

# Glossary of Energy-Related Terms

*Information Provided by the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy*

A

## **Absolute Humidity**

The ratio of the mass of water vapor to the volume occupied by a mixture of water vapor and dry air.

## **Absorbent**

A material that extracts one or more substances from a fluid (gas or liquid) medium on contact, and which changes physically and/or chemically in the process. The less volatile of the two working fluids in an absorption cooling device.

## **Absorber**

The component of a solar thermal collector that absorbs solar radiation and converts it to heat, or, as in a solar photovoltaic device, the material that readily absorbs photons to generate charge carriers (free electrons or holes).

## **Absorption**

The passing of a substance or force into the body of another substance.

## **Absorption Chiller**

A type of air cooling device that uses absorption cooling to cool interior spaces.

## **Absorption Coefficient**

In reference to a solar energy conversion devices, the degree to which a substance will absorb solar energy. In a solar photovoltaic

device, the factor by which photons are absorbed as they travel a unit distance through a material.

### **Absorption Cooling**

A process in which cooling of an interior space is accomplished by the evaporation of a volatile fluid, which is then absorbed in a strong solution, then desorbed under pressure by a heat source, and then recondensed at a temperature high enough that the heat of condensation can be rejected to a exterior space.

### **Absorption Refrigeration**

A system in which a secondary fluid absorbs the refrigerant, releasing heat, then releases the refrigerant and reabsorbs the heat. Ammonia or water is used as the vapor in commercial absorption cycle systems, and water or lithium bromide is the absorber.

### **Absorptivity**

In a solar thermal system, the ratio of solar energy striking the absorber that is absorbed by the absorber to that of solar energy striking a black body (perfect absorber) at the same temperature. The absorptivity of a material is numerically equal to its emissivity.

### **Accent lighting**

Draws attention to special features or enhances the aesthetic qualities of an indoor or outdoor environment.

### **Accumulator**

A component of a heat pump that stores liquid and keeps it from flooding the compressor. The accumulator takes the strain off the compressor and improves the reliability of the system.

### **Acid Rain**

A term used to describe precipitation that has become acidic (low pH) due to the emission of sulfur oxides from fossil fuel burning power plants.

### **Active Cooling**

The use of mechanical heat pipes or pumps to transport heat by circulating heat transfer fluids.

### **Active Power**

The power (in Watts) used by a device to produce useful work. Also called input power.

### **Active Solar Heater**

A solar water or space-heating system that use pumps or fans to circulate the fluid (water or heat-transfer fluid like diluted antifreeze) from the solar collectors to a storage tank subsystem.

### **Adiabatic**

Without loss or gain of heat to a system. An adiabatic change is a change in volume and pressure of a parcel of gas without an exchange of heat between the parcel and its surroundings. In reference to a steam turbine, the adiabatic efficiency is the ratio of the work done per pound of steam, to the heat energy released and theoretically capable of transformation into mechanical work during the adiabatic expansion of a unit weight of steam.

### **Adjustable Speed Drive**

An electronic device that controls the rotational speed of motor-driven equipment such as fans, pumps, and compressors. Speed control is achieved by adjusting the frequency of the voltage applied to the motor.

### **Adobe**

A building material made from clay, straw, and water, formed into blocks, and dried; used traditionally in the southwestern U.S.

## **Aerobic Bacteria**

Microorganisms that require free oxygen, or air, to live, and that which contribute to the decomposition of organic material in soil or composting systems.

## **Air**

The mixture of gases that surrounds the earth and forms its atmosphere, composed of, by volume, 21 percent oxygen, 78 percent nitrogen.

## **Air Change**

A measure of the rate at which the air in an interior space is replaced by outside (or conditioned) air by ventilation and infiltration; usually measured in cubic feet per time interval (hour), divided by the volume of air in the room.

## **Air Collector**

In solar heating systems, a type of solar collector in which air is heated in the collector.

## **Air Conditioner**

A device for conditioning air in an interior space. A Room Air Conditioner is a unit designed for installation in the wall or window of a room to deliver conditioned air without ducts. A Unitary Air Conditioner is composed of one or more assemblies that usually include an evaporator or cooling coil, a compressor and condenser combination, and possibly a heating apparatus. A Central Air Conditioner is designed to provide conditioned air from a central unit to a whole house with fans and ducts.

## **Air Conditioning**

The control of the quality, quantity, and temperature-humidity of the air in an interior space.

## **Air Diffuser**

An air distribution outlet, typically located in the ceiling, which mixes conditioned air with room air.

## **Air Infiltration Measurement**

A building energy auditing technique used to determine and/or locate air leaks in a building shell or envelope.

## **Airlock Entry**

A building architectural element (vestibule) with two airtight doors that reduces the amount of air infiltration and exfiltration when the exterior most door is opened.

## **Air Pollution**

The presence of contaminants in the air in concentrations that prevent the normal dispersive ability of the air, and that interfere with biological processes and human economics.

## **Air Pollution Control**

The use of devices to limit or prevent the release of pollution into the atmosphere.

## **Air Quality Standards**

The prescribed level of pollutants allowed in outside or indoor air as established by legislation.

## **Air Register**

The component of a combustion device that regulates the amount of air entering the combustion chamber.

## **Air Retarder/Barrier**

A material or structural element that inhibits air flow into and out of a building's envelope or shell. This is a continuous sheet composed of polyethylene, polypropylene, or extruded polystyrene. The sheet

is wrapped around the outside of a house during construction to reduce air in-and exfiltration, yet allow water to easily diffuse through it.

### **Air-Source Heat Pump**

A type of heat pump that transfers heat from outdoor air to indoor air during the heating season, and works in reverse during the cooling season.

### **Air Space**

The area between the layers of glazing (panes) of a window.

### **Airtight Drywall Approach (ADA)**

A building construction technique used to create a continuous air retarder that uses the drywall, gaskets, and caulking. Gaskets are used rather than caulking to seal the drywall at the top and bottom. Although it is an effective energy-saving technique, it was designed to keep airborne moisture from damaging insulation and building materials within the wall cavity.

### **Air-to-Air Heat Pump**

see Air-Source Heat Pump.

### **Air-to-Water Heat Pump**

A type of heat pump that transfers heat in outdoor air to water for space or water heating.

### **Albedo**

The ratio of light reflected by a surface to the light falling on it.

### **Alcohol**

A group of organic compounds composed of carbon, hydrogen, and oxygen; a series of molecules composed of a hydrocarbon plus a hydroxyl group; includes methanol, ethanol, isopropyl alcohol and others.

## **Algae**

Primitive plants, usually aquatic, capable of synthesizing their own food by photosynthesis.

## **Alternating Current**

A type of electrical current, the direction of which is reversed at regular intervals or cycles; in the U.S. the standard is 120 reversals or 60 cycles per second; typically abbreviated as AC.

## **Alternative Fuels**

A popular term for "non-conventional" transportation fuels derived from natural gas (propane, compressed natural gas, methanol, etc.) or biomass materials (ethanol, methanol).

## **Alternator**

A generator producing alternating current by the rotation of its rotor, and which is powered by a primary mover.

## **Ambient Air**

The air external to a building or device.

## **Ambient lighting**

Provides general illumination indoors for daily activities, and outdoors for safety and security.

## **Ambient Temperature**

The temperature of a medium, such as gas or liquid, which comes into contact with or surrounds an apparatus or building element.

## **Ammonia**

A colorless, pungent, gas (NH<sub>3</sub>) that is extremely soluble in water, may be used as a refrigerant; a fixed nitrogen form suitable as fertilizer.

## **Amorphous Semiconductor**

A non-crystalline semiconductor material that has no long-range order.

## **Ampere**

A unit of measure for an electrical current; the amount of current that flows in a circuit at an electromotive force of one Volt and at a resistance of one Ohm. Abbreviated as amp.

## **Amp-Hours**

A measure of the flow of current (in amperes) over one hour.

## **Anaerobic Bacteria**

Microorganisms that live in oxygen deprived environments.

## **Anaerobic Digestion**

The complex process by which organic matter is decomposed by anaerobic bacteria. The decomposition process produces a gaseous byproduct often called "biogas" primarily composed of methane, carbon dioxide, and hydrogen sulfide.

## **Anaerobic Digester**

A device for optimizing the anaerobic digestion of biomass and/or animal manure, and possibly to recover biogas for energy production. Digester types include batch, complete mix, continuous flow (horizontal or plug-flow, multiple-tank, and vertical tank), and covered lagoon.

## **Anaerobic Lagoon**

A holding pond for livestock manure that is designed to anaerobically stabilize manure, and may be designed to capture biogas, with the use of an impermeable, floating cover.

## **Anhydrous Ethanol**

One hundred percent alcohol; neat ethanol.

## **Anemometer**

An instrument for measuring the force or velocity of wind; a wind gauge.

## **Angle of Incidence**

In reference to solar energy systems, the angle at which direct sunlight strikes a surface; the angle between the direction of the sun and the perpendicular to the surface. Sunlight with an incident angle of 90 degrees tends to be absorbed, while lower angles tend to be reflected.

## **Angle of Inclination**

In reference to solar energy systems, the angle that a solar collector is positioned above horizontal.

