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|  | Rosatom digital press office <https://atommedia.online/en/>  | **Additional information**01.03.24 |

**Wind power plant (WPP) in figures**

A wind power plant, on average, consists of 7000-8000 different parts. Inside there are utility power converters that convert direct current into direct current of fixed frequency for transmission to the grid, a control panel that shows the technical parameters of the WPP in real time, a pitch grease lubrication system, a generator, a pitch control system and others.

Rated wind speed: 11.4 m/s (41 km/h). Rated speed of rotation: 14.8 rpm. Operating wind speed range: 2.5-25 m/s (9-90 km/h).

**Wind power plant elements**

* **Foundation** ensures the stability of the wind power plant under wind loads;
* **Tower**, on which the rotor, generator and nacelle are mounted;
* **Nacelle** – it houses a number of the main control components of the generator module: hydraulic and braking systems, motors, nacelle rotation sensor and other equipment;
* **Generator** is attached to the nacelle and converts mechanical rotational energy into electrical energy and regulates the shaft rotation speed;
* **Rotor** is attached to the generator and represents a **hub with blades** that convert wind energy into rotational energy of the main shaft. The hub contains the mechanism for the angle of attack of the blades into the wind;
* **Other mandatory equipment**: transformer, cables, grounding, protection systems, etc.

**Description of WPP elements**

1. **Foundation**

Number of piles: 18-20 pcs. Piles diameter: 1.2 m, foundation diameter: 20 m. Pile height: 18-25 m (height of 6-8-storey building). **Weight of the foundation is about 1900 tons (33 cars of a passenger train).**

1. **Tower**

It consists of about one hundred bent steel sheets, which are made on special bending presses and fastened into sections. Inside the tower there are power cables that transmit electric current from the generator to the convector.

The number of sections: 8 pcs. The height of the first section is 9.5 meters, from the second to the seventh: 12 meters, the eighth: 18 meters. **The total height of the tower is 96 meters (the height of a 31-storey building). For comparison, the height of the Statue of Liberty in New York is 93 meters.**

The diameter at the base is 4.2 meters. Diameter at the top point: 2.3 m. **The weight of the tower is 217 tons (54 elephants or about 4 cars of a passenger train).** Number of components: 49,763 pcs. Number of bolts: 10,000 pcs. Time it takes to climb up using the technical elevator: 7 min.

1. **Nacelle**

Serves for attaching the generator and wind wheel to the tower. It provides access of the maintenance personnel to the generator and the wind wheel. **Weight: 16 tons (4 elephants). Number of components: 9,321 pcs.**

1. **Synchronous multi-pole generator**

DC generator is an electrical machine that converts mechanical energy into DC electric energy. **The weight of the generator: 49.5 tons (9 Indian elephants or 99 cows). Diameter: 4.3 meters. Number of components: 368,206 pcs. Power: 2.5 MW.**

300,000 plates are needed to make the generator. The plates are made of electrical steel to accommodate copper windings and permanent magnets. The permanent magnets form a magnetic field and when the rotor rotates, an electric current is generated in the copper windings. The weight of the magnets is 3.3 tons and the weight of the copper conductors is 3.9 tons.

1. **Rotor assembly (hub and 3 blades)**

**Diameter: 100 m (33-storey building). Swept area: 7,900 square meters (soccer field: 7,140 square meters).**

* **Hub**

It is a high-tech large-size casting made of high-strength cast iron, machined on special high-precision machines. **Weight: 20 tons (5 elephants).** Number of components: 2,609 pcs.

* **Blades**

The efficiency of the wind generator directly depends on the perfection of the aerodynamic characteristics of the blade. Blades must be strong and elastic, otherwise high altitude winds will break them like matchsticks. In addition, the blades must have a minimum weight, because increasing the weight increases the stresses on the structure as a whole. **Weight: 8.6 tons. Length: 49.05 meters (16-storey building). Speed of rotation at the end of the blade: 225 km/h (equal to the average speed of a racing car).**

1. **WPP assembly**

The total WPP weight is about 324 tons. Total height (taking into account the length of the blades): 150 m (about 50-storey building). WPP service life is 20-25 years.