Dc wind generator

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A permanent magnet DC generator is a type of wind power generator that uses a permanent magnet rotor to generate direct current electricity.

According to our prior wind turbine lesson, an electrical generator is a revolving mechanism that transforms mechanical energy from the rotor blades (the prime mover) into electrical energy or power. Using Faraday’s equations of electromagnetic induction, the generator’s rotation induces a dynamic e.m.f. (electro-motive force) into the coils. Electrical generators come in a wide variety of shapes and sizes, but one kind that works well in a wind energy system is the permanent magnet DC generator, or PMDC generator.

There is no fundamental difference in the construction of permanent magnet DC machines employed as conventional motors or DC wind turbine generators. One PMDC machine may be used as either a motor to move a mechanical load or a simple generator to produce an output voltage, depending on how it is controlled. For this reason, the permanent magnet DC generator (PMDC generator) is the best option for use in a basic wind turbine.

We invite you to read: "Jamaican Hotel Runs a Hybrid Trigeneration System: Solar & Wind"

Connecting a DC machine to a DC source causes the armature to revolve at a constant speed proportional to the supply voltage and the magnetic field strength, transforming the machine into a “motor” that can generate torque. But if we use the rotor blades to spin the armature faster than the motor speed, we can turn this DC motor into a DC generator with an emf output that is proportional to the speed of rotation and the strength of the magnetic field.

Common DC machines have the field winding on the stator and the armature winding on the rotor. Thus, they generate the necessary magnetic flux by means of a rotating output coil in conjunction with a fixed magnetic field. Carbon brushes are used to get direct current from the armature, and either permanent magnets or an electromagnet control this current by making a magnetic field.

An electrical current is created in the armature coils when they rotate through the static magnetic field. When the armature of a permanent magnet DC generator is in motion, the current flowing through it must go from the commutator or slip rings and carbon brushes to the generator’s output terminals.

Different configurations of magnetic field coils and their connections to the armature allow for different designs of basic DC generators. A shunt-wound DC generator, where the primary field winding is linked in parallel with the armature, is one of the two fundamental connections for a self-excited DC machine. Series-wound DC generators have the field winding carrying the current linked in series with the armature.

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There are benefits and drawbacks to using any DC generator design.

Because the field (excitation) current in a shunt-wound DC generator is proportional to the output voltage, the magnetic field produced by such a generator grows in proportion to the rise in rotational speed. In addition, as the armature rotates faster, the voltage and electrical torque applied to it rise. Operating at a constant speed under changing loads, the shunt-wound generator’s voltage output is significantly more consistent than that of a series-wound generator. Due to power loss across the armature, the output voltage drops as the load current goes up.

If the load current is far larger than the design of the generator, the fall in output voltage becomes so severe that it causes massive internal armature losses and overheating. That’s why shunt-wound DC generators aren’t often used when massive continuous current demands must be met.

A DC generator with a series winding configuration has a field (excitation) current that is identical to the current delivered to the load. When the current drawn by the associated load is low, the excitation current is correspondingly low. This results in a low voltage and a weak magnetic field from the series field winding.

If the current drawn by the connected load is high, then the excitation current will be too. As a result, the series field winding produces a substantial magnetic field and a high output voltage. An important drawback of series-wound DC generators is their poor voltage control, which means they are seldom employed for variable loads.