Western European Journal of Modern Experiments and Scientific Methods
Volume 2, Issue 6, June, 2024
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

RESULTS OF MONITORING THE WORKING EFFICIENCY OF MOBILE PHOTOELECTRIC STATIONS WITH TIME DEPENDENCE (DEVICE'S TIME AND POWER COEFFICIENT)

Abdullayev H.S.
Chirchik State Pedagogical University is a teacher of the Physics Department
Isroilov A.A.
Chirchik State Pedagogical University is a teacher of the Teaching Methods of Physics and Astronomy Department
Raxmonov M.A.
Chirchik State Pedagogical University is a teacher of the Teaching Methods of Physics and Astronomy Department

Abstract: This article provides information on the results of time-dependent monitoring of increasing the efficiency of medium-sized mobile photoelectric plants for agricultural needs (device speed and power factor).
Key words: photovoltaic battery, inverter, photovoltaic battery, mobile photovoltaic device, photovoltaic panel.

Nowadays, the rural population of our republic has a growing need to use low-power (100-500 W) mobile photoelectric devices. This is due to the convenience of using such power sources to provide electricity to various energy consumers, both economic and household rural residents. In such a photoelectric device, photoelectric batteries are used together with buffer batteries. This provides consumers with stable electricity supply at any time of the day and regardless of daily and weather changes in the intensity of solar radiation. Photovoltaic equipment, in addition to photovoltaic batteries, accumulators and consumers of electricity, usually has an electronic control device that excludes overcharging and deep charging of the battery. Voltage converters (inverters) are used to connect 220V and 380V (alternating current) power consumers. It is necessary to ensure multi-functional use of mobile photoelectric devices when connecting various energy consumers to a source of direct and alternating current.
"Fizika-Quyosh" Institute of Physics and Technology is developing portable and mobile versions of autonomous photoelectric power sources of various power, up to 100 W, portable up to 600 W on carts for home needs, and up to 5000 W on two-way and multi-channel . Axle trailers manufactured by industry. [1-2] The mobile photoelectric device we developed based on silicon photoelectric batteries with a capacity of 300 W can be used in rural areas of the republic to provide consumers with electricity for economic and domestic needs.
Figure 1 shows 2 gel batteries with a total capacity of 100 V/h, 24 V, connected in series to a mobile photovoltaic array, a 24 V, 20 A controller, a "sine" waveform with a capacity of 1000 includes an inverter.

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Figure 1. Measurement of mobile photoelectric device parameters under sunlight conditions

Figure 2 shows photovoltaic devices based on silicon batteries, a - measurement of parameters in full-scale conditions, b - arrangement of components and blocks in the compartment inside the platform of the cart, and c - the state of the mobile photovoltaic device during transportation. A two-axle four-wheeled platform (trolley) with a geometric size of 1300 X 800 mm, manufactured to our order, with a rotating front axle for movement in rural areas, a platform load capacity of 700 kg until Modernization of the platform to accommodate the necessary equipment was carried out by specialists of our laboratory. The set of mobile photovoltaic device includes 2 gel batteries with a voltage of 100 V, 24 V, connected in series, a controller with a voltage of 24 V, 20 A, a "sine" wave inverter with a capacity of 1000. Submersible pump for raising water from a depth of up to 20 meters, alternating 24 V direct current with 220 V voltage, 250 W power, 4 m3 per hour. In addition, connection points for connecting consumers for 5 and 12 V DC and 220 V AC. To ensure safety against failure when the component blocks are moving, a space is left to allow placement inside the mobile photovoltaic device.

a b

Figure 2. a - Arrangement of equipment inside the platform of the mobile photovoltaic device. b The assembled state of the mobile photovoltaic device

The tests were conducted in natural conditions in the open air at the heliopolygon of the Institute of Physics and Technology. The optimal position for the photovoltaic battery is the position where the sunlight hits the surface at an angle of 900 degrees. However, it is not always possible to achieve such an effect. Keeping the photovoltaic cells at a constant 900-degree angle to the Sun would require expensive tracking systems that require a lot of extra space and consume energy themselves. Fig. 3 is the current voltage in two cases of using a mobile photoelectric device, c - relative to the zenith point of the source of the Sun during the measurement (390 from the vertical axis of the horizon), b - to the correct position relative to

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the Sun every 15-20 minutes observation of the mobile photovoltaic device's operating voltage when it is brought up.

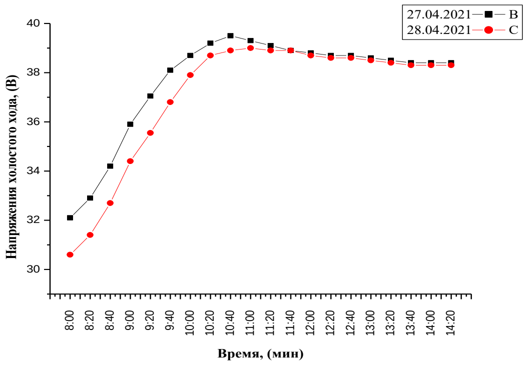

Figure 3. Time dependence of sled voltage in two different ways of using a mobile photoelectric device

As can be seen in Figure 4, the value of Ux from 8 hours to 10 hours is 30.5 V to 38.8 V for curve c and 32 V to 39.2 V for curve b, respectively. It goes up to V. In [3-7], when measuring the dependence of the tripping voltage at the same time for a hundred days, this dependence has an inverse character, that is, Ux decreases over time due to the heating of the structure of silicon elements. The intensity of solar radiation that falls on the surface of the photoelectric battery with sunlight, i.e. around 9 o'clock in the morning, has a value that ensures the maximum values of the open circuit voltage. Such rotating structures facilitate the movement of the solar panels in the direction of the movement of the Sun and ensure that the batteries are automatically kept at the right angle. When using portable and mobile devices, tracking the Sun can be done manually after a certain period of time (for example, every hour or half hour). Because the solar radiation current density is sufficient to obtain an open circuit voltage value close to the maximum value, for a given temperature.

