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Solar And AC Mains Hybrid Charge Controller

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***Abstract*- Energy is the key input to drive and improve the life cycle. Primarily, it is the gift of the nature to the mankind in various forms. The consumption of the energy is directly proportional to the progress of the mankind. With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy is expected to increase rather significantly in the near future. Most of the world's energy sources are derived from conventional sources-fossilfuels such as coal, oil, and natural gases. The primary source of energy is fossil fuel, however, the available quantity of these fuels are extremely large, they are nevertheless finite and so will in principle 'run out' at some time in the future. In addition to this, in many rural areas of India, electricity has not reached their home yet as well as many people face load shedding problems. A hybrid design of a battery charging system and its implementation has been explained in this paper. Besides AC mains supply charging, solar PV also charges the battery whenever it is available through a charge controller. This system ensures continuous power supply and faster charging of the battery. The system has been designed to suit a typical Indian scenario where there is intermittent power supply due to power shortage which results in scheduled and unscheduled load shedding.**

***Keywords*- Battery; Hybrid; Charging; Solar; AC mains supply**

I. INTRODUCTION

Energy is the basic necessity for life. But for energy no form of life would have ever emerged. We all know energy for providing us light and comfort. It can help us to cool down during summers and feel warm during winters. It also helps us to go from one place to another. All automobiles need energy to run; but even otherwise all other means of transport need energy. But even though we use it every moment of our life and learn about it at school it often remains a riddle for many all through the life. An energy crisis is any great bottleneck (or price rise) in the supply of energy resources to an economy. In popular literature though, it often refers to one of the energy sources used at a certain time and place, particularly those that supply national electricity grids or serve as fuel for vehicles. There has been an enormous increase in the global demand for energy in recent years as a result of industrial development and population growth. Supply of energy is, therefore, far less than the actual demand. An energy crisis is a situation in which a nation suffers from a disruption of energy supplies connected by increasing energy prices that threaten economic and national security. At the moment, there is an increasing worldwide demand for electrical power and transportation, both which depend mostly on fossil fuels, such as oil products. Because the population and new technology is always expanding, demand for energy is expected to increase year by year. With ninety percent of the world's oil reserves already discovered, people need to find new ways to make energy. The energy crisis of this new century needs charge, attention, and a change that will keep the country running on more than just fumes. Renewable energy has huge potential to already discovered, people need to find new ways to make energy. The energy crisis of this new century needs charge, attention, and a change that will keep the country running on more than just fumes. Renewable energy has huge potential to provide solution to increase energy crisis and it is the key

factor to the future of energy, food and economic security.

The solar energy technology, a novel technology for the people, provides superior energy for cooking, lighting and many other purposes. There are divergent opinions regarding the application of solar energy as the best alternative as well as renewable source of energy. Accordingly different persons including scientists, technocrats, economists, etc. view solar energy from multiple angles. It is in this background that an attempt has been made to review the literature on the subject of solar energy, to understand the varied perspectives on conventional energy scenario, power development and its present position, and to understand renewable energy in general terms and solar energy in particular.

Existing method of battery charging system based on the charging systems which use either solar power or ac mains supply as a source but efficient hybrid battery charge system that can utilize both solar power and ac mains supply is necessity when there is a intermittent power supply.

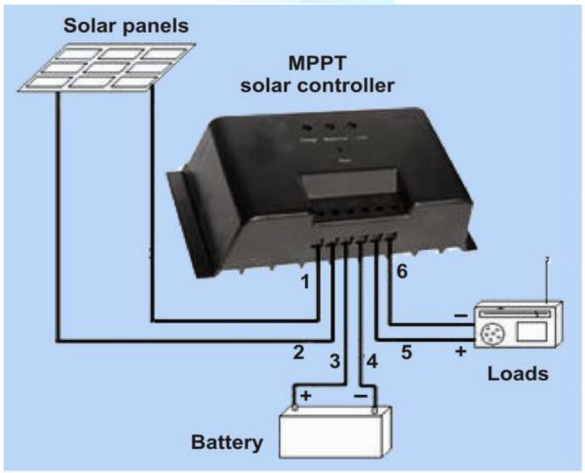

Fig.1.Existing battery charging system

II. MODE OF OPERATION-

- When both Solar and AC mains supply available, then preference given to Solar Power.
- In case Solar power more than Load, then Solar Power serves the Load, and differential power charges the battery.
- In case Solar power less than Load, then Solar Power serves the Load, and differential power is drawn from battery discharge.
- When Solar energy is not available, but AC Mains available, then obviously AC supply serve the load, and the battery is also charged.

