Relatedness of the amount of energy obtained using solar cells to the lighting of the surface

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Abstract. This paper studies the dependence of the amount of energy obtained by solar cells depends on the illumination of the solar cell surface. It was shown that, if the angle between the normal which transferred on the surface of the solar cell and the incident sunlight is smaller, the illumination will be higher. Forever, the higher amount of energy which obtained by solar cell depends on the higher illumination.

1 Introduction

The rising population, the construction of new production enterprises and the increase of their production capacity lead to an increasing demand for electricity. It is obvious that the currently used energy sources are mainly obtained at the expense of coal, oil, natural gas, water and other natural resources and are produced at great expense. In addition, the reserves of mineral resources are limited, and their amount is decreasing year by year.

Therefore, at the same time, finding renewable energy sources and meeting the population's needs for electricity through it is one of the urgent problems. Examples of renewable energy sources include solar, wind, and bioenergy sources. Among these, the use of solar energy in the conditions of Uzbekistan has a number of advantages.

Experts say that the Earth receives 174 petawatts of energy from the sun every day. Our country, which has 300 days of sunshine a year, is very convenient for the use of solar energy technologies.

By 2030, solar and wind power plants with a capacity of 3,500,000 megawatts are planned to be put into operation in our republic. In the next 10 years, 25 solar power plants will be launched in Uzbekistan. The reason is that most of the year is open and warm. In the next period, large-scale scientific energy production works on the use of solar energy are being carried out, and on the basis of the obtained scientific productions, water heating constructions, hot water supply of industrial objects and lighting constructions are being developed. Alternative energy devices are being installed in different regions of our republic. It is important to save traditional energy sources while meeting the need for electricity.One of such alternative energy devices is solar batteries.The main parameters of solar cells:integral sensitivy Sn f (f)S(its value does not exceed 700 A/m) . Photo electric absorbing power (its value is around 0.6 V): the threshold frequency of sensitivity (its value

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does not exceed several hundred Hz); coefficient of useful work (CUW), the CUW of silicon solar batteries is around 13-19%

Obtaining CUW of solar cells developed on the basis of semiconductor materials is an urgent problem. Various ways to solve this problem are being sought. Among them, one of the most common methods to date is the introduction of impurities that form deep layers into semiconductor materials. It has been widely studied that it is possible to control the electrophysical properties of semiconductors by introducing an impurity forming a deep layer [2-6]

It should be noted that some impurity elements increase the sensitivity of silicon to light. For example, in [7], the authors created light-sensitive structures based on Si<S> and Si<Rh>. The increased sensitivity of the structure to light is explained by the uneven distribution of cerium and rhodium atoms in silicon.

In [8-10], the sensitivity of semiconductor materials to light depends on the recombination processes and the structure of semiconductor zones, and the advantages of using semiconductors with the wrong zone for making solar cells with high sensitivity to light are explained.

In this work, the dependence of the amount of energy obtained by solar cells on the illumination of the solar cell surfaces was studied.

2 Materials and methods

In order to practically check the dependence of the illumination of the surface on the angle of incidence of the light, the author created a “Light search device” (Figure 1).