## **Angstrom Unit**

A unit of length named for A.J. Angstrom, a Swedish spectroscopist, used in measuring electromagnetic radiation equal to 0.000,000,01 centimeters.

## **Annual Fuel Utilization Efficiency (AFUE)**

The measure of seasonal or annual efficiency of a residential heating furnace or boiler. It takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.

## **Annual Load Fraction**

That fraction of annual energy demand supplied by a solar system.

## **Annual Solar Savings**

The annual solar savings of a solar building is the energy savings attributable to a solar feature relative to the energy requirements of a non-solar building.

### **Anode**

The positive pole or electrode of an electrolytic cell, vacuum tube, etc. (see also sacrificial anode).

### **Anthracite (coal)**

A hard, dense type of coal, that is hard to break, clean to handle, difficult to ignite, and that burns with an intense flame and with the virtual absence of smoke because it contains a high percentage of fixed carbon and a low percentage of volatile matter.

### **Anthropogenic**

Referring to alterations in the environment due to the presence or activities of humans.

### **Antifreeze Solution**

A fluid, such as methanol or ethylene glycol, added to vehicle engine coolant, or used in solar heating system heat transfer fluids, to protect the systems from freezing.

### **Antireflection Coating**

A thin coating of a material applied to a photovoltaic cell surface that reduces the light reflection and increases light transmission.

### **Aperture**

An opening; in solar collectors, the area through which solar radiation is admitted and directed to the absorber.

### **Apparent Day**

A solar day; an interval between successive transits of the sun's center across an observer's meridian; the time thus measured is not equal to clock time.

## **Apparent Power (kVA)**

This is the voltage-ampere requirement of a device designed to convert electric energy to a non-electrical form.

## **Appliance**

A device for converting one form of energy or fuel into useful energy or work.

## **Appliance Energy Efficiency Ratings**

The ratings under which specified appliances convert energy sources into useful energy, as determined by procedures established by the U.S. Department of Energy.

## **Appliance Standards**

Standards established by the U.S. Congress for energy consuming appliances in the National Appliance Energy Conservation Act (NAECA) of 1987, and as amended in the National Appliance Energy Conservation Amendments of 1988, and the Energy Policy Act of 1992 (EPAct). NAECA established minimum standards of energy efficiency for refrigerators, refrigerator-freezers, freezers, room air conditioners, fluorescent lamp ballasts, incandescent reflector lamps, clothes dryers, clothes washers, dishwashers, kitchen ranges and ovens, pool heaters, television sets (withdrawn in 1995), and water heaters. The EPAct added standards for some fluorescent and incandescent reflector lamps, plumbing products, electric motors, and commercial water heaters and Heating, Ventilation, and Air Conditioning (HVAC) systems. It also allowed for the future development of standards for many other products. The U.S. Department of Energy (DOE) is responsible establishing the standards and the procedures that manufacturers must use to test their models. These procedures are published in the Code of Federal Regulations (10 CFR, Ch. II, Part 430), January 1, 1994 (Federal Register).

## **Argon**

A colorless, odorless inert gas sometimes used in the spaces between the panes in energy efficient windows. This gas is used because it will transfer less heat than air. Therefore, it provides additional protection against conduction and convection of heat over conventional double -pane windows.

## **Array (Solar)**

Any number of solar photovoltaic modules or solar thermal collectors or reflectors connected together to provide electrical or thermal energy.

## **Ash**

The non-combustible residue of a combusted substance composed primarily of alkali and metal oxides.

## **ASHRAE**

Abbreviation for the American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

## **ASTM**

Abbreviation for the American Society for Testing and Materials, which is responsible for the issue of many standard methods used in the energy industry.

## **Asynchronous Generator**

A type of electric generator that produces alternating current that matches an existing power source.

## **Atmospheric Pressure**

The pressure of the air at sea level; one standard atmosphere at zero degrees centigrade is equal to 14.695 pounds per square inch (1.033 kilograms per square centimeter).

**Atrium**

An interior court to which rooms open.

**Attic**

The usually unfinished space above a ceiling and below a roof.

**Attic Fan**

A fan mounted on an attic wall used to exhaust warm attic air to the outside.

**Attic Vent**

A passive or mechanical device used to ventilate an attic space, primarily to reduce heat buildup and moisture condensation.

**Audit (Energy)**

The process of determining energy consumption, by various techniques, of a building or facility.

**Automatic Damper**

A device that cuts off the flow of hot or cold air to or from a room as controlled by a thermostat.

**Automatic (or Remote) Meter Reading System**

A system that records the consumption of electricity, gas, water, etc, and sends the data to a central data accumulation device.

**Auxiliary Energy or System**

Energy required to operate mechanical components of an energy system, or a source of energy or energy supply system to back-up another.

**Availability**

Describes the reliability of power plants. It refers to the number of hours that a power plant is available to produce power divided by the total hours in a set time period, usually a year.

**Available Heat**

The amount of heat energy that may be converted into useful energy from a fuel.

**Average Demand**

The demand on, or the power output of, an electrical system or any of its parts over an interval of time, as determined by the total number of kilowatt-hours divided by the units of time in the interval.

**Average Cost**

The total cost of production divided by the total quantity produced.

**Average Wind Speed (or Velocity)**

The mean wind speed over a specified period of time.

**Avoided Cost**

The incremental cost to an electric power producer to generate or purchase a unit of electricity or capacity or both.

**Axial Fans**

Fans in which the direction of the flow of the air from inlet to outlet remains unchanged; includes propeller, tubaxial, and vaneaxial type fans.

**Axial Flow Compressor**

A type of air compressor in which air is compressed in a series of stages as it flows axially through a decreasing tubular area.

## **Axial Flow Turbine**

A turbine in which the flow of a steam or gas is essentially parallel to the rotor axis.

## **Azimuth (Solar)**

The angle between true south and the point on the horizon directly below the sun.

## **AWG**

The abbreviation for American Wire Gauge; the standard for gauging the size of wires (electrical conductors).

## **Awning**

An architectural element for shading windows and wall surfaces placed on the exterior of a building; can be fixed or movable.

## **B**

### **Backdrafting**

The flow of air down a flue/chimney and into a house caused by low indoor air pressure that can occur when using several fans or fireplaces and/or if the house is very tight.

### **Backup Energy System**

A reserve appliance; for example, a stand-by generator for a home or commercial building.

### **Bacteria**

Single-celled organisms, free-living or parasitic, that break down the wastes and bodies of dead organisms, making their components available for reuse by other organisms.

**Baffle**

A device, such as a steel plate, used to check, retard, or divert a flow of a material.

**Bagasse**

The fibrous material remaining after the extraction of juice from sugarcane; often burned by sugar mills as a source of energy.

**Baghouse**

An air pollution control device used to filter particulates from waste combustion gases; a chamber containing a bag filter.

**Balance-of-System**

In a renewable energy system, refers to all components other than the mechanism used to harvest the resource (such as photovoltaic panels or a wind turbine). Balance-of-system costs can include design, land, site preparation, system installation, support structures, power conditioning, operation and maintenance, and storage.

**Balance Point**

An outdoor temperature, usually 20 to 45 degrees Fahrenheit, at which a heat pump's output equals the heating demand. Below the balance point, supplementary heat is needed.

**Baling**

A means of reducing the volume of a material by compaction into a bale.

**Ballast**

A device used to control the voltage in a fluorescent lamp.

### **Ballast Efficacy Factor**

The measure of the efficiency of fluorescent lamp ballasts. It is the relative light output divided by the power input.

### **Ballast Factor**

The ratio of light output of a fluorescent lamp operated on a ballast to the light output of a lamp operated on a standard or reference ballast.

### **Band Gap**

In a semiconductor, the energy difference between the highest valence band and the lowest conduction band.

### **Band Gap Energy**

The amount of energy (in electron volts) required to free an outer shell electron from its orbit about the nucleus to a free state, and thus promote it from the valence to the conduction level.

### **Barrel (petroleum)**

42 U.S. gallons (306 pounds of oil, or 5.78 million Btu).

### **Basal Metabolism**

The amount of heat given off by a person at rest in a comfortable environment; approximately 50 Btu per hour (Btu/h).

### **Baseboard Radiator**

A type of radiant heating system where the radiator is located along an exterior wall where the wall meets the floor.

### **Baseload Capacity**

The power output of a power plant that can be continuously produced.

**Baseload Demand**

The minimum demand experienced by a power plant.

**Baseload Power Plant**

A power plant that is normally operated to generate a base load, and that usually operates at a constant load; examples include coal fired and nuclear fueled power plants.

**Basement**

The conditioned or unconditioned space below the main living area or primary floor of a building.

**Base Power**

Power generated by a power generator that operates at a very high capacity factor.

**Batch Heater**

This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. A batch heater is mounted on the ground or on the roof (make sure your roof structure is strong enough to support it). Some batch heaters use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit radiative loss. Also known as bread box systems or integral collector storage systems.

**Batch Process**

A process for carrying out a reaction in which the reactants are fed in discrete and successive charges.

**Batt/Blanket**

A flexible roll or strip of insulating material in widths suited to standard spacings of building structural members (studs and joists). They are made from glass or rock wool fibers. Blankets are continuous rolls. Batts are pre-cut to four or eight foot lengths.

