

WIND POWER DICTIONARY

A

Aggregation — the bundling of several wind energy projects together so that they are treated as one larger project (when purchasing turbines, interconnecting, or maintaining a project, for example,) in order to spread out costs over more turbines or projects. Aggregation can improve the economics of a wind project

Airfoil – the cross-section profile of the leeward side of a wind generator blade. The airfoil is designed to give the blade low drag and good lift to improve performance.

Air Gap – the distance between the magnets and the laminates in a permanent magnet alternator

AC – Alternating Current

Alternating Current – electricity that changes direction cyclically and 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 is also used to measure battery capacity

Anemometer – a device that measures the wind speed and transmits wind speed data to the controller

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 – is the moving part of an alternator, generator or motor and is also called a rotor. In many PM alternator designs, the armature carries the magnets and is attached to the blades and hub.

Atom – the smallest unit of matter

Average Wind Speed – the mean wind speed over a specified period of time

Axial Alternator – an alternator design where a flat disc carrying magnets on the face [armature] rotates near a flat disc carrying coils [stator]

Axis – the centerline of a rotating object's movement

B

Balancing — the adjustment of weight and weight distribution of wind turbine blades through two axes so that all blades are the same to prevent damaging vibration.

Battery – an electrochemical device for storing energy

Battery Bank – an array of batteries that are connected in a 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. This 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 consequently is not used for extracting energy.

Blade – the aerodynamic part of a wind generator rotor that catches the wind. Wind blowing over the blades causes the blades to "lift" and rotate. Most turbines have either two or three blades

Brake – a disc brake that can be used to slow a wind turbine's shaft speed down to safe levels mechanically, electrically, or hydraulically in an emergency

Brakedrum Windmill – a home-built wind generator that was designed by Hugh Piggott of Scotland.

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 usually made of carbon for transferring power to or from a rotating object

C

Capacity Factor — a measure of the productivity of a wind turbine, calculated by the amount of power that a wind turbine produces over a set period of time, divided by the amount of power that would have been produced if the turbine had been running at full capacity during that same time interval.

Ceramic Magnets -- same as Ferrite Magnets

Charge – the measure of how much electricity is available

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 making it detrimental to start up

Coil – a length of wire wound around a form in multiple turns

Cold-Rolled Steel – steel that is processed by working at room temperatures. Cold-rolled steel is 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

Conductor – a material that allows electricity to move through it easily because the electrons in their atoms allow the electricity to flow through it easily. Water and most metals are good conductors of electricity.

Controller – starts up the machine at wind speeds of about 8 to 16 miles per hour (mph) and shuts off the machine at about 55 mph. Turbines do not normally operate at wind speeds above 55 mph because they might be damaged by the high winds.

Converter – same thing as Inverter - a device for converting direct current into alternating current

Convex – a surface curved like the exterior of a circle or sphere

Coulomb – the unit normally used to measure large charges; 1 coulomb = the amount of electricity passing through a given point in 1 second at a current of 1 ampere

Cowling – see Nacelle - the protective covering over a generator or motor

Current – see Amperage - a unit of electrical current, equal to coulombs per second.

Cut-in Speed — the rotational speed at which the turbine blades begin to rotate and produce electricity, typically around 10 miles per hour

Cut-out Speed — the rotational speed at which the turbine automatically stops the blades from turning and rotates out of the wind to avoid damage to the turbine, usually around 55 to 65 miles per hour

Cyanoacrylate – a fast-setting, hard and brittle adhesive [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.

D

Darrieus Wind Turbine - a Vertical Axis Wind Turbine design from the 1920s and 1930s named after the French inventor F.M. Darrieus. Looking like a giant “eggbeater” the turbines have good efficiency, but produce large torque ripple and cyclical stress on the tower, which contributes to poor reliability. They also generally require some external power source, or an additional Savonius rotor to start turning, because the starting torque is very low. Newer Darrieus type turbines are not held up by guy wires but have an external superstructure connected to the top bearing.

