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W Celula Solar

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Abstract

The solar cell that is made of crystalline silicon represents more than 80% from the total solar cells, where its efficiency reaches to 20%. The most important factors that have an effect on the cell's efficiency have been identified namely: the effect of dust, variation in temperature, the occurrence of corrosion due to salt and moisture.

Radiative cooling was one of the methods used to increase the efficiency of the solar cells. It limits the reduction of the solar cells efficiency with rate of 3%. The more cells become hotter, its efficiency become less.

We measure the efficiency of the solar cells, before and after being affected by one of the mentioned factors such as dust with different angel of falls of the sunlight, results have been compared and found that dust reduces the voltage of the cell and consequently reduces the efficiency of rays absorption. Therefore, automatic fan was installed to clean the dust and get rid of the moisture available in the cell. Furthermore, lens was put to guarantee a greater rate of absorption.

Introduction

The most promising technologies are the technologies that use the solar power. The direct thermal conversion of solar radiation into electrical energy is considered to be new and sophisticated technology of solar cells, and it is a strategic industry as a source of energy.

The impact of external and internal factors of solar cell is important and key to reduce its efficiency and this requires the application of some solutions on it. It is well known that solar cells is low efficiency. Therefore, in our research we examine different solutions on the solar cells after influencing on it by factors to identify results.

We aim to increase the efficiency produced by the solar cells, as well as cleaning it practically and making practical application for such cell to increase its efficiency.

The solar cells manufactured from crystalline silicon, representing more than 80% of all solar cells in the market, which is considered the highest solar cells .The solar cells manufactured from crystalline silicon can be divided into two parts:

mono-crystalline or polycrystalline. Also, there are other types with efficiency up to 10%.

And represents 15% of the total cells in the markets . There are also organic solar cells that have a short life and low efficiency: CdTe-cds . $CIGS^2$

Type	**Efficiency**	**Cost**	**Provided the market**
Mono crystalline SI	17-20	3.0	30
Polycrystalline SI	15-18	2.0	40
Amorphous SI	5-10	1.0	5
CIGS	11-13	1.5	5
CdTe-CdS	9-11	1.5	10

Table (1) : Types of cells and how to choose the good ones.

Solar cells made from mono-crystalline silicon have efficiency up to 20% and with total cost up to three dollars per watt. Whereas, the polycrystalline has efficiency ranges from 15-18% with total cost of two dollars per watt. Also, there are amorphous Si with efficiency ranges from 5-10. Whereas, CIGS, CdTE-Cds have efficiency up to 12% and 10% with total cost of two dollars per watt.[2]

There are many Factors affected the cell efficiency:

1. Dust : The most important problem encounter researcher ad reduces the efficiency of the solar cell with rate of 50% is the dust.[1]
2. Temperature: Variation in temperature is one of the factors that lead to reduce the efficiency of the solar cell. The rate of variation ranges between 1.7% and 11.3%.[1]
3. salts in the water :used for the heating cycles that cause rust and corrosion in the solar complexes.[1]
4. Moisture: Vaporized water molecules reduce sunlight levels which are a prerequisite for the work of the solar cell. When moisture formed on the cell surfaces, the incoming sunlight scattered either by refraction, reflection or diffraction. It was found that the effect of moisture on the solar cells is higher than the temperature effect by 50%.[1]

There have been many invented to improve solar cell efficiency one of these ways is:
The Use of amorphous Colored Sheets: When using efficient crystalline pigments such as protection paint for the solar cell, the efficiency will increase by 2.7% when the paint in green and 17.27% when the paint in pink. This increase is due to the coating reduces the reflectivity from 40% to 20%. The preferable colors are the golden, green, brown and gray.
These systems are being used because it suited to the solar spectrum more than the single gap systems, and thus a higher efficiency (11%).[3]

Another way the compound solar cell Appropriate Alloy of V Alloy-v (III-III) is selected to manufacture atchm-Lattice deposited on a certain floor. This cell developed from 2% in 1980 to 30% in 1996.[3]

