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Stand Alone Photovoltaic System

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Abstract: Renewable energy sources and technologies have potential to provide solutions to the long-standing energy problems being faced by the developing countries. The renewable energy sources like wind energy, solar energy, geothermal energy, ocean energy, biomass energy and fuel cell technology can be used to overcome energy shortage in India. To meet the energy requirement for such a fast-growing economy, India will require an assured supply of 3-4 times more energy than the total energy consumed today. The renewable energy is one of the options to meet this requirement. Today, renewable account for about 33% of India's primary energy consumptions. India is increasingly adopting responsible renewable energy techniques and taking positive steps towards carbon emissions, cleaning the air and ensuring a more sustainable future. In India, from the last two and half decades there has been a vigorous pursuit of activities relating to research, development, demonstration, production and application of a variety of renewable energy technologies for use in different sectors.

Keywords **- Solar panel, inverter and battery.**

1. INTRODUCTION

Over the years there has been an increase in the earth's population which is directly proportional to the energy used as well. All the possible gadgets and equipment need some or the other kind of energy to function. With depleting fossil fuel reserves it becomes necessary to identify viable renewable energy resources that can decrease the dependency on fossil fuels. Solar energy is the most abundant form of energy available to us. It is approximated that 10000 TW worth of solar energy is incident on earth's surface in a day (Bosshard, 2006). A 4 KW solar panel used in homes for 25 years can offset 199,697 lbs. of CO_2. It is fascinating to know the impact in the environment by using Solar panels.

Paper-thin solar cell

Since their inception in the 1960s, solar technologies have undergone a lot of changes over the years. Researchers and developers in the solar energy industry are constantly searching for new ways to improve the efficiency of solar panels. Earlier, solar photovoltaic (PV) were considered the future of solar cells. But today, with greater developments made in solar PV technology. Any recognized solar energy company is adopting the recent trends in solar energy, thus contributing to the industry's success. One such development is Paper-thin solar cells. Solar panels as thin as paper and as flexible as fabric that could be applied to many different surfaces and used in a wide variety of applications could be available soon thanks to a new approach to manufacturing solar cells being developed at MIT.

MIT (Massachusetts Institute of Technology) researchers developed a scalable fabrication technique to produce ultra-thin, flexible, durable, lightweight solar cells that can quickly and easily turn any surface to a power source. Glued to high-strength fabrics, the solar cells are only one-hundredth the weight of conventional cells while producing about 18 times more power-per-kilogram.

The solar cells are entirely printable using ink-based mats and scalable fabrication technique so making them fast and easy to deploy.

To create a solar cell, the researchers coat a stack of nanomaterials that are in the form of printable electronic inks onto a prepared peel able substrate.

Then using simple screen-printing technique an electrode which collects the generated power is added to the top of the solar cell. After this, the cell can be peeled of the substrate and then laminated onto a variety of materials such as flexible fabric (Dyneema fabric).

Figure 1.1 Paper-thin solar cell

When they tested the device, the MIT researchers found it could generate 730 watts of power per kilogram when freestanding and about 370 watts-per-kilogram if deployed on the high-strength Dyneema fabric, which is about 18 times more power-per-kilogram than conventional solar cells.

They also tested the durability of their devices and found that, even after rolling and unrolling a fabric solar panel more than 500 times, the cells still retained more than 90 percent of their initial power generation capabilities.

A typical rooftop solar installation in Massachusetts is about 8,000 watts. To generate that same amount of power, our fabric photovoltaic would only add about 20 kilograms (44 pounds) to the roof of a house.

