automatic switch off if the array output is too high or too low.
- Automatic re-start

 Protecting scheme to take care of short circuit and overloading.

Generally the inverter to be used that would produce the quality output must have the following features[3,4,5]:
 Overload protections
 Miniature Circuit Breaker Trip Indicator(MCB)
 Low - battery protection
 Constant and trickle charging system
 Load status indicator

1.5 WIND POWER

A wind power is a wind farm that passes through a machine known as a windmill. Electricity can be generated by a wind farm. This is done by moving the wind to move the air, which in turn results in power generation and power generation by the machine [6]. A windmill in this case is often referred to as a windmill. This air conditioner converts wind energy into mechanical energy, which in turn converts electricity and electrical energy. Assembly of wind turbines, wind turbines, wind turbines known as wind turbines (WECS)

2. METHODOLOGY OF SOLAR POWER GENERATION

Wind power development in India began in the 1990s, and has grown significantly in recent years. It is estimated that an additional 6,000 MW of wind power capacity will be installed in India in 2012. Wind power represents 6% of India's total installed power capacity, and generates 1.6% of the country's power. Average daily solar energy events in India vary from 4 to 7 kWh/m2 with about 1500-2000 hours of sunshine per year (depending on location), which is much more than the current total energy consumption. By complementing the properties of solar and wind energy sources for a given location, Hybrid PV/Wind systems with storage banks provide an insurmountable option for supplying small electrical loads in remote locations where there is no utility grid power supply.

Borowy gave, and Salmeh, a methodology for maximizing wind/PV hybrid systems. calculate optimal sizes for cycle battery banks and PV systems based on low-cost hybrid systems using graphic building techniques. Based on the genetic algorithm technique developed by Hongxing et.al design sizing means matching the best for the solar wind hybrid system [2]. Diaf et.al [3] presents mathematical models for PV modules, wind generators and battery characterization by considering various types and configuration capabilities of devices and systems that meet the desired system reliability based on the type and size of the system device changes. Wang and Singh [4] presented the optimal design of an autonomous hybrid generating system including various power sources such as wind turbine generators, photovoltaic batteries, and storage. Adopt the multipurpose particle swarm optimization algorithm (CMIMOPSO) to the non-dominant solution to get the best design. Due to its simple operation and well-converged performance, DPI turns out to be an outstanding heuristic expert for design problems, complex engineering, multiple, and over-developed optimization procedures to reduce at the same time the cost of the system as well as to maximize the reliability of the system.. A probabilistic approach based on the convolution technique to assess the long term performance of a hybrid for both standalone and grid- linked applications was provided by Tina et.al. [5].This approach uses energy index of reliability (EIR) directly related to energy expected to estimate energy performance of HSWPS for the reliability analysis. Yang and Burnett [6] used simulation model for analyzing the probability of power supply failure in hybrid photovoltaic wind power generation systems incorporating a storage battery bank and also analyzes the reliability of the systems, for the loss of power supply probability (LPSP) analysis.

Let's understand the circuit in details with the help of the following explanation:

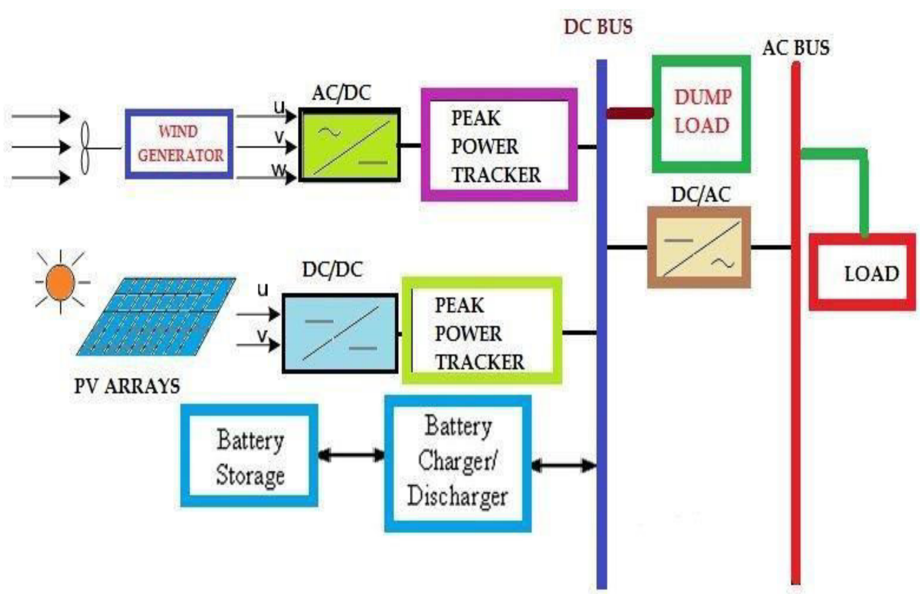

Fig.3 Block Diagrma of Solar And Wind Power Generator

• The figure above shows the proposed solar, wind twin hybrid battery charger circuit, using very ordinary components such as opamps and transistors.

• We can see two exactly similar opamp stages being employed, one on the left side of the battery and the other on the
right side of the battery.

- The left side opamp stage becomes responsible for accepting and regulating the wind energy source while the right side opamp stage processes the solar electricity for charging the single common battery in the middle.

- Although the two stages look similar, the modes of regulation are different. The wind energy controller circuit regulates the wind energy by shunting or shorting the excess energy to ground, while the solar processor stage does the same but by cutting of the excess energy instead of shunting.

- The above explained two modes are crucial since in wind generators which are essentially alternators require the excess energy to be shunted, and not cut off, so that the coil inside can be safeguarded from over current, which also keeps the speed of the alternator at a controlled rate.

- This implies that the concept can be also implemented in ELC applications also.

- Now let's investigate the functioning of the opamp stages through the following points:

- The opamps are configured as comparators where the pin#3 (non-inverting input) is used as the sensing input and pin#2 (inverting input) as the reference input.

- The resistors R3/R4 are selected such that at the required battery charging voltage, pin#3 just becomes higher than pin#2 reference level.

- Therefore when the wind energy is applied to the left circuit, the opamp tracks the voltage and as soon as it tries to exceed the set threshold voltage, pin#6 of the IC goes high which in turn switches ON the transistor T1. T1 instantly short circuits the excess energy restricting the voltage to the battery at the desired safe limit. This process goes on continuously ensuring the required voltage regulation across the battery terminal
- The opamp stage at the solar panel side also implements the same function however here the introduction of T2 makes sure that whenever the solar energy is higher than the set threshold, T2 keeps on cutting it OFF, thereby regulating the supply to the battery at the specified rate, which safeguards the battery as well as the panel from unusual inefficient situations.
- R4 on both the sides may be replaced with a preset for facilitating easy setting up of the threshold battery
charging level.

- Parts list for the solar wind dual hybrid battery charger circuit
- R1, R2, R3, R5, R6 = 10k

- Z1, Z2 = 4.7V , 1/2 watt zener diode
- C1 = 100uF/25V
- T1, T2 = TIP147,
- T3 = BC547
- D2 = 1N4007
- D1 = 10 amp rectifier diode or Schottky diode

The functional objective is the number of batteries and the number of PV modules. The radiation level and speed data of 8736 for one year are used to illustrate the best hybrid type. Air conditioning and PV power fluctuations as required are about a year old. For each hour per day per month, the output power of the wind turbine is calculated in PV modules. Then for the power of lost power, the combination of several PV modules and several batteries is also assembled. The selection of the optimal number of PV modules and batteries depends on the minimum cost of the system using the Model Management System.

