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"A Small Scale Solar Power Generation Connected to the Power Grid"

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***Abstract*—** The main purpose of this paper is inversion of DC power to AC power and power switching system. To achieve a stable output of 230 AC and it should be able to self-generate the drive voltage and switching the power supply between the power grid and solar power system. Solar power system contains the theory, simulation, implementation and solar energy storage battery charging and discharging control system. Theory and examples of solar power AC step-up circuit and implementation. This paper gives direction for giving stabled voltage and low cost of solar energy power conversion system.

Keywords: *solar system, control switching, power grid, Power Generation, Conversion, inversion.*

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I. INTRODUCTION

We all are well known about the solar power, an economic, environmental source of power generation. In this the solar panel receives sunlight, PV cell convert it in to electrical power, which is in the form of DC, this DC power store it in the battery the purpose of the charge and discharge controller is to reduce the unnecessary damage to the storage battery. When the solar system not able to generated electrical power in cloudy day, the electricity will be provided by the storage battery, and it use the digital display to show the voltage and current values of the prevailing circumstances. Automatic switching circuit is a power switching circuit between the solar panel and power grid. When the capacity of the solar panel and the storage battery are insufficient for the load, the power switch will automatically switch to power grid; therefore, the load can be gate continuous supply. The output of the battery storage system, through the quasi-resonant PWM DC to AC inverter, and step up transformer and the power filter, the output 230 V AC can supply to the general household load to use. Fig 1 shows the solar power system architecture & Fig. 2 shows the block diagram of total solar system.

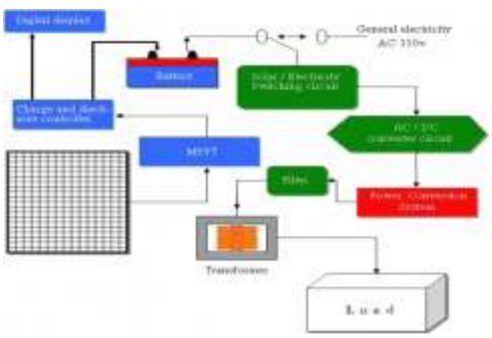

Figure 1. Solar Power System Architecture

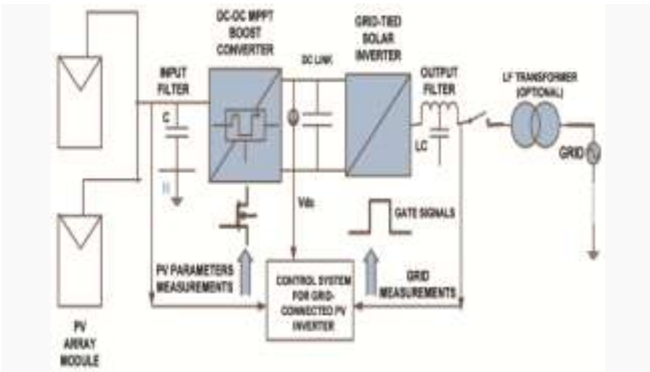

Figure 2. Block Diagram of total solar system

II. PARALLEL CONNECTION BETWEEN THE POWER GRID LOAD AND THE SOLAR POWER PANELS

Solar energy system generates DC power, normally power grid required AC power so needs to convert DC to AC by means of converter and we gate 230 volt, AC supply.

A Voltage Source Inverter

This is voltage source inverter it is having 2 half bridge rectifiers phase difference of each π/2 diodes are connected to control the reverse current flow PWM method has to be used to control the gate signal of power device (IGBT) as shown below.

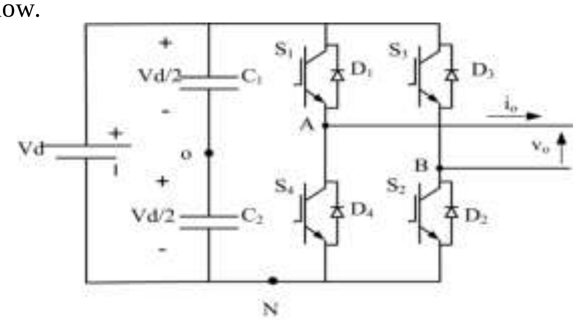

Figure 3. Single phase voltage source inverter

B Booster Circuit and Reversed Voltage Circuit

This section describes the solar energy boost circuit and the Reverse voltage circuit. The solar panels supply going through the charge and discharge controller and it charge by the storage batteries through the boost circuit and the reverse voltage of the circuit is divided into +20V and -20V.The purpose is to switch the power between the power grid and the solar panel. To achieve this goal, MC34063 is in line with our needs, not only can boost more but also can convert to reverse voltage.

