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Hybrid Power Generation by Using Solar and Wind Energy Hybrid Power Generation Applicable To Future Electric Vehicle

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Abstract :
The objective of this concept is to generate electric power from windmill and solar panel and synchronizing with EB power supply. Nowadays power demand is increased highly so need the alternate power source it is very useful to generate the electrical power from natural resources in order to compensate the electric power demand. The hybrid power generation is a new innovative concept which have designed in this project. It is one of the non conventional energy; here generating the power supply from the natural resources and also during un availability of natural resources the EB power supply is used for the load and excessive generation of solar, wind mill supply is exported to the grid of the EB supply at any voltage level. This project is designed with the following parts are wind mill arrangement, solar panel, dynamo, rectifier, filter andbattery and connected to the Electricity Board supply.

Working Principle:

Wind mill arrangement is the mechanical arrangements which are easily rotated. The rotating speed depends upon the wind strength. The windmill arrangements and solar panel arrangements are fixed as shown in the figure. The solar panel will get the energy from the direct sunlight the generated power from the solar panel is directly connected to the control unit and charged to the battery. The wind mill arrangement is coupled with the dynamo. The fan shaft which is coupled with the dynamo shaft is used to generate the electricity power from the generator. The electric power is generated through the dynamo. The generated electric power is the alternating voltage. The AC voltage given to the rectifier circuit will convert into DC voltage. Then the rectified voltage is given to filter circuit to remove the ripple voltage. After the filtration the pure DC voltage is given to battery through the charging circuit. The stored DC voltage can be used to different application and the excessive energy is connected to the grid using energy meter for reading purpose. During the non-availability of wind mill, Solar panel will supply the load which is fed from EB supply.

Advantages

- Power generation is double
- Reduce the power demand
- Easy to implement
- Used in many areas
- Uninterrupted power supply

Disadvantages

- Cost is high
- Solar power is not available during night time
- Used for lighting purpose only
- If used for power loads initial cost is very high.

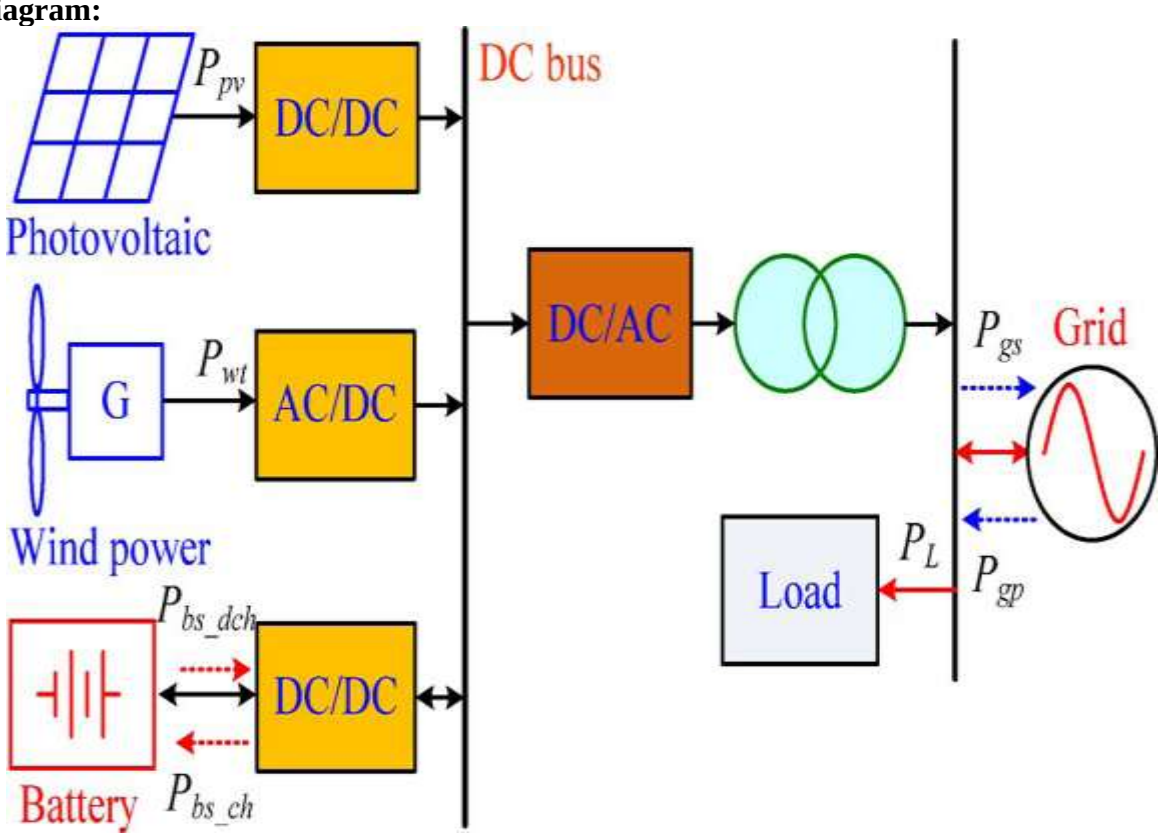
- During non – availability of natural sources EB supply is used so it increase the running cost.

