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Research Article

Astronomical Data On The Energy Power Of The Sun And Prospects For Using It

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ABSTRACT

This article pays special attention to the development of solar energy in our country, reveals the prospects and advantages of solar energy, the volume of solar energy use, and the general characteristics of renewable energy sources. The work carried out at the Navoi State Pedagogical Institute on the use of solar energy was noted.

Key words: Sun, solar radiation, light absorption, solar radiation power, solar energy, solar energy, solar panels, electrical energy, albedo, seasonal energy, absorption, sunny days, 8÷10 hours, profit.

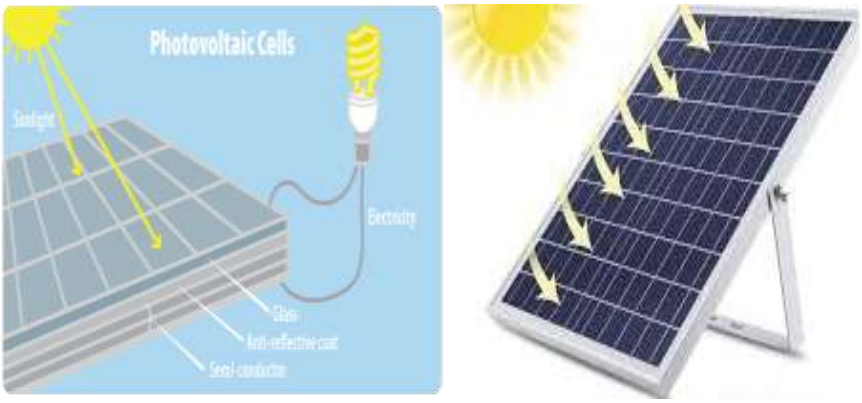
We all know that on June 10, 2022, under the chairmanship of the President of the Republic of Uzbekistan Sh.M. Mirziyoev, a video selector meeting was held on the issues of expanding the use of renewable energy, in which there is an additional demand for energy in our country today of 2-3 billion kW hours, and in the next 5 years this need will increase to 10 billion It was recorded to reach kW·h. For this purpose, it was necessary to carry out preparatory work from now on, information was given on the work carried out, the expenses incurred on the installation of installed solar panels and the income received from them were also discussed. Advantages of using solar energy were widely disclosed by our head of state. For example, it was noted that 2 billion soums worth of electricity was saved in one year due to the installation of 100 kW solar panels and 36 water heaters in the Tashkent branch of the Mendeleev Institute of Chemical Technology. It was mentioned at this meeting that starting from 2023, part of the hot water supply and lighting system of many shopping and entertainment complexes, restaurants, hotels, airports, railway stations, commercial banks and gas stations will be covered by alternative energy.

Also, development of the potential of higher educational institutions and scientific organizations, effective organization of their activities, science and establishment of close communication and cooperation between production areas was envisaged. One of our pressing problems today is the problem of electricity shortage, which can also be solved on the basis of close cooperation between science and industry. We all know that the need for electricity is increasing day by day, hour by hour, not only in our Republic, but also worldwide. If we take the last five years, the world's electricity demand is increasing by 50% every year. This requires the increase and development of non-traditional, alternative energy types. If we pay attention to the information of the International Energy Agency, if the use of solar energy develops at such a pace, by 2050, it will be possible to meet 25% of the world's electricity needs at the expense of solar energy, and at the same time, the annual carbon dioxide emissions alone will be reduced to 6 billion tons. reduction is achieved. This will prevent environmental pollution and help us preserve the resources of the earth. According to the world data, the electricity generated by all the solar panels installed on Earth was 635 GW in 2019 and 760 GW in 2020, which is only 2.7% of the electricity generated. Currently, the electricity consumed by mankind every day is equal to the energy that can fuel the equivalent of 2.45·108 barrels (1 barrel=159 liters) of petroleum products. The daily energy coming from the Sun to the Earth is about 11·103 times more than that. Solar energy is really promising, convenient and inexhaustible (if the Sun continues to radiate like this, it will take billions of years to lose only 1% of its mass), an unlimited source of energy, and also Solar energy is cheaper than conventional energy resources. keeps its standard value even when it increases. To generate electricity from solar radiation, apart from solar

