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IMPROVING THE EFFICIENCY OF SOLAR POWER SYSTEM BY USING SOLAR PLATE INDEXING

Rohit Pandey
Assistant Professor, Mechanical & Automation Engineering Department,
Amity School of Engineering & Technology, Amity University, Gwalior (M.P.)-474005, INDIA

ABSTRACT
Solar plate indexing system is also one of such efforts made to improve efficiency of solar power extraction. Survey data say that very few days are left when the all reserves will nearly deplete i.e. till 1050 all the reserves of petroleum products which are available under earth will vanish. Therefore, human being is very much worried about the future energy sources. The recent upsurge in the demand of PV systems is due to the fact that they produce electric power without hampering the environment by directly converting the solar radiation into electric power. Solar energy is completely natural; it is considered a clean energy source. So the studies on improving the efficiency of solar panel is very necessary in this paper I have discuss various methods of efficiency improvement of solar panel. Aiming the improvement of the efficiency of current energy generating equipment's we have designed to index the solar plate according to the solar track so that perpendicular rays could fall on the plates. We have used 5 watt, 1450 rpm motor to rotate the shaft on which our solar plate is mounted. Electronic cyclic timers have been used to index the plate in the span of 1300 in the duration if 9 hours a day. On off switch have been used to start the cycle of rotation of plate. Sunrise and sunset limiting switches have been used to decide the pan of the solar plate. After using solar plate indexing we improved the efficiency the solar power system and calculated the total cost of construction of the solar plate indexing mechanism.

Keywords: Solar panel, indexing mechanism, Solar Tracking, Utilization of Solar energy.

INTRODUCTION

Photovoltaic (PV) panels directly convert sunlight into electricity. The cells of a PV panel contain materials which absorb particles of light and emit electrons, generating an electrical current. 3 The three main types of PV panels are monocrystalline silicon, polycrystalline silicon, and thin-film.4 Of the three panel types, monocrystalline silicon panels are made of the highest-grade silicon, making them the most efficient type of panel. These panels convert 15-20 percent of incoming sunlight into electricity. Because monocrystalline panels are the most efficient type, they require the least surface area per unit of energy produced. They are the most expensive panel type.

Polycrystalline silicon panels contain lower-grade silicon than monocrystalline panels. The panels are less efficient than monocrystalline panels, converting only 13-16 percent of incoming sunlight into electricity. These panels require a larger surface area to generate the same amount of electricity produced by monocrystalline panels.6 Thin-film solar cells consist of one or more ultra-thin light-absorbing layers.7 The thin-film manufacturing process is simpler than the monocrystalline or polycrystalline manufacturing process but results in panels with lower electricity conversion rates that range from 7-13 percent.8 Because of these lower conversion rates, even more surface area is needed to achieve the same energy generation as either of the other panel types. Thin-film solar cells are the cheapest PV panel system.

