

## Solar Wind Hybrid Energy System

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### ABSTRACT

As the developing technology has made humans to depend on energy. So as the energy crisis begins and electricity is for most essential need for domestic as well as industrial work. In modern technology all the non-renewable sources are depleting. So now we have to shift from non-renewable to renewable sources. So we need to develop renewable sources of energy in more amounts for this development. Therefore the combination of solar and wind energy hybrid can be the solution to many problems we common people, as well as the industrial workers face. We need a hybrid energy system of wind and solar energy. Solar and wind energy extract their energies from the nature and generate electricity. The main purpose of this paper is to generate energy without damaging the nature, pollution etc. This way generation of more electricity will lead to the economical development and the prices will become affordable for common people.

**Keywords:** Solar Energy, Wind Energy, Hybrid Power System, Generation.

### I. INTRODUCTION

We require electricity for operating almost all the appliances we use in our day to day life. Energy has been playing important role in human and economic development and world peace. Electrical energy demand increases in word so to fulfill demand we have to generate electrical energy.

The biggest disadvantage with the usage of conventional resources is that their usage causes pollution due to the production of various pollutants like ash in case of a coal power plant, smoke in case of diesel power plant, radioactive material in case of nuclear power plant. So we need to find some other methods to produce electricity. There are two ways of electricity generation either by renewable or non-renewable energy sources. Since, all the non-renewable sources are depleting so we need to develop renewable sources. The new sources should be reliable, pollution free and economical.

Renewable energy i.e., energy generated from solar, wind, biomass and hydropower could increase diversity of energy supplies and offer us clean energy beyond all doubt. The energy generated from solar and wind is much less than the production by fossil fuels, however, electricity generation by utilizing PV cells and wind turbine increased rapidly.

Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine.

#### Solar Energy

Solar energy is that energy which we get from the sun in form of radiation. Solar energy is present on

earth continuously and in abundant manner. It does not produce any gas that means it do not cause any kind of pollution, it is inexhaustible. It is available free of cost. It has low maintenance cost. Only problem with solar system it cannot produce energy in bad weather conditions. But in a country like India where sun shines for almost 300 days in a year, it is therefore a convenient mode of electricity production. Meager amount of investment is involved in setting up a solar power plant and also it is quite easy to maintain and has greater efficiency than other energy sources. The efficiency of the system is also quite good. Long life span and less emission of pollutants are its major advantages.

### Wind Energy

Wind energy is the energy which is extracted from wind. For extraction we use wind mill. It is renewable energy sources. The wind energy needs less cost for generation of electricity. Maintenance cost is also less for wind energy system. Wind energy is present almost 24 hours of the day. It has less emission. Initial cost is also less of the system. Generation of electricity from wind is depend upon the speed of wind flowing. The major disadvantages of using independent renewable energy resources are that unavailability of power for all time. For overcoming this we use solar and wind energy together. So that any one source of power fails other will take care of the generation. In this proposed system we can use both sources combine. Another way is that we can use any one source and keep another source as a stand by unit. This will leads to continuity of generation. This will make system reliable. The main disadvantages of this system are that it needs high initial cost. Except that it is reliable, it has less emission. Maintenance cost is less. Life span of this system is more. Efficiency is more. A main advantage of this system is that it gives continuous power supply.

## II. DESIGN OF HYBRID ENERGY SYSTEM

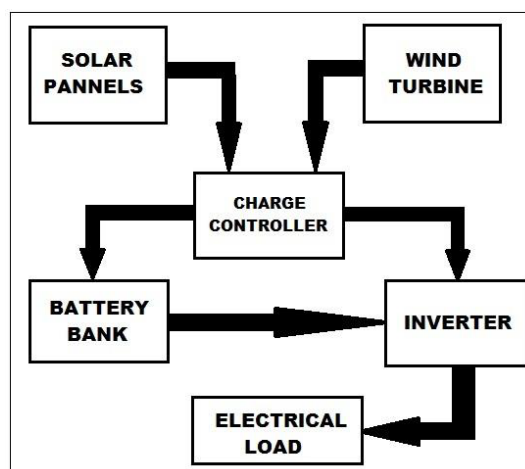
For design of the hybrid energy system we need to find the data as follows

### A. Data required for Solar System:

1. Annual mean daily duration of Sunshine hours
2. Daily Solar Radiation horizontal (KWH/m<sup>2</sup>/day)

### B. Data required for Wind System:

1. Mean Annual Hourly Wind Speed (m/sec)
2. Wind Power that can be generated from the wind turbine



**Figure 1.** Block diagram of Hybrid energy generation system

Above figure shows the block diagram of the hybrid power generation system using wind and solar power. This block diagram includes following blocks.

- i. Solar panel
- ii. Wind turbine
- iii. Charge controller
- iv. Battery bank
- v. Inverter

### i. Solar panel

Solar panel is use to convert solar radiation to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron-proton system of the material, creating charge carriers that are

separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.

### ii. Wind turbine

Wind turbine is that system which extracts energy from wind by rotation of the blades of the wind turbine. Basically wind turbine has two types one is vertical and another is horizontal. As the wind speed increases power generation is also increases. The power generated from wind is not continuous its fluctuating. For obtain the non-fluctuating power we have to store in battery and then provide it to the load.

### iii. Charge controller

Charge controller has basic function is that it control the source which is to be active or inactive. It simultaneously charge battery and also gives power to the load. The controller has over-charge protection, short-circuit protection, pole confusion protection and automatic dump-load function. It also the function is that it should vary the power as per the load demand. It add the both the power so that the load demand can fulfill. And when power is not generating it should extract power from battery and give it to the load.

