A Study on the Energy Efficiency of Polycrystalline Solar Panels

Assist Prof Riyad ŞİHAB[1], Prof. Yüksel OĞUZ[2]
[1]*Building Departman, Dazkırı Vocation Scholl, Afyon Kocatepe Unıversty, Turkey*
[2] *Electrical-Electronics Engineering, Faculty of Technology, Afyon Kocatepe Unıversty, Turkey*

***Abstract*— Solar panels are one of the most renewable energy sources. The limited reserves of fossil fuels lead people to renewable energy sources. Polycrystalline solar panels are the most preferred solar panel types among the solar panels. Even if the energy production is not as efficient as monocrystallion, it is more preferred because of the ease of production method and cheap cost. In this study, it has been calculated how much energy of the polycrystalline solar panel to be established in Antalya / Turkey which will produce with 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. By using these values, the monocrystalline solar panel shows how much energy is produced on a monthly basis.**

***Keywords*— policrystalline solar panel, solar panel, energy, monthly-yearly energy services.**

I. INTRODUCTION.

Then, the semiconductor materials are assembled together to make connections and they are attached to each other by special adhesives. In the latest process, the solar cell is formed by gluing the anti-reflection glass layer. The polycrystalline silicon is not homogeneous because the Czochralsi method or another purification method is not used in the production of polycrystalline silicon. Due to the convenience of making polycrystalline silicon, its prices are lower than mono-crystalline solar cells. In poly-crystalline solar cells, if there is glass in the reflection, there is a blue color and the reflection glass does not appear in silver. Figure 1 shows the poly-crystalline silicon solar cell. Electrical, optical and structural properties of multi-crystalline material; ant the properties of single crystal material are the same. Since the multi-crystalline material is not pure relative to the single crystal, the veins present in the structure are sometimes wide and sometimes narrow. The size of the veins is directly proportional to the crystalline quality. The irregularity between the veins plays a significant role, especially in the transmission of electrical charge carriers.

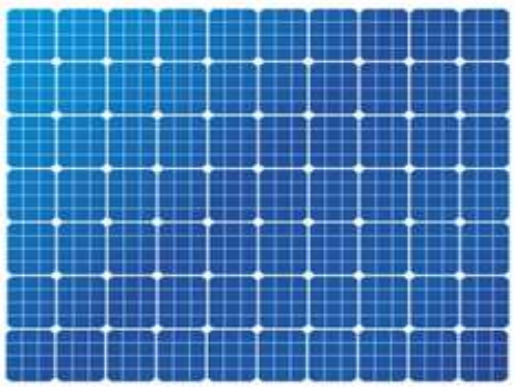

Figure 1 Polycrystalline silicon solar cell.

The degradation of the electrical properties of the multi-crystalline material in proportion to the shrinking vessel size results in a smaller yield compared to the single crystal (Öztürk 2008). A lot of work has been done in relation to solar panels. While some of the work is a part of simulation, some of them are real applications. The degradation of the electrical properties of the multi-crystalline material in proportion to the shrinking vessel size results in a smaller yield compared to the single crystal (Öztürk 2008).

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A. Solar Panel

100 Watt monocrystalline solar panel data was used in the system. 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. Sunshine Time and Radiation Value

The two most effective solar panels for solar energy production are solar exposure time and radiation. These two factors contribute a lot to the solar panel energy production. The following figures show the monthly sunshine duration and radiation values of Antalya / Turkey.

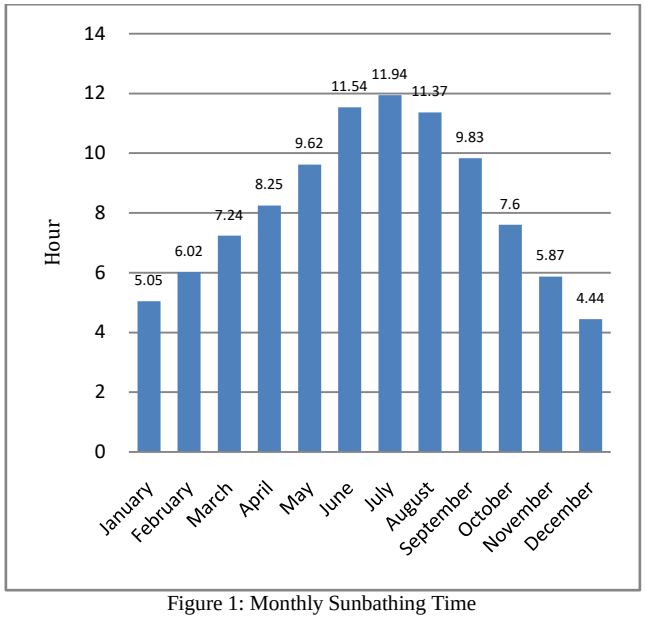

Figure 1: Monthly Sunbathing Time

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 2 shows the monthly radiation values.