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EXPERIMENTAL SET UP

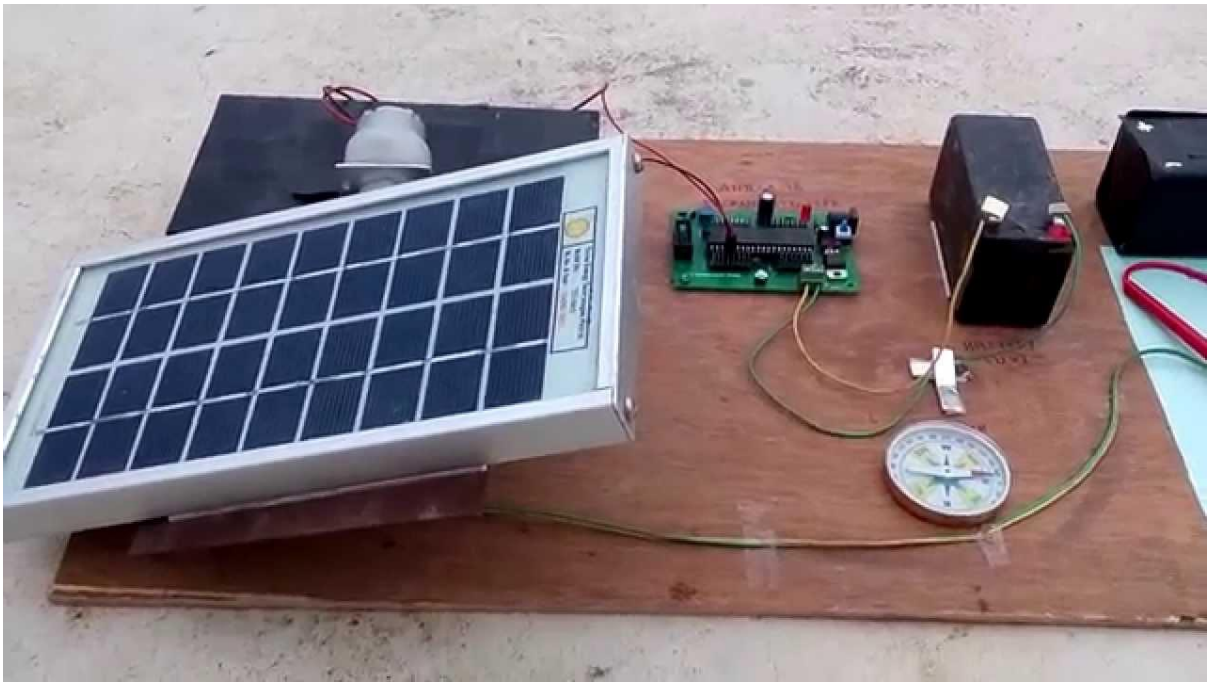

Figure1. Experimental set up of PV System using solar plate indexing system

The plate gets charged more effectively if it gets the more flux of radiation. That mean to get more flux we have to put our solar plate perpendicular to the radiation that is sun. For this we have to mountain the plate on a shaft and lime to rotate that according to the sun and for this porous we have to provide motor which will perform that task and to operate that motor we will use the solar energy. Designing of this concept involved several steps. It will include the motor selection, reduction of rpm of motor to desired limit for the specific operation. Designing the timing circuit for the operation. Design of shaft, bearing and all related article like support, base etc. material selection is also very important aspect which is going to be consider during the design.

METHODOLOGY

A Solar plate indexing with area of 25 cm^2 was tested. Characteristics were determined with the use of the electrical circuit presented in figure 1. The experimental set up consisted of the following elements: Rheostat (R) in the range from 0 to 1000 Ω, Ammeter (A), type DT9205A, Voltmeter (V), type MS8205F. The measurements were carried out in Dohuk, Iraq, at the latitude of 36° 51' during October and November 2012.
Measurements were carried out for direct normal irradiance (DNI) using solar radiation intensity meter (Voltcraft). The average value I = 700 W/m2 .
The air temperature was 36 o C, and the water temperature range was between 28 oC and 30o C. wind speed = 1 m/s.
Efficiency of the tested solar cell was calculated by applying the following relation: $\eta = (Vm \cdot Im / I \cdot S) \cdot 100\%$ ……(1)
Where: Vm – maximum voltage [V], Im – maximum current [A], I – intensity of radiation [W/m2],S – area of the cell [m2].
Fill factor of current – voltage characteristic of solar cells can be calculated by using the following relation: $FF = Vm \cdot Im / Voc \cdot Isc$ …… (2)
Where: Voc– open circuit voltage [V],Isc – short circuit current [A].

Atypical full current – voltage characteristic curve for polycrystalline silicon panel before submerging it in distillated water (i.e. depth-d=0) and for maximum power are displayed in Figure 2a and figure 2b respectively. The maximum voltage Vm = 5.2 V for I = 0.023 A, maximum power Pmax = 0.119 W and fill factor = 0.65 are

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obtained. The current – voltage characteristic, and the power characteristic for the PV panel submerged under different water depths (d) were presented in Figure 3 and figure4 respectively.

