Chapter 16
The Features of the Work of Wind–Receiving Devices on Different Speeds of the Wind Flow

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ABSTRACT
This chapter describes the features of the work of wind-receiving devices in the insufficient power mode when the current wind speed is below the construction value of the wind power plant. The term “effective angle” is introduced. The importance of this problem is shown and the amount of time in the insufficient power mode, for example, wind power plant, is calculated. The main characteristics of an electrical generator and a wind receiving device are considered. The importance of the mapping the characteristics of the wind-receiving device and the electrical generator is shown.

TYPES OF WIND RECEIVING DEVICES (WRD)
There are many different types of wind power plant constructions exist at the moment which could be separated into two main types: wind turbines with horizontal axis (blade turbine) and turbines with vertical axis (carousel and H-type turbines) as shown on the figure 1.

The construction of the wind power plant consist of:

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Wind receiving device which could have 2-24 blades; WRD with the number of blades between 2 and 4 are called few-blades turbines and have the speed ratio $Z=6-9$ and the turbines with the number of blades above 4 called multi-blades turbines and have speed ratio $Z=1.5-6$;

- The wind orientation device, which for low-power plants is the vane; the vane directs the power plant on wind flow and is attached to the nacelle, it rotate the nacelle above the vertical axis;
- The tower, which is used to raise the nacelle above the wind obstacles;
- The device for control of the rotation speed, which limits the rotation speed or take out the WRD from the wind.

If the WRD has less than 10 kW of the power it is mounted on the same axis with electrical generator because of at the low-speed wind flow in range from 4 m/s to construction $V_n$ the energy of the wind flow is not enough to force the breakaway torque with the multiplicator device (Morenko, 2011).

The rotating speed of the axis of the generator depend on the speed of wind flow through the speed ratio directly. The speed ratio depends on the construction of the turbine.

It is easy to conclude from researches that the high-speed few-blades wind power plants with the speed ratio $Z=6-9$ work only 152-720 hours in a year (2-8%) in zones with the average wind speed in range 4-7 m/s. Multi-blade turbines with the speed ratio 1.5-6 has slow rotating speed which leads to necessity to use special very expensive constructions of the generator. This fact doesn’t allow to use this type of turbines for producing electrical energy.

The reason of this is in the methods of the constructing wind receiving devices. Construction parameters of the WRD are depended on the speed ratio

$$Z = \frac{ER}{V_w}$$
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