Applications

- Applicable in high wind flow areas
- Applicable in high sun light areas.
- Applicable in home, all buildings, waste lands, etc.,

DRAWING FOR HYBRID POWER GENERATION

Block Diagram:



Objectives:

The objective of this project is to generate green energy from the renewable energy sources such as Solar and Wind Energy. By using this Hybrid Power Generation pollution free earthing system and to maintain the level of non-renewable energy resources is obtained. By using the solar and wind energy generation system the global warming will be reduced.

In this project generation of energy by using domestic Solar panels and domestic wind mill arrangement is made . During day time power is generated from the solar panel and during night and rainy season the power is generated from the windmill arrangement. The battery is used to store the generating energy and gives required timings.

Thus generating the green energy from the natural resources. The output is verified by using Simulation Software.

Introduction:

Solar Panel**:**

A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel is used as a component in a larger photovoltaic system to offer electricity for commercial and residential applications.
A single solar panel can only produce a limited amount of power, many installations contain several panels. This is known as a photovoltaic array.
Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate). The majority of modules use wafer-based crystalline silicon cells or a thin-film cell based on cadmium telluride or silicon. Crystalline silicon, which is commonly used in the wafer form in photovoltaic (PV) modules, is derived from silicon, a commonly used semi-conductor.
In order to use the cells in practical applications, they must be connected electrically to one another and top protected from mechanical damage. Protected from moisture, which corrodes metal contacts and interconnects. Most modules are usually rigid.

Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired amount of current source capability. Diodes are included to avoid overheating of cells in case of partial shading. Since cell heating reduces the operating efficiency it is desirable to minimize the heating hence to provide good ventilation behind the module.

New designs of module include concentrator modules in which the light is concentrated by an array of lenses or mirrors into an array of small cells. This allows the use of cells with a very high-cost per unit area (such as gallium arsenide) in a cost-competitive way.

In this project the solar panel range used is 380 V, 3500 Watts.

WIND MILL:

Wind turbines are used to convert the wind power into electric power. Electric generator inside the turbine converts the mechanical power into the electric power. Wind turbine systems are available ranging from 50 Watts to 2 to 3 MW. The production by wind turbines depends on the wind velocity acting on the turbine.

Wind turbines can be classified with respect to the physical features (dimensions, axes, number of blade), generated power and so on. Wind turbines with respect to axis structure: horizontal rotor plane located turbines, turbines with vertical or horizontal spinning directions with respect to the wind. Turbines with blade numbers: 3-blade, 2-blade and 1-blade turbines.

Power production capacity based on classification has four subclasses

- Small Power Systems
- Moderate Power Systems
- Big Power Systems
- Megawatt Turbines

In this project 200 V, 3500 Watts wind generator is used.

Design and Implementation of Domestic Solar-Wind Hybrid Energy System

Hybrid systems are the ones that use more than one energy resources. Integration of systems (wind and solar) has more influence in terms of electric power production. Such systems are called as "hybrid systems".

Hybrid solar-wind applications are implemented in the field, where all-year energy is to be consumed without any chance for an interrupt. It is possible to have any combination of energy resources to supply the energy demand in the hybrid systems. This project is similar with solar power panel and wind turbine power. Differently, it is only an add-on in the system.

Photovoltaic solar panels and small wind turbines depend on climate and weather conditions. Therefore, neither solar nor wind power is sufficient alone. A number of renewable energy expert claims to have a satisfactory hybrid energy resource if both wind and solar power are integrated within a unique body. In the summer time, when sun beams are strong enough, wind velocity is relatively small. In the winter time, when sunny days are relatively shorter, wind velocity is high on the contrast.

