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IDENTIFY A COST-EFFECTIVE TYPE OF SUPPLY OF ALTERNATIVE ENERGY SOURCES TO CONSUMERS WHO DO NOT HAVE ACCESS TO ELECTRICITY

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ABSTRACT

This article provides an analysis of the provision of autonomous electricity consumers with alternative energy sources. The technical parameters of the proposed wind energy source and the graphs of the power curves of these turbines are given.

KEYWORDS: *Microges, Autonomous, Air Speed, Power Supply, Power Curve, Panel, Wind Map, Technical Parameter.*

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INTRODUCTION

Resolution of the President of the Republic of Uzbekistan No. PQ-4422 of August 22, 2019 put plans to increase the share of renewable energy sources to 25% by 2030. At present, this figure is 10%.

Providing quality and reliable energy to autonomous electricity consumers far from power grids remains a challenge even today. It is not cost-effective to supply consumers through power grids, so it is advisable to choose alternatives to supply this type of consumer. Currently, this type of consumers are offered to burn a diesel generator or other type of fuel.

In Uzbekistan, the use of solar energy is more efficient, as the country has an average of more than 300 sunny days a year, but the efficiency of solar panels is low (about 15%), and the surface of solar panels is covered with dust due to regional characteristics. causes a further decline. Cleaning and cooling the surface of solar panels is one of the challenges facing the industry.

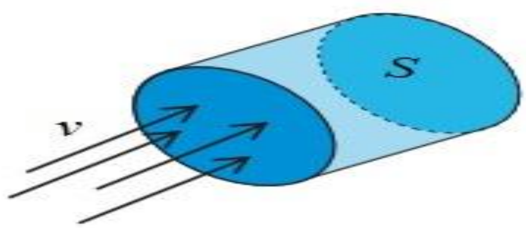
It is not always possible to supply energy to such consumers through micro-hydroelectric power station, as given the fact that this category of consumers is usually located in hot regions or desert areas, the availability of these energy sources is low.

So, as can be seen from the above considerations, the use of wind energy resources has some advantages. The basic equation of wind energy answers the question of how much energy is in the wind (5). Power is the speed of energy over time. For example, we need to know how much energy a wind turbine can produce per unit of time. Wind energy depends on: [4]

• Amount of air,

• Air speed,

• Air mass.



Picture 1. Schematic of wind speed velocity flow. Represents the volume flowing in a unit of time passing through the area of the cylinder.

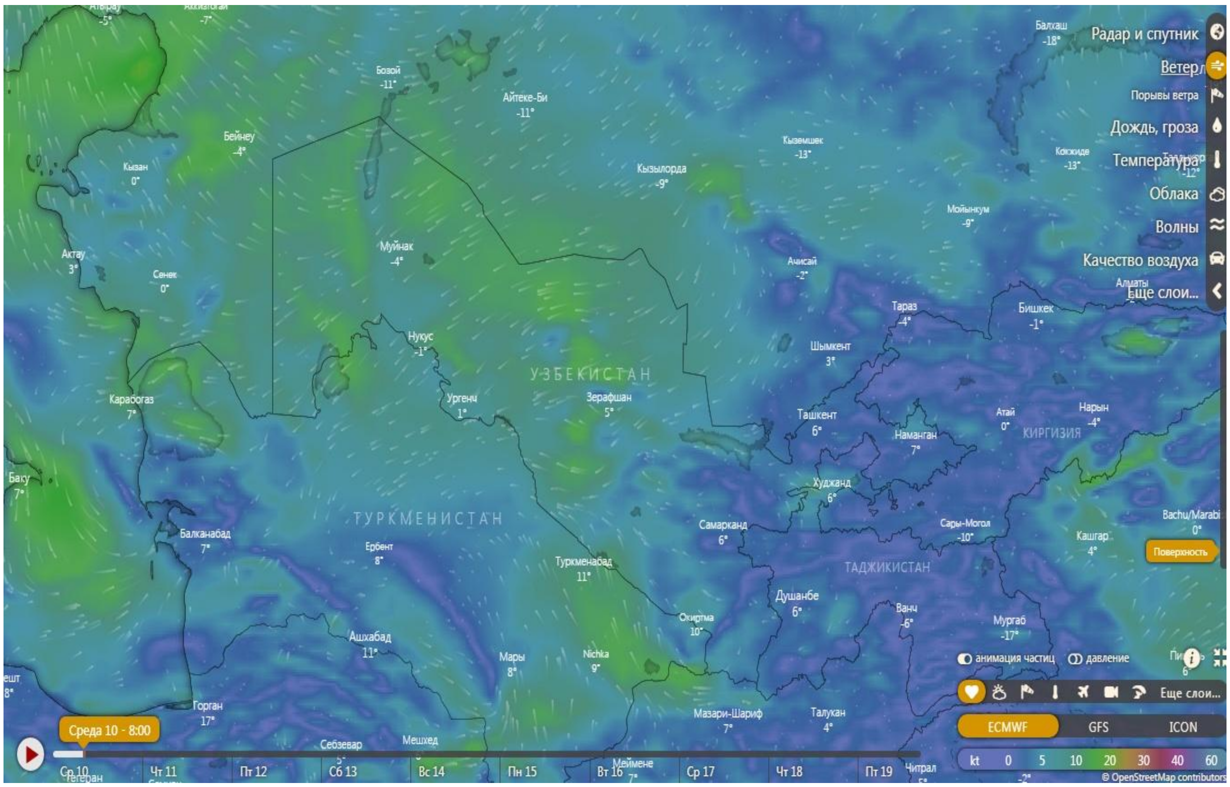
A cylinder with an area of influence S and a length v * dt, i.e. a volume S * V * dt. Therefore, the flow rate of the volume is S * v, and the flow rate is v. The flow rate is the product of the flow velocity v and the current density ρ.