2. METHODOLOGY

2.1 BLOCK DIAGRAM

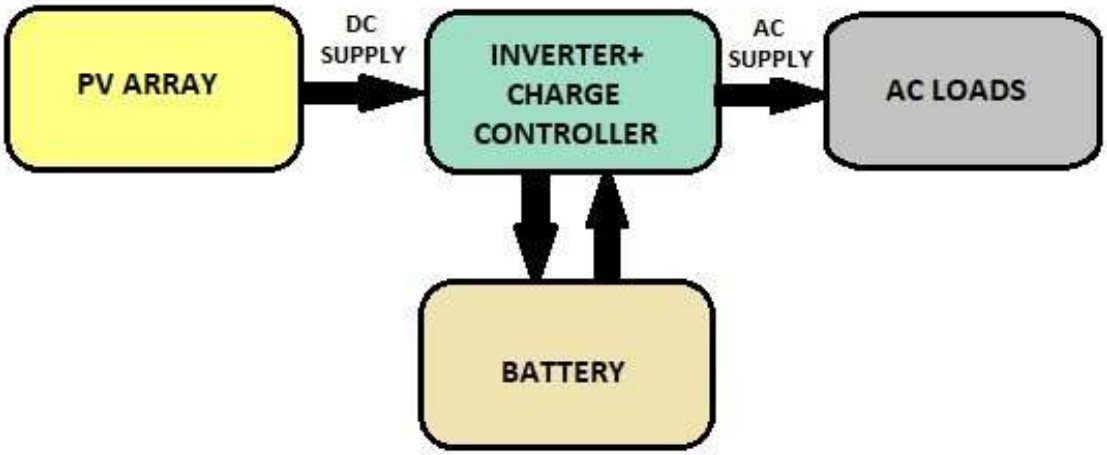

Figure 2.1 Block diagram of proposed system

2.2 WORKING PRINCIPLE

When sunlight strikes a solar cell, electrons in the silicon are ejected, which results in the formation of "holes"—the vacancies left behind by the escaping electrons. If this happens in the electric field, the field will move electrons to the n-type layer and holes to the p-type layer. If you connect the n-type and p-type layers with a metallic wire, the electrons will travel from the n-type layer to the p-type layer by crossing the depletion zone and then go through the external wire back of the n-type layer, creating a flow of electricity.

2.3 COMPONENTS

2.3.1 Solar panels

A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that generate electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or stored in batteries. Solar panels are also known as solar cell panels, solar electric panels or PV modules. Solar panels are usually arranged in groups called arrays or systems.

2.3.2 Inverter

Inverter deals with following main tasks of energy:

- Convert DC from PV module to AC.
- Ensure that the cycle of alternating current cycles is 60 cycles.
- Reduce voltage variations.
- Ensure that the condition of the AC waveform is suitable for the application.

2.3.3 Battery

An electrochemical power source or battery is a device which enables the energy liberated in a chemical reaction to be converted directly into electricity. Batteries fulfill two main functions; they are portable sources of electric power and they are used to store the electrical energy. For our application we select the lithium-ion battery because it came with less maintenance cost and more power efficient. We used two 12V 150Ah battery in series connection.

2.4 ADVANTAGES

Solar energy for domestic systems is free. What you'll invest as the upfront cost will be recovered within 3 to 5 years, and you'll continue to get free electricity for almost 25 years. The benefits that the society draws from installing a solar power system are:

CONCLUSION

Solar energy is a clean, pollution free and renewable source of energy. Development of this source of energy requires an accurate detailed long-term knowledge of the potential taking into account seasonal variations. The conventional solar cell is in the form of a p–n junction (a semiconductor junction). Silicon is the most common semiconductor used. However, compound semiconductors, such as Copper Indium Gallium Selenide (CIGS) and Cadmium Telluride (CdTe) are also used. Different semiconductors in bulk form differ in the energy band gap, which governs the photon energy at which the cell works. We further demonstrate their transfer onto light-weight and high-strength composite fabrics, resulting in durable fabric PV systems ~50 microns thin, weighing under 1 gram over the module area (corresponding to an area density of 105 g m^{-2}), and having a specific power of 370 W kg. Integration of the ultra-thin modules onto composite fabrics lends mechanical resilience to allow these fabric PV systems to maintain their performance even after 500 roll-up cycles. This approach to decouple the manufacturing and integration of photovoltaic enables new opportunities in ubiquitous energy generation.

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