

# Design of Hybrid Power Plant for Smart City

Prashant Hirgal<sup>1</sup> Sudhir Kawade<sup>2</sup> Liyakat Sayyad<sup>3</sup> Pravin Keskar<sup>4</sup> Rinesh Patel<sup>5</sup>

<sup>1,3,4,5</sup>Student <sup>2</sup>Assistant Professor

<sup>1,2,3,4,5</sup>Department of Electronics & Telecommunication Engineering

<sup>1,2,3,4,5</sup>SCSCOE, Rahuri Factory, India

**Abstract**— Energy crisis are of special attention now-a-days. In this project presents a new system configuration of the front-end rectifier stage for a hybrid Hydro/wind/photovoltaic energy system. This system allows the three sources to supply the load separately or simultaneously depending on the availability of the energy sources. In household power generation wind and solar are the general hybrid energy options, which are used. But the overhead water tank is one of the neglected energy generation sources which are available in normal household and commercial places. In today's world each and every source of energy has to be utilized. Therefore we are trying to use the stored energy in overhead water tank for power generation. Solar and Wind energy will contribute major part of power generation. Generated power will be stored in the battery which sources power to inverter and inverter to load. It gives us multiple sources of energy and also helps us to recover some amount of energy which is stored in overhead water tank.

**Key words:** Solar PV Energy, Hybrid Power Plant

## I. INTRODUCTION

Energy is one of the most fundamental elements of our Universe and it helps in the progress of any nation. The energy is the main important factor of our day today life. It also plays an important role in education, health, transportation and infrastructure for attaining a reasonable standard of living and is also a main factor for economic growth and employment. It is a main factor responsible for development of rural area and industrial power plant in a country like India. Power consumption is steadily increasing for past few years. Power consumption in many countries around the world is getting their attention towards more energy efficient and renewable power sources. Generation of electric energy through any stand-alone energy system cannot meet their requirements. So there is a need to make different types of energy systems to supply the economical and reliable power. Such a system is known as 'Hybrid Power Systems'. The needs for hybrid power system are

- More use of traditional power resources like coal, gas, diesel, petrol etc.,
- However to the nuclear power stations many precautions are to be taken to because this will pollute the whole environment.
- Over 200million people living in 80,000villages of India where un- electrified due to problems in hilly locations, the economy of transmission, configuration and instalment cost.
- As to save these renewable resources in our country India hybrid power systems are to be installed.

### A. Solar PV Energy:

Solar panels are used for to convert the solar energy into the electrical energy. Solar panels are used to convert the energy

directly. These solar panels are also used for to heat the water with the induced energy. Photovoltaic is the process between radiation absorbed from the sun and the electricity induced. Solar power is converted into the electric energy by the principle known as photo electric effect. The solar cell or panel consists of an exactly the number of solar cell device connected in series or parallel based on the required output current or voltage. Photo-voltaic cells are made by the semiconductor structures as used in the computer technologies. Sun rays are taken by this material and electrons are emitted from the atoms which activate a current. Power is stored in the batteries. The batteries are for the backup power during bad weather to store the extra power or some part of power from the solar photo-voltaic cells. This solar power generating system is used in household power consumption, railway stations and the places like theatre, hotel, restaurant etc.

### B. Wind Energy:

The terms wind energy or wind power describes the process by which the wind power is used to make mechanical power or electric power. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be a converted into the electrical power by the use of generator. Wind is the flow of air as according to the temperature, which carries higher amount of energy. This wind is passes from the propeller and generates the circular force and axial thrust. This circumferential force is also known as torque, which drives the turbine to produce the electrical power. The wind power is a variable quantity, both in magnitude and in direction. This variable wind power feature of wind turbine power making is different from regular power generation systems like fossil fuel, nuclear or hydroelectric power systems. Wind energy is one of the least expensive renewable energy technologies in regular use. There are many advantages of generating electricity from wind that are, it is renewable, does not pollute environment and it takes less maintenance of system. Wind is available as free, it can get everywhere in the world and it will be around with us at any time. The power which is generated from wind is directly correspond to area covered by wind turbine swept by the wind and also to the cube of the velocity of the wind.

### C. Hydro Power:

A flow of water moving down to the height difference contains energy which can be maintained using some waterwheel or turbine. That free water drives the waterwheel and this rotation drives machinery directly like electric pump, hammer etc or is coupled with a generator which produces electric power. Hydro power is probably the first form of automated power production which is not human / animal driven. By moving the grind stone for milling first, this had been made for for the driving of an electrical generator. Next to steam it was for long the main

power source for electricity. The water does not require continual availability of any power storage. It is formed by mainly mechanical hardware. This makes it relative make it easy to understand and repair-/maintainable. By using the smaller units it does not make more environmental impact.

## II. LITERATURE SURVEY

In Literature survey the Design of hybrid power plant for smart city many inventions had been done about this project. Many solutions have been provided to focus on issue of generation of power from natural resources.

