ISSN: 2277-9655
Impact Factor: 1.852

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Efficient factor of G2AL PhotoVoltaic Cell

M. Arun Magesh
Department of Electrical and Electronics Engineering, Arunai College of Engineering, India
arunmagesh@ymail.com

Abstract

Solar energy radiant light and heat from the sun has been harnessed by humans since ancient times using a range of ever-evolving technologies. A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. This paper deals with the introduction of a new type of cell called as G2AL (Glass to ALuminium) PV cell which uses solar PV cell and water heater, by using a Fresnel lens. Water is used to cool the PV cell which reduces its working temperature thereby increasing its efficiency.

Keywords: PV cell, G2AL cell, Fresnel lens and Solar energy.

Introduction

Energy is the amount of force or power when applied can move one object from one position to another. Energy is broadly classified into two main groups. They are renewable and non-renewable energy. Renewable energy is the energy which is generated from natural sources i.e. sun, wind, rain, tides. Non-Renewable energy is the energy which is taken from the sources that are available on the earth in limited quantity. There are much different natural and renewable energy available throughout the world. Much of the non renewable resources causes real problem to the environment causing the global warming. As the awareness among people has increased they have started to use renewable resources as their primary source of energy.

The most common energy source for local power generation is using solar energy. Solar energy can be used directly or by using solar photovoltaic cell which converts the solar energy into a useful electric energy. Concentrating Solar Power (CSP) technologies are the most economic, with their cost projections being such that they are becoming competitive with traditional power plants [1, 2]. Solar cells are often electrically connected and encapsulated as a **module.** The cell is sometimes used as aphotodetector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity. Materials presently used for photovoltaic solar cells include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium selenide/sulfide.

The use of glass-to- glass technology in PV module encapsulation and fabrication is an example of how electricity costs can be hedged through innovation and technology rather than through financial tools," said Lawrence Hefler [3]. This paper deals with effective utilization of energy with the help of Fresnel lens and solar PV cell. The life of a normal PV cell usually reduces by 5% for every 5 degree rise in temperature. But in this method, the temperature of the PV cell can be kept at a minimum level thereby increasing its efficiency.

Materials and Methods

Solar energy

Solar energy technology include solar heating, solar photovoltaic's, solar thermal energy and solar architecture, which can make considerable contributions to solving some of the most urgent problems the world now faces. Solar thermal energy is a technology for harness solar energy for thermal energy; solar thermal collectors are classified as low, medium, high-temp collectors. These collectors use concentrate sunlight using mirrors and lens and are generally used for electric power production. The first large-scale, demonstration solar power tower was built-in the early 80's in the desert near Barstow, California, called the Solar One. The Parabolic Trough Collector (PTC) power plant PTC plants are becoming very competitive in the actual context of high energy prices and environmental pressures [4-6].

Photovoltaic's is a method of generation of electric power by converting solar radiation into direct current electricity using semiconductors that exhibits the

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photovoltaic's effect. Photovoltaic's power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Due to the growing demand for the renewable energy sources, the manufacturing of solar cells and photovoltaic arrays has advanced considerably in recent years

Frensel lens

A Fresnel lens is a type of lens whose design allows the construction of lens of larger aperture and short focal length without the mass and volume of material that would be required by a lens of conventional design. These lenses are much thinner, larger, and flatter and capture more oblique light from a light source, thus allowing lighthouse to be visible over a much greater distance. Figure-1 shows the picture of Fresnel lens.

Figure - 1: Shows the picture of Fresnel lens.

G2AL PV Cell

Here we have introduced a new type of solar PV cell called as G2AL PV cell. It is a modified form of G2G PV cell. Here the base of the normal solar PV cell is replaced by the aluminium sheet because aluminium has higher thermal dissipation power than glass (which is normally used in the G2G based PV cell).

Working Setup

Working of this prototype is simple. Figure-2 shows the working principle of G2AL cell. It consist of a simple overhead water tank which is used for domestic purpose which is fitted with a high efficiency G2AL PV cell. Inner surface of the concreted walls of the overhead water tank were fully covered with reflecting material.
The top of the tank is has the fresnel lens which is fitted with a system to rotate the lens as per the direction of the sun present in different sides of the sky. As the sun rays pass onto the tank by using the movable lens which is again focused to the target PV cell using the Fresnel lens.