panels, no additional tools and equipment, specially prepared structures, railway sidings or large manpower are required. If we could convert the solar energy falling on the entire surface of our planet Earth (5.1·108 km2) into full electric energy for 1 hour, then this energy would be equal to the amount of energy consumed by the world in 1 year.
Therefore, to date, the use of solar energy is considered one of the most acceptable and ecologically clean types of energy. Although solar energy is theoretically harmless to the environment, its use has the potential to change the albedo (reflectance of light) of the Earth's surface. Currently, the amount of energy received from solar radiation is unlikely to change the Earth's albedo, because the amount of energy consumed by solar energy is very small. It is also distinguished by the fact that its amount changes depending on the season (taking into account the change of the day, the change of the seasons) in the generation of solar energy, it is relatively more in the summer months, and relatively less in the winter months. Also, when installing solar panels, a large area is required, and it is necessary to clean the surface of the panels periodically. For example, an area of about 1 hectare is required to install 1 MW·h of solar panels. If we take into account that the panels do not shade each other, then even more space is needed. Although the above-mentioned partial defects are considered theoretically and practically, they are not harmful to humans.

The irradiance of the light stream coming from the center of the Sun, which is 1 astronomical unit of length (150·106 km) from the Earth, is equal to 1360 W/m^2 per 1m2 of surface located perpendicular to it (outside the Earth's atmosphere). If we take into account the absorption of solar radiation by the mass of the Earth's atmosphere, then the luminous flux radiation is equal to 1020 W/m^2 per 1 m2 of surface at sea level (at the equator and near it). The daily value of the average luminous flux radiation is about 3 times less than the average, which is also caused by the change of night and day and the Sun at a different angle relative to the horizon. It can be seen that the efficiency of solar panels currently used by us does not exceed (15÷20)%. It should be noted that solar radiation is absorbed in the lithosphere and hydrosphere in addition to the atmosphere. The Earth's atmosphere, lithosphere, and hydrosphere absorb 3.85·1024 Joules of light energy during 1 year, or if we consider 3,600,000 Joules as 1 kW·h, the light energy absorbed by the entire globe is 1.07·1018 kW·h. This is a great energy for humanity.

Absorption of solar radiation in the atmosphere (the process of light absorption throughout the entire volume of the atmosphere, which can be explained simply by the rise and fall of the air temperature during the day) ensures the continuous circulation of water in it, and the circulation of water is controlled by the wind created as a result of temperature changes in the atmosphere. Also, as a result of the absorption of solar radiation in the atmosphere, the temperature of the atmosphere increases and it gradually cools. On Earth, there are no sharp changes between night and day temperatures (for example, the Moon does not have an atmospheric layer, so if it is +150 ˚C during the day, it will be -170 ˚C at night). Absorption of solar radiation in the lithosphere (on land) and hydrosphere (mainly oceans and seas) balances the average annual temperature of the Earth's surface (atmosphere), which today is 287 K or 14˚C.
The principle of operation of the device that converts solar radiation into electrical energy is as follows: The device that converts solar radiation into electrical energy uses photocells (semiconductor equipment). 85% of the used photocells are made of silicon (Si), about 10% of cadmium tellurium (CdTl) crystals. Also, the rest corresponds to the share of crystals such as germanium (Ge), indium phosphide (InP), gallium arsenide (GaAs). We all know that photocells were first used in space, that is, in satellites, and later they are used for human needs on Earth. All of the satellites' electricity needs are met by solar energy. A photocell has a positive and negative charge layer that creates an electric field. A stream of light falling on a photocell (a stream of photon particles) knocks electrons from it, and these electrons pass through an electric field and generate an electric current. When the electric current enters the inverter, it generates electricity and transfers it to the source. Consumers of electricity, i.e., all appliances that work on electricity (bulbs, refrigerators, vacuum cleaners, televisions, radios, etc.) can be connected to the source and used for human needs.



