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# STUDY OF POWER DEPENDENCE OF WIND POWER FROM WIND SPEED

**K P Trubaev**

State Municipal Budget School No.45, Belgorod, 308015, RU

**Abstract.** The paper presents aim of the work was to study the dependence of the power of the wind generator on wind speed on the laboratory installation. The hypothesis is proved - the higher the wind speed, the greater the power of the wind generator. But at low wind speeds, the wind generator rotates, but does not generate electricity. In Belgorod, the average wind speed is about 4 m / s, so wind generators will work, but not full power.

The needs of mankind for electricity are increasing every year. At present, most of the world's electricity is generated by power plants that burn irreplaceable fuel - natural gas, oil and coal. The fuel reserves are not unlimited, they can end in a few decades.

When burning fuel, harmful substances are released, which adversely affects the environment. With the goal of eliminating these problems, alternative sources of energy have been used in the world.

One of the promising areas of alternative energy is the use of wind turbines [1]. The wind generator works thanks to the wind, which rotates its blades. The energy of rotation of the shaft is transferred to the electric generator, as a result, electricity is generated.

In the course of studying and theoretical analysis of literature, we were interested in the following question: does the power generated by the wind generator depend on the wind speed?

Thus, the purpose of the work is to study the dependence of the power of the wind generator on wind speed.

Object of work: power of wind generator.

The subject of the study is the dependence of the power of the wind generator on the wind speed.

To achieve the goal, the following tasks were accomplished:

- 1) scientific sources of information have been studied and basic concepts have been revealed on the question of research [2-4];
- 2) the necessary equipment for carrying out a physical experiment has been prepared;
- 3) conducted laboratory studies aimed at studying the dependence of wind turbine-toroot wind speed;
- 4) the results of studies are processed and systematized;
- 5) investigated what the wind speed in Belgorod;
- 6) a comparative analysis of the results obtained

Empirical, practical and theoretical research methods were used in the work. The basic methods (study and analysis of literature and Internet resources, measurement, physical experiment, comparison of values, construction of tables and graphs) made it possible to determine the dependence of wind turbine power on wind speed and to determine that in Belgorod the wind generator will not work at full capacity.



The practical stage included the conduct of laboratory studies aimed at studying the dependence of wind turbine power on wind speed.

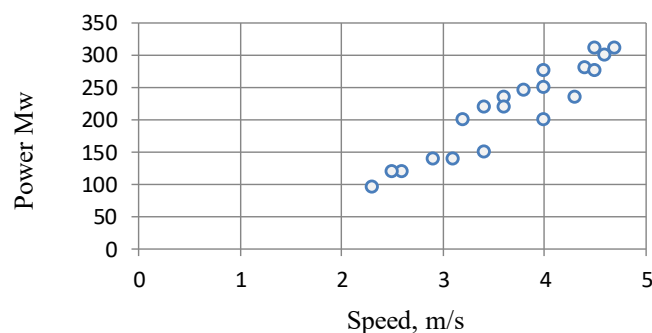
For the study, a special installation was used, consisting of: a fan, a wind generator, an anemometer, a tachometer, a wattmeter (Fig. 1).



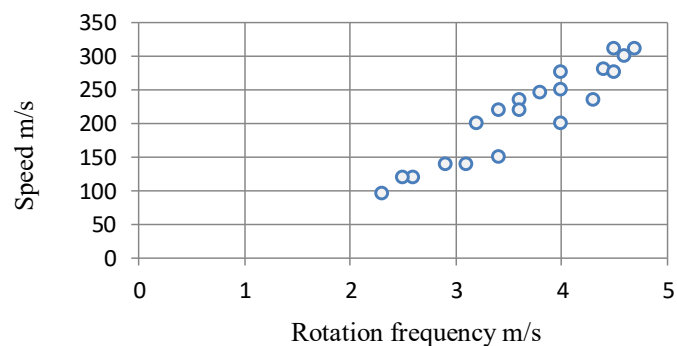
**Figure 1.** Laboratory installation

The fan, located opposite the wind generator, created a flow of air. The anemometer, installed in front of the wind generator, measured the velocity of the air flow. The tachometer, on a special stand, measured the rotor speed of the wind generator. A wattmeter connected to a wind generator measured the power of an electric current.

After the blades of the wind generator were untwisted, the instrument readings were taken. The experiment was carried out at different airflow rates. Based on the results of the experiment, graphs were constructed (Fig. 2, 3).