Figure 3-4 shows the graph of the short-circuit current and the power of the mobile photovoltaic panel as a function of time. In this case, when taking measurements in the first half of April, the dependence on Ux is from 8 o'clock to 11 o'clock, due to the low temperature (9-160) the large evaporation from the Earth's surface of various substances that fell on the Earth's surface at night creates. Therefore, until these substances completely evaporate, the Sun's rays are partially absorbed by the atmosphere. This shows that the intensity of the Sun's rays changes from 620 W/m2 to 830 W/m2.

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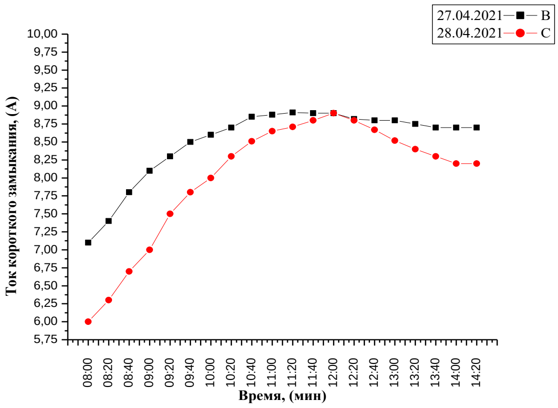

Figure 4. Short circuit current with respect to time

In the future, the voltage of walking in the open air will not change much. We can see that the lines of the short-circuit current and power versus time graphs are similar. Components of c and b curves, dependence on current and power are related to the change of the angle of incidence of solar radiation on the surface of photoelectric batteries and are distinguished by the stationary direction of the source to the zenith point. During the measurement, the Sun differs in that one is 900 to the Sun and the other is 900 to the Sun's zenith point. The effect of the angle of incidence of solar radiation is about two volts at the beginning of the measurement difference. It decreases further until the Sun's rays pass the zenith point (from 12:00 to 20:00 p.m.). At this zenith point of the sun, the Ux values for both measurement options match. In addition, the change of the angle of incidence of solar radiation on the surface of the photoelectric battery does not affect the value of Ux.

The difference between the two curves (c and b) decreases as the Sun approaches the zenith point and coincides at the zenith point (which is 28 minutes after 12:00 p.m.). In addition, the difference between current and power values increases. Between 11:00 AM and 2:00 PM, the difference between the current values is minimal. A comparison of the power dependence values for the two measurement methods shows that when manually pointing a mobile photovoltaic device at the Sun, the generated power increases by about 25-30% compared to a stationary source every 30-40 minutes. From 10 hours until the end of the experiments, the electricity generated by the mobile photovoltaic device in clear weather conditions is constant and can be increased to ~ 250 W.

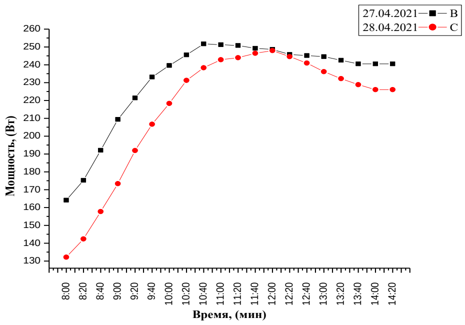

Figure 5. A graph of the electric power of a mobile photovoltaic device as a function of time

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It should be noted that AB with a capacity of 200 hours per hour used in a mobile photovoltaic device has a reserve power of more than 3000 W. Therefore, when used in the summer, a large amount of electricity is always available in the energy storage system of the mobile photovoltaic device. Currently, a copy of the mobile photoelectric device is being tested in Tashkent. According to preliminary information, a large collection of various energy consumers, lighting systems with a power of up to 400 W, connecting computers, a water pump, various plumbers and drilling tools (drill machines, crushers, sprayers) etc. to optimize load quality, design and parameters. There are opportunities to increase the electricity produced and the power connected by energy consumers. For this, new options for placing more efficient photovoltaic batteries in supporting structures with increased capacity are being developed. In the future, instead of the photoelectric battery, use high-efficiency photothermal batteries to obtain hot water for the daily life of the villagers.

In conclusion, if we take into account that half of the population of our Republic lives in villages, more than 30% of them are 60-80 km away from the centralized power grids of mountainous and desert areas, which leads to a number of difficulties in supplying these areas with electricity. These include the increase in the population of such areas, the improvement of living conditions, the demand for energy, and the obsolescence of the equipment of the power line system. Shortages in the gas supply lead to a number of stresses in the power line, and these stresses lead to interruptions in the networks, and so long. Adjustment works in areas will cause power outages for weeks. In this situation, regardless of work or production, ordinary people spend their precious time of their children on solving problems that are temporary and do not solve anything, which leads to a decrease in the level of existing knowledge and other intellectual knowledge.

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