

Daftar Istilah Dalam Energi Angin / Kincir Angin / Wind Turbine

- **AC**--See Alternating Current
- **Airfoil**--The cross section profile of the leeward side of a wind generator blade. Designed to give low drag and good lift. Also found on an airplane wing.
- **Air Gap**--In a permanent magnet alternator, the distance between the magnets and the laminates.
- **Alternating Current**--Electricity that changes direction periodically. The period is measured in Cycles per Second (Hertz, Hz).
- **Alternator**--A device that produces Alternating Current from the rotation of a shaft.
- **Amperage**--A unit of electrical current, equal to Coulombs per second. This is the flow rate of electrons moving through a circuit, very roughly analogous to gallons per minute flowing from a faucet.
- **Ampere-Hour**--A measure of energy quantity, equal to amperes times hours. Also used to measure battery capacity.
- **Anemometer**--A device that measures wind speed.
- **Angle of Attack**--The angle of relative air flow to the blade chord.
- **Annealing**--A heat treatment process that makes Cold-rolled steel more suitable for forming and bending.
- **Area of a Circle**--Pi multiplied by the Radius squared.
- **Armature**--The moving part of an alternator, generator or motor. In many PM alternator designs, it carries the magnets and is attached to the blades and hub. Also called a Rotor.
- **Axial Alternator**--An alternator design where a flat disc carrying magnets on the face (the Armature) rotates near a flat disc carrying coils (the Stator).
- **Axis**--The centerline of a rotating object's movement.
- **Balancing**--With wind turbine blades, adjusting their weight and weight distribution through 2 axes so that all blades are the same. Unbalanced blades create damaging vibration.
- **Battery**--An electrochemical device for storing energy.
- **Battery Bank**--An array of Batteries connected in series, parallel, or both.
- **Bearing**--A device that transfers a force to structural supports. In a wind generator, bearings allow the Shaft to rotate freely, and allow the machine to Yaw into and out of the wind.
- **Belt**--A device for transferring power from a rotating shaft to a generator. Allows the use of Pulleys to change the ratio of shaft speed to and from the generator.
- **Betz Coefficient**--59.3 percent. This is the theoretical maximum efficiency at which a wind generator can operate, by slowing the wind down. If the wind generator slows the wind down too much, air piles up in front of the blades and is not used for extracting energy.
- **Blade**--The part of a wind generator rotor that catches the wind.
- **Brakedrum Windmill**--A home-built wind generator design by Hugh Piggott of Scotland.
- **Braking System**--A device to slow a wind turbine's shaft speed down to safe levels electrically or mechanically.
- **Bridge Rectifier**--An array of diodes used to convert Alternating Current to Direct Current. Single-phase bridge rectifiers use 4 diodes, 3-phase bridge rectifiers use 6 diodes.
- **Brushes**--Devices for transferring power to or from a rotating object. Usually made of carbon-graphite.
- **Ceramic Magnets**--See Ferrite Magnets.
- **Chord**--The width of a wind turbine blade at a given location along the length.