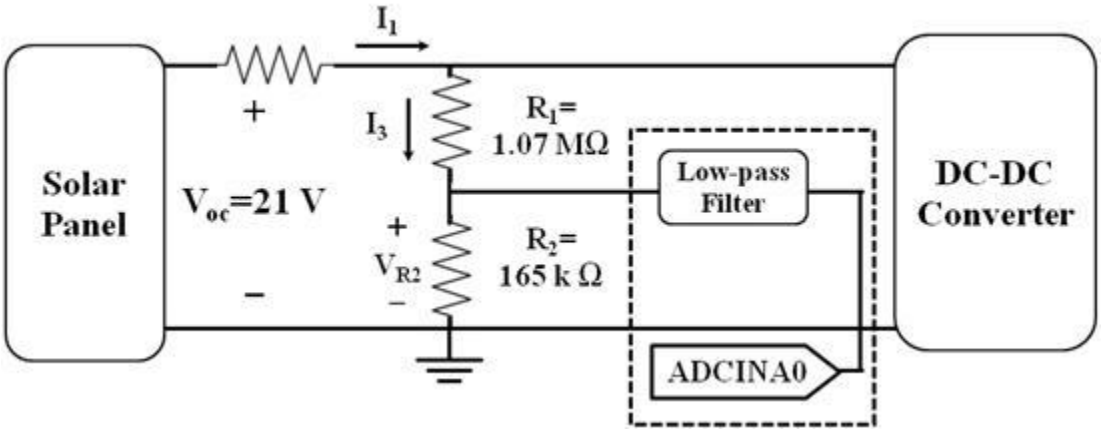

Figure2: Current – Voltage characteristic for polycrystalline silicon panel electrical circuit diagram.

Increments in efficiency can be observed with increasing water depth, there is a maximum value for the efficiency about 22 % at a depth of 6 cm. This increase in efficiency may be related to change in the band gap of the corresponding absorber material in the PV cell, since the value of temperature coefficient is correlated to the band gap [2]. It was found that when the depth of water is more than 6 cm, the efficiency for the PV panel started to decrease.

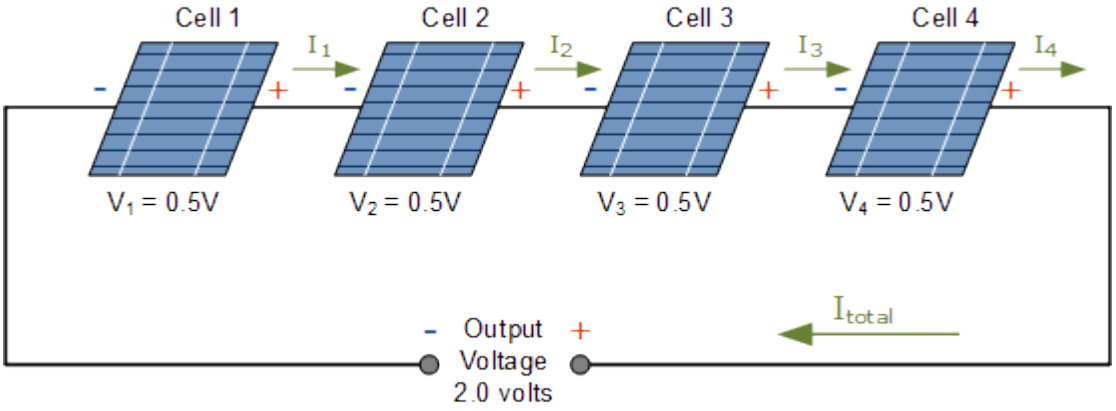

Figure 3: Increments in efficiency with increasing depth of solar plate indexing.

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RESULTS AND DISCUSSION:-

The average reading of every hour is taken of both; it was found that the average power output of solar panel with tracking mechanism was more than stationary one. Thus, increasing in the efficiency was calculated. Constant angle between 70° to 80° with respect to sun rays was obtained. A solar tracker was proposed, designed and constructed. The final design was successful, in that it achieved an overall power collection efficiency increase from only 40% for a fixed panel to over 70% for the same panel on the tracking device.