**Battery**

An energy storage device composed of one or more electrolyte cells.

**Battery Energy Storage**

Energy storage using electrochemical batteries. The three main applications for battery energy storage systems include spinning reserve at generating stations, load leveling at substations, and peak shaving on the customer side of the meter.

**Beadwall**

A form of movable insulation that uses tiny polystyrene beads blown into the space between two window panes.

**Beam Radiation**

Solar radiation that is not scattered by dust or water droplets.

**Bearing Wall**

A wall that carries ceiling rafters or roof trusses.

**Benefits Charge**

The addition of a per unit tax on sales of electricity, with the revenue generated used for or to encourage investments in energy efficiency measures and/or renewable energy projects.

**Bimetal**

Two metals of different coefficients of expansion welded together so that the piece will bend in one direction when heated, and in the other when cooled, and can be used to open or close electrical circuits, as in thermostats.

**Binary Cycle**

Combination of two power plant turbine cycles utilizing two different working fluids for power production. The waste heat from the first

turbine cycle provides the heat energy for the operation of the second turbine, thus providing higher overall system efficiencies.

### **Binary Cycle Geothermal Plants**

Binary cycle systems can be used with liquids at temperatures less than 350 F (177 C). In these systems, the hot geothermal liquid vaporizes a secondary working fluid, which then drives a turbine.

### **Bin Method**

A method of predicting heating and/or cooling loads using instantaneous load calculation at different outdoor dry-bulb temperatures, and multiplying the result by the number of hours of occurrence of each temperature.

### **Biochemical Oxygen Demand**

The weight of oxygen taken up mainly as a result of the oxidation of the constituents of a sample of water by biological action; expressed as the number of parts per million of oxygen taken up by the sample from water originally saturated with air, usually over a period of five days at 20 degrees centigrade. A standard means of estimating the degree of contamination of water.

### **Bioconversion**

The conversion of one form of energy into another by the action of plants or microorganisms. The conversion of biomass to ethanol, methanol, or methane.

### **Bioenergy**

The conversion of the complex carbohydrates in organic material into energy.

### **Biogas**

A combustible gas created by anaerobic decomposition of organic material, composed primarily of methane, carbon dioxide, and hydrogen sulfide.

## **Biogasification or biomethanization**

The process of decomposing biomass with anaerobic bacteria to produce biogas.

## **Biomass**

As defined by the Energy Security Act (PL 96-294) of 1980, "any organic matter which is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants."

## **Biomass Energy**

Energy produced by the conversion of biomass directly to heat or to a liquid or gas that can be converted to energy.

## **Biomass Fuel**

Biomass converted directly to energy or converted to liquid or gaseous fuels such as ethanol, methanol, methane, and hydrogen.

## **Biomass Gasification**

The conversion of biomass into a gas, by biogasification (see above) or thermal gasification, in which hydrogen is produced from high-temperature gasifying and low-temperature pyrolysis of biomass.

## **Biophotolysis**

The action of light on a biological system that results in the dissociation of a substrate, usually water, to produce hydrogen.

## **Blackbody**

An ideal substance that absorbs all radiation falling on it, and reflecting nothing.

## **Blower**

The device in an air conditioner that distributes the filtered air from the return duct over the cooling coil/heat exchanger. This circulated air is cooled/heated and then sent through the supply duct, past dampers, and through supply diffusers to the living/working space.

## **Blower Door**

A device used by energy auditors to pressurize a building to locate places of air leakage and energy loss.

## **Blown In Insulation (see also Loose Fill)**

An insulation product composed of loose fibers or fiber pellets that are blown into building cavities or attics using special pneumatic equipment.

## **Boiler**

A vessel or tank where heat produced from the combustion of fuels such as natural gas, fuel oil, or coal is used to generate hot water or steam for applications ranging from building space heating to electric power production or industrial process heat.

## **Boiler Feedwater**

The water that is forced into a boiler to take the place of that which is evaporated in the generation of steam.

## **Boiler Horsepower**

A unit of rate of water evaporation equal to the evaporation per hour of 34.5 pounds of water at a temperature of 212 degrees Fahrenheit into steam at 212 degrees F.

## **Boiler Pressure**

The pressure of the steam or water in a boiler as measured; usually expressed in pounds per square inch gauge (psig).

**Boiler Rating**

The heating capacity of a steam boiler; expressed in Btu per hour (Btu/h), or horsepower, or pounds of steam per hour.

**Bone (Oven) Dry**

In reference to solid biomass fuels, such as wood, having zero moisture content.

**Bone Dry Unit**

A quantity of (solid) biomass fuel equal to 2,400 pounds bone dry.

**Booster Pump**

A pump for circulating the heat transfer fluid in a hydronic heating system.

**Boot**

In heating and cooling system distribution ductwork, the transformation pieces connecting horizontal round leaders to vertical rectangular stacks.

**Boron**

The chemical element commonly used as the dopant in solar photovoltaic device or cell material.

**Bottled Gas**

A generic term for liquefied and pressurized gas, ordinarily butane, propane, or a mixture of the two, contained in a cylinder for domestic use.

**Bottoming-cycle**

A means to increase the thermal efficiency of a steam electric generating system by converting some waste heat from the condenser into electricity. The heat engine in a bottoming cycle would be a condensing turbine similar in principle to a steam turbine

but operating with a different working fluid at a much lower temperature and pressure.

### **Brayton Cycle**

A thermodynamic cycle using constant pressure, heat addition and rejection, representing the idealized behavior of the working fluid in a gas turbine type heat engine.

### **Bread Box System**

This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. A bread box system is mounted on the ground or on the roof (make sure your roof structure is strong enough to support it). Some systems use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit radiative loss. Also known as batch heaters or integral collector storage systems.

### **Brine**

Water saturated or strongly impregnated with salt.

### **British Thermal Unit (Btu)**

The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories.

### **Building Energy Ratio**

The space-conditioning load of a building.

### **Building Envelope**

The structural elements (walls, roof, floor, foundation) of a building that encloses conditioned space; the building shell.

### **Building Heat-Loss Factor**

A measure of the heating requirements of a building expressed in Btu per degree-day.

### **Building Orientation**

The relationship of a building to true south, as specified by the direction of its longest axis.

### **Building Overall Energy Loss Coefficient-Area Product**

The factor, when multiplied by the monthly degree-days, that yields the monthly space heating load.

### **Building Overall Heat Loss Rate**

The overall rate of heat loss from a building by means of transmission plus infiltration, expressed in Btu per hour, per degree temperature difference between the inside and outside.

### **Bulb**

The transparent or opaque sphere in an electric light that the electric light transmits through.

### **Bulb Turbine**

A type of hydro turbine in which the entire generator is mounted inside the water passageway as an integral unit with the turbine. These installations can offer significant reductions in the size of the powerhouse.

### **Bulk Density**

The weight of a material per unit of volume compared to the weight of the same volume of water.

### **Burner Capacity**

The maximum heat output (in Btu per hour) released by a burner with a stable flame and satisfactory combustion.

### **Burning Point**

The temperature at which a material ignites.

**Bus (electrical)**

An electrical conductor that serves as a common connection for two or more electrical circuits; may be in the form of rigid bars or stranded conductors or cables.

**Busbar**

The power conduit of an electric power plant; the starting point of the electric transmission system.

**Busbar Cost**

The cost of producing electricity up to the point of the power plant busbar.

**Bypass**

An alternative path. In a heating duct or pipe, an alternative path for the flow of the heat transfer fluid from one point to another, as determined by the opening or closing of control valves both in the primary line and the bypass line.

**C****Cage**

The component of an electric motor composed of solid bars (of usually copper or aluminum) arranged in a circle and connected to continuous rings at each end. This cage fits inside the stator in an induction motor in channels between laminations, thin flat discs of steel in a ring configuration.

**Calorie**

The amount of heat required to raise the temperature of a unit of water, at or near the temperature of maximum density, one degree Celsius (or Centigrade [C]); expressed as a "small calorie" (the amount of heat required to raise the temperature of 1 gram of water one degree C), or as a "large calorie" or "kilogram calorie" (the amount of heat required to raise one kilogram [1,000 grams]

of water one degree C); capitalization of the word calorie indicates a kilogram-calorie.

### **Calorific Value**

The heat liberated by the combustion of a unit quantity of a fuel under specific conditions; measured in calories.

### **Candela**

The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency  $540 \times 10^{12}$  hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

### **Candle Power**

The illuminating power of a standard candle employed as a unit for determining the illuminating quality of an illuminant.

### **Capability**

The maximum load that a generating unit, power plant, or other electrical apparatus can carry under specified conditions for a given period of time, without exceeding its approved limits of temperature and stress.

### **Capability Margin**

The difference between net electrical system capability and system maximum load requirements (peak load); the margin of capability available to provide for scheduled maintenance, emergency outages, system operating requirements and unforeseen loads.

### **Capacitance**

A measure of the electrical charge of a capacitor consisting of two plates separated by an insulating material.

## **Capacitor**

An electrical device that adjusts the leading current of an applied alternating current to balance the lag of the circuit to provide a high power factor.