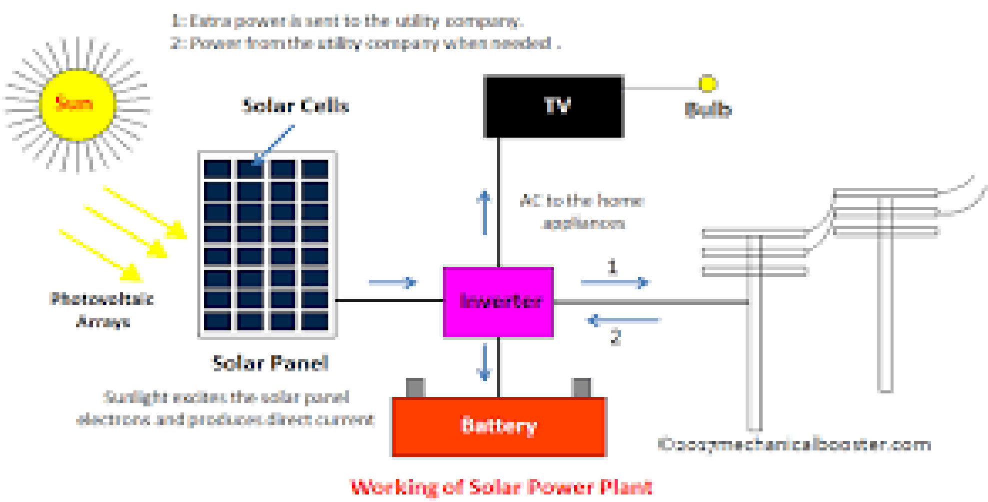

Fig.4 Working of Solar Power Plant.

3. Methodology of Wind Generator

• The process is also structured using the same process as the management system described at the outset, whether it is transient or inactive.

• Some admission techniques include geometric shaping to adjust this gradient. The use of plant manufacturers working for separation controls the addition of Gurney flap at the end-to-end, and the placement of long graves or landmarks on the top to reduce.

Active control methods can be broken into two categories

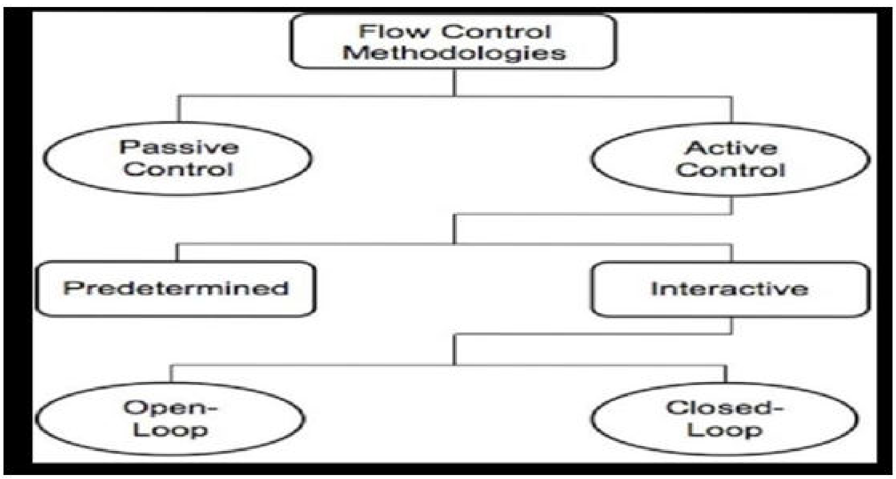

Fig. 5 Flow Control Methodologies

4. Conclusion

This book provides an overview of the Respiratory System of Restoration (HRES). Parts like system, unit sizing and optimization, safety and power flow management, ar specifically evaluated. The future process and challenges are also highlighted in the paper. This published book helps interested researchers develop and manage energy.

Reference

[1] I. A. Adejumobi, A. A. Esan, and A. B. Okunuga "Discovering Potential sites for Small Hydro Power (SHP) in Nigeria", Journal of Advanced Material Research, Trans Tech Publication, Switzerland. 18-19, 93- 97(2007) ; (online at {http://www.scientific.net).

[2] L, Fagbile ."Estimation of Total Solar Radiation in Nigeria Using Metrological, Nigeria Journal of Renewable Energy 1,1-10. (1990)

[3] M.B. Olajide and J.O. Oni "Application of Solar Energy for offices and homes,Workshop Seminar Paper, International Training School and Workshop on Solar Energy, organized at University of Agriculture, Abeokuta,9th-11th June, 18-29. (2009),

[4] M. Thomas (Ed) "Solar Electricity", John Wiley and Sons Ltd, Chichester, 2ndEdition. (2004).

[5] U.K Mehta. "Principle of Electronics", S. Chand & Company Ltd.New Delhi. (2004),

[6] Technical brief on Wind Electricity Generation: Retrieved from www.windpower.org,(2009).

[7] E.E. Iheonu, F.O. A. Akingbade, M. Ocholi Wind Resources Variations over selected sites in the West African sub-region. Nigerian J. Renewable Energy, 10, 43-47(2002