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ҚОРАҚАЛПОҒИСТОНДА ФАН ВА ТАЪЛИМ

ҚАРАҚАЛПАҚСТАНДА ИЛИМ ҲӘМ ТӘЛИМ

НАУКА И ОБРАЗОВАНИЕ В КАРАКАЛПАКСТАНЕ

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O‘zbekiston Respublikasi Вазирлар Махкамаси хузуридаги OAK Tartib-qoida komissiyasi qarori 24.05.2017 y., №5/2.
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ASSESSMENT OF QUALITY INDICATORS OF GENERATED ELECTRICITY

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Summary: *The article discusses the combined use of solar and hydropower based on the choice of a rational combination of traditional and renewable energy sources in the energy supply of agriculture and water management. The optimal technical solution for the efficient and joint use of solar and water energy has been developed.*

Key words: *Solar, water, renewable energy, small hydroelectric power plant, energy consumption, frequency, combination.*

Introduction. During the practical testing of the solar and small HPP hybrid device, it became known that if the constant solar radiation and water flow are chosen correctly based on the geographical capabilities of the area, and if the experience of preparing a solar-hydro hybrid power plant with different geometric dimensions is fully mastered, then in the agricultural and water management areas of our republic located small pumping stations, households, small enterprises, clusters and farms can be used for their electricity needs (see Figure 1).

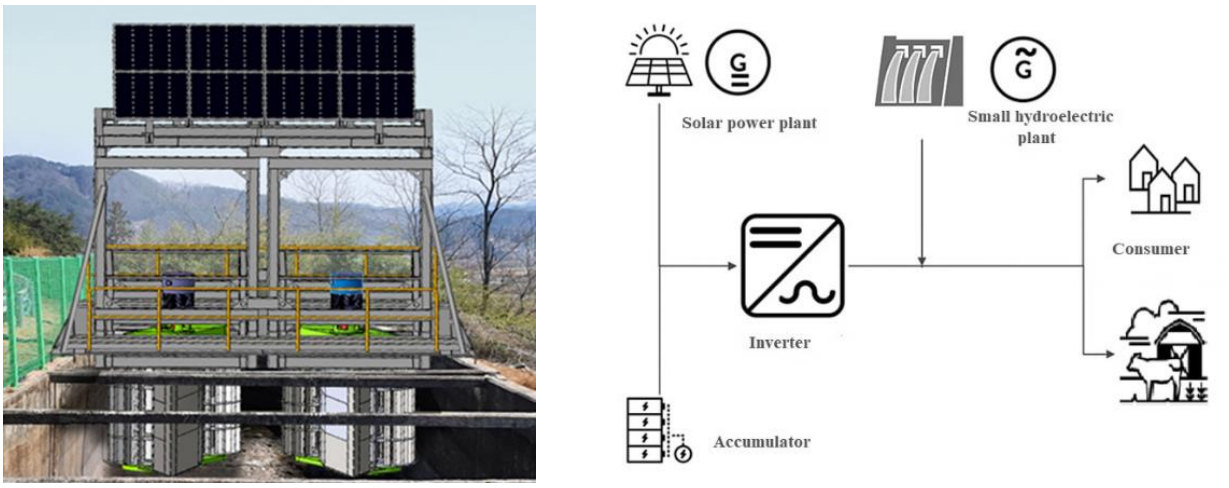


Figure 1. A hybrid combination of solar and small hydropower plants.

Installation of solar and small hydropower plants hybrid power plant at the specified facility should be performed based on the following requirements:

- all electrical devices, automatic switches and fuses, electrical equipment protecting against short circuit must be protected by a fuse;
- solar panels, electric generator and its terminals and electric cable must be in a place where water does not touch;
– it is necessary to follow the instruction on technical safety rules when using a hybrid power plant.

Research Methods. The following sequence should be followed when preparing a solar and small hydroelectric hybrid device for testing:

- solar panels, hydro generator, control unit, counter, control unit, centralized power grid and consumers are connected in sequence as shown in Figure 2;
- the solar panels and the hydro generator are connected to the control unit using electrical cables (see Figure 2).

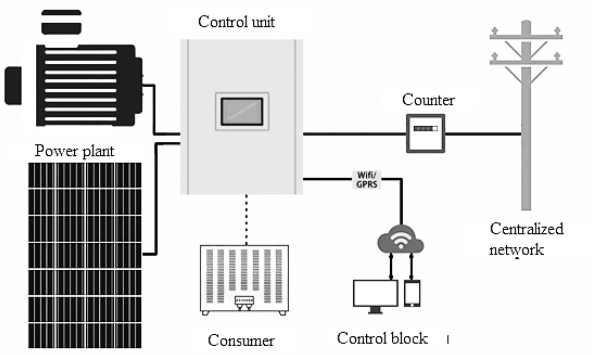


Figure 2. Connection sequence of hybrid power plant devices.