- **Coercivity**--The amount of power needed to magnetize or demagnetize a permanent magnet. Measured in MegaGauss Oersted (mGO)
- **Cogging**--The cyclic physical resistance felt in some alternator designs from magnets passing the coils and gaps in the laminates. Detrimental to Start-up.
- **Coil**--A length of wire wound around a form in multiple turns.
- **Cold-Rolled Steel**--Steel processed by working at room temperatures. More expensive than hot-rolled steel.
- **Commutator**--The rotating part of a DC generator.
- **Concave**--A surface curved like the interior of a circle or sphere.
- **Convex**--A surface curved like the exterior of a circle or sphere.
- **Cowling**--See Nacelle.
- **Current**--See Amperage.
- **Cut-In**--The rotational speed at which an alternator or generator starts pushing electricity hard enough (has a high enough voltage) to make electricity flow in a circuit.
- **Cyanoacrylate**--A fast-setting, hard and brittle adhesive. See Superglue®.
- **Cycles per Second**--Measured in Hertz. In electricity, it is the number of times an AC circuit reaches both minimum and maximum values in one second.
- **Darrieus**--A Vertical Axis Wind Turbine design from the 1920s and 1930s by F.M. Darrieus, a French wind turbine designer.
- **DC**--See Direct Current
- **Delta**--A 3-phase alternator wiring configuration in which all phases are connected in Series.
- **Diameter**--A straight line passing through the center of a circle, and ending on both edges. Equal to 2 times the Radius.
- **Diode**--A solid-state device that allows electricity to flow in only one direction.
- **Downwind**--Refers to a Horizontal Axis Wind Turbine in which the hub and blades point away from the wind direction, the opposite of an Upwind turbine.
- **Drag**--In a wind generator, the force exerted on an object by moving air. Also refers to a type of wind generator or anemometer design that uses cups instead of a blades with airfoils.
- **Dump Load**--A device to which wind generator power flows when the system batteries are too full to accept more power, usually an electric heating element. This diversion is performed by a Shunt Regulator, and allows a Load to be kept on the Alternator or Generator.
- **Duty Cycle**--In a circuit, the ratio of off time to on time.
- **Dynamo**--A device that produces Direct Current from a rotating shaft. See Generator.
- **Eddy Currents**--Currents that flow in a substance from variations in magnetic induction. See also Lenz Effect. Laminates are used to prevent eddy currents, which cause physical and electrical resistance in an alternator or transformer, therefore wasting power.
- **Efficiency**--The ratio of energy output to energy input in a device.
- **Electromagnet**--A device made of wire coils that produces a magnetic field when electricity flows through the coils.
- **Epoxy**--A 2-part adhesive system consisting of resin and hardener. It does not start to harden until the elements are mixed together. NOT compatible with Fiberglas® Resin.
- **Excitation**--Using an electric current to create a magnetic field. See Electromagnet.
- **Fatigue**--Stress that causes material failure from repeated, cyclic vibration or stress.
- **Ferrite Magnets**--Also called Ceramic Magnets. Made of Strontium Ferrite. High Coercivity and Curie Temperature, low cost, but brittle and 4-5 times weaker than NdFeB

magnets.

- **Fiberglass Resin**--Another 2-part adhesive system, NOT compatible with Epoxy. Often used for making castings, since it is much cheaper than Epoxy.
- **Field**--See Magnetic Field
- **Flux**--See Magnetic Field
- **Freewheeling**--a wind generator that is NOT connected to a Load is freewheeling, and in danger of self-destruction from overspeeding.
- **Frequency**--See Cycles per Second.
- **Furling**--The act of a wind generator Yawing out of the wind either horizontally or vertically to protect itself from high wind speeds.
- **Furling Tail**--A wind generator protection mechanism where the rotor shaft axis is offset horizontally from the yaw axis, and the tail boom is both offset horizontally and hinged diagonally, thus allowing the tail to fold up and in during high winds. This causes the blades to turn out of the wind, protecting the machine.
- **Gauss**--A unit of magnetic induction, equal to 1 Maxwell per square centimeter. Higher Gauss measurements mean more power can be induced to flow in an alternator. Gauss readings can be increased by putting steel behind magnets, stacking magnets, or using larger or higher-grade magnets.
- **Gearing**--Using a mechanical system of gears or belts and pulleys to increase or decrease shaft speed. Power losses from friction are inherent in any gearing system.
- **Generator**--A device that produces Direct Current from a rotating shaft.
- **Governor**--A device that regulates the speed of a rotating shaft, either electrically or mechanically.
- **Guy Anchor**--Attaches tower guy wires securely to the earth.
- **Guy Radius**--The distance between a wind turbine tower and the guy anchors.
- **Guy Wire**--Attaches a tower to a Guy Anchor and the ground.
- **H-Rotor**--A Vertical Axis Wind Turbine design.
- **HAWT**--See Horizontal Axis Wind Turbine.
- **Hertz**--Frequency measurement. See Cycles per Second
- **Horizontal Axis Wind Turbine**--A "normal" wind turbine design, in which the shaft is parallel to the ground, and the blades are perpendicular to the ground.
- **Hub**--The center of a wind generator rotor, which holds the blades in place and attaches to the shaft.
- **Impedance**--See Resistance.
- **Induction**--The production of a magnetic field by the proximity of a electric charge or the production of a magnetic field by proximity of an electric charge.
- **Induction Motor**--An AC motor in which the rotating armature has no electrical connections to it (ie no slip rings), and consists of alternating plates of aluminum and steel.
- **Kerf**--The width of a cut made by a saw.
- **Kilowatt**--1000 Watts (see Watt)
- **kW**--See Kilowatt.
- **Laminations**--Electrical circuit core parts, found in motors, generators, alternators and transformers. When core parts are subjected to alternating electrical or magnetic fields, the buildup of Eddy Currents causes physical and electrical power loss. Laminations are made of thin strips of materials that make good temporary magnets and poor permanent magnets, and each strip is insulated electrically from the next.