## **Capacity**

The load that a power generation unit or other electrical apparatus or heating unit is rated by the manufacture to be able to meet or supply.

### **Capacity (Condensing Unit)**

The refrigerating effect in Btu/h produced by the difference in total enthalpy between a refrigerant liquid leaving the unit and the total enthalpy of the refrigerant vapor entering it. Generally measured in tons or Btu/h.

### **Capacity (Effective, of a motor)**

The maximum load that a motor is capable of supplying.

### **Capacity (Heating, of a material)**

The amount of heat energy needed to raise the temperature of a given mass of a substance by one degree Celsius. The heat required to raise the temperature of 1 kg of water by 1 degree Celsius is 4186 Joules.

## **Capacity Factor**

The ratio of the average load on (or power output of) a generating unit or system to the capacity rating of the unit or system over a specified period of time.

## **Capital Costs**

The amount of money needed to purchase equipment, buildings, tools, and other manufactured goods that can be used in production.

## **Carbon Dioxide**

A colorless, odorless noncombustible gas with the formula  $\text{CO}_2$  that is present in the atmosphere. It is formed by the combustion of carbon and carbon compounds (such as fossil fuels and biomass), by respiration, which is a slow combustion in animals and plants, and by the gradual oxidation of organic matter in the soil.

## **Carbon Monoxide**

A colorless, odorless but poisonous combustible gas with the formula  $\text{CO}$ . Carbon monoxide is produced in the incomplete combustion of carbon and carbon compounds such as fossil fuels (i.e. coal, petroleum) and their products (e.g. liquefied petroleum gas, gasoline), and biomass.

## **Carbon Zinc Cell Battery**

A cell produces electric energy by the galvanic oxidation of carbon; commonly used in household appliances.

## **Carnot Cycle**

An ideal heat engine (conceived by Sadi Carnot) in which the sequence of operations forming the working cycle consists of isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression back to its initial state.

## **Catalytic Converter**

An air pollution control device that removes organic contaminants by oxidizing them into carbon dioxide and water through a chemical reaction using a catalysis, which is a substance that increases (or decreases) the rate of a chemical reaction without being changed itself; required in all automobiles sold in the United State, and used in some types of heating appliances.

## **Cathedral Ceiling/Roof**

A type of ceiling and roof assembly that has no attic.

**Cathode**

The negative pole or electrode of an electrolytic cell, vacuum tube, etc., where electrons enter (current leaves) the system; the opposite of an anode.

**Cathode Disconnect Ballast**

An electromagnetic ballast that disconnects a lamp's electrode heating circuit once it has started; often called "low frequency electronic" ballasts.

**Cathodic Protection**

A method of preventing oxidation of the exposed metal in structures by imposing between the structure and the ground a small electrical voltage.

**Caulking**

A material used to seal areas of potential air leakage into or out of a building envelope.

**Ceiling**

The downward facing structural element that is directly opposite the floor.

**Ceiling Fan**

A mechanical device used for air circulation and to provide cooling.

**Cell**

A component of an electrochemical battery. A 'primary' cell consists of two dissimilar elements, known as 'electrodes,' immersed in a liquid or paste known as the 'electrolyte.' A direct current of 1-1.5 volts will be produced by this cell. A 'secondary' cell or accumulator is a similar design but is made useful by passing a direct current of

correct strength through it in a certain direction. Each of these cells will produce 2 volts; a 12 volt car battery contains six cells.

### **Cellulase**

An enzyme complex, produced by fungi and bacteria, capable of decomposing cellulose into small fragments, primarily glucose.

### **Cellulose**

The fundamental constituent of all vegetative tissue; the most abundant material in the world.

### **Cellulose Insulation**

A type of insulation composed of waste newspaper, cardboard, or other forms of waste paper.

### **Central Heating System**

A system where heat is supplied to areas of a building from a single appliance through a network of ducts or pipes.

### **Central Power Plant**

A large power plant that generates power for distribution to multiple customers.

### **Central Receiver Solar Power Plants**

Also known as "power towers," these use fields of two-axis tracking mirrors known as heliostats. Each heliostat is individually positioned by a computer control system to reflect the sun's rays to a tower-mounted thermal receiver. The effect of many heliostats reflecting to a common point creates the combined energy of thousands of suns, which produces high-temperature thermal energy. In the receiver, molten nitrate salts absorb the heat energy. The hot salt is then used to boil water to steam, which is sent to a conventional steam turbine-generator to produce electricity.

**Cetane Number**

A measure of a fuel's (liquid) ease of self-ignition.

**Char**

A byproduct of low-temperature carbonization of a solid fuel.

**Charcoal**

A material formed from the incomplete combustion or destructive distillation (carbonization) of organic material in a kiln or retort, and having a high energy density, being nearly pure carbon. (If produced from coal, it is coke.) Used for cooking, the manufacture of gunpowder and steel (notably in Brazil), as an absorbent and decolorizing agent, and in sugar refining and solvent recovery.

**Charge Carrier**

A free and mobile conduction electron or hole in a semiconductor.

**Charge Controller**

An electronic device that regulates the electrical charge stored in batteries so that unsafe, overcharge conditions for the batteries are avoided.

**Chemical Energy**

The energy liberated in a chemical reaction, as in the combustion of fuels.

**Chemical Vapor Deposition (CVD)**

A method of depositing thin semiconductor films used to make certain types of solar photovoltaic devices. With this method, a substrate is exposed to one or more vaporized compounds, one or more of which contain desirable constituents. A chemical reaction is initiated, at or near the substrate surface, to produce the desired material that will condense on the substrate.

## **Chiller**

A device for removing heat from a gas or liquid stream for air conditioning/cooling.

## **Chimney**

A masonry or metal stack that creates a draft to bring air to a fire and to carry the gaseous byproducts of combustion safely away.

## **Chimney Effect**

The tendency of heated air or gas to rise in a duct or other vertical passage, such as in a chimney, small enclosure, or building, due to its lower density compared to the surrounding air or gas.

## **Chlorofluorocarbon (CFC)**

A family of chemicals composed primarily of carbon, hydrogen, chlorine, and fluorine whose principal applications are as refrigerants and industrial cleansers and whose principal drawback is the tendency to destroy the Earth's protective ozone layer.

## **Circuit**

A device, or system of devices, that allows electrical current to flow through it and allows voltage to occur across positive and negative terminals.

## **Circuit Breaker**

A device used to interrupt or break an electrical circuit when an overload condition exists; usually installed in the positive circuit; used to protect electrical equipment.

## **Circuit Lag**

As time increases from zero at the terminals of an inductor, the voltage comes to a particular value on the sine function curve ahead of the current. The voltage reaches its negative peak exactly 90 degrees before the current reaches its negative peak thus the current lags behind by 90 degrees.

## **Circulating Fluidized Bed**

A type of furnace or reactor in which the emission of sulfur compounds is lowered by the addition of crushed limestone in the fluidized bed thus obviating the need for much of the expensive stack gas clean-up equipment. The particles are collected and recirculated, after passing through a conventional bed, and cooled by boiler internals.

## **Clean Power Generator**

A company or other organizational unit that produces electricity from sources that are thought to be environmentally cleaner than traditional sources. Clean, or green, power is usually defined as power from renewable energy that comes from wind, solar, biomass energy, etc. There are various definitions of clean resources. Some definitions include power produced from waste-to-energy and wood-fired plants that may still produce significant air emissions. Some states have defined certain local resources as clean that other states would not consider clean. For example, the state of Texas has defined power from efficient natural gas-fired power plants as clean. Some northwest states include power from large hydropower projects as clean although these projects damage fish populations. Various states have disclosure and labeling requirement for generation source and air emissions that assist customers in comparing electricity characteristics other than price. This allows customers to decide for themselves what they consider to be "clean." The federal government is also exploring this issue.

## **Cleavage of Lateral Epitaxial Films for Transfer (CLEFT)**

A process for making inexpensive Gallium Arsenide (GaAs) photovoltaic cells in which a thin film of GaAs is grown atop a thick, single-crystal GaAs (or other suitable material) substrate and then is cleaved from the substrate and incorporated into a cell, allowing the substrate to be reused to grow more thin-film GaAs.

## **Clerestory**

A window located high in a wall near the eaves that allows daylight into a building interior, and may be used for ventilation and solar heat gain.

## **Climate**

The prevailing or average weather conditions of a geographic region.

## **Climate Change**

A term used to describe short and long-term effects on the Earth's climate as a result of human activities such as fossil fuel combustion and vegetation clearing and burning.

## **Close Coupled**

An energy system in which the fuel production equipment is in close proximity, or connected to, the fuel using equipment.

## **Closed Cycle**

A system in which a working fluid is used over and over without introduction of new fluid, as in a hydronic heating system or mechanical refrigeration system.

## **Closed-Loop Geothermal Heat Pump Systems**

Closed-loop (also known as "indirect") systems circulate a solution of water and antifreeze through a series of sealed loops of piping. Once the heat has been transferred into or out of the solution, the solution is recirculated. The loops can be installed in the ground horizontally or vertically, or they can be placed in a body of water, such as a pond. See [horizontal ground loop](#), [vertical ground loop](#), [slinky ground loop](#), and [surface water loop](#) for more information on the different types of closed-loop geothermal heat pump systems.

