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# ADVANCE HYBRID POWER SYSTEM

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***Abstract*—** One of the primary needs for development in any nation in the world is the terms of reliable electricity supply systems. The purpose of this work is the development of a Solar-Wind hybrid Power system that renewable energies in Sun and Wind to generate electricity. As the wind does not hold throughout the day and the sun does not shine for the whole day, using a single source will not be a suitable choice. A hybrid power system means combining the wind and the sun and stored in a battery. It can be a much more reliable and sensible power source. The load can be powered using the stored energy in the batteries when there is no sun or wind. Battery system is needed to store solar and wind energy during the day time. During night time, the presence of wind is an added advantage, which increases the reliability of the system. In the heavy rain seasons,
the effect of sun is less at the site and thus it is suitable to use a hybrid wind solar system. In general, the use of wind energy is cheaper than that of solar energy. The solar-wind hybrid system is more cost-effective and reliable. The hybrid system is usually defined "A approach of working, organizing or doing incredible that is collected of element of two separate systems". A hybrid is the combination of two more different things, aimed to achieving particular objective or goal**s.**

## I. INTRODUCTION

Energy is important to our society to ensure our quality of life and to support all other elements of our economy. The growth in cost and environmental concerns involving conventional electrical energy. Sources have increased interest in renewable energy sources. It is debatable whether the utilization of electricity should be allowed to grow unrestricted, but the actuality is that there is an growing require for this energy form[1]. Presently almost all the electricity takes place at central power station which utilize fuel, lubricate, water or fissile nuclear material as the main fuel source.

### *A. Energy Resources and Types*

Energy resources are classified into non-renewable and renewable resources.

### *1. Non-renewable Energy Resources*

This energy resources are the ones which are limited and become destroyed with the time , such as oil, coal and coal derivative, natural gas, wood and radioactive material and also produces a lot of harmful waste.

### *2. Renewable Energy Resources*

This energy resources are the ones that are continuously available and renewing itself with the time. Solar energy, wind energy, biomass, tidal energy, wave energy, geothermal power is popular

## II. LITERATURE SUVERAY

Hybrid models have been an helpful means of producing electricity throughout the world. Many research work has been done and accommodate new advances in this ystem. The probabilistic performance assessment of a wind, olar in Hybrid Energy System has been reported. In addition to this solar/wind system with backup storage batteries were designed, included and optimized to predict the behavior of generating system.

E.Muljadi, C.P Butterfied [2] proposed how wind variable speed operation with pitch control The maximum energy by minimizing the loads and the medium speed control the wind turbine speed at high speed and the wind turbine control the power production. Two method can be used to control the power, first is pitch control and second is generator control load.

Meei-Song Kang [3] presented a paper about power system with fuzzy wind generation. Calculation of the demand of load of different consumer at different time, compared the cost of different plant and show the profile of different load by consumer has been discussed. We can neglect the production cost of wind energy by evaluating the load profile of consumer. It is found that the wind power generation can economically and effectively substitute the production cost of the diesel power plant and provide the partial power supply capability for the net peak load demand.

T.Tanabert, T.Sato [4] proposed the control system which can be used to accomplish the requirement. Each control system was confirmed to be practical by simulations depend on an actual network and data. Determined the capacity of Battery which can full fill the requirement demand. Also discussion about the scheduling of generation by wind and other plants by direction and speed of wind energy

controlling and and how much energy we can get from the system has been done. These requirements demand wind power generators for the additional equipment to become stable wind power fluctuations.

### III. SOLAR WIND HYBRID ENERGY SYSTEM

Hybrid Power system is the united power generating system by solar energy panel and windmill. It contain a battery which is used to accumulate the energy generated from both the wind and solar system. Using hybrid power system, achievement of power generation by windmill when wind source is available and production from PV module when light radiation is available. When both sources are available both units can generate power. By providing the battery uninterrupted power supply is possible when both sources are idle.