Efficiency of these renewable systems show also differences through the year. In other words, it is needed to support these two systems with each other to sustain the continuity of the energy production in the system.

Maximum Power Point Tracking:

Maximum power point tracking (MPPT) is a technique that grid connected inverters, solar battery chargers, wind generators and similar devices use to get the maximum possible power from one or more photovoltaic devices, typically solar panels, though optical power transmission systems can benefit from similar technology. Solar cells have a complex relationship between solar radiation, temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve. It is the purpose of the MPPT system to sample the output of the cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions. MPPT devices are typically integrated into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving various loads, including power grids, batteries, or motors.

Operation With Batteries:

At night, an off-grid PV power system may use batteries to supply loads. Although the fully charged battery pack voltage may be close to the PV panel's maximum power point voltage, this is unlikely to be true at

sunrise when the battery has been partially discharged. Charging may begin at a voltage considerably below the PV panel maximum power point voltage, and an MPPT can resolve this mismatch.
When the batteries in an off-grid system are fully charged and PV production exceeds local loads, an MPPT can no longer operate the panel at its maximum power point as the excess power has no load to absorb it. The MPPT must then shift the PV panel operating point away from the peak power point until production exactly matches demand. (An alternative approach commonly used in spacecraft is to divert surplus PV power into a resistive load, allowing the panel to operate continuously at its peak power point.) In a grid connected photovoltaic system, all delivered power from solar modules will be sent to the grid. Therefore, the MPPT in a grid connected PV system will always attempt to operate the PV panel at its maximum power point.

Dc To Dc Converters:

DC to DC converters are important in portable electronic devices such as cellular phones and laptop computers, which are supplied with power from batteries primarily. Such electronic devices often contain several sub-circuits, each with its own voltage level requirement different from that supplied by the battery or an external supply (sometimes higher or lower than the supply voltage). Additionally, the battery voltage declines as its stored power is drained. Switched DC to DC converters offer a method to increase voltage from a partially lowered battery voltage thereby saving space instead of using multiple batteries to accomplish the same thing.
Most DC to DC converters also regulate the output voltage. Some exceptions include high-efficiency LED power sources, which are a kind of DC to DC converter that regulates the current through the LEDs, and simple charge pumps which double or triple the input voltage.
DC-to-DC converters are now available as integrated circuits needing minimal additional components. They are also available as a complete hybrid circuit component, ready for use within an electronic assembly.
A converter may be designed to operate in continuous mode at high power, and in discontinuous mode at low power.

Boost Converter

A **boost converter** (**step-up converter**) is a power converter with an output DC voltage greater than its input DC voltage. It is a class of switching-mode power supply (SMPS) containing at least two semiconductor switches (a diode and a transistor) and at least one energy storage element. Filters made of capacitors (sometimes in combination with inductors) are normally added to the output of the converter to reduce output voltage ripple.

Buck Converter:

A **buck converter** is a step-down DC to DC converter. Its design is similar to the step-up boost converter, and like the boost converter it is a switched-mode power supply that uses two switches (a transistor and a diode), an inductor and a capacitor.
The simplest way to reduce a DC voltage is to use a voltage divider circuit, but voltage dividers waste energy, since they operate by bleeding off excess power as heat; also, output voltage isn't regulated (varies with input voltage). Buck converters efficiency is up to 95% for integrated circuits

Inverter:

An **inverter** is an electrical device that converts direct current (DC) to alternating current (AC) the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits.
Static inverter is used for this purpose and the rating is 415Volts.

Battery:

An electrical **battery** is one or more electrochemical cells that convert stored chemical energy into electrical energy.

The lead acid battery for a capacity of 80 Volts, 100AH is used for this project.