### iv. Battery Bank

We have to choose battery bank size per the load requirement so that it should fulfill the requirement of load for calculating the battery bank size we need to find following data

1. Find total daily use in watt-hour (Wh).
2. Find total back up time of the battery

For increase in battery bank size we need to connect cell in series so that we can get the larger battery bank size.

### v. Inverter

We have to choose greater rating inverter than the desired rating .The pure sign wave inverter is recommended in other to prolong the lifespan of the inverter. Inverter is need to convert DC power into AC power. As our load working on the AC supply so we need to convert DC power. The input voltage Output voltage and frequency, and overall power handling depends on the design of the specific device or the circuitry. The inverter does not produce any power. The power is provided by the DC source.

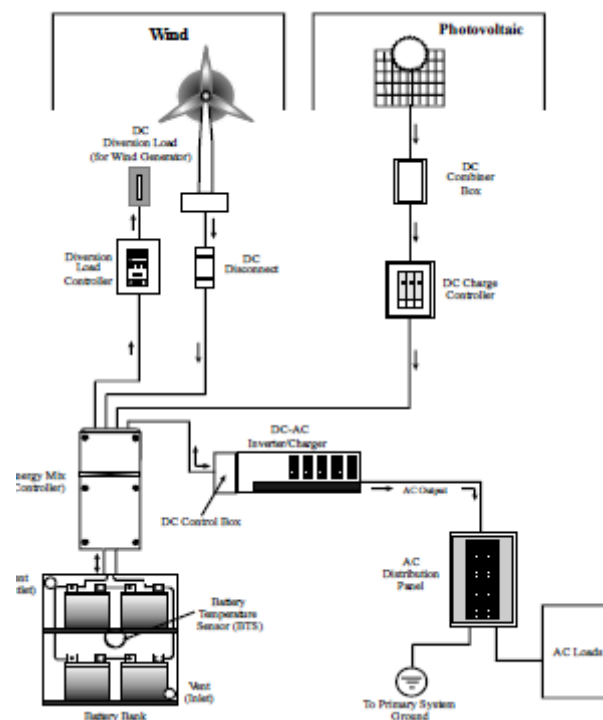


Figure 2. Schematic diagram of hybrid solar wind power system

## III. SPECIAL ISSUES WIND TURBINES AND PV CELLS

As the wind does not blow all the time nor does the sun shine all the time, solar and wind power alone are poor power sources. Hybridizing solar and wind power source together with storage batteries to cover

the periods of time without sun or wind provides a realistic form of power generation. This variable feature of wind turbine power generation is different from conventional fossil fuel, nuclear or hydro-based power generation. Wind energy has become the least expensive renewable energy technology in existence and has peaked the interest of scientists and educators the world over.

Photovoltaic or PV cells, known commonly as solar cells, convert the energy from sunlight into DC electricity. PVs offer added advantages over other renewable energy sources in that they give off no noise and require practically no maintenance. PV cells are a familiar element of the scientific calculator owned by many students. Their operating principles and governing relationships are unfortunately not as pedagogically simple as that of wind turbines. However, they operate as using the same semiconductor principles that govern diodes and transistors and the explanation of their functioning is straightforward and helps to make more intuitive many of the principles covered in semiconductor electronics classes.

Most industrial uses of electricity require AC power. Wind turbines and PV cells provide DC power. A semiconductor-based device known as a power inverter is used to convert the DC power to AC power. This device has a relatively simple operation that is a vivid illustration of many topics traditionally covered in power electronics classes.

### 5. Basic Components of Solar Power

The major components include P.V. modules, battery, and inverter. The most efficient way to determine the capacities of these components is to estimate the load to be supplied. 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 power system, all of these factors are to be taken into consideration when battery size is to be chosen.

Lead-acid batteries are the most common in P.V. systems because their initial cost is lower and also they are readily available nearly everywhere in the world.

Deep cycle batteries are designed to be repeatedly discharged as much as 80 percent of their capacity and so they are a good choice for power systems. Figure 2 is a schematic diagram of a typical Photovoltaic System.

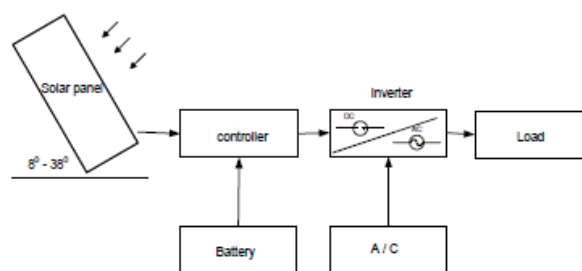


Figure 3. Photovoltaic System

## IV. CONCLUSION

Obviously, a complete hybrid power system of this nature may be too expensive and too labour intensive for many Industrial Technology Departments. However, many of the same benefits could be gleaned from having some subset of the system, for example a PV panel, batteries, and an inverter or even just a PV panel and a DC motor. The enhancement to instruction, especially in making electrical power measurement more physical, intuitive, and real world are substantial and the cost and labour involved in some adoptions of the ideas in this paper to a smaller scale setup are responsible.

The use of solar and wind hybrid power generation is an especially vivid and relevant choice for students for electrical Technology as these are power sources of technological, political, and economic importance of the country. Hybrid combination of wind power, solar power, geothermal power, power from incineration of solid waste, and many other technologies could also be considered depending on local interest and

resources. The key elements of this test bed concept present in the paper are two or more renewable power sources can be connected to a power grid with complex electrical interactions.

## V. REFERENCES

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