ADJUSTMENT OF BANKI HYDRAULIC TURBINE IN ORDER TO OBTAIN ELECTRICAL ENERGY FROM WIND POTENTIAL

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The energy demand in the whole world and in our country is in a continuous growth as an effect of the industrial and economical development. The main problem for society, experts and decision factors is the energetic resources. The necessity of a sustainable development imposes the development of the renewable energy sources especially for keeping those existing at a convenient level and at the same time for environment conservation.

In Romania the areas with o good wind intensity have a small size and these areas are placed in the mountains and near the Black Sea. In the other geographic areas the wind has low intensity fact that imposed to be made researches regarding wind turbines that can be used for speeds lower than 8 m/s.

This paper proposes a model of a wind turbine used in areas with low wind intensity. Banki hydraulic turbine has horizontal spindle, but this type of turbine can be adjusted for obtaining electrical energy from the wind. The paper will proposes a turbine model with vertical spindle.

Keywords: wind potential, Banki turbine, vertical spindle

1. Introduction

Wind, as the primary energy source, costs nothing and can be used decentralised. There is no need for an extensive infrastructure such as that required for a power supply network or for the supply of oil or natural gas.

Regarding the Romanian wind potential have been identified five areas, taking into account the environment and top geographic conditions. From the result of the measurements results that Romania has a temperate continental climate and a very important wind energy potential is found especially in areas near the Black Sea and the coastline (gentle climate) as well as in the mountains (hard climate). The existence of areas with low wind intensity is a characteristic of

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Romania and because of this, a study regarding the intensive use of this domain of lower wind speeds is very useful.

Based on the evaluation and interpretation of the recorded dates, resulted that in Romania the most favorable wind potential is found in areas near Black Sea, in Dobrogea, in Moldavia plateaus and in the mountains. At the same time have been identified favorable locations in areas with a relatively good wind potential if it is taking into account the exploit of the channeling effect of air currents etc.

Preliminary evaluations regarding the Black Sea coastline areas inclusive the off-shore areas demonstrate that the wind potential that can be assembly in a short and medium period of time is high, with the possibilities to obtain a large quantity of energy.

In the whole world the most known and used wind turbines are those with horizontal spindle. This paper will propose another type of turbine for producing electrical energy - Banki hydraulic turbine.

This type of turbine is used to produce electrical energy in small hydro power plants. In this paper will be projected a model of a wind turbine that can be used in areas with low speed intensity of the wind.

2. The utilization of Banki turbine to produce electrical energy using the wind potential

Vertical axis turbines have vertical drive shafts. The blades are long, curved and attached to the tower at the top and bottom. There are not so many manufacturers of such turbines in the world. Vertical axis wind turbines have an axis of rotation that is vertical, and so, unlike their horizontal counterparts, they can harness winds from any direction without the need to reposition the rotor when the wind direction changes.

Banki hydraulic turbine has horizontal spindle, but it can be adjusted for obtaining electrical energy from the wind. The paper will proposes a turbine model with vertical spindle.

The researches regarding this type of wind turbine are based on the contrivances established for the known Banki turbine. Excepting some modifications regarding the computations relations, the sizing technology for the Banki turbine will be respected. This fact is possible because in areas with low wind intensity, lower than 10 m/s, the Mach number will be lower than 0,4 and so the gases are acting as the fluids. In this area of Mach number (lower than 0,4) the gases (the air) can be considered incompressible. The behavior of the gases and its movement thru the aerodynamic machine is similar with the behavior of the fluid.

Turbine rotor computation is similar with the method utilized for the computation in the case of turbo machines, elaborated by Leonard Euler, that of the relative movement speed triangles of the fluid thru the revolving equipment.

A special problem is the realization of a nose pipe capable to conduct the fluid current thru the aerodynamic machine. This nose pipe will be able to create the optimal attack angles at the rotor blades and to favor the evacuation of the fluid current from the aerodynamic machine in a way that assures the maximum efficiency.

The dimensions of the rotor geometry resulted from the dimensioning are presented bellow:

- $D_1 = 4.000$ mm (rotor external diameter);
- Rotor height b = 4.000 mm eventual 6.000 mm;
- Internal rotor diameter $D_2 =$ 3.200 mm;
- The blades of the rotor are like an arc of a circle with the radius: $R = 652$ mm;
- The blades have the center of these arc circles on the circle with the radius: $R_C = 1.472$ mm.

The number of the blades is established based on the estimation of the opposed trends generated by the growth of blades number that is conducting to a better guidance of the air current, as well as the reduction of blades number that is conducting to a lower friction of the air current with the blades. Finally the blades number is assumed to be equal with z = 24. The results regarding the transversal section are presented in figure 1.

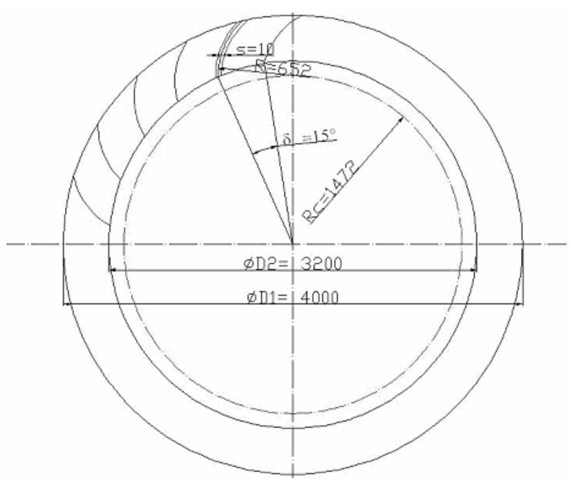

Fig. 1. Double flux rotor - transversal section.

Results that the center angle between two blades is equal with: $\delta = 15^\circ$.

The disposal angles of the blades for D_1 diameter are: $\beta_1 = 30^\circ$ and for diameter D_2 are: $\beta_2 = 80^\circ$.

3. Conclusions

Beside of wind turbine rotor geometry, kinematics and dynamics a very important aspect is the shape of the machine elements used to bring the air to the rotor and the shape of the machine elements used to evacuate the air from the rotor. These elements can spin for orientate on wind direction (in this way the wind turbine will have greater efficiencies and powers).

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