

Investigation of Monocrystalline Solar Panel Energy Production

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Abstract— The level of development of countries is now measured by the amount of energy they consume. The more energy a country consumes, the more advanced it is called. The best example for this issue is the energy consumption of countries in the African continent and the energy consumption of the countries in the European continent. The energy consumption of the countries in the African continent remains very low, as well as the energy consumption of the countries in the European continent. The level of development country is parallel to the consumption amount of energy which they use. According to the countries on the continent of Europe, the energy of monocrystalline solar panel to be installed in Antalya / Turkey will be calculated by using the package program. In order to calculate this, monthly sunshine duration and monthly radiation values of Antalya province were taken from the meterology general directorate. How long a monocrystalline solar panel with these values is on a monthly basis energy production is shown in tables.

Keywords— monocrystalline solar panel, solar panel, energy, monthly-yearly energy services.

I. INTRODUCTION

Although single crystalline silicon is one of the materials used in the production of solar cells, the high cost of production has led to the use of multi-crystalline materials as different options in this field. Silicon material is widely used in solar technology the main reasons for use; Silicon electrical, optical and structural properties do not change for a long time and has achieved significant success in the production of silicon technology. Pure single crystal production, quite difficult and expensive technology It requires. Most commonly found on earth after oxygen silicon, the most common form of sand and Quartz. Since the purity of the sand is very low, not suitable for use. However, 90% of quartz comprise the silicon. 99% purity silica obtained by processing quartz It may be. Then, silicon is made of silicon. In the following stage, silicon is purified and semi-conductive multi-crystalline silicon has obtained. Up to obtaining a multi-crystalline silicon each of the stages would be a process of increasing the costs of energy needs.



Figure 1 shows the application of the czochralski method.

In the production of mono-crystal silicon, the production method known as 'Czochralski Method' is used. In this method, developed in 1918, Czochralski puts the silicon dioxide (SiO₂) compound into a container and melts at a very high temperature. A small graft crystal is then immersed in the molten material and slowly drawn upwards into the cold zone. As a result of this process, long and single crystalline cylinders are obtained.

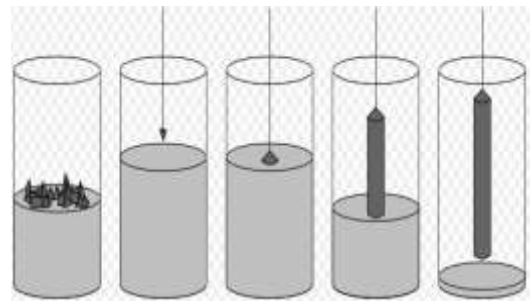


Figure 2 shows the application of the czochralski method.

After the Czochralski Method, single crystal cylinder material which is 30 cm in diameter and several meters in size is circular, rectangular or polygonal and its thickness is sliced in 0.2-0.3mm thickness. The resulting layers are P-type semiconductor material of solar cells. N-type semiconductor material has lower thickness. P-type and N-type semiconductor materials are assembled to make connections and they are attached to each other with special adhesives. In the latest process, the solar cell is formed by gluing the anti-reflection glass layer. The color of the mono-crystal silicon batteries is a color in the dark blue-black range.

A lot of work has been done in relation to solar panels. While some of the study is made simulation, some of them are actual applications.[1-30].

A. Solar Panel

Solar Panel 100 Watt monocrystalline solar panel data is used in the system realized. The technical data of the solar panel is given in the table below.

. TABLE I: Technical data of the solar panel

The high voltage load	17,50 V
The high current load	5,72 A
The high open circuit voltage	21,50 V
Short circuit current	6,34A
Operating temperaturerange	-40 - 85

B. Sunrise Time and Radiation Value

Sunshine Time and Radiation ValueSolar panel is the two most effective in energy productionsunlight time and radiation values. These two factors contribute a lot to the solar panel energy production.Figure 3 shows the sunshine duration and radiation values of Antalya / Turkey Province on a monthly basis.