Pradeep Maheshwari and Dr. Sushma Gupta (2012)-The Hybrid (Wind and Solar) Renewable Energy Resources in Distribution System. The hybrid energy systems are recognized as a viable different to grid provide or standard, fuel-based, remote space power provides everywhere the planet. The literature review reveals that, renewable energy based. [1]

Shamim Kaiser (2006) has analysed the Hybrid Options for Power Systems in St. Martin's Island for fulfilling the energy demand using Solar & Wind resources and analysed that it will be better to use Wind-PV combination system for 50 homes instead of single home system & the overall cost of energy would be low if turbine cost decreases. [2]

Muralikrishna & Laxminarayana (2008) has developed a Hybrid (Solar & Wind) Energy System for Rural Electrification to decrease energy storage requirements. The methodology of Life Cycle Cost (LCC) for economic evaluation of stand-alone photovoltaic system, stand-alone wind system and PV-wind hybrid system have been developed and simulated using this model. Also it is designed to meet the requirement load at specified Deficiency of Power Supply Probability (DPSP). [3]

Ghassan Halasa & Johnson Asumadu (2009) has developed a Wind-Solar Hybrid Electrical Power model to support National Grid in Jordan. In this paper they presented that the next generation of power energy systems depends on solar- and wind-energy for the country of Jordan. Sights are chosen to produce electricity using the wind in the Mountains in Northern Jordan and the sun in the Eastern Desert. The paper discusses different power electronics circuits, electrical generators and control methods to link the renewable energy to the national grid and which improved significantly solar and wind energy technologies. [4]

Sunanda Sinha & S.S.Chandel (2013) has studied Pre-feasibility analysis of solar-wind hybrid system potential in a complex hilly terrain. In this paper, a prefeasibility study is carried out to assess the potential using HOMER software (Hybrid Optimization Model for Electric Renewable). The results of the study indicated that there is good potential for utilizing solar-micro wind hybrid systems to supplement the energy needs in hilly regions. [5]

## III. BLOCK DIAGRAM

### A. Block Diagram Description

In this project we shall first step down input ac power from wind and hydro power source. Then we rectify it by rectifier. This output will then be filtered and regulated using filter and regulator respectively. Solar input will be directly given to the regulator. This regulated output is given

to the battery for charging. The battery voltage will be monitored through signal conditioning by arm microcontroller. If the battery is fully charged then the ARM microcontroller will take decision to cut off charging using relay switching. If battery voltage reaches below acceptable level then the ARM microcontroller will take decision to switch off dc supply of battery to inverter section using relay switching.

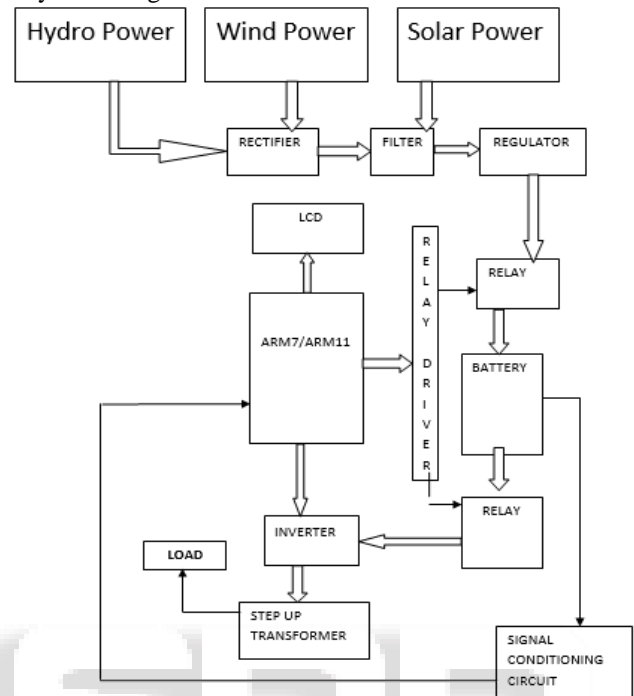


Fig. 1: Block Diagram of Hybrid Power Plant

The ARM microcontroller will also generate timing signals required for MOSFET switching to generate quasi square wave from DC source of battery. This quasi square wave will be given to step up transformer which will give 230V RMS voltage through secondary winding. This ac power will be given to the load.

In this project we use two controller ARM & PIC. PIC is used for clock to inverter & ARM is used to ON & OFF the inverter. Here we use the MPPT (Maximum Power Point Tracking) for solar plate.

Here LCD display is used for display the status of the system. This is connected to ARM 7.

## IV. CONCLUSION

As we know the energy is most fundamental element of our universe. Thus we have tried to implement the system to get as much as energy from nature.

Here we use natural sources solar, wind, and hydro power to develop the electrical energy. We are using these three types of natural sources. The previous work was done on these sources separately. Here we try to develop the concept of system which uses these sources simultaneously. To convert natural energy to electrical energy as much as possible.

Thus there we developing this concept to develop energy with the help of ARM7, wind turbine, hydro turbine, solar panel, inverter, battery, DC motor etc.

REFERENCES

- [1] Pradeep Maheshwari and Dr. Sushma Gupta “The Hybrid (Wind and Solar) Renewable Energy Resources in Distribution System” (2012).
- [2] Shamim Kaiser “Hybrid Options for Power Systems in St. Martin’s Island”, *Journal of engineering and applied sciences* (1) 3: 257-261 2006.
- [3] M.Muralikrishna and V. Lakshminarayan “Hybrid (Solar and Wind) Energy Systems for Rural Electrification”, *ARPJ Journal of Engineering and Applied Sciences*, VOL. 3, NO. 5, ISSN 1819-6608 2008.
- [4] Ghassan Halasa, “Wind-Solar Hybrid Electrical Power Production to Support National Grid: Case Study – Jordan”, *Asian Research Publishing Network (ARPJ)* 2009.
- [5] Sunanda Sinha and S.S.Chandel, “Pre-feasibility analysis of solar-wind hybrid system potential in a complex hilly terrain”, *International Journal of Emerging Technology and Advanced Engineering*, Volume 3, pages 277-282 2013.

