

A Hybrid Model of Solar – Wind Power Generation System

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Abstract :- This paper presents the applications and therefore the effective use of solar radiation Hybrid Energy systems (SWHES). The future of Energy generation depends on solar power, because it the foremost abundant natural source of energy. Conventional power generation goes to become a difficult task within the future; it's thanks to the non availability of coal. The increased per unit generation cost with in the thermal power station. The transmission power loss is additionally one reason. Pollutants released from the conventional power generation will affect the environment. to beat these difficulties in future we've to depend upon solar power generation. it's clean source of energy and it can transform to any source of energy with no effect on the environment. To get continuous power supply we should always operate wind and solar energy plants together as one unit. By this combined mode of operation, the general efficiency of the system increases. The combined power generation will give the continuity power supply for household applications with battery as a storage element. SWHES are more reliable to small power application. This configuration also reduces the load on the traditional power generating system with no effect on the environment.

Keywords: Hybrid Energy Systems, solar energy Applications, wind generation Applications, Combined Power Generation, Continuous Power Supply, SWHES.

Nomenclature

PV : Photovoltaic

AC : Alternating current

DC : Direct Current

K.E : Kinetic Energy

SWHES : Solar Wind Hybrid Energy Systems

WECS : Wind Energy Conversion System

ρ : air density

A : rotor swept area

m : mass of air

v : velocity of air

d : Distance

I. INTRODUCTION

Solar-Wind Hybrid Energy Systems are using solar panels and turbine generators to get electricity power. Renewable Energy experts will explain that a little hybrid system that mixes wind generation, solar energy technologies offers several advantages to home applications. In future electric power is most vital in our lifestyle, without electricity, we can't imagine the present world. the thought of the combined power generation is to urge continuous power during day and night for little power applications with accumulator. This will achieve by SWHES.

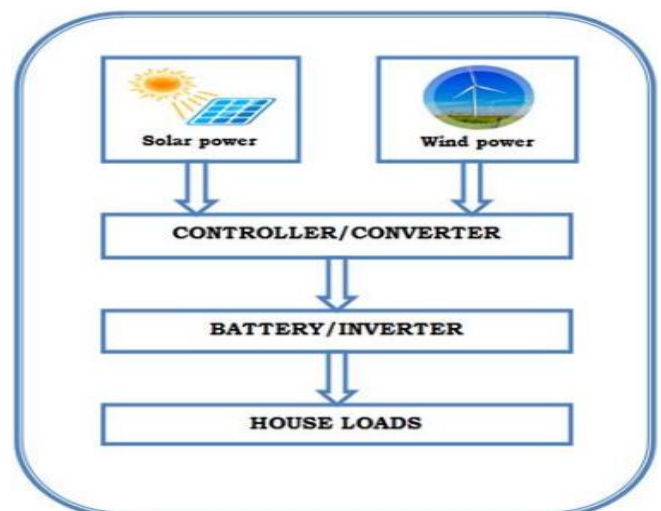


Fig. 1.1 the diagram of the solar - wind hybrid energy system.

SWHES consists of two generating units, solar and wind up to their maximum power operation. Depending on the load requirement these units gets

into operation mode. Remaining period this technique to feed the battery gets charged. Through this battery, the house loads are connected with the assistance of inverter just in case of AC loads. The Combine power generation consists of two small units fitted to the house as in convenient places. On the roof we will place the solar panels. On the highest and nearby windows also, we may put the wind models of small power capacity. the whole system is connected to the battery of energy storage. For effective usage of the building we will attach the solar panels to the house. It makes good appearance and saving the land cost. In household applications, we use one phase power from morning to evening for water heaters, cookers, fans, lights, etc. This creates the more burdens on the conventional power grid. This load could also be diverted to the solar energy plant. Every individual household should have SWHES to scale back the load on the traditional power system.