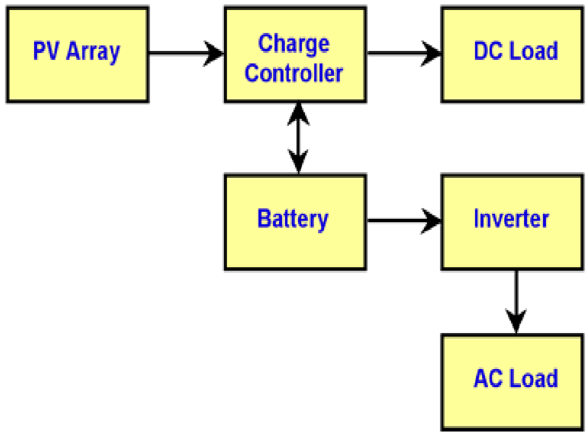

Figure 4. Solar system, Power Distribution Diagram

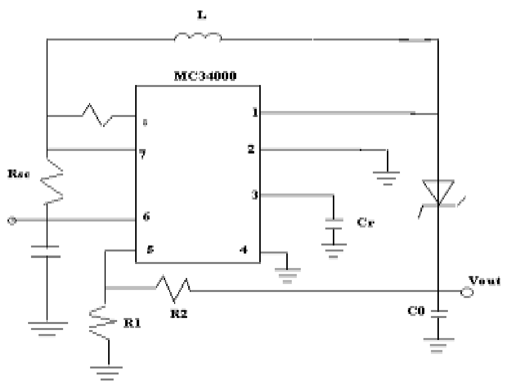

Figure 5. Booster circuit diagram.

the boost circuit formed by the MC64063, when the switch T1 turns on, the power supply go through the resistance Rsc ' the inductor L, when the pin 1 and pin 2 of MC34063, the inductor begins to store energy, but Co is responsible to provide energy V to the load. When the inductor releases the energy, the polarity is the same. So the load voltage can be higher than the supply voltage. Due to the back and forth of switching oscillation, as long as we adjust the relative frequency high enough of the load time constant, that we can make a continuous DC load voltage.[3] when Tl turn-on, the current flowing through the pin 1, pin 2 of MC34063 and the inductance and grounded, the inductor L store energy, when T1 are not conducted, due to the current flowing through the inductor cannot raised simultaneously, so when diode conducted, the inductor energy through the diode is to provide a negative voltage output to the load.

C Switching Circuits

The automatic control of switching through the Solar panels and the grid, in order to avoid the power generation system and to reach an uninterruptible power supply, we use Darlington circuit with the relay and photosensitive resistance to achieve the switching purpose. We use two cascaded transistors to build the Darlington amplifier when the circuit needs high input impedance, or large current gain. So the relay combine with the use of Darlington transistors are sampled, easy and inexpensive to build such automatic switching circuit. Relay coil is not powered when the COM interlinked with those for the B-point, often called NC (normally close). While those who do not usually inter linked with the COM as the A point, often represent by N.O. (normally open). When at no power, COM is the same as NC. But when the current through the coil, the coil will produce magnetic suction under the armature, making NO and COM interlinked. Therefore, as long as we control the coils with the power or not, and can take Advantage of the relay contact to control the circuits on or off. Therefore, when solar power is sufficient, with its output voltage is connected to the NC, the city grid is connected to N.O. We use the "light-sensitive resistors", because of this parts are low priced and the photosensitive resistors are commonly made of cadmium sulphide CdS. When the light is strong the resistance become smaller, and vice versa [4].

We connected the solar energy input in parallel with a light bulb as shown in following figure 6. When the solar power is sufficient, light bulbs indicate the output of solar power; on the other hand, when the solar power is shortage, light bulbs do not light, light-sensitive resistors not receiving light, this indicate the system is supplied by the power grid. (C) Solar Electricity Distribution Circuit.