**1) Wind Power**

The wind energy is a renewable resource of energy. Wind turbines are used for transforming the wind power into electric ower. Electric generator which present inside the turbine, electric power is transforms from the mechanical power Wind turbine systems are available ranging from 50W to 3-4 MW. The energy production by wind turbines based on the wind velocity acting on the turbine. Wind power is capable of feeding both energy production and requirement in the countryside areas. It is
used to run a windmill which in return run a wind generator or wind turbine to generate electricity.

Practically the flexible three blades propeller is used which is 40m in diameter and 62 Km/hr wind pressure with a revolution speed of 48 rpm produce maximum power 14 MW. For small wind power generation system, several blade type (3 - 5 number of blades) or Darrieus type i.e Curved Blade 3 - 5 numbers is appropriate. The main problem of this system is that as the wind speed or velocity is not stable with respect to time i.e. changeable, hence the electric power thus generated is also does not have a set value. Thus, it is used to provide the wind electricity to the battery or any power storage device which supply the load one after the other, rather than directly supply to the load as shown in Figure. 1.1.

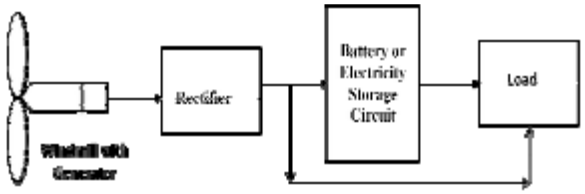



**Figure 1.1: Block Diagram of basic Windmill Power System**

In wind power system as shown in Figure 1.2, the power generation increases in proportion to the cube of the wind speed. Thus it is highly exaggerated in rainy and stormy season when the wind speed is very less to produce electricity. This power generation system is pollution free and economically fair. In wind power system, the power generation increases in quantity to the cube of the wind speed.

**Figure 1.2: Wind Energy**

**2) Photovoltaic Solar Power**

Solar panels are the medium to change solar energy into the electrical energy. Photo-voltaic cells are made from semiconductor structures as in the computer technologies. Sun rays are mesmerized with this material and electrons are emitted from the atoms .This release activates a current. Photovoltaic is known as the procedure between radiation absorbed and the electricity induced. Solar power is converted into the electric power by a common standard called photo electric effect. The solar cell array or panel include an appropriate number of solar cell modules connected in series or parallel based on the required current and voltage as shown in Figure 1.3.

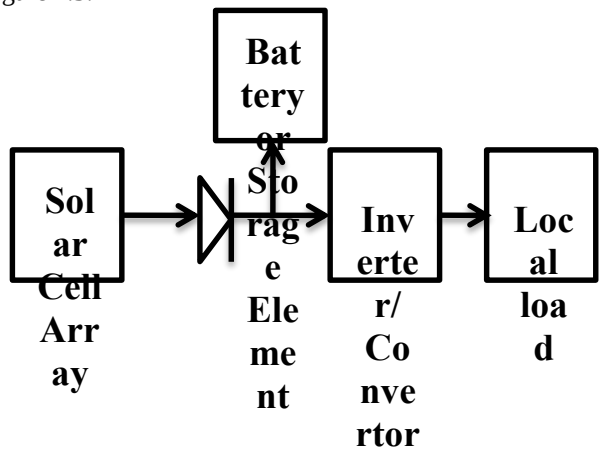


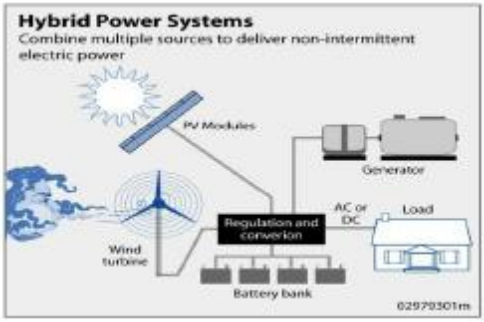

**Figure 1.3: Basic Solar System**

Storage batteries as shown in Figure 1.4 provide the backup power throughout cloudy weather to pile up the surplus power or some part of power from the solar arrays. This solar power generating system is used for meteorological stations, domestic power consumption and entertainment places like hotel, theatre, etc.