- **Leading Edge**--The edge of a blade that faces toward the direction of rotation.
- **Leeward**--Away from the direction from which the wind blows.
- **Lenz Effect**--See also Eddy Currents. From H.F.E Lenz in 1833. Electromotive force is induced with variations in magnetic flux. It can be demonstrated physically in many different ways--for example dragging a strong magnet over an aluminum or copper plate, or shorting the terminals of a PM alternator and rotating the shaft by hand. Laminates are used to reduce power losses from this effect.
- **Lift**--The force exerted by moving air on asymmetrically-shaped wind generator blades at right angles to the direction of relative movement. Ideally, wind generator blades should produce high Lift and low Drag.
- **Live**--A circuit that is carrying electricity. When live, it can shock you.
- **Load**--Something physical or electrical that absorbs energy. A wind generator that is connected to a battery bank is loaded. A disconnected wind generator is NOT loaded, so the blades are free to spin at very high speed without absorbing any energy from the wind, and it is in danger of destruction from overspeeding.
- **Losses**--Power that is harvested by a wind generator but is not transferred to a usable form. Losses can be from friction, electrical resistance, or other causes.
- **Magnet**--A body that attracts ferromagnetic materials. Can be a Permanent magnet, Temporary Magnet, or Electromagnet.
- **Magnetite**--A common Iron-containing mineral with ferromagnetic properties.
- **Magnet Wire**--The kind of wire always used in making electromagnets, alternators, generators and motors. Uses very thin enamel insulation to minimize thickness and maximize resistance to heat.
- **Magnetic Circuit**--The path in which magnetic flux flows from one magnet pole to the other.
- **Magnetic Field**--Magnetic fields are historically described in terms of their effect on electric charges. A moving electric charge, such as an electron, will accelerate in the presence of a magnetic field, causing it to change velocity and its direction of travel. An electrically charged particle moving in a magnetic field will experience a force (known as the Lorentz force) pushing it in a direction perpendicular to the magnetic field and the direction of motion. Also called magnetic flux.
- **Maximum Energy Product**--Determines how good a magnet that different materials can make. Technically, the amount of energy that a material can supply to an external magnetic circuit when operating within its demagnetization curve.
- **MegaGauss Oersted**--Magnetic force measurement, see Maximum Energy Product.
- **MGOe**--See MegaGauss Oersted.
- **Moment**--A force attempting to produce motion around an axis.
- **NdFeB**--See Neodymium-Iron-Boron Magnet.
- **Nacelle**--The protective covering over a generator or motor.
- **Neodymium-Iron-Boron Magnet**--The composition of the most powerful Permanent Magnets known to man. The materials are mined, processed, and sintered into shape. Then, they are subjected to an extremely strong magnetic field and become Permanent Magnets.
- **Ohm's Law**--The basic math needed for nearly all electrical calculations. Please see a dictionary or Pocket Ref for all of the variations on Ohm's Law! $E=I*R$ (voltage(E)=amperage(I)*resistance(R)), and all of the algebraic variations of this ($I=E/R$, $R=E/I$). Also, for DC circuits, $Watts=Volts*Amps$. For AC circuits, $Watts=Amps * Volts * Cosine$

of phase angle theta.

- **Open-Circuit Voltage**--The voltage that a alternator or generator produces when it is NOT connected to a Load.

- **Parallel**--In DC electrical circuits such as a battery bank or solar panel array, this is a connection where all negative terminals are connected to each other, and all positive terminals are connected to each other. Voltage stays the same, but amperage is increased. In AC circuits such as a wind generator alternator, each parallel coil is connected to common supply wires, again increasing amperage but leaving voltage the same. Opposite of Series. See also Star.

- **Permanent Magnet**--A material that retains its magnetic properties after an external magnetic field is removed.

- **Permanent Magnet Alternator**--An Alternator that uses moving permanent magnets instead of Electromagnets to induce current in coils of wire.

- **PM**--See Permanent Magnet.

- **PMA**--See Permanent Magnet Alternator.

- **Phase**--The timing of AC current cycles in different wires. 3-phase alternators produce current that is cyclically timed between 3 different wires and a common wire, while single phase produces it in only 1 wire and a common. In a 3-phase alternator, wire #1 receives a voltage peak, then wire #2 receives a peak, then wire #3, and so on. A diagram is an easier way to explain phase, check out [Windstuffnow.com's](http://Windstuffnow.com) [3-Phase and 1-Phase Basics](#) page for detailed diagrams.

- **Pillow Blocks**--Bearings that support a horizontal shaft.