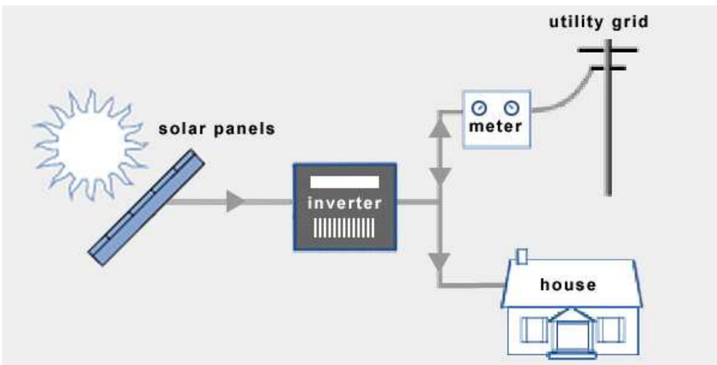

Figure 6. The Circuit Diagram of the Solar Power Circuit in Parallel Connect with the power Grid

III. DESIGN PRINCIPLES OF SOLAR ENERGY VOLTAGE BOOSTER

The voltage source converter converts less amount of voltage so by using step up transformer, we step up the voltage. When the left hand side of the power input, by the Faraday's law of electromagnetic induction electromotive force f1 induced in the coil, causing the magnetic flux, so the energy spread to the right side of the load side of the coil. As the input is AC, so the current is Vm sin ωt, from Faraday's law, we can see the coil and secondary coil's emf are shown below respectively: [5][6]

$$E_1 = N_1 \frac{d\emptyset}{dt} \quad (1)$$

$$E_2 = N_2 \frac{d\emptyset}{dt} \quad (2)$$

Since the input is sinusoidal, so the magnetic flux on the core is also a sinusoidal waveform, so we assume that the maximum value of magnetic flux

$$\emptyset = \emptyset_m \sin \omega t = \varphi_m \sin 2\pi f t \quad (3)$$

Also the maximum value of sine wave is 1; the minimum value is -1, substitute with the electromotive force into the equation, so we have the following

$$E_1 = N_1 \frac{d\emptyset}{dt} = 2\pi f \emptyset_m N_1 sin2\pi f t \quad (4)$$

$$= 2\pi f \emptyset_m N1 \quad (5)$$

$$E_2 = N_2 \frac{d\emptyset}{dt} = 2\pi f \emptyset_m N_2 sin2\pi f \quad (6)$$

$$= 2\pi f \emptyset_m N_2 \quad (7)$$

And the RMS (root-mean-square value) of the average induced electromotive force

$$E_{rms1} = \frac{2\pi}{\sqrt{2}} f N_1 \emptyset_m = 4.44 f N_1 \emptyset_m \quad (8)$$

$$E_{rms2} = \frac{2\pi}{\sqrt{2}} f N_2 \emptyset_m = 4.44 f N_2 \emptyset_m \quad (9)$$

We then divided both sides of the electromotive force,

$$\frac{E_{rms1}}{E_{rms2}} = \frac{N1}{N2} = \frac{V1}{V2} \quad (10)$$

However, since NJJ (t) = N212 (t), therefore, the
Number of tums and voltage, current relationship shall be

$$\frac{N_i}{N_o} = \frac{V_i}{V_o} = \frac{I_o}{I_i} \quad (11)$$

IV.NEW IDEAS IMPLEMENTED

New ideas are implemented by Maharashtra government with the help of net meter commercial circular no.258 according to that consumer can sale electricity to MSEDCL in respect to DTC capacity. This is one of the solution for energy crises.

V. CONCLUSIONS AND FUTURE PROSPECTS

This paper, gives idea of actual working of solar PV system. It also gives brief analysis and design of solar photovoltaic energy converter, the circuit structure designed to include DC to AC converter (DC to AC Inverter) and its integrity in order to achieve the final goal of stabilizing the output of 230V AC. Also, this system having the switching circuit to switch between the city grid and solar panels. Under the Independent mode of operation, this system can directly convert the solar power into a 50 Hz, 230 V AC to provide to the small household load.

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