The quality indicators of electricity produced by solar and hydroelectric power stations were checked with the Circutor AR.6 electrical analyzer measuring device. In the course of research, 2 parameters that mainly determine the quality indicators of electricity are given great importance: voltage (V) and frequency (Hz). The obtained results are compared with the value limits specified in the regulatory documents of the international standard. The energy audit for evaluating the quality indicators of electric energy is performed using the Circutor AR.6 electrical analyzer in the following order: - We start the AR.6 electrical analyzer and connect its flash according to the scheme;

- we enter the necessary dimensions into the measuring device. This includes time intervals for measurement, voltage, current limit values and their memory recording processes;

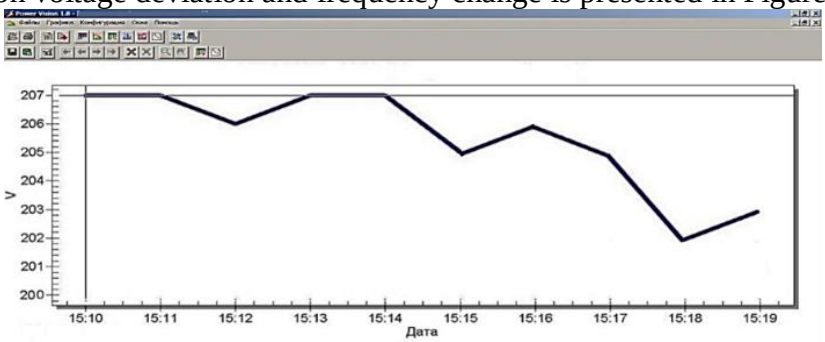
- we check that all the data obtained after carrying out measurement work on the measuring device in the specified time interval are recorded in its memory;

- after making sure that the measuring device has recorded all the data in its memory, we turn it off and disconnect the klesh from the network;

- in order to process the received data, we connect the device to the computer and process all measurement data using the Power Vision program.

Results and Discussions. Our first research was held on March 21, 2021 from 15:10 to 15:20. In this case, all inspections were carried out at the same time. Analysis of the data obtained as a result of the test on voltage deviation and frequency change is presented in Figure 3.

a)



b)

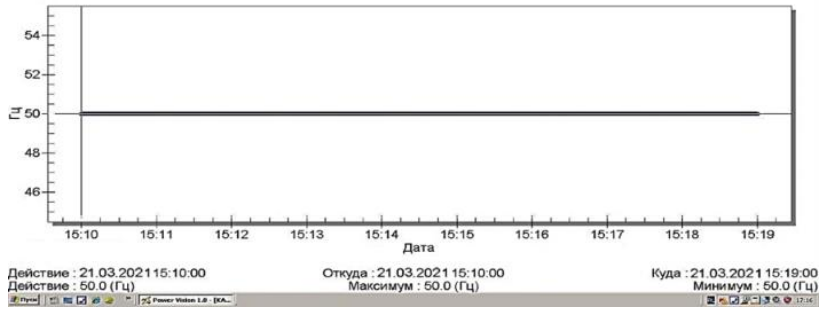


Figure 3. Voltage (a) and frequency change (b) between 15:10 and 15:20.

In the diagram above, the maximum voltage is 207 V, the minimum voltage is 202 V, and the average voltage is 205 V. This indicator is ±10% (198-242 V) variable voltage limit according to the international standard regulatory document. The voltage of 205 V determined during the research is fully compatible with the requirements of agricultural and water industry consumers. The frequency change value obtained from the test experiment was equal to 50 Hz and did not change. This indicator is also equal to the frequency of alternating voltage 50 Hz according to the international standard normative indicators.