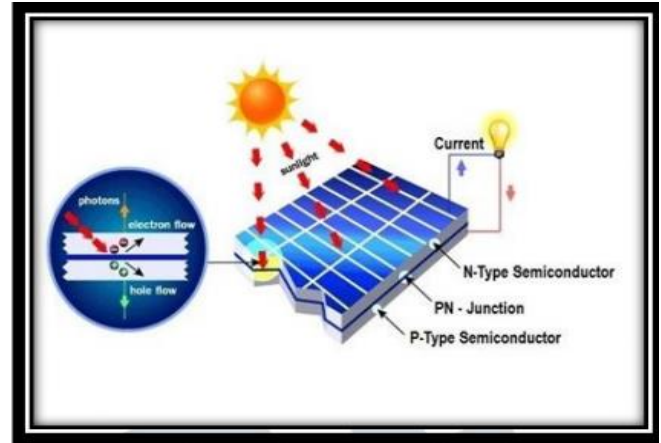
II. POWER GENARATION FROM SOLAR SYSTEM

Sun energy reaches the world in several amounts at different places; it's due to geographical conditions of the world .the main renewable energy resources are the solar power which will be used for various applications. Like; Water heaters, solar lamps, etc.

A. Solar Panel's working rule

Solar panel is formed from solar cells; it's wont to convert solar power into electricity .The working principle of photovoltaic cell is analogous to PN junction diode operation. because it may be a semi conductor device, initially every particle is in stationary in their orbit. because the nature of semiconductor, only few electrons are available, they form an energy gap between P-type and N-type regions. Majority carriers are electrons in N-type, holes in P Type regions. As Photon energy falls on the solar panels, excited electrons from N-type region allowed to P-type region constitutes a flow of current. This process continues the battery to urge charged. The recombination of electrons and holes takes place. Solar cells are arranged in serial manner to sum up the voltage. It makes the solar array behaves like another battery, these serially connected batteries store energy. Energy from the solar array is additionally connected to the inverter, if we need a 3 phase power supply. In the above fig 2.1 shows the working rule of the solar panel. It resembles the PN junction diode model. As the photon energy falls on the solar array electrons gets energized. This moves towards the P- type channel. This constitutes the present to flow if the load is connected. Continuations of the electros flow within

the closed path drive the load. The battery is connected for reliability of power. This stored energy are often used for DC operated devices. If the connected load is an AC load, to dive this Inverter is needed.



B. solar energy System

Power from the PV panels is connected to the hundreds , in grid connected or stand alone manner. Grid connected PV systems have more efficient as they will feed the hundreds continues by using grid power. Small power PV systems provides the value effective power generation in remote places.

III. WINDPOWER

Wind power, the natural source of energy. Wind flows from high to low. this is often thanks to solar radiation falling on the world surface. The flow of wind having K.E. it's thanks to the virtue of its motion.

Wind power is out there more at the coastal areas during day and night, whereas solar power is out there only during the daytime. Power generation is done only in this half of the day. Next half of the day (i.e., night time) the unit has to be off mode. To overcome this difficulty wind generation is integrated with the solar power generation. Wind turbine will extract the K.E. from the wind and converts to mechanical power which helps to rotate the Electric power generator. Fig 3.1 shows the wind energy conversion principle.

A. Wind Energy Conversion

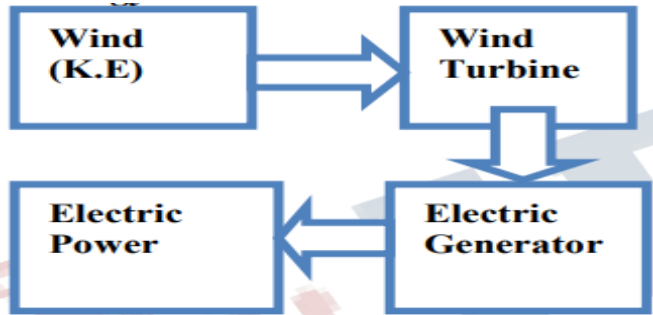


Fig. 3.1 Block Diagram of Wind Energy Conversion Energy conversion takes place from wind energy to electrical energy. Wind turbine, electric generator plays a key role in this conversion. The amount of converted energy depends on the wind energy available at that place. The classical equation of wind power can be explained below. Wind power can be computed by the kinetics which relates the objects in motion.

Kinetic energy KE Where,

m: mass of particle (kg),

v : velocity of the particle (m/s), and

$$m = \rho A d$$

We can write the Kinetic energy as below

Kinetic Energy KE ρ

Power (Pw) = Energy per unit time.