**Figure 1.4: Solar Energy**

### 3) Hybrid power systems

Hybrid Power System send discontinuous current of fixed frequency are an emerging technology for supplying electric power in distant locations .They can take benefit of the




easiness of transforming the AC power to higher voltages to minimize power loss in transferring the power over moderately long distances. According to a lot of renewable energy experts, a tiny "hybrid". electric system that combines home wind electric with home solar electric technologies offers more than a few benefits over any single system. Hybrid systems are more possible to create power when you require it. Many hybrid systems are separate systems, which operate "off- grid" -- not linked to an electricity distribution system as shown in Figure 1.5. For the period when neither the wind nor the solar system are producing, most hybrid systems provide power through batteries and an engine generator motorized by conventional fuels, such as diesel. The generator provide power and recharge the battery if the battery run low. When the engine generator is added it makes the system more complicated, but modern electronic controllers can operate these systems automatically. The size of the other components required for the system can be reduced by an engine generator. To supply the electric requirement large enough to supply electrical needs during non-charging periods. Battery banks are typically sized to supply the electric load for one to three days.

**Figure 1.5: Hybrid (Renewable) Solar Wind Power Source**

## IV. BLOCK DIAGRAM OF HYBRID SYSTEM

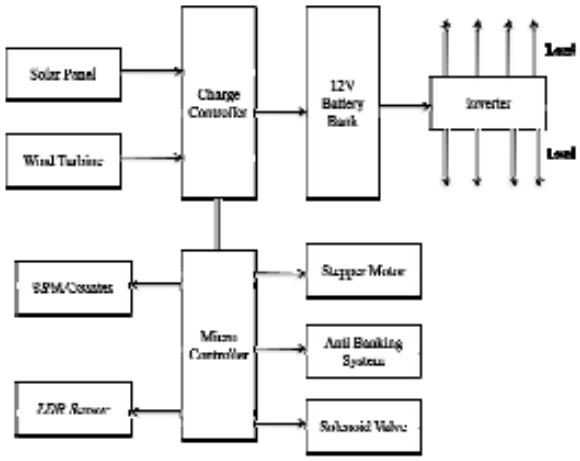



**Figure 1.6: Block Diagram of Advance Hybrid Power System**

As the wind does not flow during the day and the sun does not shine for the whole day, using a single source will not be a appropriate choice. A hybrid arrangement of combining the power generated from both the wind and the sun and that power is stored in a battery can be more reliable and realistic power resource. Stored energy in the batteries even when there is no availability of sun or wind. For designing a system having lowest cost and with maximum reliability, hybrid systems are typically built.

Due to the costly solar PV cells, large capacity designs are less competent. This is where the wind turbine comes into the picture, the main feature being its cheap cost as compared to the PV cells. Battery system is needed to store solar and wind energy produced during the day time. During night time, the presence of wind is an added advantage, which increases there liability of the system. In the monsoon seasons, the effect of sun is less at the site and thus it is apt to use a hybrid wind solar system. In addition to the technical considerations, cost benefit is a factor that has to be incorporated into the process of optimizing a hybrid energy system.

In general, the use of wind energy is cheaper than that of solar energy.

The solar-wind hybrid system is more cost-effective and

reliable when wind is taken as a source. In these wind mill and solar panel attached to charge controller which controls the charge then it is attached to the 12V battery bank which gives 12V dc voltage which is attached to the inverter. Inverter which converts dc into ac voltage. Load will connect to the inverter. In this system we are using rpm counter which measure the speed of the wind turbine. This rpm value will be given to the microcontroller. The fixed rpm value will be stored in the microcontroller. Because when turbine will rotate fastly beyond particular limit then anti braking system will be activated which control the speed of the wind turbine? In these systems we are using LDR sensor which sense the present of sunlight according to that solar panel will move for tracking the sun using stepper motor with the help of microcontroller. Solenoid valve is used for lubrication purposes.