Darrieus Giromill Turbine – a variation of the Darrieus turbine that has straight blades instead of the curved blades normally associated with the Darrieus. It has a variable pitch to reduce the torque pulsation, is more efficient operation in turbulent winds and is self-starting.

DC – Direct Current

Delta – a 3-phase alternator wiring configuration in which all phases are connected in series

Density – mass per unit of volume

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

Distribution Lines – power lines [either overhead or underground] that carry electricity through towns and neighborhoods

Downwind Turbine – 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 – the force exerted on an object by moving air in a wind generator. Also refers to a type of wind generator or anemometer design that uses cups instead of 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 -- the ratio of off time to on time in a circuit

Dynamo – a device that produces direct current from a rotating shaft. See Generator.

E

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

Electric Field – the space near a charge body where other charges are affected

Electricity – the flow of electrons

Electromagnet – a device made of wire coils that produces a magnetic field when electricity flows through the coils.

Epoxy – a two-part adhesive system consisting of resin and hardener. It does not start to harden until the elements are mixed together. Epoxy is not compatible with Fiberglass® Resin.

Excitation – the use of an electric current to create a magnetic field. See Electromagnet.

F

Fatigue Failure - is stress that causes material failure from repeated, cyclic vibration or stress. Fatigue failure occurs when a specimen has completely fractured into two parts, has softened or has otherwise significantly reduced in stiffness by thermal heating or cracking. It can also be arbitrarily defined as having occurred when the specimen can no longer support the applied load within the deflection limits of the apparatus

Faraday Cage – the name given to a device that shields its inside from electric fields generated by static electricity

Ferrite Magnets – also called Ceramic Magnets, they are made of Strontium Ferrite. High Coercivity and Curie Temperature, low cost, but brittle and 4-5 times weaker than NdFeB magnets.

Fiberglas Resin – a two-part adhesive system and often used for making castings, since it is much cheaper than epoxy. Fiberglass Resin is not compatible with epoxy.

Field – see Magnetic Field

Fission – the splitting apart of an atom's nucleus and releasing a large amount of heat energy

Flux – see Magnetic Field

Freewheeling – a wind generator that is not connected to a load is freewheeling, and makes it 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. This allows the tail to fold up and in during high winds, turning out of the wind and protecting the machine.

G

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. Placing steel behind magnets, stacking magnets, or using larger or higher-grade magnets helps to increase Gauss readings.

Gear box – connect the low-speed shaft to the high-speed shaft and increase the rotational speeds from about 30 to 60 rotations per minute (rpm) to about 1000 to 1800 rpm, the rotational speed required by most generators to produce electricity. The gear box is a costly part of the wind turbine and adds a lot of weight. Engineers are exploring "direct-drive" generators that operate at lower rotational speeds and don't need gear boxes.

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 machine that converts mechanical energy into electrical energy - normally an off-the-shelf induction generator that produces 60-cycle AC electricity from a rotating shaft.

Giromill - a subtype of Darrieus turbine with straight, as opposed to curved, blades. The cycloturbine variety has variable pitch to reduce the torque pulsation and is self-starting. The advantages of variable pitch are: high starting torque; a wide, relatively flat torque curve; a lower blade speed ratio; a higher coefficient of performance; more efficient operation in turbulent winds; and a lower blade speed ratio which lowers blade bending stresses. Straight, V, or curved blades may be used.

Governor – a device that regulates the speed of a rotating shaft, either electrically or mechanically.

Grid – the utility distribution system – a network that connects electricity generators to electricity users

Grid-connected System — a residential electrical system such as solar panels or wind turbines which are connected to the electrical grid. In such systems the grid serves as a battery backup for the residential system for those times when there is no sun or wind.