Power (Pw) ρ Power (Pw) Power (Pw) ρ

Where, Velocity (v) ρ = air density,

A = rotor swept area,

d = distance,

m = mass of air = air density * volume $m = \rho * A * d$, and v = distance/time

From above, equations (1) and (2), it is observed that the amount of power depends on the cube of the velocity of the wind. Generally to run the wind turbine minimum and maximum speeds calculated by the ratings of the turbine-generator. We can extract the wind generation up to its cut in speed 3m/s. Research goes on to decrease the cut in speed, so from the little bit of wind flow, it is possible to extract the power.

B. Electric Power Generator

Electric power generator is connected to the wind turbine in WECS. In this we use Synchronous or induction generator depends on the requirement. Which generates the AC power, and it converts to DC by Rectifiers if required depending on the load.

C. Converters

In this proposed system of SWHES, the use of converter and inverter are needed. Generated AC power can be converted to DC to store the battery. Solar panel generates the DC Power, this power **has got to** convert to AC Power if the connected load is AC Power operated device. DC power operated devices directly connected to the battery. In hybrid systems, power converters plays important role. Load switching from solar to wind vice versa will be done by these converters.

D. Energy Storage

Solar Wind Hybrid Wind Energy System uses the battery for storage of energy. Storage elements improve the system reliability. The rating of the battery depends on our load. All the DC power operated devices connected this battery directly.

IV. HYBRID SOLAR WIND ENERGY SYSTEMS

Solar-Wind energy systems integrated to make the SWHES (Solar Wind Hybrid Energy System). during this proposed system two renewable energy sources works in tandem to charge A battery via controllers. The energy sources supply the load separately or simultaneously depending upon their availability. Each source operates on its maximum point operation for generating maximum power. The combine power generation system improves the general efficiency of the system. It's more suitable for isolated power applications. Addition of additional power source helps in supplying continuous power. Below fig. 4.1 describes the integrated solar radiation hybrid energy system. The combination of wind turbines and solar arrays generate the electric power with the help of respective controllers. Generated power may supplies the connected house load. In small utility areas this SWHES is far preferred. This two energy sources are acting simultaneously to get electrical power . Load sharing takes place during this proposed system. And it are often operated on their maximum point . Continuity of power supply also takes place during this technique , if anybody didn't generate power the other one will supply the load. This load monitoring was done by the respective control algorithms. Under this both power generating systems works to get the facility . By this SWHES the

general system performance is increased and can get continuous power supply.



Fig. 4.1 Integrated solar radiation Hybrid Energy System

V. APPLICATIONS

- Solar Wind Hybrid Energy Systems are using in almost all field small electric power usage. Some of the applications of SWHES are given below.
- Grid connected and Stand alone
- Grid connected: The large power rating of SWHES, where the access of wind and sun irradiation is more, they can be connected to Grid. In these types of generation, if the system failed to generate power the Grid will supply the load.
- Stand alone: Almost all SWHES applications are stand - alone not connected to the grid.
- Street lighting: The foremost application of SWHES is solar street lighting. Solar Street light become as SWHES lighting. Use of this reduces the load from conventional power plants.
- Household: Residential appliances can use power generated through hybrid solar wind energy system. SWHES are used to supply electricity to different offices or other parts of the building in reliable manner.
- Remote Applications: like military services where it is impossible to provide conventional power supply these SWHES systems are useful.
- Ventilation system: The proposed systems also are used for ventilation purposes, these helps in running Bath fans, floor fans and ceiling fans in buildings.
- Power Pump: SWHES also can help to pump the water to any building. DC power operated pump can circulate the water through your home.
- Village Power: The proposed system is extremely useful in
- villages which are in valley and on hills, where it's not possible to send electricity
- On shore : The wind blows more at coastal areas, SWHES are installed near sea and on the boats for power generation

- Commercial: In hotels, tourist places SWHES give the required electrical power .

VI. CONCLUSION

Solar Wind Hybrid energy Systems become reliable for small power applications. to strengthen the solar Photovoltaic power generation efficiency, wind energy is integrated to make as hybrid energy system. The proposed systems help to scale back pollution caused by the normal power generation system. By installing SWHES to each house, the burden on the normal power generating system reduces. The storage of the battery will give power for a few of your time, even no generation takes place by this technique. Almost altogether field of electrical power usage, the SWHES are getting used. It provides the facility to inaccessible convention power places. SWHES are more reliable and efficient energy generating system with less effect on the environment and almost no maintenance.

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