## **Closed-Loop Biomass**

As defined by the Comprehensive National Energy Act of 1992 (or the Energy Policy Act; EAct): any organic matter from a plant which is planted for the exclusive purpose of being used to produce energy." This does not include wood or agricultural wastes or standing timber.

## **Codes**

Legal documents that regulate construction to protect the health, safety, and welfare of people. Codes establish minimum standards but do not guarantee efficiency or quality.

## **Coefficient of Heat Transmission (U-Value)**

A value that describes the ability of a material to conduct heat. The number of Btu that flow through 1 square foot of material, in one hour. It is the reciprocal of the R-Value ( $U\text{-Value} = 1/R\text{-Value}$ ).

## **Coefficient of Performance (COP)**

A ratio of the work or useful energy output of a system versus the amount of work or energy inputted into the system as determined by using the same energy equivalents for energy in and out. Is used as a measure of the steady state performance or energy efficiency of heating, cooling, and refrigeration appliances. The COP is equal to the Energy Efficiency Ratio (EER) divided by 3.412. The higher the COP, the more efficient the device.

## **Coefficient of Utilization (CU)**

A term used for lighting appliances; the ratio of lumens received on a flat surface to the light output, in lumens, from a lamp; used to evaluate the effectiveness of luminaries in delivering light.

## **Coincidence Factor**

The ratio of the coincident, maximum demand or two or more loads to the sum of their noncoincident maximum demand for a given

period; the reciprocal of the diversity factor, and is always less than or equal to one.

### **Coincident Demand**

The demand of a consumer of electricity at the time of a power supplier's peak system demand.

### **Cofiring**

The use of two or more different fuels (e.g. wood and coal) simultaneously in the same combustion chamber of a power plant.

### **Cogeneration**

The generation of electricity or shaft power by an energy conversion system and the concurrent use of rejected thermal energy from the conversion system as an auxiliary energy source.

### **Cogenerator**

A class of energy producer that produces both heat and electricity from a single fuel.

### **Coil**

As a component of a heating or cooling appliance, rows of tubing or pipe with fins attached through which a heat transfer fluid is circulated and to deliver heat or cooling energy to a building.

### **Cold Night Sky**

The low effective temperature of the sky on a clear night.

### **Collector**

The component of a solar energy heating system that collects solar radiation, and that contains components to absorb solar radiation and transfer the heat to a heat transfer fluid (air or liquid).

## **Collector Efficiency**

The ratio of solar radiation captured and transferred to the collector (heat transfer) fluid.

## **Collector Fluid**

The fluid, liquid (water or water/antifreeze solution) or air, used to absorb solar energy and transfer it for direct use, indirect heating of interior air or domestic water, and/or to a heat storage medium.

## **Collector Tilt**

The angle that a solar collector is positioned from horizontal.

## **Color Rendition**

How colors appear when illuminated by a light source. Color rendition is generally considered to be a more important lighting quality than color temperature. Most objects are not a single color, but a combination of many colors. Light sources that are deficient in certain colors may change the apparent color of an object. The Color Rendition Index (CRI) is a 1–100 scale that measures a light source's ability to render colors the same way sunlight does. The top value of the CRI scale (100) is based on illumination by a 100-watt incandescent light bulb. A light source with a CRI of 80 or higher is considered acceptable for most indoor residential applications.

## **Color Rendition (Rendering) Index (CRI)**

A measure of light quality. The maximum CRI value of 100 is given to natural daylight and incandescent lighting. The closer a lamp's CRI rating is to 100, the better its ability to show true colors to the human eye.

## **Color Temperature**

The color of the light source. By convention, yellow-red colors (like the flames of a fire) are considered warm, and blue-green colors (like light from an overcast sky) are considered cool. Color

temperature is measured in Kelvin (K) temperature. Confusingly, higher Kelvin temperatures (3600–5500 K) are what we consider cool and lower color temperatures (2700–3000 K) are considered warm. Cool light is preferred for visual tasks because it produces higher contrast than warm light. Warm light is preferred for living spaces because it is more flattering to skin tones and clothing. A color temperature of 2700–3600 K is generally recommended for most indoor general and task lighting applications.

### **Combined-Cycle Power Plant**

A power plant that uses two thermodynamic cycles to achieve higher overall system efficiency; e.g.: the heat from a gas-fired combustion turbine is used to generate steam for heating or to operate a steam turbine to generate additional electricity.

### **Combustion**

The process of burning; the oxidation of a material by applying heat, which unites oxygen with a material or fuel.

### **Combustion Air**

Air that provides the necessary oxygen for complete, clean combustion and maximum heating value.

### **Combustion Chamber**

Any wholly or partially enclosed space in which combustion takes place.

### **Combustion Gases**

The gaseous byproducts of the combustion of a fuel.

### **Combustion Power Plant**

A power plant that generates power by combusting a fuel.

### **Combustion Turbine**

A turbine that generates power from the combustion of a fuel.

## **Commercial Building**

A building with more than 50 percent of its floor space used for commercial activities, which include stores, offices, schools, churches, libraries, museums, health care facilities, warehouses, and government buildings except those on military bases.

## **Commercial Sector**

Consists of businesses that are not engaged in transportation or manufacturing or other types of industrial activities. Standard Industrial Classification (SIC) codes for commercial establishments are 50 through 87, 89, and 91 through 97.

## **Comfort Zone**

A frequently used room or area that is maintained at a more comfortable level than the rest of the house; also known as a "warm room."

## **Commissioning**

The process by which a power plant, apparatus, or building is approved for operation based on observed or measured operation that meets design specifications.

## **Compact Fluorescent**

A smaller version of standard fluorescent lamps which can directly replace standard incandescent lights. These lights consist of a gas filled tube, and a magnetic or electronic ballast.

## **Complete Mix Digester**

A type of anaerobic digester that has a mechanical mixing system and where temperature and volume are controlled to maximize the anaerobic digestion process for biological waste treatment, methane production, and odor control.

## **Composting**

The process of degrading organic material (biomass) by microorganisms in aerobic conditions.

## **Composting Toilet**

A self-contained toilet that use the process of aerobic decomposition (composting) to break down feces into humus and odorless gases.

## **Compound Paraboloid Collector**

A form of solar concentrating collector that does not track the sun.

## **Compressed Air Storage**

The storage of compressed air in a container for use to operate a prime mover for electricity generation.

## **Compressed Natural Gas (CNG)**

Natural gas (methane) that has been compressed to a higher pressure gaseous state by a compressor; used in CNG vehicles.

## **Compression Chiller**

A cooling device that uses mechanical energy to produce chilled water.

## **Compressor**

A device used to compress air for mechanical or electrical power production, and in air conditioners, heat pumps, and refrigerators to pressurize the refrigerant and enabling it to flow through the system.

## **Concentrating (Solar) Collector**

A solar collector that uses reflective surfaces to concentrate sunlight onto a small area, where it is absorbed and converted to heat or, in the case of solar photovoltaic (PV) devices, into electricity. Concentrators can increase the power flux of sunlight hundreds of

times. The principal types of concentrating collectors include: compound parabolic, parabolic trough, fixed reflector moving receiver, fixed receiver moving reflector, Fresnel lense, and central receiver. A PV concentrating module uses optical elements (Fresnel lense) to increase the amount of sunlight incident onto a PV cell. Concentrating PV modules/arrays must track the sun and use only the direct sunlight because the diffuse portion cannot be focused onto the PV cells. Concentrating collectors for home or small business solar water heating applications are usually parabolic troughs that concentrate the sun's energy on an absorber tube (called a receiver), which contains a heat-transfer fluid.

### **Condensate**

The liquid resulting when water vapor contacts a cool surface; also the liquid resulting when a vaporized working fluid (such as a refrigerant) is cooled or depressurized.

### **Condensation**

The process by which water in air changes from a vapor to a liquid due to a change in temperature or pressure; occurs when water vapor reaches its dew point (condensation point); also used to express the existence of liquid water on a surface.

### **Condenser**

The device in an air conditioner or heat pump in which the refrigerant condenses from a gas to a liquid when it is depressurized or cooled.

### **Condenser Coil**

The device in an air conditioner or heat pump through which the refrigerant is circulated and releases heat to the surroundings when a fan blows outside air over the coils. This will return the hot vapor that entered the coil into a hot liquid upon exiting the coil.

## **Condensing Furnace**

A type of heating appliance that extracts so much of the available heat content from a combusted fuel that the moisture in the combustion gases condenses before it leaves the furnace. Also this furnace circulates a liquid to cool the furnace's heat exchanger. The heated liquid may either circulate through a liquid-to-air heat exchanger to warm room air, or it may circulate through a coil inside a separate indirect-fired water heater.

## **Condensing Unit**

The component of a central air conditioner that is designed to remove heat absorbed by the refrigerant and transfer it outside the conditioned space.

## **Conditioned Space**

The interior space of a building that is heated or cooled.

## **Conduction**

The transfer of heat through a material by the transfer of kinetic energy from particle to particle; the flow of heat between two materials of different temperatures that are in direct physical contact.

