

Experimental study of Photovoltaic Energy Storages System with Self-Regulating Power Control

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Abstract— Energy storage systems such as batteries are applied to grid-connected residential PV systems for maximum power shaving. This paper presents the analysis of a static conversion of power for treatment of the solar energy from photovoltaic panels. These systems are connected with the mains power supply, contributing to the generation of the electrical energy. The power structure is composed by a direct converter. The main features of the system are simple control strategy, robustness, and lower harmonic distortion of the current and natural isolation.

Key words: Photovoltaic Cells, Energy Storage System, Battery Level Circuit

substitute our picture with the electrical current generating properties of the solar cell core.

It isn't economical to use this individually designed cell configuration in an active solar power application. In reality, a number of these individual solar cell cores are connected in series to form a solar panel. The panel, containing multiple solar cell cores would be framed in metal and covered with clear glass and a backing support material. Let's dissect the actual components used in a photovoltaic solar cell from top to bottom.

I. INTRODUCTION

The conventional energy sources are obtained from our environment. The solar energy appears as an important alternative to the increase of the energetic consumption. The quantity of the energy from the sun, that arrives on the earth surface in a day. Through the photovoltaic effect the energy contained in the sunlight can be converted directly into electrical energy. This method of energy conversion presents some advantages, such as:

- Simplicity.
- Does not exist any moving mechanical part.
- Its modular characteristic offers large flexibility in the design and application of this kind of energy generator.
- Short time of installation and operation.
- High reliability, and low maintenance.

A. Photovoltaics (Solar Cells)

Solar cells, or photovoltaic cells, transform light, usually sunlight, into electric current. Few power-generation technologies are as clean as photovoltaic (PV). As it silently generates electricity, PV produces no air pollution or hazardous waste. It doesn't require liquid or gaseous fuels to be transported or combusted. And because sunlight is free and abundant, PV systems, especially base load Space Solar Power, may eliminate uncertainties surrounding oil, gas, or other energy fuel supplies from politically unstable regions. Because PV systems burn no fuel and have no moving parts, they are clean and silent, producing no atmospheric emissions or greenhouse gases to cause detrimental effects on our water, air, and soil.

Each individual solar cell is constructed by layering different component materials together. Individually, these components cannot generate electricity. However, when combined in a specific configuration, they generate and conduct electricity from sunlight. Imagine a solar cell as a framed picture. Enclosed in a metal frame and sandwiched in between the clear, protective cover glass and a sturdy backing material would be the picture. Solar cell construction is similar. The difference would be to

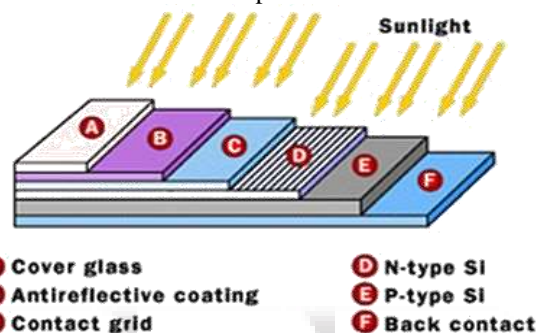


Fig. 1: Solar cell

The Top Cover Layer of the solar cell uses clear glass or plastic and is part of the enclosure. The clear cover lets sunlight through to the cells, protects the cells, adds rigidity and is encased by a sturdy metal frame. The Contact Grid is made of conductive metals. The contact grid collects the electrons generated in the semi-conductive cell core and transmits them out through the contact grid to an electronic device or a "load" as electrical voltage. The surface area of the contact grid is designed to be large enough to collect as many electrons as possible without sacrificing or blocking the sunlight absorbing surface area of the solar cell's core.

Antireflective Coatings are used to help avoid the incoming sunlight from being reflected back off the solar cell. Only by capturing and absorbing as much of the incoming sunlight as possible can a solar cell maximize its electricity generating capacity. Since only spectral solar light is processed during the photovoltaic effect, the antireflective coating helps increase absorption over the entire solar spectrum and aides in the absorption of sunlight when the cells aren't oriented to optimum sun angles.