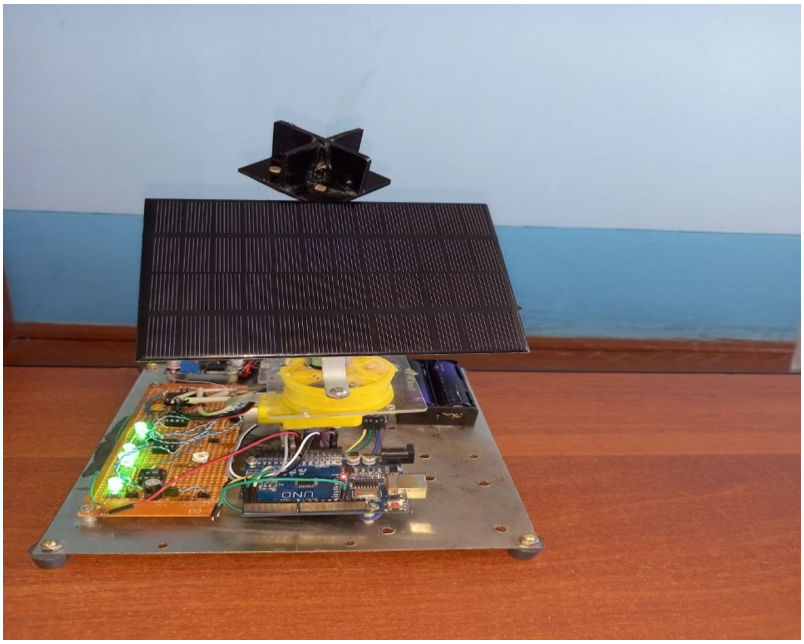

Fig. 1. Light searching device.

This device keeps the surface of the solar cell facing the sunlight during the day either in a stationary position or as a result of rotating movement in vertical and horizontal directions. This ensures that the amount of energy obtained by the solar battery is the same

and high (25-30%) throughout the day. The energy obtained by the device can also be transferred to the consumer.

Through this automatic device, the amount of energy obtained from the solar battery can be monitored using a wireless mobile phone.

3 Results

The amount of energy obtained using a solar cell with a surface area of 136 was studied in two cases:

- Stationary state of the solar battery. It is known that the solar batteries, which are used as an alternative energy source at the same time, are installed in a stationary (fixed) position. In this case, the amount of electricity obtained with the help of the installed solar battery is not the same throughout the day. (Figure 2, line 2). During the day, from 11:00 to 15:00, the voltage reaches its highest values. In the time intervals from 8-00 to 11-00 and from 15-00 to 18-00, the value of the voltage is 1.5-2 times lower than the maximum value. The reason is that during these time intervals, the angle between the normal transferred to the surface of the solar cell and the light falling on the surface is large.
- Non-stationary state of the solar battery. In this case, the solar cell faces the sun throughout the day, like a "sunflower" plant. In this case, the variation of the voltage generated by the battery during the day as a function of time is shown in Figure 2 (line 1). In this case, the value of the voltage reaches its highest value between 11:00 and 15:00. It almost does not change between 12-00 and 14-00. During the day, the value of the voltage differs by 20% compared to the maximum value.

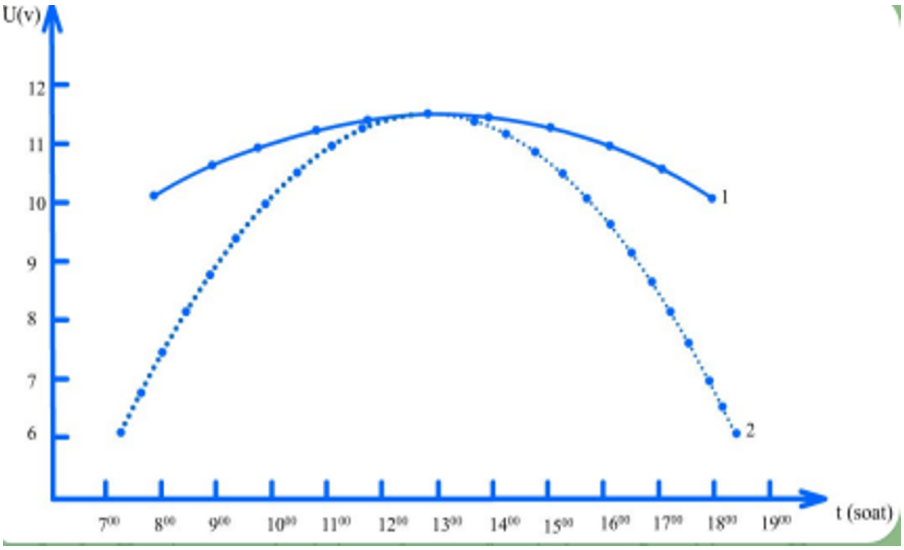

Fig. 2. Variation of the amount of energy received by the solar battery during the day.

