

Increase the Efficiency of Your Renewable Energy Generator by Adjusting the Output Voltage and Frequency

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Introduction: Today, an atlas of the country's winds has been compiled. This, in turn, promotes the idea of generating electricity for low-power consumers, when energy is needed after the initial energy collection of low currents. Let us determine the conditions necessary for the operation of the device at a given power.

Studies on a prototype device made it possible to make sure that the frequency and voltage at the rated power of the generator are within the limits of the standard values of electrical quality indicators. The elastic cable in the device is 18 m, which allows the generator to work for several minutes. Currently, studies are underway to increase the length of the elastic rope by 2 times and its length by 10 times to ensure the operation of the device for 20-25 minutes at a power of 300-500 watts.

Key words: renewable; generator; belt extension; elastic rope; energy sources.

Methods: In recent years, a number of laws and regulations on the development of alternative energy sources have been adopted in the republic. Their implementation requires exploring the possibilities of finding and using renewable energy sources in our region. The analysis shows that we also have sufficient capacity to use wind energy. Today, an atlas of the country's winds has been compiled. According to him, the total wind power capacity is 2.2 million tons. Its technical capacity is estimated at 0.427 million tons. Seventy-five percent of the country's territory is unsuitable for wind energy. This includes flat lands where wind currents depend on the season [3.7.5.10].

This, in turn, promotes the idea of generating electricity for low-power consumers, when energy is needed after the initial energy collection of low currents. In remote areas of the country, in field camps, in deserts, the transmission of electricity to remote areas of people engaged in animal husbandry or agriculture is costly. However, energy consumption in these areas will take less time and less. Therefore, it is in these areas that the installation of such alternative energy sources provides cost-effectiveness [4.6.8.13].

Let us determine the conditions necessary for the operation of the device at a given power. The mechanical power required by the small drum to rotate the generator at a given speed is determined from the following expression, kW:

$$P_{d2} = \frac{P_{\text{gen}}}{\eta_g \cdot \eta_p \cdot \eta_m},$$

buerda η_g , η_p , η_m - generator, remenli uzatma va tishli uzatma foidali ish coefficient lari.
Bunda drumdagi aйлantiruvchi moment kuyidagicha aniqlanadi, N•m:

$$M_{d2} = F_g \cdot R_{d3} = k \cdot \Delta l \cdot \frac{D_3}{2},$$

where: gravity G_b -elastic rope, N•m; R_{d3} - average radius of drums, m; k - rigidity of the elastic rope, N•m/m; Δl - elongation of the elastic rope, m.

Reserve mechanical value that ensures the operation of the generator at rated power, kWh:

$$W_{3ax} = P_{d2} \cdot t_{3ax} \cdot$$

It can be seen from the expression that even when the input power to the device is weak, the required amount of energy can be accumulated by increasing the backup time. Output power depends on the time spent on stored energy. [9.12.18.13]

We analyze the factors influencing the production of quality electricity in the device. We determine the total length of the rope that provides the amount of energy stored.

$$L = l_0 \cdot N = l_0 \cdot \frac{W_{3ax}}{W_0} = \pi \cdot D_0 \cdot \frac{W_{3ax}}{W_0},$$

Where l_0 is the length of a winding rope wrapped around a small drum, m; Number of N-packs, pcs; W_0 is the accumulated potential energy of a twisted rope, determined from the following expression:

$$W_0 = \frac{k \cdot \Delta l^2}{2}.$$

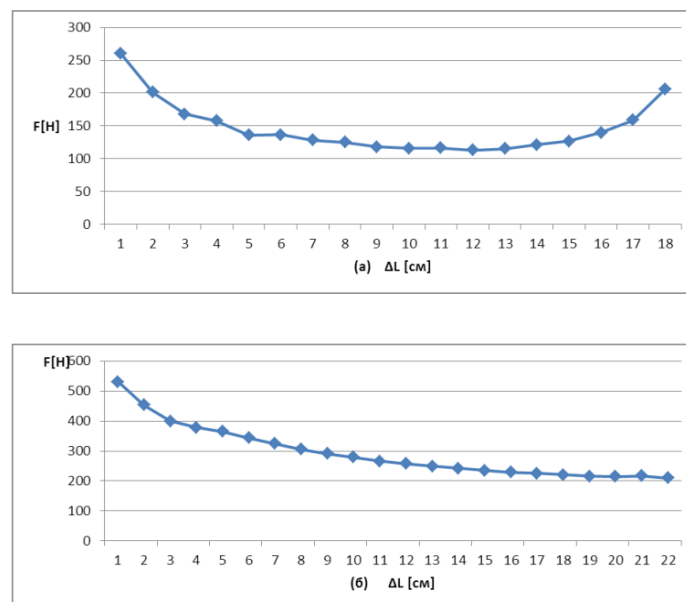


Figure 1.
 Elastic rope length (a) D = 10 mm, (b) D = 15 mm.