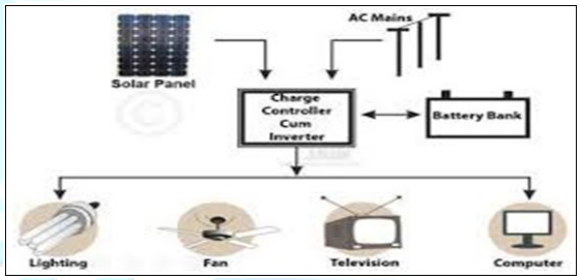

Fig.2. Block diagram of solar and AC mains hybrid charge controller

III. METHODOLOGY

A. A Hybrid Battery Charging System:

The solar battery charging systems that are currently in use consist of a charge controller whose design is customized to regulate the voltage and current according to the rating of the battery. Other designs involve supply from AC mains that rectify and regulate the utility grid supply to charge the battery. This paper describes a hybrid design that incorporates both the above mentioned methods of battery charging.

B. Design:

a) Solar Panel: A 40 watt peak solar panel has been used to charge the battery .The maximum power point voltage and current of solar panel are 20v and 2A respectively. The output of the solar panel is fed to the controller.

b) Charge controller: A charge controller with maximum power tracking ability has been used.

A charge controller design involves a boost converter for regulating the output obtained from solar panel to ensures the maximum efficiency the charge controller is designed such that a minimum of 12V and 5A.

Components of charge controller:

1. Transformer: Two transformers are used, one is for step down the voltage and other is back up one of 5A.
2. Boost converter: boost converter is also known as step up converter. it is the basic DC to Dc converter configuration with an output voltage higher than its input voltage. The DC input to a boost converter can be from many sources as well as batteries, such as rectified AC from the mains supply, or DC from solar panels, fuel cells, dynamos and DC generators. The boost converter is different to the Buck Converter in that it's output voltage is equal to, or greater than its input voltage. However it is important to remember that, as power (P) = voltage (V) x current (I), if the output voltage is increased, the available output current must decrease.

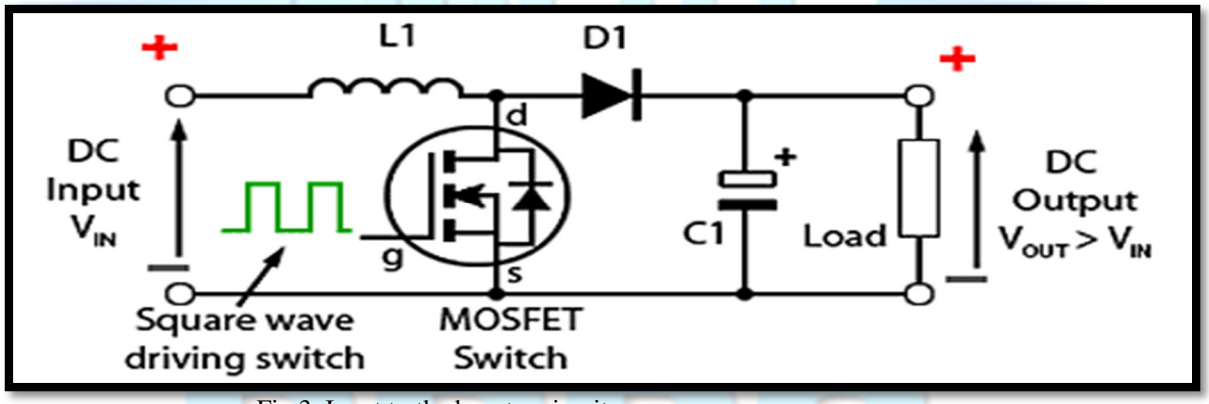

Fig.3. Input to the booster circuit

c) Battery: A 12V/7.5Ah ,5A battery is used.The battery is of solar flooded tubular monoblock type. Battery is charged from the power derived from the solar panel through a charge controller and the supply from the ac mains.