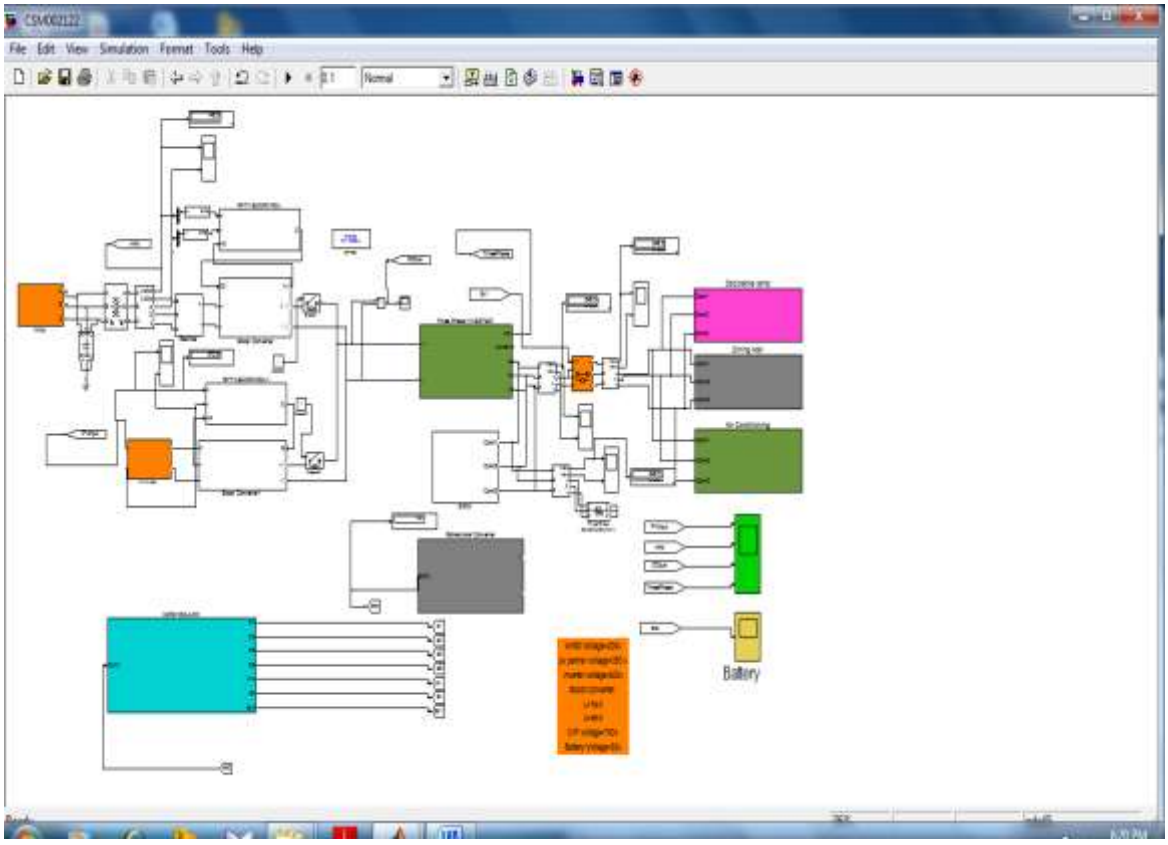
Load Sharing
In this system have a connected load of 3500 Watts. And the installed capacity is 4000Watts.

Specifications:
WIND Voltage=200v
PV pannel voltage=350 v
Inverter voltage=415v
Battery Voltage=80v

Statement of the Problem:

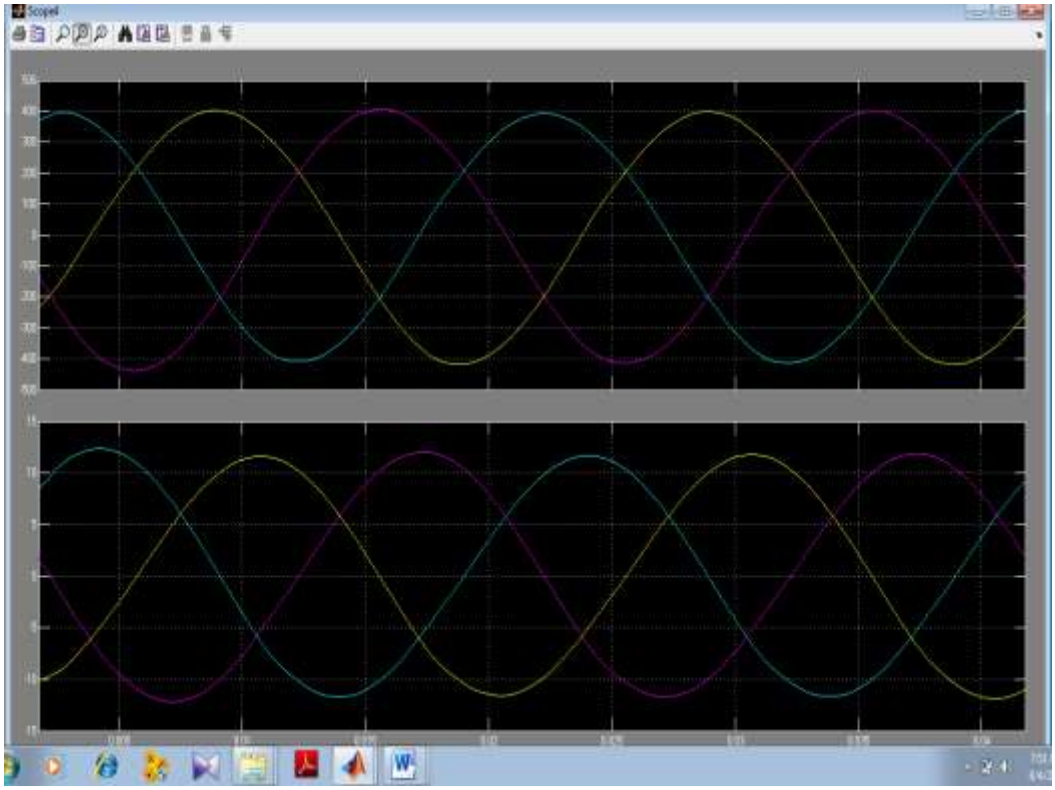
- The Wind – Solar energy conversion system is more stable.
- It requires little maintenance and operation cost.
- Easy installation as compared as non-conventional energy sources.
- Environmental friendly.
- The cost to produce unit power is comparatively lower than other renewable energy.
- Wind – Solar energy is available whole year.

Circuit Diagram:



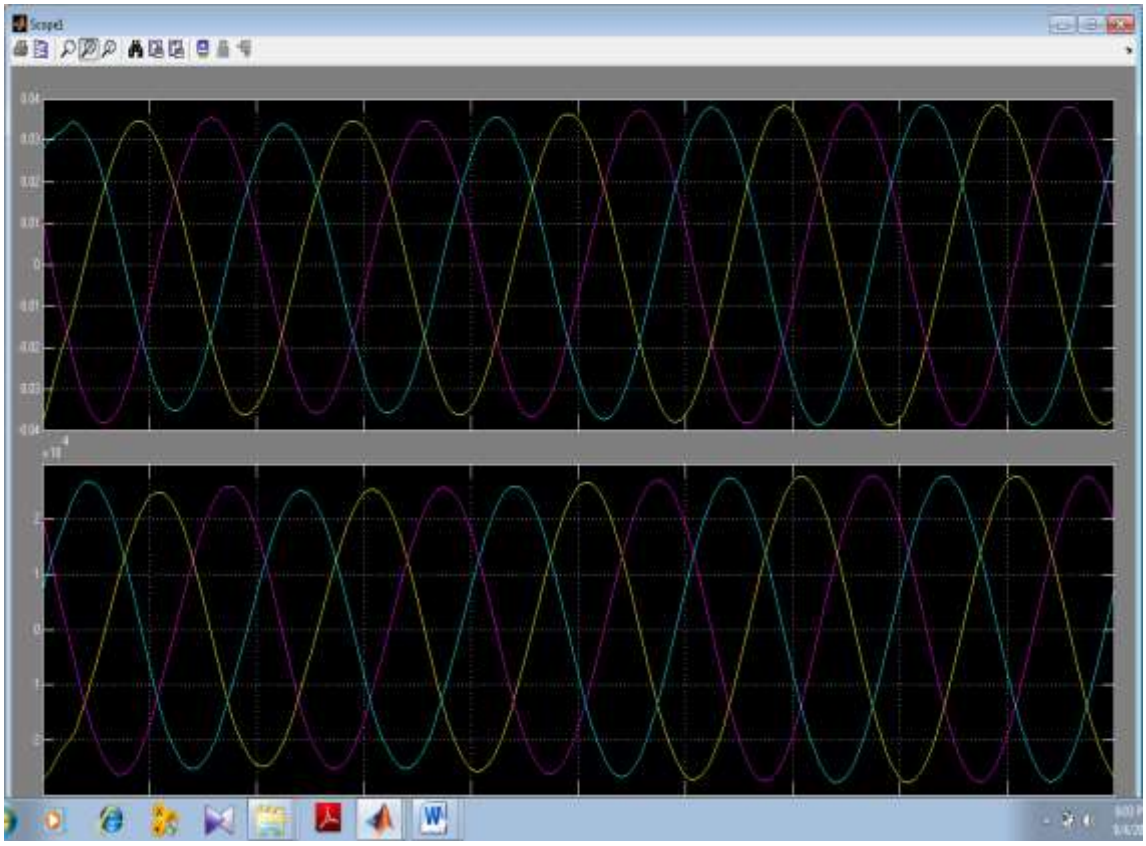
Analysis
Output Waveforms:

Figure 1: Breaker in open condition(Grid Voltage)



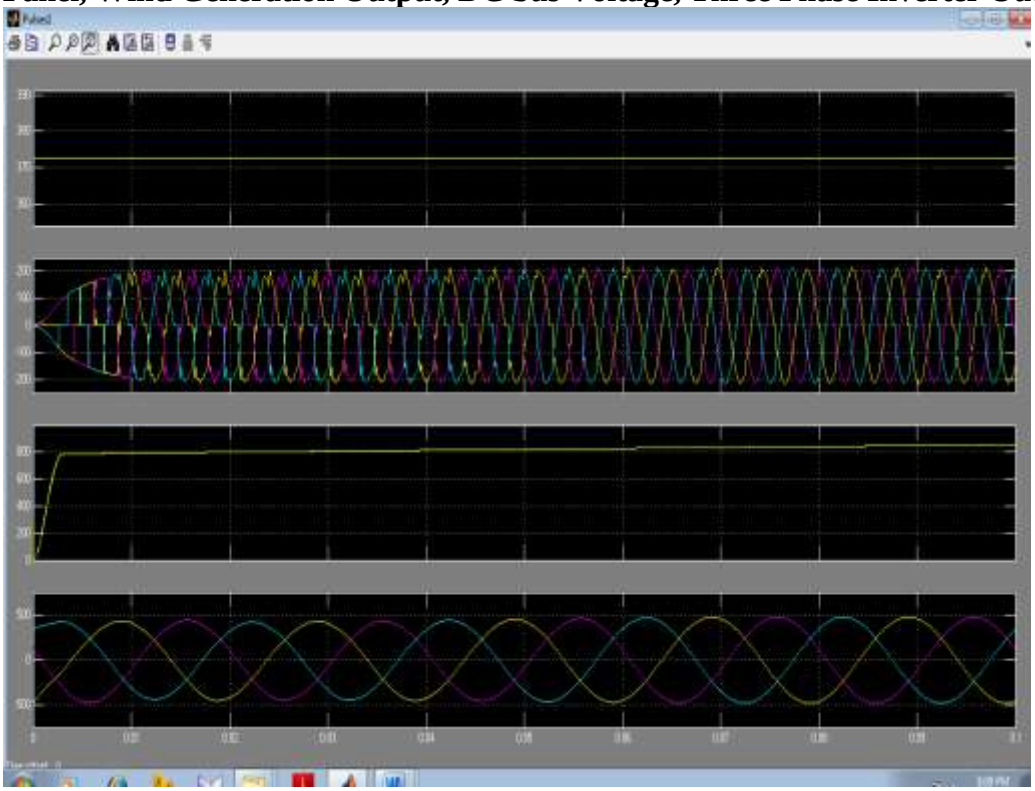
During the breaker in open condition the grid voltage will be maximum.(405 V)

Figure 2 :Breaker in open condition (Load Voltage)



During the breaker in open condition the output volage is 0.03V its for leakage voltage.

Figure 3: PV Panel, Wind Generation Output, DC bus Voltage, Three Phase Inverter Output