From the above expressions, it can be seen that the quality and quantity of the output voltage of an alternative energy source depends on the properties of the elastic rope. Small (100-500 W) power sources can be used with elastic ropes used in sports. Figure 1 (a) shows the stiffness of multi-core ropes with a diameter of 10 mm and Figure 1 (b) shows the stiffness of monolithic rubber elastic ropes with a diameter of 15 mm. As can be seen from the pictures, the stiffness of the ropes is nonlinear and has a negative effect on the source output voltage. This negative effect can be reduced by keeping the elastic rope tension in the energy source constant. [14.18.19.20].

Experimental studies have shown that the stability of the value of alternating current frequency and voltage output from an alternative energy source has been increased by 15-20%. [1.2.].

Thus, it is possible to obtain the specified output power of the generator at any unwanted power. Only this affects the energy reserve time. This allows the device to be operated at a given power even at low currents. For example, in order to run a 500 W generator for 30 minutes, the input power to the backup must be 20 hours from the primary power supply when the power is 25 W. Because the accumulated energy is

consumed 20 times in a short time, and this allows you to increase the power by 20 times. This backup device allows the wind generator to operate efficiently even in weak wind currents.

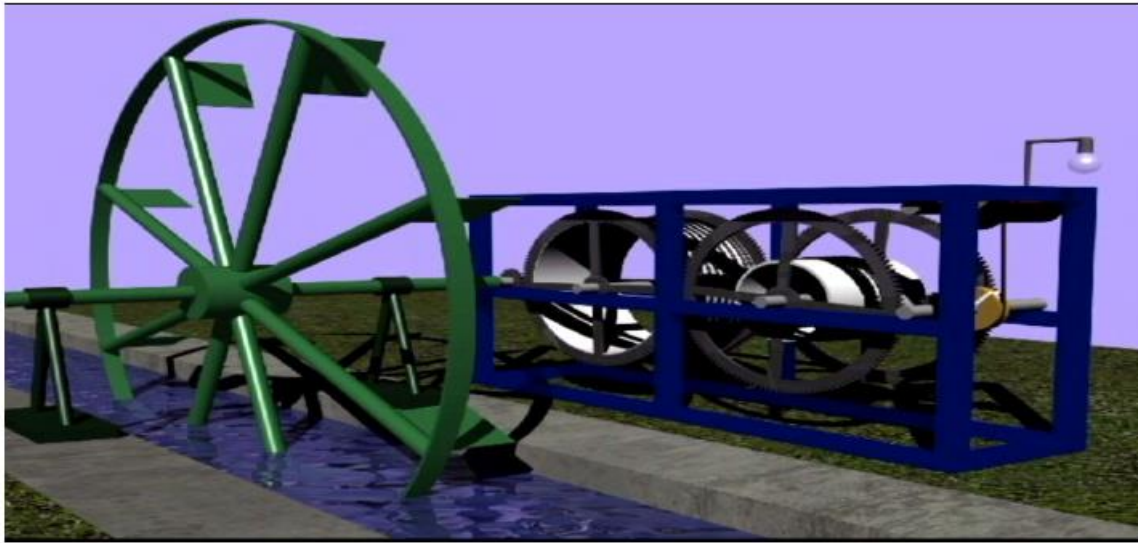


Figure 2. View of an alternative energy source in 3D Max.

Studies on the experimental model of the device have ensured that the frequency and voltage at the nominal output of the generator are within the normative values of electrical quality indicators. The elastic rope in the device is 18 m, which allows the generator to run for several minutes. Currently, research is underway to increase the elasticity of the elastic rope by 2 times and its length by 10 times to ensure that the device operates for 20-25 minutes with a power of 300-500 W [15.17.12].

Conclusion: As the world develops, people's lifestyles are improving and changing. This development, of course, requires a lot of energy. In this context, humanity is forced to address the following key issue:

1. Search for new renewable energy sources.
2. Increasing the utilization rate of existing energy sources.
3. Introduction of energy-saving equipment in industry.
4. Exploring energy saving opportunities in energy consumption.

This experimental work is also aimed at improving energy efficiency and its quality using alternative energy sources, and experimental results have been obtained.

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