Also the buried contact solar Is an attempt to develop the efficiency of performance at the lowest possible cost (Metalized) by electro less deposition for Ni/Cu/Ag layers. The highest efficiency obtained was 16-18%.[3]
And also the printed screen solar cells layers of silicon equipped with boron are usually used in these cells and manufactured by the method of (CZ), with efficiency ranges from 10% to 13%.[3]
Also Pard introduced his method to improve and increase the efficiency of solar energy In 2014, a team of inventors developed a very thin material to reflect infrared heat directly into space without raising the temperature of the atmosphere. This research was submitted to the journal of Nature under the title of (Radiation Cooling" because it directs thermal energy directly into the deep, which cools the surrounding space. In new research, The researchers applied this principle to improve the efficiency of solar cells when the sun is shining. Stanford team tested this technique on a special device to absorb solar energy.[4] to pass into solar cells. It also cools the absorbing layer up to 23 degrees Fahrenheit. For crystalline silicon cell efficiency of 20 per cent, the 23 degree cooling improves cell efficiency by more than 1 per cent. This figure represents a significant gain in energy production. The researchers said that the new transparent membrane works best in dry environments.

In 2013 the engineer mentions that cooling solar cells reduces its efficiency by less than 3%. It is also possible to reduce more than 10 degrees Celsius by putting pipes behind the cell for its ventilation. The engineer suggested another solution which is putting cold water tanks under the cells to cool it, and this proposed solution is able to reduce the temperature by 20 degrees Celsius. There is also a special spray can be sprayed on the

solar cell to prevent dust particles from sticking out. However, the easiest solution is clean it manually on a periodically process.[1] As solar cells become hotter, its efficient in converting sunlight into electricity becomes less. It is a common problem in the process of solar industry since a long time. Now Stanford engineers developed a transparent membrane leads to increase efficiency through cooling cells even in the sunlight.[1] We propose to increase the cell's efficiency by reducing the effect to the dust state .

Methods and tools:

In this project the solar cell was measured by one way and influenced by a factor of (dust) After that,
We calculated the power efficiency that is defined by that ratio of the output power to the input power:

$\eta = \frac{Pin}{Pout} \times 100\%$ (1)

Where η is the efficiency in percent (%), P_{in} is the input power consumption in watts (w),and P_{out} is the output power or actual work in watts (w).
The power is defined by equation (2):

$P = I \times V$ (2)

The Electric Power (P): Is the time rate of flow of electricity in the circuit, measured according to the International System of Units are Watts.
The Volt (V): the voltage difference between two point in a electric circuit crossed by a continuous current of fixed when dissipate ability between these two points.
The Current (I): A flow of electrical charges. Electrical charges may be electrons or ions. According to the International System of Units intensity of electric current measured in amperes. While the measured electric current ammeter device.

We use a mono-crystalline silicon cell has an efficiency up to 20% and with total cost up to three dollars per watt , Voltmeter with The range is more than 100 to 1000.
We use a Fan to clean the cell form the dust , and Magnifying glass lens to collecting the sun light in the solar cell.

We connect the circuit in the figure (1) to measure the efficiency:

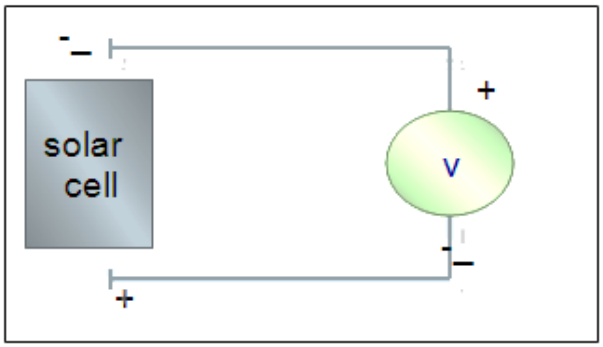

Figure (1): electric circuit that give us a high voltage, we taking into account the maximum voltage of the solar panel (1500 volt) .

Results:

The original solar cell without any effect on it:

The original voltage of the cell	10.8 V
The original Power of the cell	03 Watt
Value of the current pass in the cell	0.367 A

Table (2) :The original solar cell.