Primary function of battery in PV system:

- Energy storage and autonomy
- Voltage and current stabilization
- Supply surge current

d) Ac Mains : In the absence solar power the battery charges from the ac mains supply.voltage of 230 volts and frequence of 50 cycles is used.

e) Inverter Circuit: This one has output power of upto 18Watt stated at 12V, though we can see the output is coupled by a series capacitor/diode here. The transformer has 5 lines at input section. Central connector goes to +VE supply, through a L1 inductor coil. It absorbs the spikes due to the switching of transformer. L1 should be 10mH to 100mH wit ferrite core. There two power stage pins, and two feedback goes to each of transistor's collector, base. The initial base feeding is done by a 220 Ohm resistor to the base of any of the transistor, having a capacitor of 104(0.1uF) to the other transistor. This technology can be used for similar CFL lighting/ mobile charging etc applications which do rectify the input power to DC. The most advantage of this circuit is that this circuit glows CFL even at huge battery discharge. Experiments show, Light stays till battery voltage goes down to 5V. It's not safe to run appliances up to that discharge level, as that would lead 'sulphation' to the battery plates. Here is used D880 or 1351 transistor for a output of 18Watt, but similarly we can use 2N3055 transistor in this setup with a big transformer to make output of up to 100W.

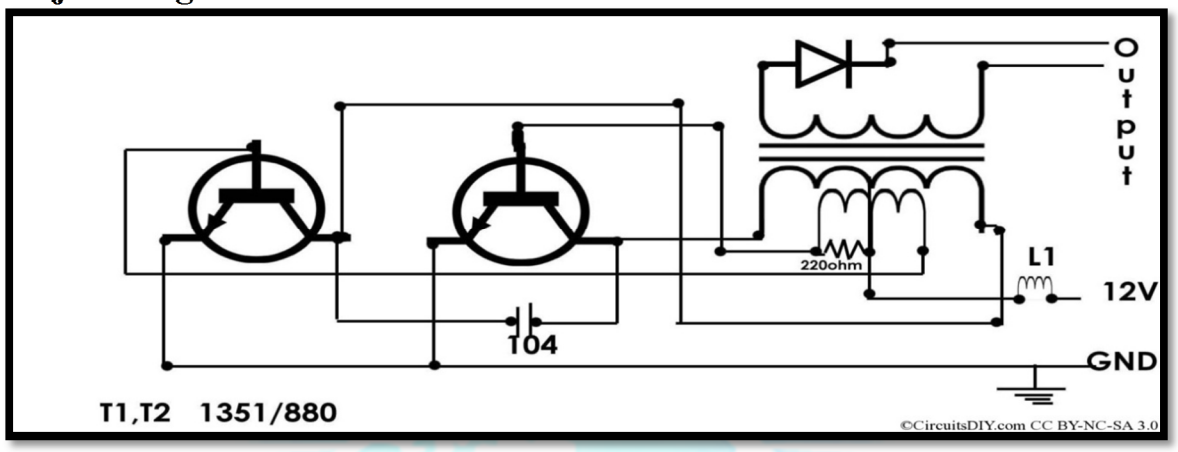

Fig.4.Inverter circuit

III . IMPLEMENTATION

1) Solar charging: The output of the solar panel is fed to the charge controller. The charge controller then regulates the voltage and current to suit the requirements of the battery to charge and its output is fed directly to the battery.

2) AC mains supply charging: The energy we are receiving from sun is non-conventional but in case of inappropriate wheather issues , solar energy from sun is insufficient to charge the battery. In such case, AC mains supply energy to the battery and charge the battery.

3) Hybrid System: The hybrid system makes use of both the solar power and AC mains supply to charge the battery.

IV. APPLICATIONS

1) Lighting for commercial buildings

2) Outdoor (street) lighting

3) Rural and village lighting

V. CONCLUSION

The hybrid system designed to charge a battery has been implemented utilizing both solar PV and AC mains supply suited to an Indian scenario. It can be inferred from the above that the hybrid charging system is much suited for those areas where both AC mains supply is insufficient and solar irradiation is available in abundance.

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