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TRENDING SOLAR ENERGY AND INSTALLATION OF SOLAR ENERGY PROJECT IN THE INSTITUTIONS

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Abstract
The world energy consumption is increasing at a very high pace, thus, leading to over exploitation of the energy resources. Electricity being one of the utmost requirements of the individual proposes an urge to deem and tame the threat. This leads to an urgent need for the alternatives of electricity. Many countries have witnessed and incorporated the alternatives in the form of solar power, biogas plant, CNG, etc. The paper mainly focuses on to reduce the cost of electricity using alternatives renewable resources like solar energy.
Keywords: *solar energy, solar cells, renewable source, electricity, photovoltaic.*

1. Introduction

In order to bridge the technological gaps in the name of social and economic developments, energy played the key role. As a result of the generalization of agricultural, industrial and domestic activities the demand for energy has increased remarkably, especially in emergent countries. [3]. The continuous increase in the level of greenhouse gas emissions and the climb in fuel prices are the main driving forces behind efforts to more effectively utilise various sources of renewable energy. In many parts of the world, direct solar radiation is considered to be one of the most prospective sources of energy. However, the large-scale utilisation of this form of energy is possible only if the effective technology for its storage can be developed with acceptable capital and running costs [15]. The exploitation of fossil fuels and coal in abundance by large number of corporations and industrial units, thus generating escape of greenhouses gases into the atmosphere. Therefore, reinforcing the climatic changes and posing innumerable threats to the environment. Facing the climatic disturbances, it becomes an ethical issue to soothe down sustainability and upraise the future aspects for the upcoming generations. Despite the obvious advantages of renewable energy, it presents important drawbacks, such as the discontinuity of generation, as most of the renewable energy sources depend on the climate, this requires a complex design, planning and control optimization methods. Fortunately, the continuous advances in computer hardware and

software are allowing researchers to deal with these optimization problems using computational resources, as can be seen in the large number of optimization methods that have been applied to the renewable and sustainable energy field [17]. The cost of energy sources have been on the constant rise, thus, demanding the new and usage of renewable resources. The paper discusses the renewable resources – the solar energy and installation of solar project in Khalsa College for Women, Civil Lines, Ludhiana.

2. Solar energy- a sustainable energy source

Renewable energy is accepted as a key source for the future [8]. Based on an expected large solar resource, solar energy has long been considered promising [4, 23]. Solar energy is the main prerequisite of the life on the Earth. Solar radiation is a direct source for generating heat, cold and power. Indirectly, it is possible to use solar energy through hydropower, wind energy, energy of sea waves, heat energy of environs and energy of biomass [11]. It is an effective solution to replace traditional biomass and fossil fuels in developing regions [24]. The development of solar energy, however, has been relatively low due to several obstacles although utilization of solar energy in its various aspects is very attractive for the country. The solar energy-related topics reviewed include various types of solar radiation correlations, exergetic solar radiation, solar collectors, solar photovoltaic (PV) systems, solar stills, solar-powered irrigation, solar energy-related greenhouses, solar hydrogen, solar water desalination and solar energy education. Some barriers, scenarios and constraints are also covered. The utilization of solar energy could cover a significant part of the energy demand in the country. If a major breakthrough is achieved in the field of solar-energy conversion, We can achieve this through the phenomenon of photoelectric effect in semiconductors; the solar energy in solar cells is transformed to power energy. Transformation of solar energy to power energy has wide utilization. Photovoltaic effect which permits to construct photovoltaic (PV) cell, was discovered by A. Becquerel in 1839 [16, 11]. Subsistence of the PV transformation from solar radiation to power energy is so-called inert photovoltaic effect. More people are becoming more environmentally conscience and there are going to be future students looking at how sustainable college premises are. We have taken a step to educate the upcoming generations about the adequate utilisation of earth's resources. The study is to address current applications and future aspects of solar energy along with studies conducted in this field and to assess them in the light of available sustainable energy technologies towards establishing energy policies.