Sunlight falling with angle of 30˚
Measurement time: 11:15AM:

Voltage	Current	Power
10.8	0.3	3.2

Table (3) : The sunlight falling with angle 30˚

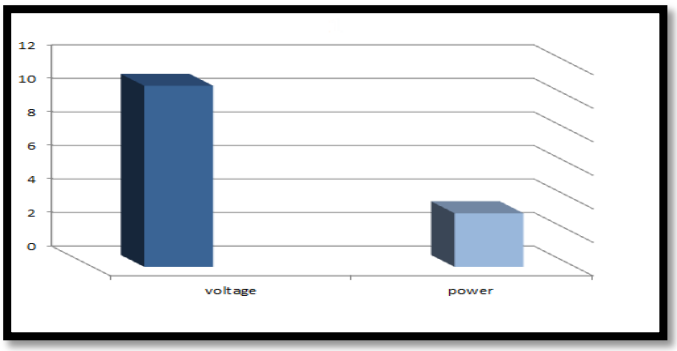

Figure (2): the sunlight coming at angle 30˚, when measuring the output voltage was 10.8 and the current value is constant =0.3, the result of the power is P=V×I= =10.8×0.3=3.2,

The result of the efficiency is $\eta = \frac{Pin}{Pout} \times 100\%$

$\frac{3.2}{3} \times 100 = 106\%$

The efficiency increase by 6%

Converging lens with Focal Length of 8 cm:

Voltage	Current	Power
11.2	0.3	3.3

Table (4) : Converging with focal length 8 cm.

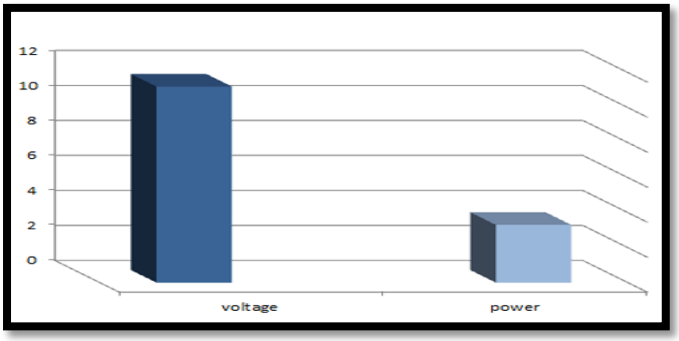

Figure (3): when shed a combined lens with a focal length of 8 cm the output voltage measurement =11.2 ,and current value is constant =0.3,the result of the power is P=V×I =11.2×0.3=3.3

The result of the efficiency is $\eta = \frac{Pin}{Pout} \times 100\%$

$\frac{3.3}{3} \times 100 = 110\%$

The efficiency increase by 10%

During fan running:

Voltage	Current	Power
10	0.3	3

Table (5) : The during fan running.

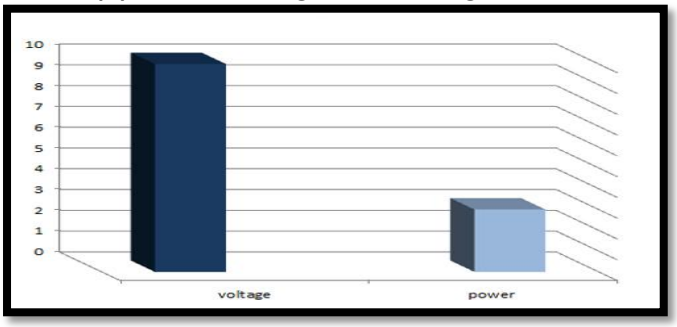

Figure (4): when adding the fan the output voltage of the cell=10, this means that the voltage constant and does not increase,
The current value is constant =0.3, the result of the power is P=V×I =10×0.3=3

The result of the efficiency is $\eta = \frac{Pin}{Pout} \times 100\%$

$\frac{3}{3} \times 100 = 100\%$

The efficiency is constant ,does not change

After adding the dust factor:

Voltage	Current	Power
6.9	0.3	2

Table (6) : The after adding the dust factor.

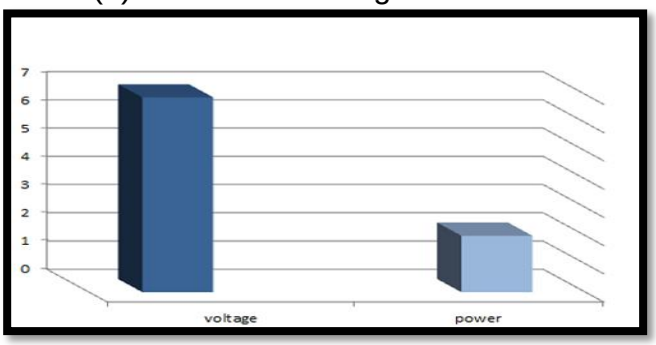

Figure (5): after adding the dust factor on the cell the output voltage less to 6.9 and current value is constant =0.3, the result of the power is P=V×I=6.9×0.3=2 the power decreasing to 2

The result of the efficiency is $\eta = \frac{Pin}{Pout} \times 100\%$

$\frac{2}{3} \times 100 = 66.\%6$

The efficiency decrease by 33.4%

After that we adding the fan on the solar cell panel to clean the cell from the dust .