In these circuit LDR circuit is interfaced with the microcontroller. LDR sensor sense the presence of sunlight and according to the signal is send to the microcontroller and using the ldr sensor output which is acts as input for the microcontroller, microcontroller will move the solar panel in the sun direction with the help of stepper motor which is interface to the microcontroller using driver IC ULN2803. Battery is charge through the solar panel and load is on through inverter which is attached to the battery. Wind turbine is attached to the dc motor. When turbine is moving motor will generate the voltage and given to the battery. Relay circuit is interfaced to the microcontroller. Relay 1 is used to control the speed of wind mill if wind mill will move above the speed rate. Anti braking system is attached to the relay. Ultrasonic sensor is interfaced to the microcontroller which sense the level of lubrication oil if level is low then automatically solenoid valve is open.

**V. CIRCUIT DIAGRAM OF ADVANCE HYBRID SYSTEM**

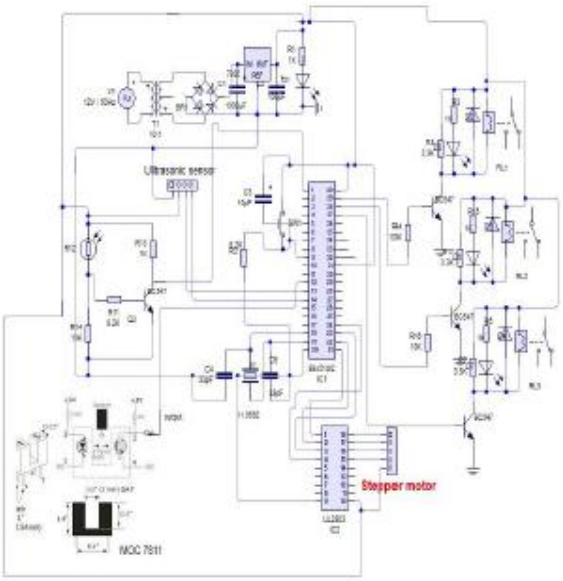



**Figure 1.7: Circuit Diagram of Advance Hybrid Power System**

**VI. DESIGN OF ADVANCE HYBRID SYSTEM**

The literature survey presents various techniques and programs that have been used and designed for advance hybrid system. Each technique has its own advantage and some or the other disadvantage. The purpose hybrid system is the development of a Solar-Wind that harnesses the renewable energies in Sun and Wind to generate electricity. The results show that the site is profuse in renewable energy and the hybrid nature increases the reliability and reduces the dependence on one single source.

**PCB Design**

Printed circuit board (PCB) pattern applied to one or both sides of an insulating base. Conductor materials available are silver, brass, aluminum and copper, copper is the most widely used which is used here also. The thickness of conducting material depends upon the current carrying capacity of the circuit.
The Printed Circuit Board usually serves three functions:

1. It provides mechanical support to the components mounted on it.
2. It provides necessary electrical interconnection.
3. It acts as heat sink that provides a transmission path leading to deletion of most of the heat generated in the circuit.

**1. Copper clad:**

The base of cover is either paper of glass fiber cloth. Copper, foil, which is produced by the method of electroplating and both are kept under hydraulic pressure for proper adhesive pressure. These copper clad are easily available in the market.

**2. Types of Laminates**

National Electrical Manufacturers Association (NEMA) has various grades of laminates that are obtained by different resins and filters.

**3. Phenol**

Phenol and Formaldehyde produce phenolic paper base laminate that has phenolic resins with proper filter. This is Brown in color and opaque. Disadvantage is poor moisture resistance.

**4. Epoxy Laminates**

Epoxy paper this is also paper based but impregnated with epoxy resin, yellowish white and translucent. Epoxy Glass base material has high mechanical strength and good electrical properties usually green in color and semitransparent. There are various laminates available but here Fiber Glass epoxy laminate is used.

