



Power Generation from Renewable Resources

Veeresh C Panshetty¹, Rashmi Ugargol², Sachin Prabha³

^{1,2,3}School of Mechanical Engineering

REVA University, Bengaluru, Karnataka, India

ABSTRACT

The natural resources are the major sources of power generation. As these major sources are non-renewable, they are depleting day by day. An alternative way to overcome this is to use renewable resources to generate power. The main objective of this paper is to come up with the most efficient way of power generation. In this paper, the powers generated from three major renewable resources are combined for an efficient power generation.

Keywords: Renewable resources, Hybrid power generation, Pelton wheel, Wind turbine, Photocell.

1. INTRODUCTION

Energy is the major input for the development of society. Hydro, solar and wind are the rapid growing renewable energies. Energy plays a great role to the mankind. According to energy reports of the world, we get around 80% of our energy from conventional fossil fuels like oil (36%), natural gas (21%) and coal (23%) [1]. The need of electricity to the world is increasing at a very high rate. The time is not too long when these non-renewable resources would completely exhaust. The alternative resources should be used to avoid the energy crisis in the future. Alternate resources are namely solar energy, wind energy and hydro energy.

Hydro technology has improved appreciably over the few decades. The hydropower plants are installed in more than 150 countries, over 32% of hydro power is generated in Asia-Pacific region only [2]. Hydroelectricity is an acronym which refers to electricity by hydro power; i.e., the electrical power is produced through the potential energy of falling water or kinetic energy of flowing water.

Wind energy is extracted from the wind using wind turbines. It can be installed in the parts of world where the transmission infrastructure is not fully developed. It can also be installed quickly as possible, so it is easy to match both electricity supply and demand. The work here makes use of wind turbine and the wind energy obtained is stored in a battery.

Solar energy has been harnessed by humans and since ancient times. In India, the annual global solar radiation is about 5 kWh/ sq.m per day with about 2300-3200 sunshine hours per year [3]. This solar radiation, secondary based solar-powered resources like wind and wave power, hydroelectricity, biomass, are mostly used renewable energy on earth. Even though a huge amount of solar energy is available, only a minuscule fraction of it has been used. The most abundant method followed to extract energy from radiant sunlight is through a solar panel. In solar panel, the solar energy is directly converted to electrical energy by the photocells.

The solar energy based uses are limited only by human ingenuity. A partial list of solar-based applications includes, solar electric power generation, solar cooking, solar furnaces, solar-pumping, solar-distillation, solar heating of buildings, solar thermal power production, solar greenhouses, etc.

The entire system involves three types of power based generations i.e. solar, wind and hydro based power generation systems.

2. TECHNICAL DETAILS

In this study solar panel, wind turbine, hydel turbine set up, charging circuit, rechargeable battery, inverter, step up transformer are required.

Hydel power generation: Pelton wheel is used in this setup. Pelton wheel is an impulse turbine. Impulse turbines operate under relatively high heads and low flow rates. The nozzle accelerates the water flow. The water is impelled on the buckets that are attached to a rotating Pelton wheel. This drives the generator through a shaft that is connected to the Pelton wheel. The shaft of the turbine is connected to a dynamo which converts this mechanical energy to direct current through commutator. This electrical energy thus generated is further stored.

Wind power generation: When the wind passes through the wind turbine blades, the blades experience a lift due to the airfoil shape of the blade cross-section of the blade. Due to the lift produced, the blades move and turbine starts rotating. The gears transmit rotation of the turbine to the dynamo to generate electricity. The electricity generated is further stored.

Solar power generation: The solar panel is placed in the daylight. The solar panel contains photocells. The radiant light from the sun is converted to electricity in these photocells. The solar energy is converted into electrical energy due to the photovoltaic effect. The solar cell works in three steps:

- Photons in sunlight hit the semiconductor atoms present in the photocell.
- Electrons are knocked loose from the semiconductor atoms.
- The electrons start flowing when they come in contact with metal and the electricity (direct current) is generated, which is further stored.