Fan running and lens shedding:

Voltage	Current	Power
11	0.3	3.3

Table (7) : The fan running and lens shedding.

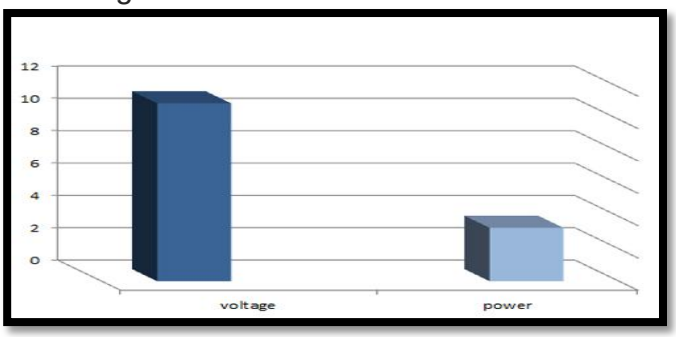

Figure (6): when running the fan and shed the lens, the resulting cell voltage =11, and the current value is constant=0.3, the result of the power is P=V×I =11×0.3=3.3
The result of the efficiency is $\eta = \frac{Pin}{Pout} \times 100\%$

$\frac{3.3}{3} \times 100 = \%110$

The efficiency increase by10%

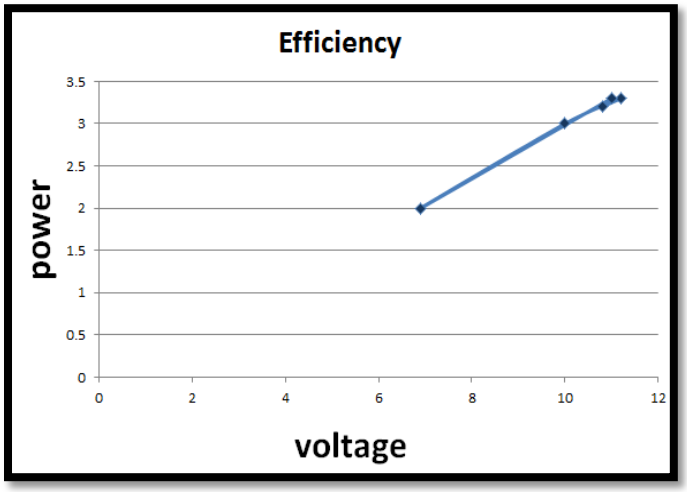

Figure (7): when sunlight shading on the solar cell with an angle of 30˚ the power increase by 3.2 and the efficiency increase by 6%. then we adding a combined lens with a focal length 8 cm so the voltage increase by 11.2, the power increase to 3.2 and efficiency increase by 10%. we installing the fan on the cell and running the voltage ,the power, and the efficiency is constant . when a solar cell exposed to dust factor the voltage is less than from the original voltage by 3.9, note that the original voltage of the cell and efficiency decrease by 33.4%and the power 10.8 decreased to 2 .when running the fan and shed the lens the voltage increase to 11 and the power increase to 3.3 then the efficiency increase by 10%.

Conclusions:

We find that the dust factor on the solar cell is reducing the efficiency so we add the fan to clean all accumulated dust which makes the efficiency increasing ,and we adding the magnifying glass lens to calculated the sunlight which makes the efficiency increase. In tow way the efficiency increase by 10%

Challenge and future work:

While working on the research methodology, there are no adequate studies on solar cell efficiency .When trying to increase efficiency by adding insulators it was difficult to add a carbon insulator and increasing the temperature of measuring devices when exposed to the sun. Efficiency values are variable due to the change in the brightness of sunlight and thus the difficulty in determining a fixed value for the efficiency of the solar cell.

References:

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4-http://science.ma/?p=23176 Stanford University