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Overview of Electro-Generators Used in Wind Turbines

Wind power plant (WPP) - is the complex of synchronistic installations and structures which are designed for wind energy conversion into other forms of energy.

With a sharp update of wind power technologies, different plans for wind turbines were developed. Power generators for wind turbines are very simple - three-phase, only the size differs at times.

At the moment, almost always, wind generators are installed with asynchronous generators. Therefore, during the change of wind speed there is a big loss of electricity in generators through their low efficiency, and asynchronous generators appear electro jet large currents, which must be replenished. To eliminate this problem in wind turbines two generators are used with power ratings. For small wind one generator is switched off.

The choice of generators for wind turbines is affected by such factors as:

- 1) the required capacity is determined by the power converter, regardless of the speed of rotation of the blades and capacity battery;
- 2) during continuous operation in the absence of wind, the estimated battery capacity depends on the power and duration of use;
- 3) battery charge rate is dependent on electric power.

There are several types of wind turbine generators: synchronous generator that outputs DC and AC current, and asynchronous generators.

AC generator

Such generators are characterized by the strongest design. When they are installed in the grid, their synchronized frequencies on the network require precise operation.

Recently, generators in which permanent magnets are gradually began to be used in wind turbines. Such generators are usually considered for small wind turbines. Their work is similar to synchronous, without counting the fact that they can operate asynchronously. The advantages of these generators: the absence of the collector connecting rings and brushes, so that these machines are strong, reliable and easy to operate. But there is a major problem - rotation speed, because it is unstable, the setting can not generate electricity at a fixed frequency. It must be connected to the power supply via an AC conversion using a power converter. It is rational to use these machines for direct application of the drive.

DC generator

DC generator is called a device that converts mechanical energy into electrical constant value. The source is any mechanical stress. Electricity is transmitted to the brush, which has a connection to the inverter, which is used to convert AC to DC. It requires constant maintenance due to the use of brushes and switch.

In general, the use of such a generator is unusual in a wind turbine except that under the condition of low energy use, where the load is close to a wind turbine.

Asynchronous generators

For electricity they almost always use synchronous machines, and for the energy systems of current wind turbines induction machines are used. Such generators have two types: asynchronous generator with short-circuited rotor and machine power is doubled. They differ from the synchronous generators, the most reliable, easy assembly and low weight, it is necessary to improve the quality of wind-electro generators.

Induction generators are simple, reliable, have a high level of damping, and are able to absorb vibrations of the rotating speed of the rotor. These wind turbines rotate at a speed of approximately 1500 rpm. per minute, for 50 Hz mains, with three-speed reducer.

Asynchronous generator with short-circuited rotor is used both as a variable speed wind turbine, and a synchronous control machine. A three-phase cage induction generators, to work in a narrow range of close-line speeds. Other weaknesses of these machines are related to their size, low efficiency and safety. These machines caused problems and demanded a lot of services.

Now, more than 85% of all wind turbines use the dual power car. Such a device can operate in a large sliding scale (typically $\pm 30\%$ of the synchronous speed). As a result, they have several advantages: high output power, reducing mechanical stresses and oscillation power controlled by reactive power. Another quality - the machine can operate at sub synchronous conditions. Advantages of such generators: possibility to be used in combination with other machines; small vibrations of generated power, electromagnetic torque and current in parallel operation, under variable wind speed and gusts.

The result: for the wind turbines it is the best to place asynchronous generators with squirrel-cage rotor. In the role of an electromechanical transducer for wind turbines they use synchronous generators. A three-phase cage induction generators, is used only for small capacities.