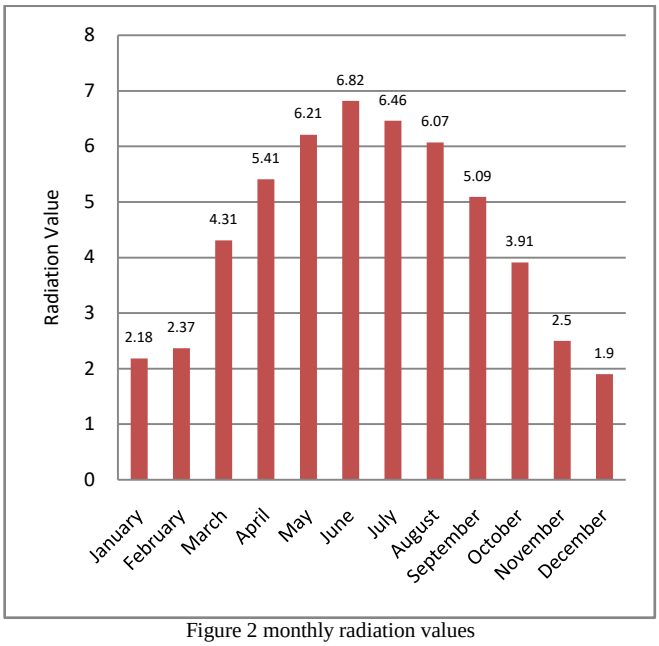

Figure 2 monthly radiation values

When the monthly radiation values were examined, the highest rate was 6,82, while the lowest one was 1,9 in December. Figure 3 shows the monthly average temperature values.

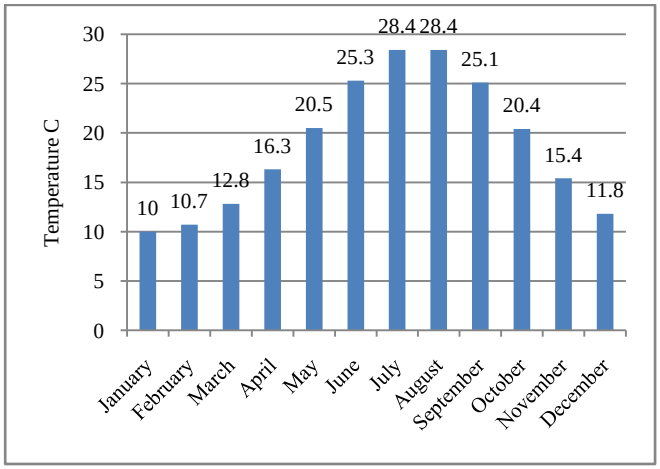

Figure 3 monthly average temperature values

In summer the temperature values reach very high values. Especially in July and August there are 28 degrees. The temperature contributes to the energy increase in the solar panels up to a certain level and this is reversed at high temperatures.

C. Result

The energies which produced as a monthlyas are shown in Table II.

TABLE I: monthly energies

Monthly	The total power generated (W/hr)
January	4040,39
February	5813,16
March	7265,11
April	10238,37
May	16310,15
June	21834,91
July	24724,61
August	24572,45
September	18619,25
October	10077,48
November	7292,45
December	4282,53

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 4.

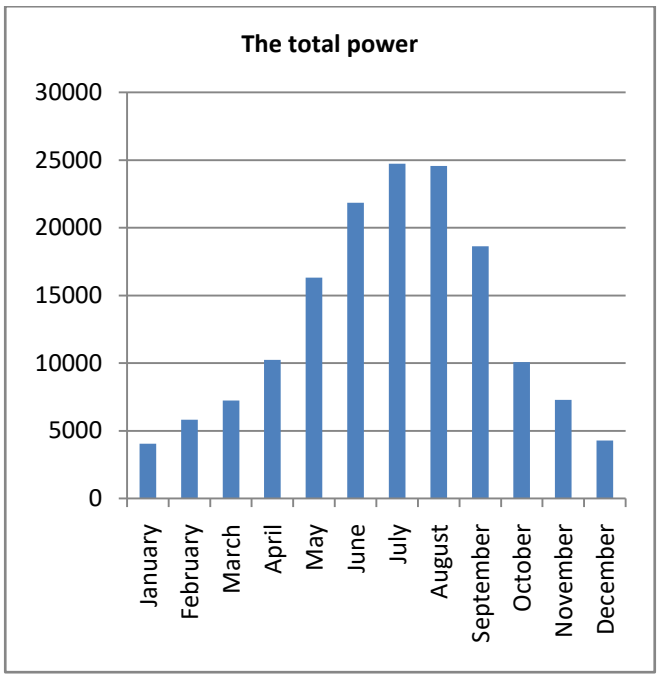

Figure 4 Energy produced on a monthly basis

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 5 shows the value of the monthly energy production in%.

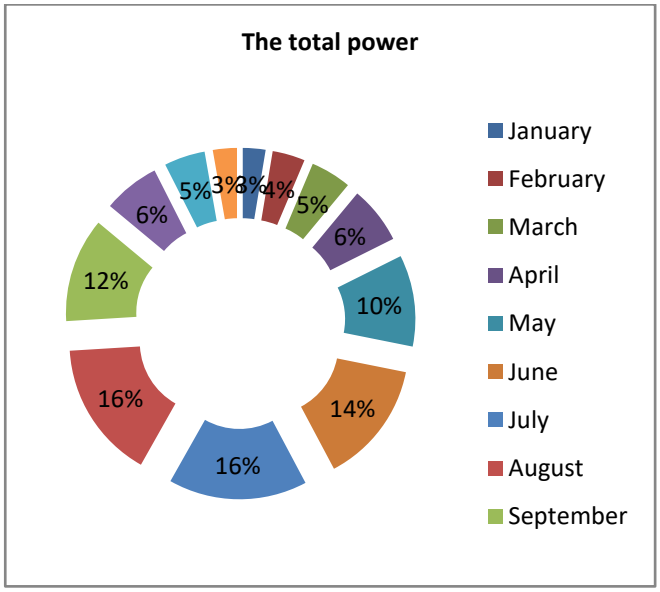

Figure 5.% value of monthly energy production

When Figure 5 is examined, 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

The solar panel has a very variable effect on energy production. Among them, sunshine duration, radiation values and temperature are at the top. 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.

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Annual total energy production is calculated as 155051,51W / h. The biggest contribution to this energy production is 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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