Guy Anchor – attaches tower guy wires securely to the ground

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

H-Rotor – a Vertical Axis Wind Turbine design

HAWT – Horizontal Axis Wind Turbine

Hertz – a frequency measurement. See Cycles per Second

High-speed shaft – drives the generator

Horizontal Axis Wind Turbine – one of more common wind turbine designs, in which the shaft is parallel to the ground, and the blades are perpendicular to the ground. These turbines have the main rotor shaft and electrical generator at the top of a tower, and must be pointed into the wind. Small turbines are pointed by a simple wind vane, while large turbines generally use a wind sensor coupled with a servo motor. Most have a gearbox, which turns the slow rotation of the blades into a quicker rotation that is more suitable to drive an electrical generator

Hub – the center of a wind generator rotor, which holds the blades in place and attaches to the shaft. The central part of the wind turbine, which supports the turbine blades on the outside and connects to the low-speed rotor shaft inside the nacelle.

Hybrid System — the combination of multiple energy-producing technologies such as photovoltaic systems combined with small wind turbine systems.

I

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 [slip rings] to it and consists of alternating plates of aluminum and steel.

Insulator – is a material that electricity has difficulty moving through; electricity does not move through them easily because the electrons in their atoms do not move easily from atom to atom

Inverter – a device for converting direct current into alternating current

K

Kerf – the width of a cut made by a saw

Kilowatt --1000 Watts of electricit

Kilowatt Hour – one kilowatt of electicity produced or used in one hour

kW – see Kilowatt

L

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. A live circuit will 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.

Low-speed shaft – The rotor turns the low-speed shaft at about 30 to 60 rotations per minute.

M

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. A magnet wire 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. It is 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.

Megawatt – one million watts or 1,000 Kilowatts

met Tower — a group of instruments – including anemometers and wind vanes - that collectively measure various meteorological parameters such as wind speed, wind direction, and temperature at various heights above the ground. The term “met” is short for meteorological.

MGOe – see MegaGauss Oersted

Moment – a force attempting to produce motion around an axis

MW - Megawatt

N

NdFeB – see Neodymium-Iron-Boron Magnet

Nacelle – the protective covering over a generator or motor

Nacelle – sits at the top of the tower and contains the gear box, low- and high-speed shafts, generator, controller, and brake. Some nacelles are large enough for a helicopter to land on.

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.

Neutron – a basic particle in an atom's nucleus that has a neutral electrical charge

Nucleus – the center of an atom

O

Ohm – the unit of electrical resist

Ohm's Law – is 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! $E=I \cdot R$ (voltage(E)=amperage(I)*resistance(R)), and all of the algebraic variations of this ($I=E/R$, $R=E/I$). Also, for DC circuits, $Watts=Volts \cdot Amps$. For AC circuits, $Watts=Amps \cdot Volts \cdot \text{Cosine of phase angle theta}$.

Open-Circuit Voltage --the voltage that a alternator or generator produces when it is not connected to a load

O & M Costs – operational and maintenance costs

P

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.

Pitch – blades are turned, or pitched, out of the wind to control the rotor speed and keep the rotor from turning in winds that are too high or too low to produce electricity. See Setting Angle.

PM – 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.

Pillow Blocks – bearings that support a horizontal shaft

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.

Power Coefficient – the ratio of the power extracted by a wind turbine to the power available in the wind stream

Power Curve — the instantaneous power output of a specific turbine design at various wind speeds. Used with wind resource data to determine the potential for electricity generation at a project site.

Power Line – the wire used to carry electricity – either underground or overhead

Power Plant – a place where electricity is generated

Prop – the slang term for a propeller

Propeller – the spinning thing that makes an airplane move forward. This term is sometimes incorrectly used to describe a wind turbine rotor.

Proton – a basic particle in an atom;s nucleus that has a positive electrical charge

PUC [or PSC] – Public Utility Commission or Public Service Commission – a state agency that regulates utilities

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 – 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.

PURPA – Public Utility Regulatory Policies Act [1978], 16 U.S.C. Section 2601.18 CFR Section 292 – refers to small gearot utility connection rules

PWM – see Pulse Width Modulation

R

Radius – the distance between the center of a circle and the outside

Rare-Earth Magnets – also known as Neodymium-Iron-Boron magnets

Rated Power Output – used by wind generator manufacturers to provide a baseline for measuring performance and can vary by manufacturer.