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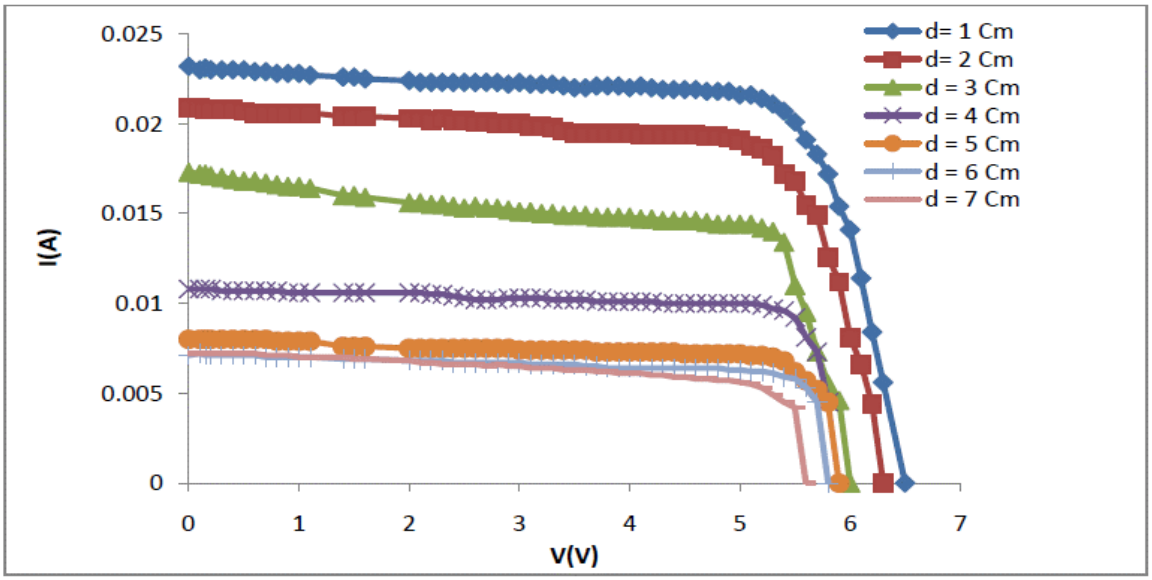

Figure4:- The behaviour of a photovoltaic (PV) panel with increases the solar panel efficiency

The behaviour of a photovoltaic (PV) panel submerged in water is studied. The PV panel performance improved after it was cooled by water. A sizeable increase of electric power output is found for shallow distillated water. The repeal of thermal drift increases the solar panel efficiency by about 11% at water depth 6 cm. Our results are in line with data presented in the literature. Experimental setup is tested for two days and the reading on each day is mentioned in sheet.

The different parameter are measured like voltage, current, radiation, panel surface temperature, chamber temperature, soil temperature, wind speed, atmospheric temperature etc. Various instrument are used to measure this parameter mainly data logger for recording temperature for half hour interval time, anemometer, multimeter, digital temperature gun, pyranometer for radiation measurement. Hybrid Photovoltaic/Thermal (PV/T) solar system is one of the most popular methods for cooling the photovoltaic panels nowadays. The hybrid system consists of a solar photovoltaic panels combined with a cooling system. Water is circulated around the PV panels for cooling the solar cells, and the warm water leaving the panels pump back to water tank. Warm water mixed with cool water of tank.

CONCLUSION

Upon completion of the solar plate indexing mechanism, it was tested to make sure that it met design requirements and specifications which were calculated theoretically. It functioned properly according to design calculations. Test showed that power used by plate indexing mechanism is less than the power gain by tracking the sun. The most important conclusion of this research is the total cost of construction of the solar plate indexing mechanism is very low. This means the system can be mass produced at lower cost and at affordable rate in the developing countries and can be used more for domestic purposes.

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