

## Utilization of Renewable Primary Energy Source in the Form of a Wind for Power Supply of Autonomous Consumers

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**Abstract:** Review of the literature on the use of renewable and non-renewable primary energy sources was performed. The construction of wind energy device AVEU – 6 was presented and recommendations for the use of this energy device in different regions of Russia were given.

**Key words:** Wind • Sources of energy • Renewable sources • Non-renewable sources • Wind energy  
• Wind energy device

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### INTRODUCTION

The problem of providing energy from the present time, is mainly due to increase consumption of non-renewable primary energy sources in the form of oil, natural gas, coal and nuclear fuel per capita.

Substance, the energy potential (calorific value) which is the result of natural processes, independent from human activities, are called primary energy sources.

The analysis of literary sources [1, 2] showed that if we consider the period from 1950 to 2010, it can be stated that every 20 years the period, consistently observed a two-fold increase in total energy consumption per capita. This trend is explained by industrial production growth and a sharp increase in the population of the globe, which increased by 75% compared with the beginning of the XX century.

It should be noted that more than 90% of total energy consumption falls on non-renewable fossil fuels (coal, oil, gas, nuclear fuel) and only 10% is from renewable resources (hydropower and biofuels) [2].

At the current rate of energy consumption by the end of XXI century, the reserves of non-renewable fossil fuels will be completely expended. So urgent becomes the problem of greater use of renewable primary energy sources, which include wind, sun, water, rivers, seas and oceans.

Wind is one of the most powerful energy resources. It is estimated over 1 year across the globe it is possible to utilize wind energy in the amount of  $j$  [1, 2]. That is why the issue of effective utilization of wind energy is receiving increasing attention.

In order to use wind energy, you need to have information about prevailing wind directions ("wind rose") in a given neighborhood or city and the values of its average speed from all directions "rose" [3]. The factors limiting the widespread use of wind power for energy supply can be attributed to the limitation of the minimum average air velocity, which should exceed 3 m/s. Also note the continuity constant direction and duration of the impact of wind load on the wind energy unit for the area. The greatest effect on the use of wind energy is achieved in areas with average wind speeds over 5 m/s.

Analyzing information sources [3,4], we can conclude that in some regions of Russia most effectively utilize the wind energy. The regions in which the average wind speed varies in the range from 5 to 10 m/s for 270 – 320 days in a year can be attributed to the Lower Volga region, the southern part of Western Siberia, the Caspian sea coast, coast of lake Baikal, Primorsky Krai, Sakhalin island and the Okhotsk sea coast, Kamchatka, the Kurile Islands and others.

Currently, the most widespread in the world received wind power units (VEA) with a capacity from 0.1 to 6.0 kW. The use of wind energy units is considered to be economically justified for power supply of autonomous consumers, where there are problems with delivery to the place of non-renewable primary energy sources.

In the period from 1930 to 1960 in our country were produced in wind power units with a wheel diameter of 18 meters and a capacity up to 30 kW. In the late 60's their production ceased because of the rapid development of the oil and gas industry.

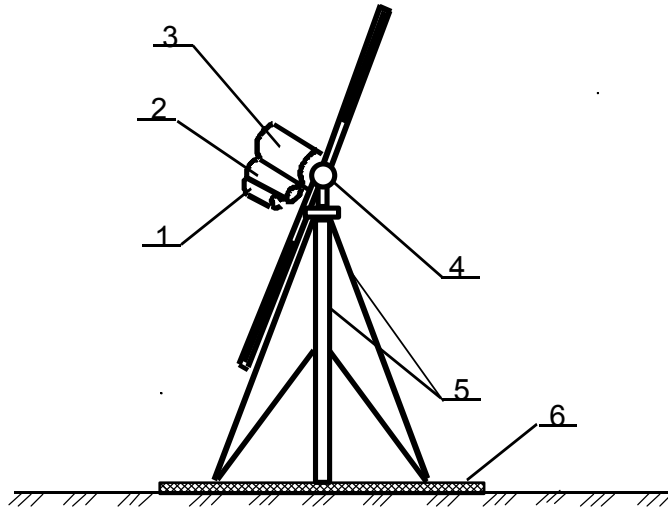


Fig. 1: General view of wind energy unit, AVAU – 6 [5, 6]

1 – windrose wheel; 2 – reducer of windrose; 3 – generator; 4 – head of a wind turbine; 5 – tower braces; 6 – the foundation.

Only in 1979 in the city of Astrakhan factory "Vetroenergo" was released lot of wind-driven power plants, AVAU - 6 power up to 4 kW (Figure 1) used areas with average annual wind speeds from 5 to 20 m/s in the temperature range from  $-40^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  [5, 6].

Wind power units, AVEU – 6 set on the Foundation with an area of 15 15 m<sup>2</sup>, which is open from all sides. WINDROSE rotation from wheel 1 via a two-stage cylindrical reducer of windrose 2 is transmitted to three phase synchronous generator 3. Installation on the prevailing wind direction of the head of a wind turbine with a wind wheel is automatically controlled by windrose consisting of two coupled on the same shaft a small multiblade windwheels placed on the sides of departure of the wind turbine. Head 4 of the wind turbine consists of two blades, speed controller, a cylindrical reducer and the connecting link. The controller automatically maintains the frequency of rotation of the propeller in the range from 186 to 200 min<sup>-1</sup> in the range of wind speeds from 5 to 40 m/s. Installation of the propeller on the prevailing wind direction is performed automatically via a worm gear.

Thus, the most important characteristics determining the efficiency of utilization of wind energy are its speed and continuous duration of winds for a given city or locality. Due to the fact that the speed and direction of air movement changes randomly, it is, unfortunately, unlikely to predict the wind power unit developed in different time periods. Therefore, in order to increase the capacity of wind energy unit, currently being developed for them a system of Autonomous automatic control with batteries.

## CONCLUSION

The analysis of literature showed that on the territory of the Republic of Tatarstan is also possible to more effectively use wind energy, since the average air speed in towns and settlements of the region exceeds 3 m/s.

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