$$\frac{dm}{dt} = \rho \cdot S \cdot v \quad (2)$$

Summarizing Picture 1 and formula (2), we obtain the following expression. $P = \frac{1}{2} \cdot \rho \cdot S \cdot v^3$ (3)

Expression 3 is the fundamental equation of wind power analysis. The cubic level of velocity in the formula shows the curvilinear dependence of wind power on velocity. A two-fold increase in wind speed results in an eight-fold increase in power, which means that speed is important (5). Wind strength is linearly related to air density and wind impact surface, so these magnitudes are of secondary importance.

Here comes another question: to what extent is the potential for wind energy in Uzbekistan, or if a wind farm is built, can the wind give the minimum speed at which we can get power from this station? Below we will try to answer this question with a wind map from wind.com:



Picture 2. Wind map of Uzbekistan.

Бухаритаданкўринибтурибдикимамлакатимизнингшимолий-ғарбийҳудудлари: Қорақалпоғистон, Хоразм, БухороваНавоийвилоятларидашамолтезлиги $5 < v < 20$ оралиқлардаўзгармоқда. Демак,буҳудулардашамолэнергияманбалариниқўллашкутилганнатижаниберади

ЮқоридагификрларниинобатгаолганҳолдаHW 77/1500 ваHW 82/1500 типлишамолэлектргенераторинингтехникпараметрлариникелтирибўтамиз.

This map shows that in the north-western regions of the country: Karakalpakstan, Khorezm, Bukhara and Navoi regions, wind speed varies in the range of $5 < v < 20$. Hence, the use of wind energy sources in these areas gives the expected result

Taking into account the above points, we cite the technical parameters of wind turbines HW 77/1500 and HW 82/1500.

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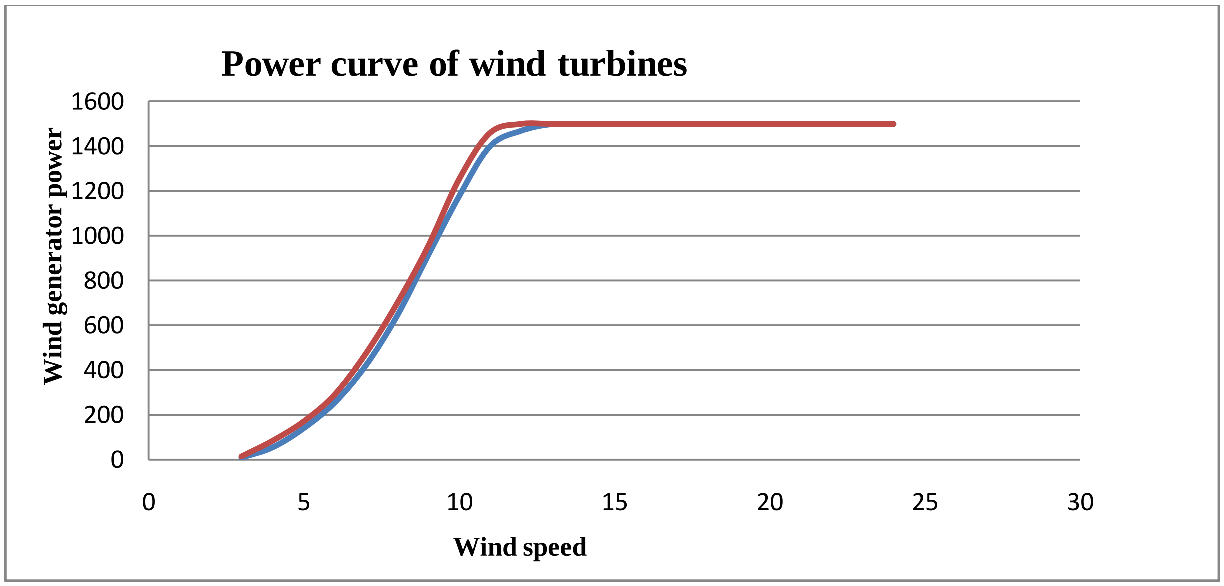
TABLE 1