## **Conduction Band**

An energy band in a semiconductor in which electrons can move freely in a solid, producing a net transport of charge.

## **Conductivity (Thermal)**

This is a positive constant,  $k$ , that is a property of a substance and is used in the calculation of heat transfer rates for materials. It is the amount of heat that flows through a specified area and thickness of a material over a specified period of time when there is a temperature difference of one degree between the surfaces of the material.

## **Conductor**

The material through which electricity is transmitted, such as an electrical wire, or transmission or distribution line.

## **Conduit**

A tubular material used to encase and protect one or more electrical conductors.

## **Congressional (Energy) Committees:**

House Subcommittee on Energy and Environment — This committee has legislative jurisdiction and general and special oversight and investigative authority on all matters relating to energy and environmental research and development and demonstration.

House Water and Power Committee — This committee has oversight over the generation and marketing of electric power from federal water projects by federally chartered or Federal RPM authorities, measures and matters concerning water resources planning, compacts relating to use and apportionment of interstate waters, water rights or power movement programs, measures and matters pertaining to irrigation and reclamation projects and other water resources development programs.

Senate Committee on Energy and Natural Resources — This committee has jurisdiction on: coal production, distribution and utilization; energy policy; energy research, conservation, and development; hydroelectric power; irrigation; mineral conservation; nonmilitary development of nuclear energy; solar energy systems; and over territorial possessions, including trusteeships of the United States.

Senate Subcommittee on Energy Research, Development, Production and Regulation — This committee has jurisdiction on the oversight and legislative responsibilities for: coal, nuclear, and non-nuclear energy commercialization projects; DOE National Laboratories; global climate change; new technologies research and development; commercialization of new technologies including,

solar energy systems; Federal energy conservation programs; energy information; and power provider policy.

### **Connected Load**

The sum of the ratings of the electricity consuming apparatus connected to a generating system.

### **Connection Charge**

An amount paid by a customer for being connected to an electricity supplier's transmission and distribution system.

### **Conservation**

To reduce or avoid the consumption of a resource or commodity.

### **Conservation Cost Adjustment**

A means of billing electric power consumers to pay for the costs of demand side management/energy conservation measures and programs. (See also Benefits Charge.)

### **Constant Dollars**

The value or purchasing power of a dollar in a specified year carried forward or backward.

### **Constant-Speed Wind Turbines**

Wind turbines that operate at a constant rotor revolutions per minute (RPM) and are optimized for energy capture at a given rotor diameter at a particular speed in the wind power curve.

### **Consumption Charge**

The part of a power provider's charge based on actual energy consumed by the customer; the product of the kilowatt-hour rate and the total kilowatt-hours consumed.

**Contact Resistance**

The resistance between metallic contacts and the semiconductor.

**Continuous Fermentation**

A steady-state fermentation process.

**Contrast**

The difference between the brightness of an object compared to that of its immediate background.

**Convection**

The transfer of heat by means of air currents.

**Conventional Fuel**

The fossil fuels: coal, oil, and natural gas.

**Conventional Heat Pump**

This type of heat pump is known as an air-to air system.

**Conventional Power**

Power generation from sources such as petroleum, natural gas, or coal. In some cases, large-scale hydropower and nuclear power generation are considered conventional sources.

**Conversion Efficiency**

The amount of energy produced as a percentage of the amount of energy consumed.

**Converter**

A device for transforming the quality and quantity of electrical energy; also an inverter.

**Cooling Capacity**

The quantity of heat that a cooling appliance is capable of removing from a room in one hour.

### **Cooling Degree Day**

A value used to estimate interior air cooling requirements (load) calculated as the number of degrees per day (over a specified period) that the daily average temperature is above 65 degrees Fahrenheit (or some other, specified base temperature). The daily average temperature is the mean of the maximum and minimum temperatures recorded for a specific location for a 24 hour period.

### **Cooling Load**

That amount of cooling energy to be supplied (or heat and humidity removed) based on the sensible and latent loads.

### **Cooling Pond**

A body of water used to cool the water that is circulated in an electric power plant.

### **Cooling Tower**

A structure used to cool power plant water; water is pumped to the top of the tubular tower and sprayed out into the center, and is cooled by evaporation as it falls, and then is either recycled within the plant or is discharged.

### **Coproducts**

The potentially useful byproducts of ethanol fermentation process.

### **Cord (of Wood)**

A stack of wood 4 feet by 4 feet by 8 feet.

### **Coulomb**

A unit for the quantity of electricity transported in 1 second by a current of 1 ampere.

## **Counterflow Heat Exchanger**

A heat exchanger in which two fluids flow in opposite directions for transfer heat energy from one to the other.

## **Covenants**

Restrictions on the use of a property.

## **Crawlspace**

The unoccupied, and usually unfinished and unconditioned space between the floor, foundation walls, and the slab or ground of a building.

## **Creosote**

A liquid byproduct of wood combustion (or distillation) that condenses on the internal surfaces of vents and chimneys, which if not removed regularly, can corrode the surfaces and fuel a chimney fire.

## **Critical Compression Pressure**

The highest possible pressure in a fuel-air mixture before spontaneous ignition occurs.

## **Crystalline Silicon Photovoltaic Cell**

A type of photovoltaic cell made from a single crystal or a polycrystalline slice of silicon. Crystalline silicon cells can be joined together to form a module (or panel).

## **Cubic Foot (of Natural Gas)**

A unit of volume equal to 1 cubic foot at a pressure base of 14.73 pounds standard per square inch absolute and a temperature base of 60 degrees Fahrenheit.

**Cube Law**

In reference to wind energy, for any given instant, the power available in the wind is proportional to the cube of the wind velocity; when wind speed doubles, the power availability increases eight times.

**Current (Electrical)**

The flow of electrical energy (electricity) in a conductor, measured in amperes.

**Current Dollars**

The value or purchasing power of a dollar that has not been reduced to a common basis of constant purchasing power, but instead reflects anticipated future inflation; when used in computations the assumed inflation rate must be stated.

**Customer Charge**

An amount to be paid for energy periodically by a customer without regard to demand or energy consumption.

**Customer Class**

Categories of energy consumers, as defined by consumption or demand levels, patterns, and conditions, and generally included residential, commercial, industrial, agricultural.

**Cut-In-Speed**

The lowest wind speed at which a wind turbine begins producing usable power.

**Cut-Out-Speed**

The highest wind speed at which a wind turbine stops producing power.

## **Cycle**

In alternating current, the current goes from zero potential or voltage to a maximum in one direction, back to zero, and then to a maximum potential or voltage in the other direction. The number of complete cycles per second determines the current frequency; in the U.S. the standard for alternating current is 60 cycles.

## **Cycling Losses**

The loss of heat as the water circulates through a water heater tank and inlet and outlet pipes.

## **Cyclone Burner**

A furnace/combustion chamber in which finely ground fuel is blown in spirals in the combustion chamber to maximize combustion efficiency.

## **Czochralski Process**

A method of growing large size, high quality semiconductor crystal by slowly lifting a seed crystal from a molten bath of the material under careful cooling conditions.

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## **D**

### **Dam**

A structure for impeding and controlling the flow of water in a water course, and which increases the water elevation to create the hydraulic head. The reservoir creates, in effect, stored energy.

### **Damper**

A movable plate used to control air flow; in a wood stove or fireplace, used to control the amount and direction of air going to the fire.

## **Darrius (Wind) Machine**

A type of vertical-axis wind machine that has long, thin blades in the shape of loops connected to the top and bottom of the axle; often called an "eggbeater windmill."

## **Daylighting**

The use of direct, diffuse, or reflected sunlight to provide supplemental lighting for building interiors.

## **Decentralized (Energy) System**

Energy systems supply individual, or small-groups, of energy loads.

## **Declination**

The angular position of the sun at solar noon with respect to the plane of the equator.

## **Declining Block Rate**

An electricity supplier rate structure in which the per unit price of electricity decreases as the amount of energy increases. Normally only available to very large consumers.

## **Decommissioning**

The process of removing a power plant, apparatus, equipment, building, or facility from operation.

## **Decomposition**

The process of breaking down organic material; reduction of the net energy level and change in physical and chemical composition of organic material.

## **De-energize(d)**

To disconnect a transmission and/or distribution line; a power line that is not carrying a current; to open a circuit.

## **Deep Discharge**

Discharging a battery to 20 percent or less of its full charge capacity.

## **Degree Day**

A unit for measuring the extent that the outdoor daily average temperature (the mean of the maximum and minimum daily dry-bulb temperatures) falls below (in the case of heating, see Heating Degree Day), or falls above (in the case of cooling, see Cooling Degree Day) an assumed base temperature, normally taken as 65 degrees Fahrenheit, unless otherwise stated. One degree day is counted for each degree below (for heating) or above (in the case of cooling) the base, for each calendar day on which the temperature goes below or above the base.

## **Degree Hour**

The product of 1 hour, and usually the number of degrees Fahrenheit the hourly mean temperature is above a base point (usually 65 degrees Fahrenheit); used in roughly estimating or measuring the cooling load in cases where processes heat, heat from building occupants, and humidity are relatively unimportant compared to the dry-bulb temperature.