**5. PCB fabrication includes following steps:**

1. Layout of the circuit
2. Artwork designing
3. Printing
4. Etching
5. Drilling
6. Mounting of components and soldering
7. Finishing

**6. Layout**

The layout of PCB has to include all the information on the board before one can go onto the all work preparation. Detailed circuit diagram, design concept and the philosophy behind the equipment are very important for the layout.

**7. Layout Scale**

Depending on the accuracy required it should be produced at a 1:1 or 2:1 or even 4:1 scale. The layout is best prepared on the same scale as the work to check the entire problem, which might be caused by redrawing of layout to the work scale. The layout scale commonly applied is 2:1 with a 1:1 scale, no demanding single sided boards can be designed but enough care should be taken, particularly during the layout preparation.

**8. Procedure**

The first rule is to be change each and every PCB layout as Viewed from the component side. This rule must be strictly followed to avoid confusion, which would be caused. Among the mechanism, the larger ones are placed first and if space is in between is filled with smaller ones. Components requiring input/output connecting come near the connector. The de-soldering of other components is not essential if they have to be replaced all components are placed in such a manner

**9. Layout Sketch**

The product of the layout designing is the pencil sketched component. It contains all information for the preparation of network.

**10. Basic Approaches**

For drawing on white cardboard paper, good quality Indian ink and ink pen set are minimum requirements. Drawing practice - drawing procedure is very at least by 0.1 - 0.2, and solder pad locations. And conductors can easily be displaced by 0.3 - 0.5mm.

**11. Conductor Holes**

A code can used for the conductor with a special width. Minimum spacing should also be provided.

**12. Screen Printing**

The method of screen - printing is known to the printing industry because of its natural capabilities of printing a large range of inks on almost any kind of surface including glass, metal, plastic fabrics, wooer, etc. It is successfully employed in printing of

- Etch resists
- Plate resists
- Solder stop lacquers
- Notation printing

It is very simple. A screen basics with uniform meshes and opening is stretched and fixed on a solid frame of wood. While the meshes in the rest of the area is closed when the circuit pattern area open,

In the actual printing step, ink is forced by the moving compress systematic the open meshes onto the surface of the material to be printed.

**13. Pattern Transfer onto The Screen**

There are two different methods in use, and each method has its own advantages and disadvantages.

With the direct method, the screen is ready, by covering a photographic suspension directly onto the screen fabric and exposing it in the pattern area. The indirect method makes use of a separate screen process film, supported on a backing sheet. The layer on its backing sheet that is there after pressed onto the screen fabric and sticks there. Finally, the backing sheet is peeled off, opening all those screen meshes, which are not covered by the film pattern.

The direct method provides very durable screen stencils with a higher dimensional accuracy but the finest details are not reproduced. The indirect method is more suitable for smaller series and where the finest details to be reproduced. The indirect method is faster but dimensionally less accurate and the screen stencils are less durable, more sensitive to mechanical damages and interruption in printing.

**14. Etching**

In all subtractive PCB process, etching is one of the most important steps. The final copper pattern is formed by selective removal of all the unwanted copper, which is not protected by an etching unit.

Solutions, which are used in etching process, are known as enchants.

1. Ferric Chloride
2. Cupric Chloride
3. Chromic Acid
4. Alkaline Ammonia

Of these Ferric Chloride is widely used because it has short etching time and it can be stored for a long time. Etching of PCBs as required in modern electronic equipment production, is usually done in spray type etching machines.

Tank or bubble etching, in which the boards kept in tank, were lowered and fully immersed into the agitated, has almost disappeared.

**15. Component Mounting**

Carefully mounting of components on PCB increases the reliability of assembly.

1. One leads must be cleaned before they are inserted in PCB holes. Asymmetric lead bending must be avoided, the ENT leads must fit into holes properly so that they can be soldered.
2. When the space is to be saved then vertical mounting is preferred. The vertical lead must have an insulating sleeve.
3. Where jumper wire crosses over conductors, they must be insulted.
4. For mounting of PCBs, TO5, DIP packages must be used of easy insertion.
5. For mounting transistors, each lead must have insulating sleeve.