In our second research, it was taken on May 17, 2021 from 14:10 to 14:25. The analysis of the data obtained as a result of the test on voltage deviation and frequency change is presented in Figure 4.

a)

b)

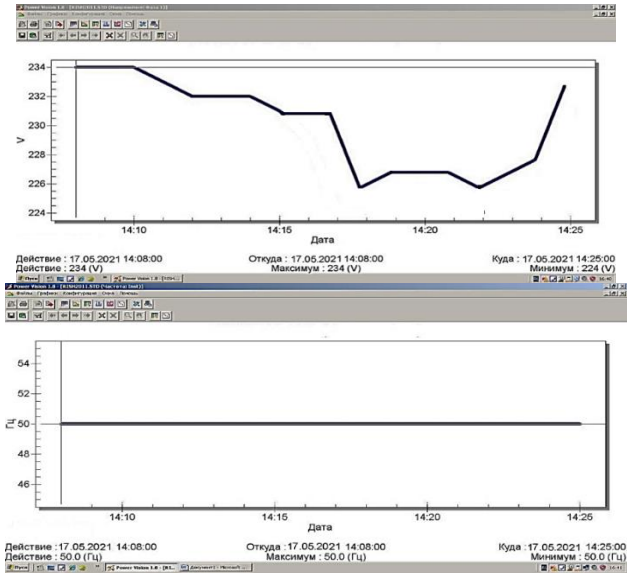


Figure 4. The analysis of the data obtained as a result of the test on voltage (a) deviation and frequency change (b) is presented

In the diagram above, the maximum voltage is 234 V, the minimum voltage is 226 V, and the average voltage is 230 V. The 230 V voltage determined during the research fully meets the requirements of agricultural and water industry consumers. On May 17, 2021, as a result of the test experiment, the frequency change value was equal to 50 Hz and did not change. This indicator also fully complies with international standard regulatory documents.

Our third research was conducted on June 22, 2021 from 17:10 to 17:19. The analysis of the data obtained as a result of the test on voltage deviation and frequency change is presented in Figure 5.

a)

b)

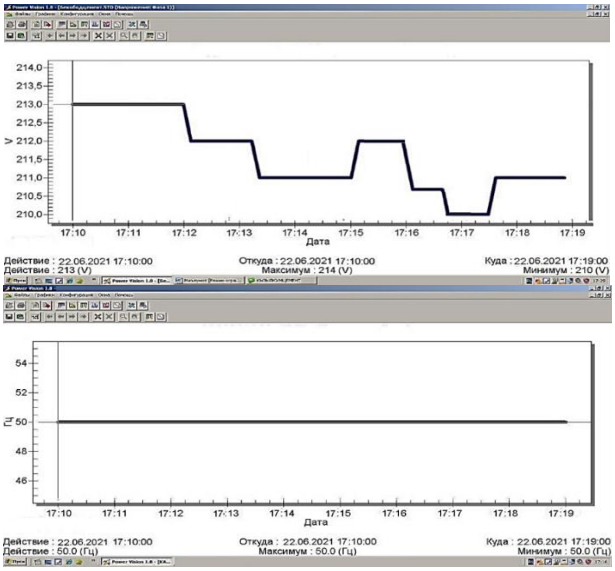


Figure 5. Voltage (a) and frequency change (b) between 17:10 and 17:20.

In the diagram above, the maximum voltage is 213 V, the minimum voltage is 210 V, and the average voltage is 212 V. The 212 Volt voltage determined during the research is fully compatible with the requirements of agricultural and water industry consumers. On June 22, 2021, as a result of the test experiment, the frequency change value was 50 Hz and did not change. This indicator also fully complies with international standard regulatory documents.

Conclusions. Summarizing the research results related to this work, we can draw the following conclusions:

Therefore, according to the results of the conducted scientific research, it was determined that the quality indicators of the electricity produced in the developed solar-hydro hybrid power plant fully meet the requirements of the normative document of the international standard.

A rational combination algorithm of renewable and traditional energy sources and a model for calculating their operating modes were developed.

The device, developed on the basis of technical solutions of solar and hydroelectric power stations, made it possible to ensure the continuity and reliability of the energy supply system by supplying high-quality electricity.

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Rezyume: *Maqolada qishloq va suv xo'jaligi energiya ta'minotida yangilanish va qayta tiklanuvchi energiya manbalarining o'ziga xos kombinatsiyasini tanlash asosidagi quvvat va suv energiyasidan birgalikda foydalanish ko'rib chiqildi. Quyosh va suv energiyasidan samarali ham birgalikda foydali ishlab chiqarish optimal texnik echim ishlab chiqarilgan.*

Резюме: *В статье рассматривается комбинированное использование солнечной и водной энергии на основе выбора рационального сочетания традиционных и возобновляемых источников энергии в энергоснабжении сельского и водного хозяйства. Разработано оптимальное техническое решение для эффективного и комбинированного использования солнечной и водной энергии.*

Kalit so'zlar: *Quyosh, suv, qayta tiklanadigan energiya, kichik gidroelektrostantsiya, energiya issiqlik, chastota, kombinatsiya.*

Ключевые слова: *Солнце, вода, возобновляемая энергия, малая гидроэлектростанция, потребление энергии, частота, комбинация.*