Rated Output Capacity – the output power of a wind machine operating at the rated wind speed

Rated Wind Speed – the lowest wind speed at which the rated output power of a wind turbine is produced.

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. A measure of how hard it is for a current to pass through a given material. See Ohm's Law.

Root – the area of a blade nearest to the hub and is generally the thickest and widest part of the blade.

Rotor – the blade and hub assembly of a wind generator OR the disc part of a vehicle disc brake OR the armature of a permanent magnet alternator, which spins and contains permanent magnets.

Rotor Diameter – the diameter of the circle swept by the rotor

Rotor Speed – the revolutions per minute of the wind turbine rotor

RPM – Revolutions Per Minute. The number of times a shaft completes a full revolution in one minute.

S

Savonius Wind Turbine - 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. They are drag-type devices with two (or more) scoops that are used in anemometers, *Flettner* vents (commonly seen on bus and van roofs), and in some high-reliability low-efficiency power turbines. They are always self-starting if there are at least three scoops. They sometimes have long helical scoops to give a smooth 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 – parts of a circuit connected together with only the impedance of the leads between them OR 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 doesn't rotate. In permanent magnet alternators the stator holds the coils and laminates

Substation – a facility where transformers lower or increase electricity's voltage

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.

Swept Area – the area swept by the turbine rotor [$A=\pi R^2$ where R is the radius of the rotor

T

Tail – the vane, which is the proper term. But the term tail is commonly used

Tail Boom – a strut that holds the tail or 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.

Torque --turning force, equal to force times radius. See also Moment.

Tower – a structure that supports a wind generator, usually high in the air

Tower - are made from tubular steel (shown here), concrete, or steel lattice. Because wind speed increases with height, taller towers enable turbines to capture more energy and generate more electricity.

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.

Transmission Lines – power lines that carry high voltage electricity for long distances

TSR – Tip Speed Ratio

Turbine – a device used in the generation of electricity. The unit has a shaft with blades at

one end and electron magnets at the other end. An energy source [like steam or water] pushes the blades and making the shaft and magnets spin quickly.

Turbulence – the changes in wind speed and direction and often caused by obstacles

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.

U

Upwind – on the same side as the direction from which the wind is blowing [or windward]

Utility – a company or organization that provide a public service – such as providing electricity, water or gas.

V

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 -- 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. Has the main rotor shaft arranged vertically. Key advantages of this arrangement are that the turbine does not need to be pointed into the wind to be effective

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.

W

Watt – one Joule of electrical energy per second. In DC circuits, $\text{Watts} = \text{Volts} * \text{Amps}$. In AC circuits, $\text{Watts} = \text{Volts} * \text{Amps} * \text{the cosine of the phase angle}$. See also Volt-Amp.

Wild AC – alternating current that varies in frequency.

Wind direction: This is an "upwind" turbine, so-called because it operates facing into the wind. Other turbines are designed to run "downwind," facing away from the wind.

Wind Farm - large turbines with a are grouped together to provide power to the electrical grid. A large wind farm may consist of several hundred individual wind turbines, and cover an extended area of hundreds of square miles with the land between the turbines being used for agricultural or other purposes. A wind farm may also be located offshore.

Wind Generator – a device that captures the force of the wind to provide rotational motion to produce power with an alternator or generator.

Wind Shear — a term and calculation used to describe how wind speed increases with height above the surface of the earth. The degree of wind shear is a factor of the complexity of the terrain as well as the actual heights measured. Wind shear increases as friction between the wind and the ground becomes greater. Wind shear is not a measure of the wind speed at a site.

Wind Vane - measures wind direction and communicates with the yaw drive to orient the turbine properly with respect to the wind.

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.

Y

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.

Yaw drive - upwind turbines face into the wind; the yaw drive is used to keep the rotor facing into the wind as the wind direction changes. Downwind turbines don't require a yaw drive, the wind blows the rotor downwind.

Yaw motor – powers the yaw drive

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