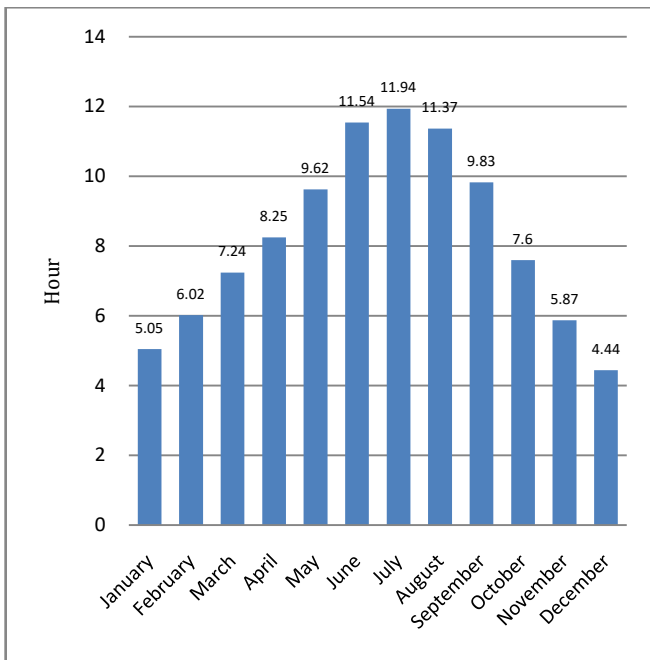


Figure 3: Monthly Sunbathing Time

When the monthly sunbathing time of Antalya province was examined, there was a sunbathing in the winter of 4,44 hours in December. The highest sunshine time was 11.94 hours in July. These sunbathing times directly affect the energy production of the solar panel. Figure 4 shows the monthly radiation values.

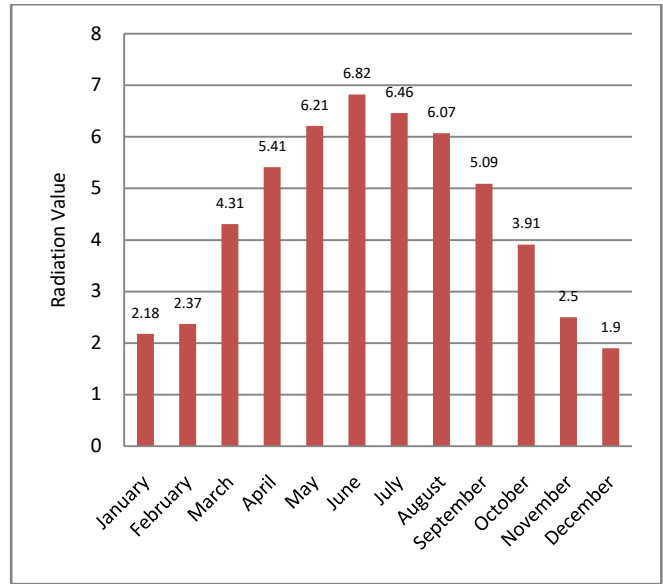


Figure 4 monthly radiation values

When the monthly radiation values are examined, the lowest number was 1.9 in December. Figure 5 shows the monthly average temperature values.

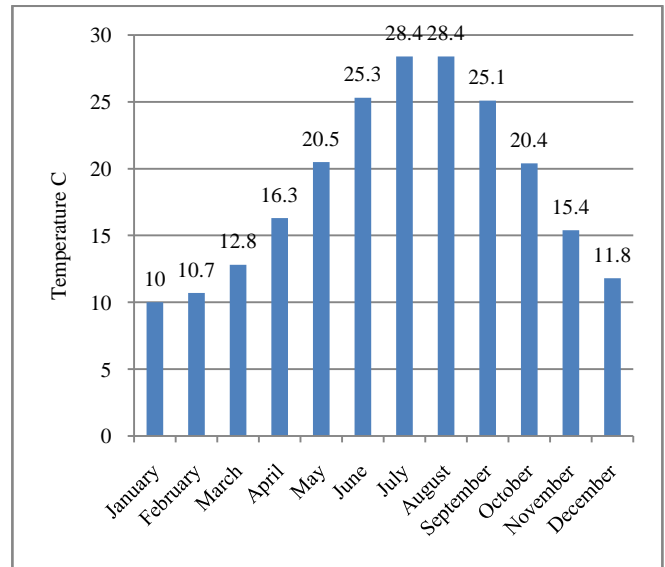


Figure 5 monthly average temperature values

The value of temperature reaches to very high in summer reach. Especially in July and August the temperature reaches to 28degrees. The temperature contributes to the energy when it increases in the solar panels up to a certain level but can be converted in reverse at high temperatures.

C. Result

As a result of the work carried out on a monthly basis energies are shown in Table II.

TABLE I: monthly energies

Monthly	The total power generated (W/hr)
January	4344,44
February	6250,71
March	7790,98
April	11009
May	17537,8
June	23478,4
July	26585,6
August	26422,2
September	20020,7
October	10836
November	7841,43
December	4604,8

If energy production is carefully examined, it is increasing in summer. Especially in June-July and August energy production is at the highest level. In the winter setting, energy production is minimal. Especially in December and January are at the bottom dip level. The energy produced on a monthly basis is shown graphically in Figure 6.