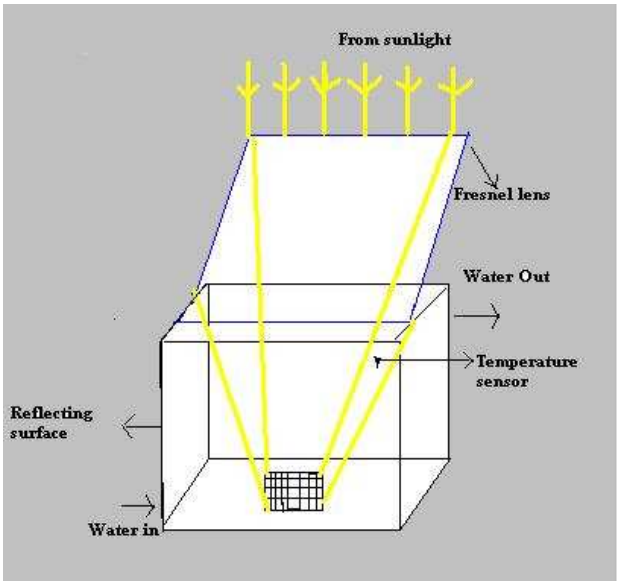

Figure - 2: Depicts the working principle of G2AL cell.

Result and Discussion

As the light is focused, the power output of the PV cell is increased according to the inclination of the light energy focused. Also the increase in the light energy leads to increase in the temperature of the PV cell. Since water present in the tank acts as the barrier of heats reducing its effects in the PV cell. So the heat energy dissipated in the water causes the heat and light to be retained for a longer time and hence increases the efficiency of the whole system.

Hot water goes up the tank and the cold water stays at the bottom cooling the solar PV cell. Water system is connected to a temperature sensor. If the temperature increases the motor is switched on and the heat water is stored for future use, and new fresh cold water comes in and cools the PV cell, the whole system can be controlled by using a simple microcontroller. Table-1 shows the comparison between normal PV cell and G2AL PV cell.

ISSN: 2277-9655
Impact Factor: 1.852

Parameters	Normal PV cell	G2AL PV cell
Dimension	140*140mm	140*140mm
Voltage	12v`	14.4v
Current	200mA	320mA
Power	2.4W	4.6W
Efficiency*	100%	191%

Table 1: Comparison between Normal PV cell and G2AL PV cell
Note: *If efficiency is considered as 100% and lens dimension 500*450mm

Conclusion

The use of information technology will be crucial to manage the new, "multiple functions" in the energy field in order to "make best use of energy" [7]. The cell can be implemented for domestic purpose in office, universities, public building, homes etc. Current solar water heater can be replaced by this system which has double advantage of electricity gain and heating water. Both solar thermal and electric energy can be obtained into his process. It is easy to maintain as it involves less error prone devices. But the disadvantage in this method is that the initial investment is high. Worldwide renewable technology is rapidly increasing its importance and deployment compared with all other energy sources in a given market.

References

[1] Price H, Lupfert E, Kearney D, Zarza E, Cohen G, Gee R, et al. "Advances in parabolic trough solar power technology", Journal of Solar Energy Engineering, 124: 109-25, 2002.
[2] Sargent and Lundy consulting group. "Assessment of parabolic trough and power tower solar technology cost and performance forecasts", NREL/SR-550-35060, 2003.
[3] http://www.prnewswire.com/news-releases/advanced-solar-photonics-introduces-line-of-glass-to-glass-crystalline-silicon-
[4] Trieb F, Langniss O, Klaiss H. "Solar electricity generation - A comparative view of technologies, costs and enviromental impact", Solar Energy, 59: 89-99, 1997.
[5] Kalogirou Lloyd, Ward. "Modelling, optimization and performance evaluation of a parabolic trough solar collector steam generation system", Solar Energy, 60: 49-59, 1997.
[6] Thomas A. "Solar steam generating systems using parabolic trough concentrators", Energy Conversion Management, 37: 215-45, 1996.
[7] Janet L. Sawin, William R. Moomaw, An enduring energy future, State of the World, Chapter 4, 134, 2009.