ANALYSIS OF INVERTER BATTERY CHARGER BY USING SOLAR POWER SYSTEM

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ABSTRACT
In this system, inverter battery charger system is analyzed for testing with solar power system with AC loads, stand fan and laptop. This paper is tested using a solar panel (300 watts), 220 Volts inverter at a frequency of 50Hz. The solar panel is used to supply power for the electronic devices for testing AC loads such as portable UPS, desktop computers, stand fans and printer etc. at Department. In this paper, solar inverter device, a local constructed inverter, converts a DC power from the battery to an AC power. This device is constructed with locally sourced components and materials of regulated standards. The basic principle of its operation is a simple conversion of 12V DC from a battery using integrated circuits and semiconductors at a frequency of 50Hz, to a 220V AC across the windings of a transformer. An additional power supply to the public power supply with the same power output is thus provided at an affordable price. And solar energy has many advantages especially in environmental, economic and social systems.

Keywords *- Solar Panel, Battery, Inverter Device, T, Power Supply, AC Load*

1. INTRODUCTION
Today, solar energy system becomes more and more popular and it is very easy to see solar panels in many countries. Some of the energy pollutes the environment to generate the electricity. Solar energy from PV panel converts into electrical energy. In this system, 300W solar panel is used to apply for many devices to be more reliable not only for the cost effective but also time save when the light is OFF at engineering department. Here, the task of DC-AC inverter is to take DC power supply from a battery source and converts it to AC power supply [1]. For example, the household inverter receives DC supply from 12 V or 24 V batteries and then inverter converts it to 240 V AC with a desirable frequency value of 50 Hz or 60 Hz. These DC-AC inverters have been widely used for industrial applications. In this inverter battery charger system, a solar inverter or convertor or photovoltaic (PV) inverter, converts the variable direct circuit (VDC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC) that can be fed into electrical devices [2]. In this system, 300W solar panel is the conversion of sunlight into electricity which is direct current (DC). It is stored in the battery. Solar inverter to convert DC to AC is used. The general block diagram is shown in Fig.1.1.

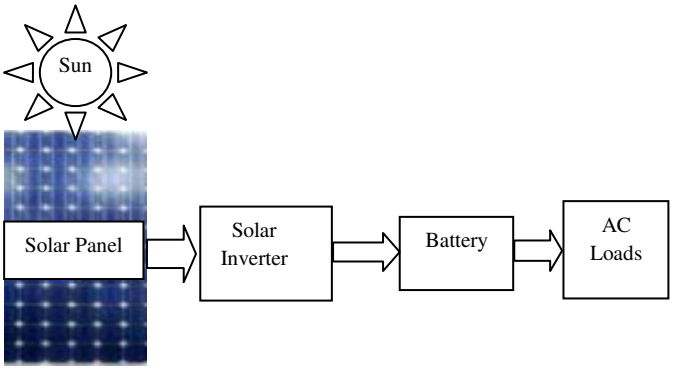

Fig. 1.1 General Block Diagram for Solar system

2. HOW SOLAR CELL WORKS?
When sunlight strikes **solar cell** surface, the cell creates charge carrier as electrons and holes. The internal field produced by junction separates some of positive charges (holes) from negative charges (electrons). Holes are swept into positive or p-layer and electrons are swept into negative or n-layer [3]. When a circuit is made, free electrons have to pass through the load to recombine with positive holes; current can be produced from the cells under illumination. The individual solar cells are connected together to make a module to increase current and the modules are connected in an array depicted in Fig. 1.2. Depending on current or voltage requirement, solar arrays are connected in a variety of ways:

-If the solar arrays are connected in parallel, the output current will increase.

- If the solar arrays are connected in series, the output voltage will increase.

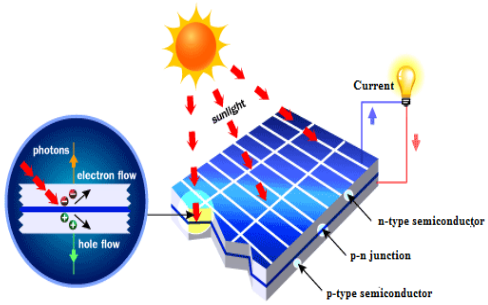

Figure 2.1. Solar Panel Operation [4]

3. HARDWARE DESCRIPTIONS

In this system, solar panel, battery, inverter and alternating current (AC) loads are described.

3.1 Solar Panel

Solar panels, also known as photovoltaic, are used to convert light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads. Solar energy begins with the sun [5]. Light from the sun is a renewable energy resource which provides clean energy, produced by solar panels. The size of the solar panel is 2.5ft and 6.5ft .It's power is 300W. There are 72cells and each cells have 0.5V .The whole current is 22A. Photovoltaic cell is shown in Figure 3.1.