- **Pitch**--See Setting Angle.

- **Poles**--A way of picturing magnetic phenomena. All magnets are considered to be "dipoles", having both a North pole (which would point North if used in a compass) and a South pole (which would point South if used in a compass. In an alternator, generator, or motor the number of Poles is a measure of how many coils, permanent magnets or electromagnets are in the armature or stator.

- **Prop**--Slang term for Propeller.

- **Propeller**--The spinning thing that makes an airplane move forward. Often incorrectly used (by Otherpower.com also!) to describe a wind turbine Rotor.

- **Pulley**--A device for transferring power when using Belts as Gearing. Changing to smaller or larger Pulleys changes the gear ratio, and can be used to make a shaft turn faster or slower than the shaft that is providing its power.

- **Pulse Width Modulation**--(abbrev. PWM) A regulation method based on Duty Cycle. At full power, a pulse-width-modulated circuit provides electricity 100 percent of the time. At half power, the PWM is on half the time and off half the time. The speed of this alternation is generally very fast. Used in both solar wind regulators to efficiently provide regulation.

- **PWM**--See Pulse Width Modulation.

- **Radius**--The distance between the center of a circle and the outside.

- **Rare-Earth Magnets**--See Neodymium-Iron-Boron magnets.

- **Rated Power Output**--Used by wind generator manufacturers to provide a baseline for measuring performance. Rated output may vary by manufacturer. For example, one manufacturer's 1500 watt turbine may produce that amount of power at a 30 mph windspeed, while another brand of 1500 watt turbine may not make 1500 Watts until it gets a 40 mph windspeed! So read manufacturer's ratings statements very carefully.

- **Rectifier**--See Diode.

- **Radial**--An alternator design in which the armature magnets are attached to the outside circumference of a disc, with the stator coils mounted around the outside.
- **Regulator**--A device to adjust incoming power so as to avoid overcharging a battery bank. In solar power, the regulator generally just turns the solar array off when the batteries are full. With a wind generator, the regulator generally diverts all or part of the incoming power to a Dump Load when the batteries fill, thus keeping a Load on the wind generator so it will not Freewheel.
- **Relay**--An electromechanical switch that uses a small amount of incoming electricity to charge an electromagnet, which physically pulls down a connecting switch to complete a circuit. This allows a low-power circuit to divert the electricity in a high-power circuit.
- **Resistance**--The voltage per amp needed to make electricity flow through a wire. See Ohm's Law.
- **Root**--The area of a blade nearest to the hub. Generally the thickest and widest part of the blade.
- **Rotor**--1) The blade and hub assembly of a wind generator. 2) The disc part of a vehicle disc brake. 3) The armature of a permanent magnet alternator, which spins and contains permanent magnets.
- **RPM**--Revolutions Per Minute. The number of times a shaft completes a full revolution in one minute.
- **Savonius**--A vertical-axis wind turbine design by S.J. Savonius of Finland from the 1920s and 30s. Shaped like a barrel split from end to end and offset along the cut. They are drag machines, and thus give very low rpm but lots of torque.
- **Series**--In DC electrical circuits such as a battery bank or solar panel array, this is a connection where all the negative terminals are connected to the neighboring positive terminals. Voltage increases, but amperage stays the same. In AC circuits such as a wind generator alternator, each coil is connected to the one next to it, and so on, again increasing voltage but leaving amperage the same. Opposite of Parallel. See also Delta.
- **Servo Motor**--A motor used for motion control in robots, hard disc drives, etc. Generally designed more like an alternator than a standard motor, most Servos need special control circuitry to make them rotate electrically. Some can be used in reverse to generate alternating current.
- **Setting Angle**--The angle between the blade Chord and the plane of the blade's rotation. Also called Pitch or blade angle. A blade carved with a Twist has a different setting angle at the Tip than at the Root.
- **Shaft**--The rotating part in the center of a wind generator or motor that transfers power.
- **Short Circuit**--1) Parts of a circuit connected together with only the impedance of the leads between them. 2) In wind generators, connecting the output leads directly together so as to heavily load a generator in high winds. This creates a "short" circuit path back to the generator, bypassing all other loads.
- **Shunt**--An electrical bypass circuit that proportionally divides current flow between the shunt and the shunted equipment. It also allows high current measurements with low-current equipment.
- **Shunt Regulator**--A bypass device for power not needed for charging batteries. When batteries are full, the regulator shunts all or part of the excess power to a Dump Load to protect the batteries from overcharging damage.
- **Slip Ring**--Devices used to transfer electricity to or from rotating parts. Used in

wound-field alternators, motors, and in some wind generator yaw assemblies.