A photocell and light falling on it

The geographical location of the areas also affects the energy potential, that is, areas near the Earth's equator receive more solar radiation, because the Sun's rays fall relatively steeply in these areas. In the conditions of Uzbekistan, there are about 260-270 sunny days a year, and if we take into account that these sunny days last about 8-10 hours, we have the opportunity to use solar energy to the maximum. At the current stage of world development, the development of green energy using modern, environmentally friendly, energy-saving technologies and renewable energies is of urgent importance due to the increase in demand for electricity and the constant increase in energy prices. In this regard, practical work is being carried out in our Republic and efforts are being made to develop it. In the Development Strategy of New Uzbekistan for 2022-2026 adopted by our government, special attention is paid to the development of "green" energy on the scale of our country.

Taking this into account, the leadership of our country is offering individuals and legal entities the proposal to install solar panels and support for its acceleration. Many benefits and subsidies are allocated. Also, the government has started buying excess energy at high prices. If one household has 5 kW in its own house. lik installs solar panels, then with its help, up to 60 kW·h of electricity is produced every day. Therefore, if 5÷10 kW·hours are used for household needs, the remaining 50 kW·hours can be sold to the state. In one year, this house can earn about 18-20 million soums from excess electricity, and the costs of installing solar panels will pay for themselves in 3-4 years (the cost of installing 1m2 of solar panels is planned to be 10-12 million soums). . During the rest of the years, the electricity generated by the solar panels serves to strengthen the household budget.

Currently, the importance and efficiency of installing solar panels in buildings belonging to legal entities is taken into account in our Republic. Including general secondary schools, academic lyceums and vocational schools, higher education institutions, hospitals, gas stations and the like.

Work on generating electricity from solar energy has also been accelerated at the Navoi State Pedagogical Institute, as a result of which, by the end of 2022, the institute will install 350 kW solar panels on the roofs of the existing buildings. Installed 1 kW. taking into account that solar panels occupy an area of approximately 5÷6 m2, solar panels were installed on the roofs of faculty educational buildings, including student accommodation buildings, occupying a total area of 1671 m2. When installing solar panels, the main angles of the Sun during the day were taken into account. If this angle is adapted to the movement of the Sun (assuming solar panels in motion), there are even more energy harvesting opportunities. Additional equipment is needed to do this. Also, the lighting systems around the main building of the institute, foreign languages, Russian and Kazakh languages, faculties of natural sciences and the technological education educational production workshop were covered by solar panels.

Information about solar panels installed in Navoi State Pedagogical Institute

№	The name of the address where the solar panel is installed	Number of solar panels	Solar panel power	The total surface of the solar panel
1	The main building of the institute	94	50	240 м²
2	Faculty of History building	56	30	143 м²
3	Building of the Faculty of Physics and Technology	75	40	191 м²
4	Preschool and elementary education faculty building	93	50	237 м²
5	The building of the Faculty of Foreign Languages	94	50	240 м²
6	Building of the Faculty of Natural Sciences and Physical Culture	75	40	191 м²
7	1-TTJ building	56	30	143 м²
8	2-TTJ building	56	30	143 м²
9	3-TTJ building	56	30	143 м²
	Total:	**655**	**358**	**1671 м²**

If the size of 1 solar panel is (2.25x1.13) meters, its surface is 2.55m2.

Solar panels

350 kW installed in the institute. 32,000 kW·h of electricity was produced in January 2023 alone at the expense of solar panels.

According to the institute, the electricity consumption in January 2023 was 44,000 kW·h, and about 75% of the electricity consumption was covered by solar panels. The energy received by the solar panels for a month is much less than the established norms. The main reason for this is the lack of sunny days in winter. Also, considering the 2-week student vacation, the amount of electricity consumed is also small. In February 2023, 31,380 kW·h of electricity was produced at the expense of the aforementioned solar panels. We can explain the lack of developed energy compared to January by the fact that February is shorter by 3 days. During the month of March 2023, 51000 kW·h of electricity was produced due to these solar panels. We explain the high number of this result due to the relatively large number of sunny days in March, and in April 2023, 59,000 kW·h, in May 2023, 69,560 kW·h, and in June, 2023, 64,580 kW·h of electricity were produced. 40 kW installed in June. The operation of the panel was temporarily stopped due to the placement of the panel at a certain angle to the Sun. The actual production of solar panels shows that they are getting closer to the target values. 350 kW in the first six months. We can see the report of the electricity received from the solar panels in the table below:

№	Time of electricity generation (months)	**Electricity produced during the month (kWh)**	**Annual minimum electricity production forecast, (kWh)**	**Plan performance (in %)**
1	January (2023)	32000		6,1
2	February (2023)	31380		6
3	March (2023)	51000		9,7
4	April (2023)	59000		11,2
5	May (2023)	69560		13,25
6	June (2023)	64580		12,3
Total		**307520**	**525000**	

During the first 6 months, 59% of the minimum annual energy production was produced. Therefore, the planned energy production in solar panels is ensured. Additional 160 kW at the Institute from July 2023. (in the building of the faculties of physics and technology and pre-school and primary education) were put into operation and total 510 kW. Solar panels have been installed.

The panels are expected to produce even more electricity in the coming months. If we take into account that 1,20,000 kWh of electricity was consumed by the institute in 2022, it will be necessary to install an additional 100 kW of solar panels at the institute, after which the institute's electricity needs will be fully covered.

In the table below, we can see the information about the electricity produced by the institute at the expense of solar panels for the full 12 months of 2023:

№	**Time of electricity generation (months)**	**Electricity produced during the month (kWh)**	**Annual minimum electricity production forecast, (kWh)**	**Plan performance (in %)**
1	January (2023)	32000	525000	6,1
2	February (2023)	31380	525000	6
3	March (2023)	51000	525000	9,7
4	April (2023)	59000	525000	11,2
5	May (2023)	69560	525000	13,25
6	June (2023)	64580	525000	12,3
7	July (2023)	65380	750000	8,7
8	August (2023)	62530	750000	8,3
9	September (2023)	61210	750000	8,16
10	October (2023)	46350	750000	6,18
11	November (2023)	35896	750000	4,78
12	December (2023)	35110	750000	4,69
Total		**613996**	**637500**	**96,31**

Thus, when calculating the electricity that can be obtained theoretically with the electricity generated in practice for 1 year with the help of solar panels, a difference of 3.7% was found. So, the practical and theoretical calculations are almost equal and the solar panels have done their job at a minimal level.

If we take into account that 10 billion dollars of electricity and gas are consumed in Uzbekistan in one year, these completed works are the first steps and should continue to develop.

The table below shows the information put on the solar panels by the manufacturing companies:

№	**Solar panel power**	**Solar panel occupied area, (m^2).**	**Annual electricity generation forecast**
1	5 kW·h	30÷60	7500÷12500
2	10 kW·h	60÷120	15000÷25000
3	20 kW·h	120÷240	30000÷50000
4	30 kW·h	180÷360	45000÷75000
5	40 kW·h	240÷480	60000÷100000
6	50 kW·h	300÷600	75000÷125000
7	100 kW·h	600÷1200	150000÷25000

8	200 kW·h	1200÷2400	300000÷500000
9	300 kW·h	1800÷3600	450000÷750000
10	400 kW·h	2400÷4800	600000÷1000000
11	500 kW·h	3000÷6000	750000÷1250000

The total annual electricity production capacity of the 510 kW solar panels is approximately 1 million kW·h. if we take into account that it will be equal to , then in 2024 the institute's need for electricity will be covered by the energy received at the expense of solar panels.

According to the methods of solar energy consumption, its processing and distribution, solar systems are divided into two types: active (systems that convert solar energy into useful energy) and passive (construction of structures and buildings in relation to the setting of the Sun, design, etc.). While active systems serve to increase power supply, passive systems serve to reduce energy needs. Knowing these two types of solar systems was considered very important for people, because they need to be taken into account when building houses and greenhouses. Buildings and structures built in this way reduce the human need for energy to a certain extent.

Taking into account the 25-year warranty period given to the solar panels currently produced in the factories, the production of electricity in this direction, together with its ecological harmlessness, is considered quite promising, and it is necessary to further develop the work in this regard. For this, we must first make a proper explanation to the general public and carry out propaganda about its benefits in an impressive spirit.

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