## **Dehumidifier**

A device that cools air by removing moisture from it.

## **Demand**

The rate at which electricity is delivered to or by a system, part of a system, or piece of equipment expressed in kilowatts, kilovoltamperes, or other suitable unit, at a given instant or averaged over a specified period of time.

## **Demand Charge**

A charge for the maximum rate at which energy is used during peak hours of a billing period. That part of a power provider service charged for on the basis of the possible demand as distinguished from the energy actually consumed.

## **Demand(ed) Factor**

The ratio of the maximum demand on an electricity generating and distribution system to the total connected load on the system; usually expressed as a percentage.

## **Demand Power**

see Peak Power

## **Demand-Side Management (DSM)**

The process of managing the consumption of energy, generally to optimize available and planned generation resources.

## **Demand (Tankless) Water Heater**

A type of water heater that has no storage tank thus eliminating storage tank stand-by losses. Cold water travels through a pipe into the unit, and either a gas burner or an electric element heats the water only when needed.

## **Dendrite**

A slender threadlike spike of pure crystalline material, such as silicon.

## **Dendritic Web Technique**

A method for making sheets of polycrystalline silicon in which silicon dendrites are slowly withdrawn from a melt of silicon whereupon a web of silicon forms between the dendrites and solidifies as it rises from the melt and cools.

## **Department of Agriculture (USDA)**

A federal government agency involved in rural development, marketing and regulatory programs, food safety, research, education and economics, food, nutrition and consumer service, farm and foreign agricultural services, and natural resources and environment programs.

## **Department of Energy (DOE)**

A federal government agency created in 1977, that is entrusted to contribute to the welfare of the United States by providing technical information, and a scientific and educational foundation for technology, policy and institutional leadership to achieve efficiency in energy use, diversity in energy sources, a more productive and competitive economy, improved environmental quality, and a secure national defense.

## **Dependable Capacity**

The load-carrying ability of an electric power plant during a specific time interval and period when related to the characteristics of the load to be/being supplied; determined by capability, operating power factor, and the portion of the load the station is to supply.

## **Derating**

The production of energy by a system or appliance at a level less than its design or nominal capacity.

## **Deregulation**

The process of changing regulatory policies and laws to increase competition among suppliers of commodities and services. The process of deregulating the electric power industry was initiated by the Energy Policy Act of 1992. (See also Restructuring)

## **Desiccant**

A material used to desiccate (dry) or dehumidify air.

**Desiccant Cooling**

To condition/cool air by dessication.

**Desiccation**

The process of removing moisture; involves evaporation.

**Design Cooling Load**

The amount of conditioned air to be supplied by a cooling system; usually the maximum amount to be delivered based on a specified number of cooling degree days or design temperature.

**Design Heating Load**

The amount of heated air, or heating capacity, to be supplied by a heating system; usually the maximum amount to be delivered based on a specified number of heating degree days or design outside temperature.

**Design Life**

Period of time a system or appliance (or component of) is expected to function at its nominal or design capacity without major repair.

**Design Temperature**

The temperature that a system is designed to maintain (inside) or operate against (outside) under the most extreme conditions.

**Design Tip Speed Ratio**

For a wind turbine, the ratio of the speed of the tip of a turbine blade for which the power coefficient is at maximum.

**Design Voltage**

The nominal voltage for which a conductor or electrical appliance is designed; the reference voltage for identification and not necessarily the precise voltage at which it operates.

## **Desuperheater**

An energy saving device in a heat pump that, during the cooling cycle, recycles some of the waste heat from the house to heat domestic water.

## **Dewpoint**

The temperature to which air must be cooled, at constant pressure and water vapor content, in order for saturation or condensation to occur; the temperature at which the saturation pressure is the same as the existing vapor pressure; also called saturation point.

## **Difference of Potential**

The difference in electrical pressure (voltage) between any two points in an electrical system or between any point in an electrical system and the earth.

## **Differential Thermostat**

A type of automatic thermostat (used on solar heating systems) that responds to temperature differences (between collectors and the storage components) so as to regulate the functioning of appliances (to switch transfer fluid pumps on and off).

## **Diffuse Solar Radiation**

Sunlight scattered by atmospheric particles and gases so that it arrives at the earth's surface from all directions and can not be focused.

## **Diffusion**

The movement of individual molecules through a material; permeation of water vapor through a material.

## **Diffusion Length**

The mean distance a free electron or hole moves before recombining with another hole or electron.

### **Digester (Anaerobic)**

A device in which organic material is biochemically decomposed (digested) by anaerobic bacteria to treat the material and/or to produce biogas.

### **Dimmer**

A light control device that allows light levels to be manually adjusted. A dimmer can save energy by reducing the amount of power delivered to the light while consuming very little themselves.

### **Dip Tube**

A tube inside a domestic water heater that distributes the cold water from the cold water supply line into the lower area of the water heater where heating occurs.

### **Diode**

An electronic device that allows current to flow in one direction only.

### **Direct Access**

The ability of an electric power consumer to purchase electricity from a supplier of their choice without being physically inhibited by the owner of the electric distribution and transmission system to which the consumer is connected to. (See also Open Access.)

### **Direct Beam Radiation**

Solar radiation that arrives in a straight line from the sun.

### **Direct Current**

A type of electricity transmission and distribution by which electricity flows in one direction through the conductor; usually relatively low voltage and high current; typically abbreviated as dc.

### **Direct-Gain**

The process by which sunlight directly enters a building through the windows and is absorbed and stored in massive floors or walls.

### **Direct Solar Water Heater**

These systems use water as the fluid that is circulated through the collector to the storage tank. Also known as "open-loop" systems.

### **Direct Vent Heater**

A type of combustion heating system in which combustion air is drawn directly from outside and the products of combustion are vented directly outside. These features are beneficial in tight, energy-efficient homes because they will not depressurize a home and cause air infiltration, and backdrafting of other combustion appliances.

### **Direct Water Heater**

A type of water heater in which heated water is stored within the tank. Hot water is released from the top of the tank when a hot water faucet is turned. This water is replaced with cold water that flows into the tank and down to just above the bottom plate under which are the burners.

### **Discounting**

A method of financial and economic analysis used to determine present and future values of investments or expenses.

### **Discount Rate**

The interest rate at which the Federal Reserve System stands ready to lend reserves to commercial banks. The rate is proposed by the 12 Federal Reserve banks and determined with the approval of the Board of Governors.

### **Dispatching**

To schedule and control the generation and delivery of electric power.

**Dispatchability**

The ability to dispatch power.

**Displacement Power**

A source of power (electricity) that can displace power from another source so that source's power can be transmitted to more distant loads.

**Distributed Generation**

A term used by the power industry to describe localized or on-site power generation.

**Distribution**

The process of distributing electricity; usually defines that portion of a power provider's power lines between a power provider's power pole and transformer and a customer's point of connection/meter.

**Distribution Feeder**

(See Feeder)

**Distribution Line**

One or more circuits of a distribution system on the same line or poles or supporting structures' usually operating at a lower voltage relative to the transmission line.

**Distribution System**

That portion of an electricity supply system used to deliver electricity from points on the transmission system to consumers.

**District Heating**

A heating system in which steam or hot water for space heating or hot water is piped from a central boiler plant or electric power/heating plant to a cluster of buildings.

## **Diversity Factor**

The ratio of the sum of the noncoincidental maximum demands of two or more loads to their coincidental maximum demands for the same period.

## **DOE-2.1**

A computer software program that simulates energy consumption of commercial buildings; used for design and auditing purposes.

## **Dome (Geodesic)**

An architectural design invented by Buckminster Fuller with a regular polygonal structure based on radial symmetry.

## **Domestic Hot Water**

Water heated for residential washing, bathing, etc.

## **Donor**

In a solar photovoltaic device, an n-type dopant, such as phosphorus, that puts an additional electron into an energy level very near the conduction band; this electron is easily excited into the conduction band where it increases the electrical conductivity over than of an undoped semiconductor.

## **Dopant**

A chemical element (impurity) added in small amounts to an otherwise pure semiconductor material to modify the electrical properties of the material. An n-dopant introduces more electrons. A p-dopant creates electron vacancies (holes).

## **Doping**

The addition of dopants to a semiconductor.

### **Double-Pane or Glazed Window**

A type of window having two layers (panes or glazing) of glass separated by an air space. Each layer of glass and surrounding air space reradiates and traps some of the heat that passes through thereby increasing the windows resistance to heat loss (R-value).

### **Double Wall Heat Exchanger**

A heat exchanger in a solar water heating system that has two distinct walls between the heat transfer fluid and the domestic water, to ensure that there is no mixing of the two.

### **Downwind Wind Turbine**

A horizontal axis wind turbine in which the rotor is downwind of the tower.

### **Draft**

A column of burning combustion gases that are so hot and strong that the heat is lost up the chimney before it can be transferred to the house. A draft brings air to the fire to help keep it burning.

### **Draft Diverter**

A door-like device located at the mouth of a fireplace chimney flue for controlling the direction and flow of the draft in the fireplace as well as the amount of oxygen that the fire receives.