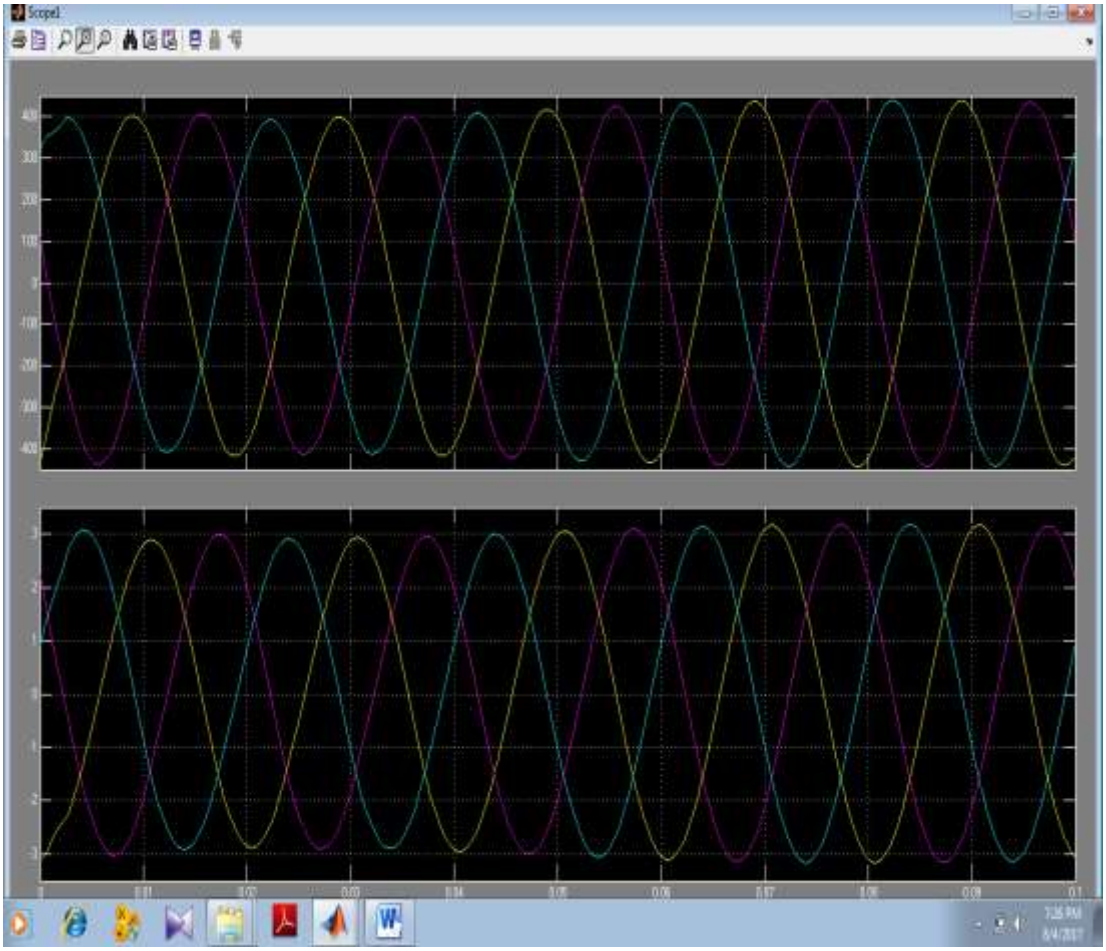


The PV Panel output is 373 Volts , Wind generator output is 200 Volts , DC bus Voltage is 800 V and the Three Phase Inverter output is 475 Volts.

Figure 4: Battery Voltage

The output of the Battery voltage is 80 Volts DC.

Figure 5 : Breaker closed condition (Load Voltage)



During the breaker closed condition the load take the voltage of 405 Volts

Result

Thus the output wave form is verified by using MATLAB 7.10 version.

The total installed capacity of Solar panel is 3500Watts and the Wind Generator is 3500 Watts and the connected load is 1500 Watts. When both Solar power and Wind generator are operating simultaneously the load power will be shared all three sources ie., Electricity supply, Wind generator and Solar panel. If any one of the system will fail the load will be shared by the remaining working systems. When EB supply is cut off Solar and wind sources will be shared equally to the connected load.

Conclusion:

In this work a hybrid power generation system is designed which shows different characteristics of the system. From the study of the model characteristics it is clear that this hybrid power system provides voltage stability and automatic load sharing capability. For these reasons the system is very much useful to provide good quality of power.

Future Study:

In future more sophisticated and less power consuming hybrid system can handle more loads for colleges and industries. In India more solar energy is received from the sun and the full energy is not utilized for generation of power. In future, using solar panel and wind generator for all domestic, industrial and colleges the more energy can be received from the hybrid system and energy requirement from the government can be reduced. So the non-renewable energy sources usages are minimized. Moreover it can be implemented in Electric Vehicle.

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