3. solar cells

If solar radiation falls on the semiconductor material, the concentration of a charge carrier will rise when compared to the condition without luminance. Incident photons transfer their energy making electrons and holes excite, what can be used for current conduction. It is necessary that the electric field is made in semiconductor, which will isolate electrons and holes from each other. This kind of field is acquired by PN junction [14]. Equipment that can use this effect is called a photovoltaic (solar) cell. This equipment directly changes solar radiation to direct current (DC) [11, 14]. The solar photovoltaic cell is a semiconductor diode. PN junction is formed in the thin slices of silicon in a small depth below the surface with metal contacts both sides. When solar radiation falls on the cell, electrons and free holes are generated. Electric field of PN junction separates them, and sends them to opposite sides; electrons to the N layer, which becomes a negative pole of the photovoltaic cell and holes to P layer, which becomes a positive pole. Electric voltage is generated on the contacts and electric current starts flowing to an appliance [13, 16].

3.1 Types of solar cells

3.1.1 Single/Mono-Crystalline Silicon Solar Cell

Mono crystalline solar cell, as the name indicates, is manufactured from single crystals of silicon by a process called Czochralski process [6, 20, 21]. During the manufacturing process, Si crystals are sliced from the big sized ingots. These large single crystal productions require precise processing as the process of "recrystallizing" the cell is more expensive and multi

process. The efficiency of mono-crystalline single-crystalline silicon solar cells lies between 17% - 18% [5].

3.1.2 2.1.2. Polycrystalline Silicon Solar Cell

Polycrystalline PV modules are generally composed of a number of different crystals, coupled to one another in a single cell. The processing of polycrystalline Si solar cells is more economical, which are produced by cooling a graphite mold filled containing molten silicon. Polycrystalline Si solar cells are currently the most popular solar cells. They are believed to occupy most up to 48% of the solar cell production worldwide during 2008 [18]. During solidification of the molten silicon, various crystal structures are formed. Though they are slightly cheaper to fabricate compared to monocrystalline silicon solar panels, yet are less efficient ~12% - 14% [10].

3.1.3 Amorphous Silicon Thin Film (a-Si) Solar Cell

Amorphous Si (a-Si) PV modules are the primitive solar cells that are first to be manufactured industrially. Amorphous (a-Si) solar cells can be manufactured at a low processing temperature, thereby permitting the use of various low cost, polymer and other flexible substrates. These substrates require a smaller amount of energy for processing [9]. The main issue of a-Si solar cell is the poor and almost unstable efficiency. The cell efficiency automatically falls at PV module level. Currently, the efficiencies of commercial PV modules vary in the range of 4% - 8%. They can be easily operated at elevated temperatures, and are suitable for the changing climatic conditions where sun shines for few hours [12].

3.1.4 Cadmium Telluride (CdTe) Thin Film Solar Cell

Among thin-film solar cells, cadmium telluride (CdTe) is one of the leading candidate for the development of cheaper, economically viable photovoltaic (PV) devices, and it is also the first PV technology at a low cost [5, 11, 22]. CdTe has a band gap of ~1.5 eV as well as high optical absorption coefficient and chemical stability. CdTe is an excellent direct band gap crystalline compound semiconductor which makes the absorption of light easier and improves the efficiency. Cadmium is regarded as a heavy metal and potential toxic agent that can accumulate in human bodies, animals and plants. The disposal of the toxic Cd based materials as well as their recycling can be highly expensive and damaging too to our environment and society [2, 12]. Therefore, a limited supply of cadmium and environmental hazard associated with its use are the main issues with this CdTe technology [1, 7, 11, 19].