- **Star**--A coil connection scheme for 3 phase alternators and generators in which all 3 coil phases are connected in parallel--they all share a common connection.
- **Start-Up**--The windspeed at which a wind turbine rotor starts to rotate. It does not necessarily produce any power until it reaches cut-in speed.
- **Stationary**--With wind generator towers, a tower that does not tilt up and down. The tower must be climbed or accessed with a crane to install or service equipment at the top.
- **Stator**--The part of a motor, generator or alternator that does not rotate. In permanent magnet alternators it holds the coils and laminates.
- **SuperGlue**®--Cyanoacrylate adhesive. Fast bonding glue, easy to find in different viscosities. Sets on its own, and sets instantly when sprayed with an accelerator chemical. Hard, but somewhat brittle. Does not react adversely with Fiberglas® resin or epoxy.
- **Tail**--See Vane. The proper term is actually Vane, but Tail is commonly used.
- **Tail Boom**--A strut that holds the tail (Vane) to the wind generator frame.
- **Tape Drive Motor**--A type of permanent magnet DC motor often used as a generator in small wind generator systems.
- **Taper**--The change in wind turbine blade width (chord) along the length.
- **Temporary Magnet**--A material that shows magnetic properties only while exposed to an external magnetic field.
- **Thrust**--In a wind generator, wind forces pushing back against the rotor. Wind generator bearings must be designed to handle thrust or else they will fail.
- **Thrust Bearing**--A bearing that is designed to handle axial forces along the centerline of the shaft--in a wind generator, this is the force of the wind pushing back against the blades.
- **Tilt-Up**--A tower that is hinged at the base and tilted up into position using a gin pole and winch or vehicle. Wind turbines on tilt-up towers can be serviced on the ground, with no climbing required.
- **Tip**--The end of a wind generator blade farthest from the hub.
- **Tip Speed Ratio**--The ratio of how much faster than the windspeed that the blade tips are moving. Abbreviation TSR.
- **Torque**--Turning force, equal to force times radius. See also Moment.
- **Tower**--A structure that supports a wind generator, usually high in the air.
- **Trailing Edge**--The edge of a blade that faces away from the direction of rotation.
- **Transformer**--Multiple individual coils of wire wound on a laminate core. Transfers power from one circuit to another using magnetic induction. Usually used to step voltage up or down. Works only with AC current.
- **TSR**--See Tip Speed Ratio.
- **Turn**--In winding stator coils, this is one loop of wire around a form. A coil will often be referred to by how many turns of a certain gauge wire are in each coil.
- **Twist**--In a wind generator blade, the difference in Pitch between the blade root and the blade tip. Generally, the twist allows more Pitch at the blade root for easier Startup, and less Pitch at the tip for better high-speed performance.
- **Upwind**--
- **Vane**--A large, flat piece of material used to align a wind turbine rotor correctly into the wind. Usually mounted vertically on the tail boom. Sometimes called a Tail.
- **Variable Pitch**--A type of wind turbine rotor where the attack angle of the blades can be adjusted either automatically or manually.

- **VAWT**--See Vertical Axis Wind Turbine.
- **Vertical Axis Wind Turbine**--A wind generator design where the rotating shaft is perpendicular to the ground, and the cups or blades rotate parallel to the ground.
- **Voltage**--A measure of electrical potential difference. One volt is the potential difference needed in a circuit to make one Ampere flow, dissipating one Watt of heat.
- **Volt-Amp**--In an AC circuit, this is Volts * Amps, without factoring in the power factor, derived from the phase angle. See also Watt.
- **Watt**--One Joule of electrical energy per second. In DC circuits, Watts=Volts * Amps. In AC circuits, Watts=Volts * Amps * the cosine of the phase angle. See also Volt-Amp.
- **Wild AC**--Alternating Current that varies in Frequency.
- **Wind Generator**--A device that captures the force of the wind to provide rotational motion to produce power with an alternator or generator.
- **Windmill**--A device that uses wind power to mill grain into flour. But informally used as a synonym for wind generator or wind turbine, and to describe machines that pump water with wind power.
- **Wind Turbine**--A machine that captures the force of the wind. Called a Wind Generator when used to produce electricity. Called a Windmill when used to crush grain or pump water.
- **Windward**--Toward the direction from which the wind blows.
- **Yaw**--Rotation parallel to the ground. A wind generator Yaws to face winds coming from different directions.
- **Yaw Axis**--Vertical axis through the center of gravity.