All the flat radial components such as resistors, diodes, and inductors are mounted and soldered. Then IC bases are soldered. The vertical components such as transistors, gang

condenser and FET are mounted and soldered.

**16. Soldering**

The next process after the component mounting is soldering, solder pint is achieved by heating the solder and base metal about the melting point of the solders used.

The necessary heat depends upon:

1. The nature and type of joints 2.
Melting temperature of solder
3. Flux

Soldering techniques are of so many types but we are using iron soldering.

**17. Iron soldering**

Soldering iron consists of an insulating handle connected through a metal shaft, of a bit accurately makes contact with

the component parts of the joint and solder and heats them up. The electrical heating element is located in the hollow shank or handles to heat the bit.

**18. Functions of Bit**

It stores heat and convey it from the heat source to the work. It may be required to store surplus solder from the joint. It may be required to store molten solder and flux to the work. It's surface must be lined or wetted, this encourages flow of solder into the joint. When the surface of the work becomes ester by solder, a continuous film of liquid metal between the bit and work provides a path of high thermal conductivity through which heat can flow into the work piece.

Solder bit are made up of copper, this metal has good wetting properly, heat capability ad thermal conductivity. Tin-lead solder affects copper during soldering operation. Production of copper bit can be made with thick iron coating followed by Ni/Tin plating. The life of the bit is increased by a factor of 10 to 15. Solder irons are specified in terms of wattage. Depending on heat input intended for working and types of work (Continuous or individual) the choice of the solder iron can be made.

**19. Procedure of Soldering**

The points to be joined must be cleaned first and fluxed. The hard solder iron and solder wire is applied to the work. The melted solder becomes bright and fluid. The iron must be removed after sufficient time and joint is allowed to coal. At the end, finishing is done.

**VII. HARDWARE RESULT**

Intermittent energy resources and energy resources unbalance are the most important reason to install a hybrid energy supply system. The Solar PV wind hybrid system suits to conditions here sunlight and wind has seasonal shifts. As the wind does not blow throughout the day and the sun does not shine for the entire day, using a single source will not be a suitable choice. A hybrid arrangement of combining the power harnessed from both the wind and the sun and stored
in a battery can be a much more reliable and realistic power source. The load can still be powered using the stored energy in the batteries even when there is no sun or wind. Hybrid systems are usually built for design of systems with lowest possible cost and also with maximum reliability. The high cost of solar PV cells makes it less competent for larger capacity designs.

Cheap cost as compared to the PV cells. Battery system is needed to store solar and wind energy produced during the day time. During night time, the presence of wind is an added advantage, which increases the reliability of the system. In the monsoon seasons, the effect of sun is less at the site and thus it is apt to use a hybrid wind solar system.

**A. Experimental Setup**

The hardware of Solar PV Wind hybrid energy system is implemented and the output is fed to the load is shown in Figure bellow. The current and voltage values from the wind turbine, solar panels, battery group and load are measured in the implemented system. Production and consumption of
power for each module are calculated.

Depending on the environmental conditions, required energy for the system can be supplied either separately from

the wind or solar systems or using these two resources at the same time is shown in Figure 1.8.

**Figure 1.8: Experimental setup**

***B. Analysis of Result***

A hybrid arrangement of combining the power harnessed from both the wind and the sun and stored in a battery can be a much more reliable and realistic power source. The load can still be powered using the stored energy in the batteries even when there is no sun or wind. Hybrid systems are usually built for design of systems with lowest possible cost
and also with maximum reliability.

**1. *For Solar Energy System***

The solar modules (photovoltaic cell) generate DC electricity whenever sunlight falls in solar cells. The solar modules

should be tilted at an optimum angle for that particular location, face due south, and should not be shaded at any time of the day. The below table shows the summary of result of for solar and wind energy system.