Figure 3.1. Photovoltaic cell [6]

3.2 Battery

When the inverter section receives AC mains supply, it stops operation but the charger section in the inverter starts its operation. The battery is connected using BVR-S5661 wire design model for battery charging between solar panel and inverter. In this mode, the inverter transformer works as a step down transformer and output 12V at its secondary winding. During the charging, MOSFET transistors at the output section works as rectifier with the drain working as the cathode while the source works as the anode. The battery used in this paper is depicted in Figure 3.2.

Figure. 3.2 Battery

3.2.1 The Main part of a Battery

The basic power unit inside a battery is called a cell, and it consists of three main bits [8]. There are two electrodes (electrical terminals) and a chemical called an electrolyte in between them. Part of the battery is shown in Figure 3.3.

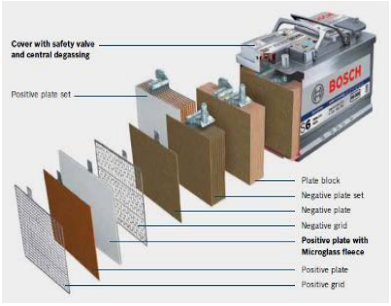

Figure 3.3 Part of the battery

For convenience and safety, these things are usually packed inside a metal or plastic outer case. There are two more handy electrical terminals, marked with a plus (positive) and minus (negative), on the outside connected to the electrodes that are inside. The difference between a battery and a cell is simply that a battery consists of two or more cells hooked up so their power adds together [9].

3.3 Inverter

In this paper, single phase inverter boost stage is used to boost the voltage from the panel and track the MPP. The input current Ipv is sensed before the input capacitance Ci along with the panel voltage Vpv. These two values are then used by algorithm, which calculates the reference point the panel input needs to be maintained. In this work, to analyze the inverter and charger system and to drive a load using solar energy is aimed [10]. The circuit diagram of inverter power is shown in Figure 3.4.

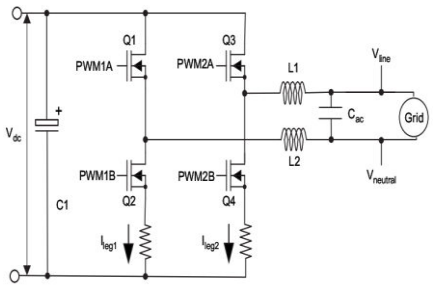

Figure 3.4 Circuit Diagram of Inverter Power

3.4 AC Loads

In this paper, laptop and stand fan are utilized for testing the power system condition.

4. TESTS AND RESULTS

This solar power is to support any AC loads when the main AC power cut off. Sun light falls onto the solar panel in Figure 4.1. The solar panel produces electricity. The DC voltage flows from solar panel to the inverter. And this wire for this system has higher resistance and higher current than wires used for home appliances shown in Figure 4.2.


Figure 4.1 Solar Panel absorbed sunlight


Figure 4.2 Wire connections via Solar Panel

There are two portions in this system operation. The first portion is to show the battery level and the second portion is to indicate the switch operation. In this system, there are four LEDs in solar inverter. The green LED shows the condition of battery full charged and the yellow LED indicates the normal and the two red LED shows the situation of low battery. The inverter can be used any AC electronics devices. The inverter had already contained current source regulator. This regulator adjusts the output current from the solar to prevent the overloading and under loading battery. The inverter directly connects to the battery. When the battery condition is fully charged, the green LED is bright shown in Figure 4.3. Although the inverter is switched OFF Green LED is brightly lighted because of solar energy maintenance.


Figure 4.3 Inverter switch-off and flow electricity

The below photo is the testing result with stand fan using solar inverter battery charger system from the solar panel shown in Figure 4.4.


Figure 4.4 Testing the Power System Condition

The switches for inverter and the battery are opened after getting solar energy from solar panel. The following photo in is the testing result with laptop device using solar inverter battery charger system by using solar energy from the solar panel.

This is testing of inverter battery charger system by using solar energy for AC load, laptop illustrated in Figure 4.5.

Figure 4.5 Testing for a Load, Laptop

When the battery is fully charged, the GREEN LED is ON. When middle switch states in normal condition in Figure 4.6. AC voltage from the inverter is 220V is instable. In higher condition, it will be over 220V. In higher condition, it will be converter will be over 220 V.

Figure 4.6 Inverter's Condition

Then, the selection of components used in this proposed system is also described in Table 1. Today, these devices used in this system can be easily obtained in market.

Table (1) Components List used in this system

Name	Type	Value	Quality
Solar	Polycrystalline	300W	1
Inverter	PH-IVC	1000VA	1
Battery	ToYo	12V,150Ah	1

5. CONCLUSION

In this paper, the main operational devices are solar panel (300) W, battery (150Ah, 12V) and inverter (1kW). Solar type is used polycrystalline. Polycrystalline is cheaper than monocrystalline and it is reliable than any others. So, this solar system can be implemented not only in our domestic appliances and surroundings but also in industrialization. The solar system is convenient for money saving process and is also reliable for rural areas where electricity cannot be got enough. Therefore, the chemical energy can be reduced and then the damage of environment is prevented. This system aims to produce electricity by using solar energy and to supply power benefit for AC devices or loads at Engineering Department.

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