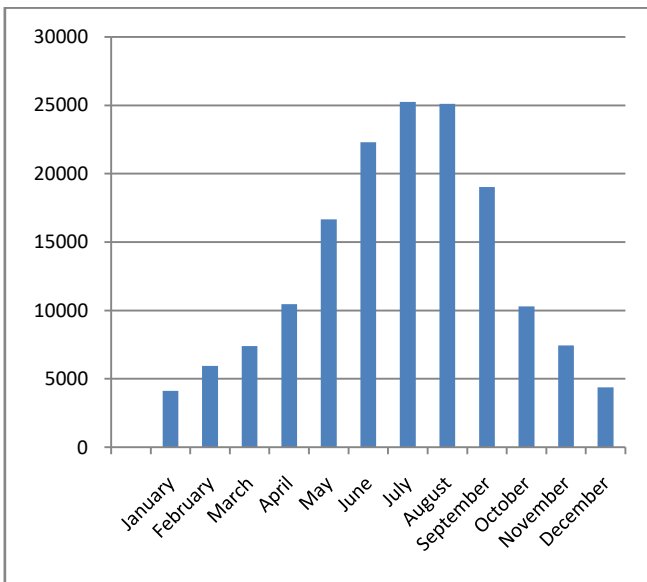


Figure 6 Energy produced on a monthly basis

The monthly energy production graph is the highest in the summer months and the lowest in the winter months. The greatest effect of this is the time of sunbathing. In summer, the sunbathing time is the highest, while in winter it is the lowest. Energy production increases or decreases in parallel with the sunshine duration. Figure 7 shows the value of the monthly energy production in%.

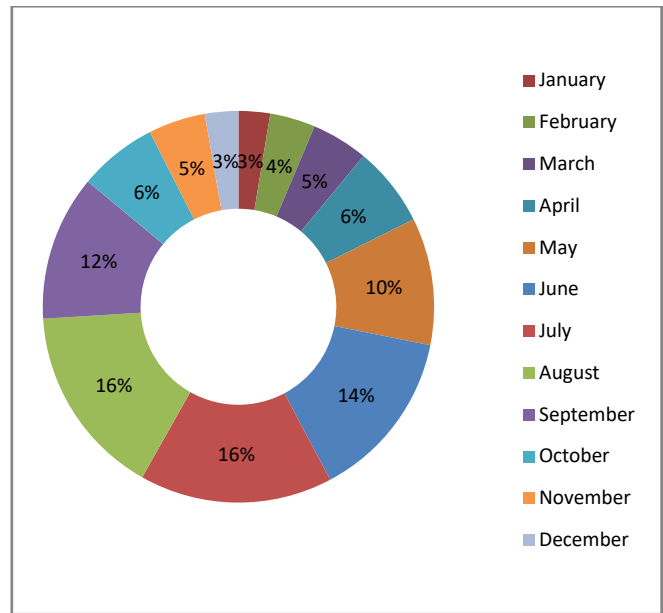


Figure 7. % value of monthly energy production

In Figure 7, the highest share in energy production is 16% in July and August. The lowest share is in December and January with 3%. In the energy production, June, July and August are 46% of the total. This is almost half the value of energy production. The winter months of Arlık, January and February are 10% of the total. The biggest reason for this is the time of sunbathing. As the sunshine duration increases, the energy production increases.

II. CONCLUSION

A very variable effect in solar panel energy production . Among them, sunshine duration, radiation values and temperature are at first. These three factors play an important role in the energy production of the solar panel. In this study, sunshine duration, radiation values and average temperature values of Antalya Province were obtained from Meterology General Directorate. The solar panel has many variations in energy production. There are many effects which play role in energy production.

As a result of the study, solar panel energy per month production is determined. The highest energy production was calculated in July with 26585.6 W / h. The lowest energy production was 4344.44W / h in January. When the results of the study are examined, it is understood that the most biggest factor in solar panel production is the sunshine duration. In parallel with the duration of the sun, energy production is increased The highest degrees occurs in July, when solar energy generation became 11.94 hours, the lowest energy production was in January.

Annual total energy production of 158385,95W / h. It was calculated. The biggest contribution of this energy production occurs in June, July and August. In this period, energy production increases to the highest level with increasing sunshine duration. At the same time the average temperature is the highest in these months. Ambient temperature benefits to the energy production of the solar panel to a certain extent, while decreasing the energy production at high temperatures.

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