4. Solar project

The objective was to put forward an efficient and energy conservative way to carry out the laboratory experiment in the physics laboratory and to put solar light system in the college premises. A polycrystalline silicon solar cell of 75 WP was implemented on the rooftop of the physics laboratory. It was placed at an inclination of 45^{o} with respect to the ground and tilted at 10^{O} towards South – East, so that maximum light can fall on it. The light falling on the solar panel is made to convert to electricity due to the electric field of PN Junction. The electrical energy so generated goes to the controller, which controls the system of LEDs. There is a two way power supply from controller in which current generated by the panel goes to 30A battery during daytime and making its way to DC ports, which are connected in parallel combination in the laboratory. These portals are receiving 10A of current through battery, 5A in each portal having 12 volts. There is an LED indicator at the controller and at the laboratory side which glows thus indicating the charging status of the battery. The LED indicator in the laboratory is conjoined with the resistances of 4400ohms to optimise the current flowing through it. A schematic diagram for the same is shown in the figure: 1. from these ports, devices with minimum current requirements can be operated. The further requirement can be meant by installing more of solar panels. After dusk, voltage from the battery flows to the controller with the help of which light glows.

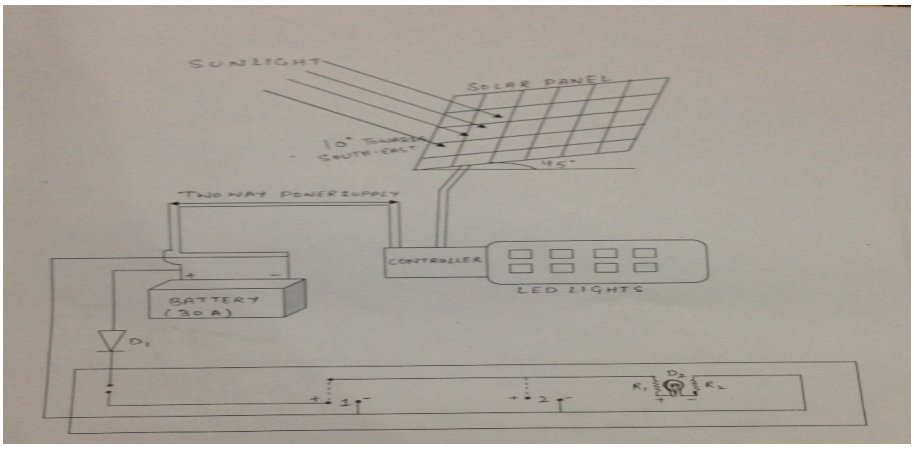

Figure: 1

So a total of 75watts power generated by the solar panel goes to the 15 watts controller connected to LEDs, which glows 8 hours at night and to 2 DC ports, from where students can perform their experiments.

5. A practical approach

Advancement in technology is all about reducing the cost and preserving the resources for the upcoming generations. The study aimed at reducing the cost of the bill produced by energy meter. A comparison was done amongst a glowing bulb of 150 watts, which glows for 8 hours at night. Hence, the total energy consumption was 1.2 KWh daily. A unit is costing 7 rupees in Punjab, so a total of 3066 rupees is consumed by the lightening bulb in a year. On replacing the lightening bulbs with that of LEDs which glows on solar energy, is saving a huge amount. So the cost of implementing the solar panel is nullified in 2 years and if the battery is working for 6 years then 11396 rupees have been saved during this time period. Therefore, if on replacing just one lightening bulb we save 11396 rupees in 6 years. These figures can be further multiplied on incorporating more solar lights and turning most of energy into solar energy.

6. Widening horizons

It is a fact that the college campus endeavoured to discuss and put up an alternate energy plan that is sustainable for the future. We have to find a way to harness energy and use it more efficiently. With declining prices of solar technology, we recommend that now is an excellent time to pursue large scale sustainable energy use. With the information provided, we have determined that the implementation of a solar array on the new Daisy Hill dormitories being built is a good idea. It will save cost from retrofitting on previously built establishments and avoid any visual infractions. In doing so, this has been proven to be cost efficient and more sustainable for the environment. Increasing technology will also produce figures that will pay for themselves within a short period of time. Now that we have this detailed information, these findings can be looked upon for future planning. Although there are obstacles to getting solar implemented on campus, this report could be referred to and can be highly beneficial to the University in the future.

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