**Table 1.1: Result of Solar Energy System**

| Sr. No. | Solar Angle from Origin | Solar Output in volt |
|---|---|---|
| 1 | $45^0$ | 10.05V |
| 2 | $90^0$ | 12.05V |
| 3 | $135^0$ | 11.98V |
| 4 | $185^0$ | 10.03V |

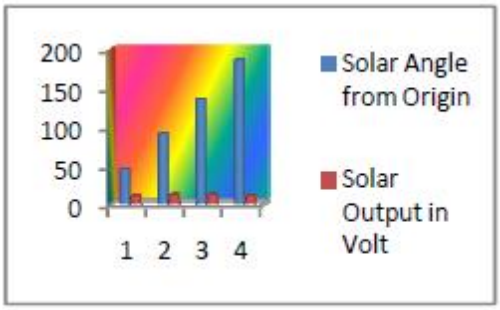



**Figure 1.9: Graph for Solar Energy System**

**2. *For Wind Energy System***

Wind is a natural phenomenon related to the movement of air masses caused primarily by the differential solar heating of he earth's surface. Seasonal variations in the energy received rom the sun affect the strength and direction of the wind. The wind turbine captures the winds kinetic energy in a rotor consisting of two or more blades mechanically coupled to an electrical generator. The turbine is mounted on a tall tower to enhance the energy capture.

**Table 1.2: Result of wind Energy System**

| Sr.No. | Wind Speed in RPM | Wind Output in Volt |
|---|---|---|
| 1 | 60 | 8.09V |
| 2 | 100 | 11.15V |
| 3 | 150 | 11.78V |
| 4 | 190 | 11.98V |

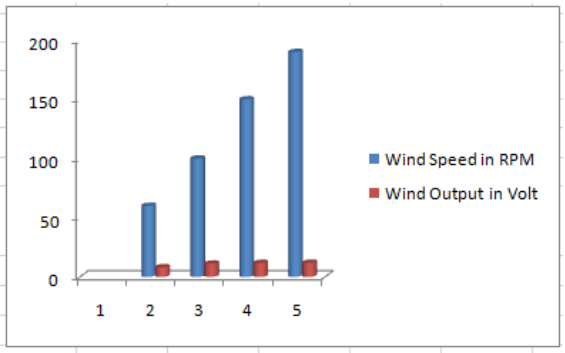



**Figure 1.10: Graph for Wind Energy System**

Table 1.1 shows to us the solar output according to sun position and Table 1.2 shows to us the wind mill output according speed in RPM of wind mill.

## VII. CONCLUSION

In the present work a Solar and Wind Hybrid Energy System was implemented. A portion of the energy requirement for a personal house, farm house, a small corporation, an educational organization or an residence house depending on the need at the location where electricity has been supplied and generated from the wind and solar power. It reduces the confidence on one single source and has increased the reliability. Hence to improve the efficiency of the system , compared with their individual mode of generation. Because the seasonal profiles of the wind and solar resources are quite complementary in some cause, combination of wind and solar perform better than either wind or solar alone Under the situation of power failure this hybrid system keeps the stability of supply without producing any noise pollution, dislike any other power generating equipment. High Efficiency than Individual systems.

Since the longer pay back time of investing renewable energy system, tiny firms are interested in investing the renewable system.

The future scope of hybrid power system is to generate huge model by develop the power in also MW to fulfill the electricity requirement of a town for a day. We can produce the large amount energy from the renewable resources into future by using the proper locations. Many locations are available into India where large potential of solar and wind energy. Into

future we can install the small plant into rural area where solar and wind is available by using this energy. We can fulfill the load requirement of the consumer of these rural areas. We can decrease the pollution by these resources compare to non-renewable resources. By using hybrid system
we can fulfill the energy demand into the future. In future by using sensor of better quality we can increase the potential. We have used the small storage capacity. Using the better quality data logger we can increase the energy production in future. In future we can install large solar and wind plant which are cheaper compare to small plants.

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