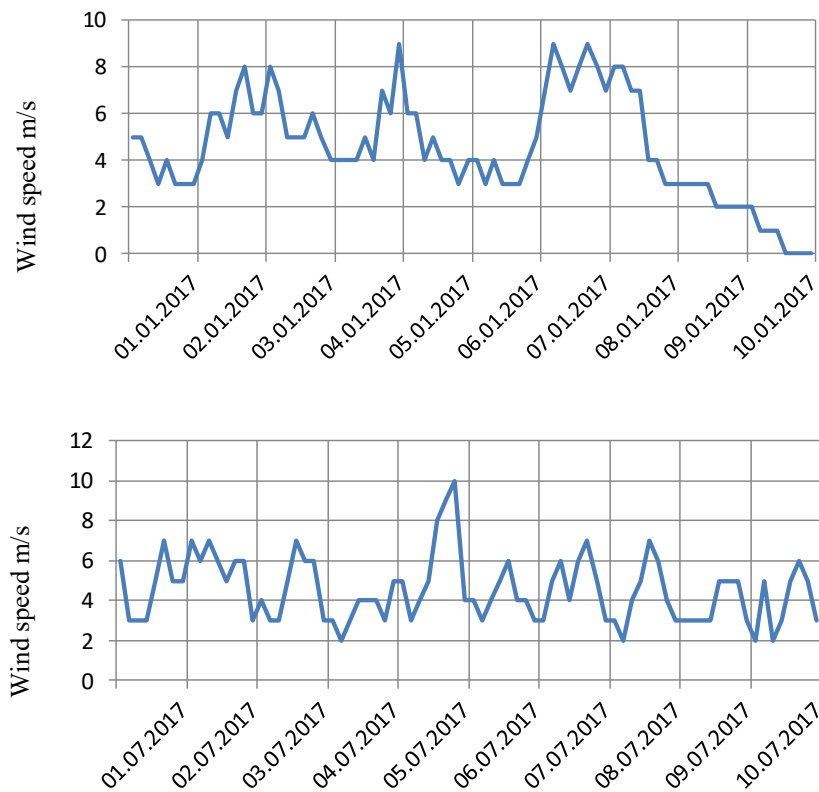
**Figure 2.** The dependence of the generated power on air speed



**Figure 3.** Dependence of the generated power on air speed

From the analysis of graphs, it can be concluded that at a flow rate of less than 2 m / s, despite the rotation of the wind generator, no electricity is generated.

In the further analysis of the work of wind generators in Belgorod. To do this, we used the data of the "Reliable Prognosis" site [5], which contains the data archive of the meteorological station of the city of Bel-city. Data on wind speed for 10 days of January and 10 days of July 2017 are shown in Fig. 4.



**Figure 4.** Change in wind speed during 10 days

By setting the start and end date on the site you can get average indications for the period. The average wind speed for seven years and average speed for each month for the last year were investigated (Tables 1, 2).

**Table 1.** Average and maximum wind speed for the year, m / s

Year	Average	Maximum
2011	4,2	15
2012	4,4	12
2013	4,4	10
2014	4,1	15
2015	4,3	14
2016	4,0	10
2017	4,2	14

**Table 2.** Average and maximum wind speed per month, m / s

Month, year	Average	Maximum	Month, year	Average	Maximum
January 2017	4,3	10	July 2017	3,9	16
February 2017	4,7	10	August 2017	3,8	10
March 2017	4,4	14	September 2017	4,1	13
April 2017	4,0	13	October 2016	3,8	10
May 2017	4,1	9	November 2016	4,8	10
June 2017	4,6	10	December 2016	4,3	9

It can be seen from the weather archive that the wind speed in Belgorod is constantly around 4 m / s. Therefore, wind generators will work, but not at full capacity.

Investigating this topic, you can make conclusions:

Firstly, after studying various sources of information, the basic concepts on research were revealed and it was determined that the higher the wind speed, the greater the power of the wind generator.

Secondly, it can be concluded that in the course of laboratory studies it is possible to study the dependence of the power of the wind generator on wind speed.

In the course of the work, the main goal was achieved-the dependence of the power of the wind generator on wind speed was studied.

Proofed the hypothesis - the more the wind speed, the greater the power of the wind generator. But at low wind speeds, the wind generator rotates, but does not generate electricity. In Belgorod, the average wind speed is about 4 m / s, so wind generators will work, but not full power.

### Acknowledgments

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### References:

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