DETERMINATION OF OPTIMAL WORKING PARAMETERS OF TECHNOLOGICAL EQUIPMENT FOR RENEWABLE ENERGY

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The start of full-scale hostilities in Ukraine significantly changed the attitude towards the country's energy sector. Issues related to energy independence have become the main task of existence today.

Nowadays, electricity is an integral part of development and comfortable existence. The production of energy by traditional sources is environmentally dangerous, and every year such production becomes more expensive.

Alternative energy is a field of energy that ensures the production of electrical, thermal and mechanical energy with minimal impact on the environment and the risk of man-made disasters. Alternative energy sources include solar energy, hydropower, geothermal water and wind, and biomass. Using these types of energy will make it possible to reduce emissions of harmful substances into the environment, reduce dependence on fuel, and create additional opportunities for various areas of the economy.

The work of various scientists is devoted to the issue of preferential tariffing of solar energy. Most European countries use various pricing models, but what they have in common is that they have elements of subsidies, incentives, and rewards. All of them are aimed at stimulating the growth of the level of renewable energy

For industrial-scale solar and wind power plants, it is already significantly cheaper than electricity from traditional generation. Moreover, every year this difference in favor of RES grows.

Today, the progress of modern technologies affects the increasing relevance of reducing the mass and size indicators of the solar power plant and the inconspicuousness of its operation. Mobile photovoltaic stations are developed and manufactured on the basis of photovoltaic converters. They represent an autonomous source of energy and can be used both in the field and for stationary use.

The clarification of generalized technical characteristics justifies the need to conduct scientific research with process modeling to find optimal operating parameters of portable solar power stations

The conducted research is aimed at the modeling and simulation of solar cells using the MathCAD environment. The influence of different solar radiation and installation parameters on the efficiency of the equipment has been determined.

The purpose of the work is to determine the optimal values of the factors of the technological process of charging the battery of a portable electric station from a solar panel by conducting an experiment using the orthogonal planning method.

The object of research is the technological process of restoring the charge of the storage device, which is part of a portable solar power station.

The subject of the study is the influence of the solar panel installation parameters on the generated voltage.

The general appearance of the portable charging station is shown in Figure 1. It is powered by a 100 W solar battery [11]. This station is intended for external and internal use. It can be used for room lighting and as a power source for power banks, mobile phones, drones, walkie-talkies, etc. A characteristic feature of the station is the presence of a battery that can be charged even at night.

Figure 1. Solar portable charging station Sanlarix Standart Plus 220V

Mobile Android applications were used for research: "Light meter", "Optimal Tilt" ("Inclinometer" function).

The model of the dependence of the voltage change (U, V) of the battery charge of the mini-solar station on the influence of two factors: the angle of inclination of the solar panel and the level of illumination is considered.

During the study of the influence of the factors, the limits of the changes of the variation factors were chosen: for the angle of inclination - 0...80°; for an illumination level of 2000...30000 lux (from cloudy to sunny day).

The orthogonal planning matrix for the 2-factor experiment is shown on the slide

An orthogonal planning matrix for a 2-factor experiment was compiled

Based on the results of the calculation, the response surfaces of the obtained regression equation were constructed. To obtain them, each of the two factors was fixed at the zero level: ; . We have substituted these values into the decoded regression equation and will construct graphic dependencies.

The influence of operating parameters on technological equipment has been established. An adequate mathematical model in the form of functional dependence was obtained.

Orthogonal planning of a two-factor experiment was carried out to determine the influence of the installation angle of the solar panel, (z1, °) and the level of illumination (z2, lx) on the value of the charging voltage of the charging unit of the portable electrical station.

The highest value of the voltage is observed at the installation angle of the solar panel at 40° and at the maximum level of solar activity (illumination) of 30,000 and above - 23.4 V. The regression equation is obtained.

The final results are consistent with industry guidelines as well as data from the Optimal Annual Tilt software running on the Android platform.

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