3. HYBRID SYSTEM

The electricity produced from all these three sources is fed to a rechargeable battery. The battery is connected to an inverter circuit to convert generated direct current (DC) into 50Hz alternating current (AC) voltage. A capacitor is used after the battery in the circuit to filter the noise in the input voltage. An astable mode of low power astable/monostable multivibrator IC is used in converting the current from direct to alternating nature. MOSFET (transistor) is used for amplifying the electronic signal. The voltage of this is controlled by a step up transformer. This alternating current is further used in the AC appliances. The figure.1 shows block diagram of this hybrid system.

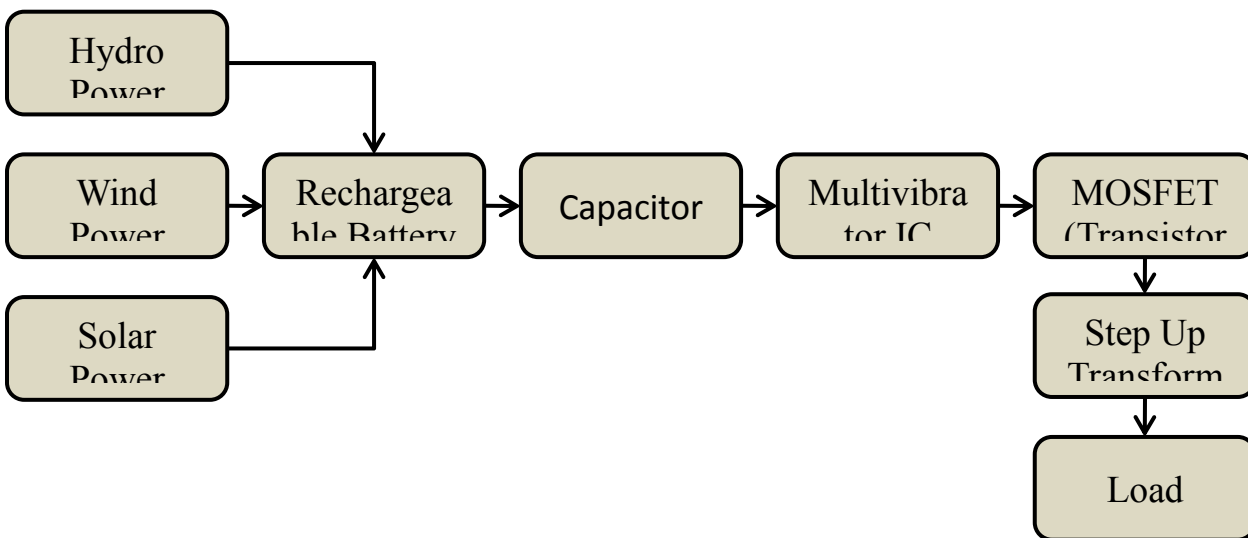


Figure 1: Block Diagram of Hybrid System



3.1. Advantages And Disadvantages

Advantages:

- As this hybrid system uses three resources to produce electrical energy, the set up can produce electricity even in absence of any one or two of the resources.
- Depletion rate of non-renewable resources can be reduced.
- The process is eco-friendly.
- Most of the renewable energy that is going waste is utilized.

Disadvantages:

- Periodic monitoring is a must.
- High maintenance is needed.
- There are chances of failure at heavy loads.
- High installation cost.

3.2. Applications

- This hybrid set up is very well suited for locations which have rich availability of these three renewable resources.
- The hybrid power generation technique can be used in industries, as an uninterrupted power supply is needed for the industries.
- The hybrid power generating system can be set up on a smaller scale for domestic purposes.

4. CONCLUSION

The system generates electrical power as a non-conventional method by wind energy, hydel energy and solar energy. The electrical power is stored in the battery. Using IC, the stored energy is utilized to do useful work.

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