There are two common techniques for applying antireflective coatings to solar cells. One is to cover them with a thin film of silicon monoxide. Another process is to texture or "rough up" the surface of the cell by chemically etching it and forming tiny scratches that resemble cones and pyramids. The cones and pyramids redirect the sunlight down into the cell core instead of allowing it to reflect back off the panel.

The N-Type Semiconductor Silicon layer produces the negatively charged electrons needed to conduct an electrical current. The conduction is made possible through

a process called doping. An N-type silicon semiconductor is doped when the impurities of phosphorus atoms are added. This creates extra negatively charged electrons. These extra negative electrons combine with holes created in the doped P-type semiconductor's positive electrons creating an electrical current which flows through to the contact grid.

The N-P Junction lies in between the top N-type semiconductor and the bottom P-type semiconductor. It is the absorber layer or the core of the semiconductor layers. The junction is created at the point where the doped N-type semiconductor negative electrons and the doped P-type semiconductor positive electrons meet and the transfer of electricity takes place through the photovoltaic effect.

II. EXPERIMENTAL PROCESS



Fig. 2: Experimental system

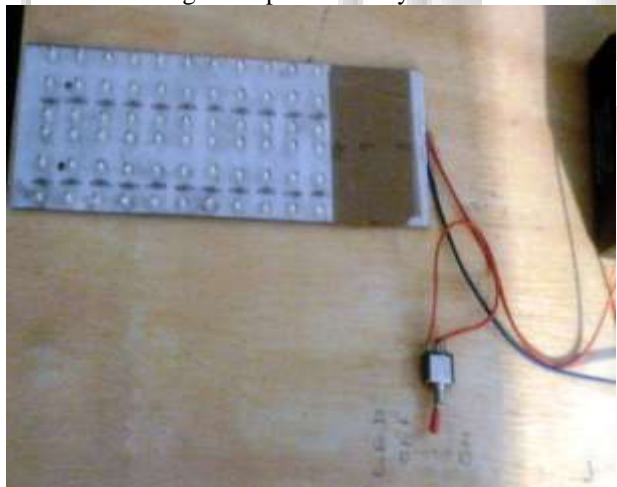


Fig. 3: LED



Fig. 4: Battery level circuit

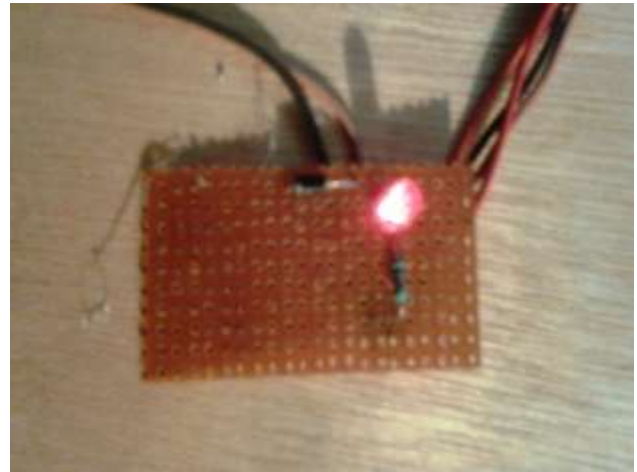


Fig. 5: Power display by solar photovoltaic cells

III. CONCLUSION

This paper has presented the experimental approach of a static conversion system of the solar energy from photovoltaic cells. This system is connected with the mains power supply, contributing to the generation of the commercial electrical energy. According to the results obtained we have a direct conversion system with the following features:

- 1) It has a simple control strategy.
- 2) Many systems can be associated in parallel.
- 3) Simple installation.
- 4) Lower harmonic distortion of current.

This system can be applied in residential or commercial buildings, for low or high power. Therefore, this type of system are very useful for some residential and/ industrial applications.

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