1	**General information**		
1.1	Rated power	кWт	1500
1.2	The smallest wind speed available.	м/с	3
1.3	Maximum allowable speed	м/с	25
1.4	Nominal wind speed	м/с	11.7/11.3
1.5	Turbine operating temperature range	°C	-40°÷ +40°
2	Turbine data		
2.1	Number of blades		3
2.2	Parrak diameters	м	77/82.6
2.3	The nominal number of revolutions of the blades	Rotation/ minutes	17.4

Performance characteristics of HW 77/1500 and HW 82/1500 type wind generators.

TABLE 2

Wind speed, m / s	3	4	5	6	7	8	9	10	11	12	13
Power, kWh	9/ 14	55/ 84	140/ 170	255/ 290	420/ 472	640/ 695	910/ 950	1175/ 1250	1400/ 1459	1470/ 1500	1500/ 1500
Wind speed, m / s	14	15	16	17	18	19	20	21	22	23	24
Power, kWh	1500 / 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500	1500/ 1500



Picture 3. Power curves of proposed wind turbines

It is important to normalize the area of influence of wind power flow. This leads to the definition of kinetic wind energy flow, called wind energy density (DEZ). As in the above definitions of flow and flow velocity, the flow of wind energy is the flow rate of wind energy per unit area.

$$DEZ = \frac{P}{S} = \frac{1}{2} \cdot \rho \cdot S \cdot v^3 \qquad (4)$$

DEZ is used to compare wind sources independently of the size of the wind turbine and is the quantitative basis for the standard classification of wind. [2]

It is important to know the wind power classes to install the turbines proposed above.

Table 3 shows the wind energy classes measured at a height of 50 m above the ground according to the classification based on wind power density.

TABLE 3

Wind power classification			
Wind power classes	Resource potential	Wind power [W / m^2]	Wind power [W / m^2]
1	Strong wind	0-200	0-5,9
2	Extreme wind	200-300	5,9-6,7
3	Medium wind	300-400	6,7-7,4
4	Strong wind	500-600	7,4-7,9
5	Strong wind	500-600	7,9-8,4
6	Strong wind	800-600	8,4-9,3
7	Very strong	>200	>9,3

The wind speed corresponding to each class is the average wind speed based on the distribution of the average equivalent of wind power at 1500 meters above sea level.

Above we have considered the overall composition of the surrounding air flow and wind power. In fact, it is not possible to use all of these capacities. The efficiency in the use of wind energy is determined by the power factor (C_p), which is the ratio of the power output from the turbine $C_p = P_T / Pwind$ to the total power of the wind resource.

The turbine power is as follows:

$$(5) \quad P_T = \frac{1}{2} \cdot \rho \cdot S \cdot v^3 \cdot C_p$$

where the value of P_T is always less than the value of $Pwind$. In fact, there is a theoretically upper limit of the maximum removable power known according to Betz limit theory, and this value does not exceed 1. [3]

In summary, despite the disadvantages of using wind energy sources, there are a number of advantages, and these advantages increase the importance of using such sources.

• Consumers supplied with wind power will be independent of the power grid, so interruptions in the network will not affect autonomous consumers.

• Installing a wind turbine is cheaper than installing a mains supply.

• The use of wind energy provides resource savings across the region.

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