As can be seen from Figure 2, the value of the voltage between 12:00 and 14:00 is very close to each other in both of the above cases. Because during this period of time, the angle between the normal transmitted to the surface of the solar cell and the light falling on the surface is very small.

4 Discussion

The concept of illuminance is introduced to quantitatively assess surface illumination. dS surface illumination E is defined as the ratio of dF light flux falling on this surface to the size of this surface. In other words, illuminance is equal to the light flux falling on a unit of surface:

$$E = \frac{d\Phi_{fol}}{dS} \tag{1}$$

The illuminance E produced by a point source can be expressed by the light intensity I, the distance r from the surface to the source, and the angle α between the surface normal n and the direction toward the source. The current falling on a surface dS is the current within the spatial angle dΩ subtended by that surface dS (Figure 3). dΩ is equal to the angle. So, dividing this current by dS, we get:

$$E = \frac{I}{r^2}\cos\alpha \tag{2}$$

That is, surface illumination can be expressed by light intensity I, the distance from the surface to the source r, and the angle between the normal of the surface n and the direction towards the source.

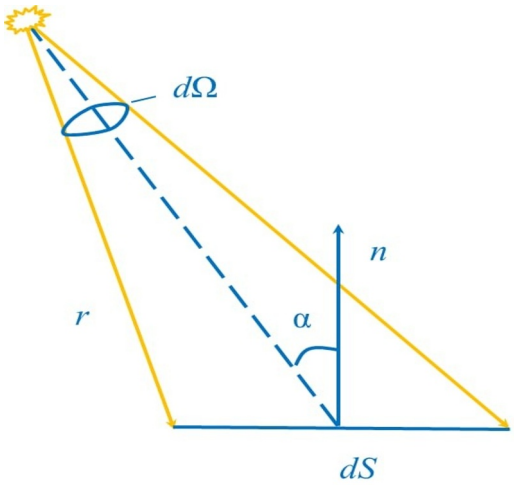

Fig. 3. Rays falling on the surface at an angle.

If the point light source is at the center of the sphere, the illumination of the inner surface equal to the face of the sphere will be:

$$E = \frac{4\pi I}{4\pi r^2} = \frac{I}{r^2} \tag{3}$$

When the rays fall perpendicularly, the illumination of the surface E is directly proportional to the light power I of the source and inversely proportional to the square of

the distance from the source to the illuminated surface.If rays parallel to the surface are falling at an angle, the illumination of the surface will be in the form of expression (2).

The alternation of seasons is explained by the dependence of illumination on the angle of incidence of light rays: in the northern hemisphere, the illumination of the Earth's surface is maximum in summer (when the angles of incidence of the Sun's rays are small) and minimum in winter (when the angles of incidence of these rays are large). These changes in illumination cause corresponding changes in temperature on Earth.

It is difficult to get the required energy if solar cells installed in residential areas are surrounded by low buildings or trees. Even in cloudy weather, the production of electricity is significantly reduced. It is observed that the energy obtained by solar cells reaches its high values only during the day (11-00 to 15-00). The reason is that the illumination of the surfaces of solar cells is not the same throughout the day

It can be seen from the above that in order for the amount of energy obtained by the solar battery to be high during the day, the sun's rays should fall on its surface during the day. That is, when the angle between the normal to the surface of the solar cell and the angle of incidence of the light is small, the illuminance is high, which in turn causes the amount of energy to be obtained to be high. According to the experimental results and theoretical analysis, we can come to the following conclusions.

5 Conclusion

- The amount of energy obtained with the help of a solar battery depends on the illumination.
- Solar batteries should be installed on the roofs of high-rise buildings that are not surrounded by trees in order to provide high illumination.
- In order to obtain a stable amount of energy during the day with the help of solar batteries, it is advisable to use automatic devices that face the sun's rays during the day in a non-stationary state.

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