### **Draft Hood**

A device built into or installed above a combustion appliance to assure the escape of combustion byproducts, to prevent backdrafting of the appliance, or to neutralize the effects of the stack action of the chimney or vent on the operation of the appliance.

## **Drag**

Resistance caused by friction in the direction opposite to that of movement (i.e., motion) of components such as wind turbine blades.

## **Drainback (Solar) Systems**

A closed-loop solar heating system in which the heat transfer fluid in the collector loop drains into a tank or reservoir whenever the booster pump stops to protect the collector loop from freezing.

## **Draindown (Solar) Systems**

An open-loop solar heating system in which the heat transfer fluid from the collector loop and the piping drain into a drain whenever freezing conditions occur.

## **Dry Bulb Temperature**

The temperature of the air as measured by a standard thermometer.

## **Dry Steam Geothermal Plants**

Conventional turbine generators are used with the dry steam resources. The steam is used directly, eliminating the need for boilers and boiler fuel that characterizes other steam-power-generating technologies. This technology is limited because dry-steam hydrothermal resources are extremely rare. The Geysers, in California, is the nation's only dry steam field.

## **Dual Duct System**

An air conditioning system that has two ducts, one is heated and the other is cooled, so that air of the correct temperature is provided by mixing varying amounts of air from each duct.

## **Dual Fuel (or Flex Fuel) Vehicle**

A vehicle with an engine capable of operating on two different types of fuels.

**Duct(s)**

The round or rectangular tube(s), generally constructed of sheet metal, fiberglass board, or a flexible plastic-and-wire composite, located within a wall, floor, and ceiling that distributes heated or cooled air in buildings.

**Duct Fan**

An axial flow fan mounted in a section of duct to move conditioned air.

**Duty Cycle**

The duration and periodicity of the operation of a device.

**Dynamo**

A machine for converting mechanical energy into electrical energy by magneto-electric induction; may be used as a motor.

**Dynamic Head**

The pressure equivalent of the velocity of a fluid.

**Dynamometer**

An apparatus for measuring force or power, especially the power developed by a motor.

**Dyne**

The absolute centimeter-gram-second unit of force; that force that will impart to a free mass of one gram an acceleration of one centimeter per second per second.

**E****Earth Berm**

A mound of dirt next to exterior walls to provide wind protection and insulation.

### **Earth Cooling Tube**

A long, underground metal or plastic pipe through which air is drawn. As air travels through the pipe it gives up some of its heat to the soil, and enters the house as cooler air.

### **Earth-Coupled Ground Source (Geothermal) Heat Pump**

A type of heat pump that uses sealed horizontal or vertical pipes, buried in the ground, as heat exchangers through which a fluid is circulated to transfer heat.

### **Earth Sheltered Houses**

Houses that have earth berms around exterior walls.

### **Earth-Ship**

A registered trademark name for houses built with tires, aluminum cans, and earth.

### **Easement**

An incorporated right, liberty, privilege, or use of another entity's property, distinct from ownership, without profit or compensation; a right-of-way.

### **Eccentric**

A device for converting continuous circular motion into reciprocating rectilinear motion.

### **Economizer**

A heat exchanger for recovering heat from flue gases for heating water or air.

### **Edge-Defined Film-Fed Growth (EFG)**

A method for making sheets of polycrystalline silicon (for solar photovoltaic devices) in which molten silicon is drawn upward by capillary action through a mold.

## **Efficacy**

The amount of energy service or useful energy delivered per unit of energy input. Often used in reference to lighting systems, where the visible light output of a luminary is relative to power input; expressed in lumens per Watt; the higher the efficacy value, the higher the energy efficiency.

## **Effective Capacity**

The maximum load that a device is capable of carrying.

## **Efficiency**

Under the First Law of Thermodynamics, efficiency is the ratio of work or energy output to work or energy input, and cannot exceed 100 percent. Efficiency under the Second Law of Thermodynamics is determined by the ratio of the theoretical minimum energy that is required to accomplish a task relative to the energy actually consumed to accomplish the task. Generally, the measured efficiency of a device, as defined by the First Law, will be higher than that defined by the Second Law.

## **Efficiency (Appliance) Ratings**

A measure of the efficiency of an appliance's energy efficiency.

## **Elasticity of Demand**

The ratio of the percentage change in the quantity of a good or service demanded to the percentage change in the price.

## **Electrical Energy**

The energy of moving electrons.

## **Electrical Charge**

A condition that results from an imbalance between the number of protons and the number of electrons in a substance.

## **Electrical System**

All the conductors and electricity using devices that are connected to a source of electromotive force (or generator).

## **Electrical System Energy Losses**

A measure of the amount of energy lost during the generation, transmission, and distribution of electricity.

## **Electric Circuit**

The path followed by electrons from a generation source, through an electrical system, and returning to the source.

## **Electric Energy**

The amount of work accomplished by electrical power, usually measured in kilowatt-hours (kWh). One kWh is 1,000 Watts and is equal to 3,413 Btu.

## **Electric Furnace**

An air heater in which air is blown over electric resistance heating coils.

## **Electricity Generation**

The process of producing electricity by transforming other forms or sources of energy into electrical energy; measured in kilowatt-hours.

## **Electricity Grid**

A common term referring to an electricity transmission and distribution system.

## **Electric Rate**

The unit price and quantity to which it applies as specified in a rate schedule or contract.

**Electric Rate Schedule**

A statement of the electric rate(s), terms, and conditions for electricity sale or supply.

**Electric System**

The physically connected generation, transmission, and distribution facilities and components operated as a unit.

**Electric System Loss(es)**

The total amount of electric energy loss in an electric system between the generation source and points of delivery.

**Electric Power Plant**

A facility or piece of equipment that produces electricity.

**Electric Power Sector**

Those privately or publicly owned establishments that generate, transmit, distribute, or sell electricity.

**Electric Power Transmission**

The transmission of electricity through power lines.

**Electric Resistance Heating**

A type of heating system where heat, resulting when electric current flows through an "element" or conductor, such as Nichrome, which has a high resistance, is radiated to a room.

**Electric Utility**

A corporation, person, agency, authority or other legal entity that owns and/or operates facilities for the generation, transmission, distribution or sale of electricity primarily for use by the public. Also known as a power provider.

## **Electric Vehicles**

A battery-powered electrically driven vehicle.

## **Electricity Industry Restructuring**

The process of changing the structure of the electric power industry from one of guaranteed monopoly over service territories, as established by the Public Utility Holding Company Act of 1935, to one of open competition between power suppliers for customers in any area.

## **Electrochemical Cell**

A device containing two conducting electrodes, one positive and the other negative, made of dissimilar materials (usually metals) that are immersed in a chemical solution (electrolyte) that transmits positive ions from the negative to the positive electrode and thus forms an electrical charge. One or more cells constitute a battery.

## **Electrode**

A conductor that is brought in conducting contact with a ground.

## **Electrodeposition**

Electrolytic process in which a metal is deposited at the cathode from a solution of its ions.

## **Electrolysis**

A chemical change in a substance that results from the passage of an electric current through an electrolyte. The production of commercial hydrogen by separating the elements of water, hydrogen, and oxygen, by charging the water with an electrical current.

## **Electrolyte**

A nonmetallic (liquid or solid) conductor that carries current by the movement of ions (instead of electrons) with the liberation of matter at the electrodes of an electrochemical cell.

## **Electromagnetic Energy**

Energy generated from an electromagnetic field produced by an electric current flowing through a superconducting wire kept at a specific low temperature.

## **Electromagnetic Field (EMF)**

The electrical and magnetic fields created by the presence or flow of electricity in an electrical conductor or electricity consuming appliance or motor.

## **Electromotive Force**

The amount of energy derived from an electrical source per unit quantity of electricity passing through the source.

## **Electron**

An elementary particle of an atom with a negative electrical charge and a mass of 1/1837 of a proton; electrons surround the positively charged nucleus of an atom and determine the chemical properties of an atom.

## **Electronic Ballast**

A device that uses electronic components to regulate the voltage of fluorescent lamps.

## **Electron Volt**

The amount of kinetic energy gained by an electron when accelerated through an electric potential difference of 1 Volt; equivalent to  $1.603 \times 10^{-19}$ ; a unit of energy or work; abbreviated as eV.

## **Electrostatic Precipitator**

A device used to remove particulate matter from the waste gasses of a combustion power plant.

### **Ellipsoidal Reflector Lamp**

A lamp where the light beam is focused 2 inches ahead of the lamp reducing the amount of light trapped in the fixture.

### **Emission(s)**

A substance(s) or pollutant emitted as a result of a process.

### **Emission Factor**

A measure of the average amount of a specified pollutant or material emitted for a specific type of fuel or process.

### **Emissivity**

The ratio of the radiant energy (heat) leaving (being emitted by) a surface to that of a black body at the same temperature and with the same area; expressed as a number between 0 and 1.

### **Enclosure**

The housing around a motor that supports the active parts and protects them. They come in different varieties (open, protected) depending on the degree of protection required.

### **Endothermic**

A heat absorbing reaction or a reaction that requires heat.

### **End Use**

The purpose for which useful energy or work is consumed.

### **Energize(d)**

To send electricity through a electricity transmission and distribution network; a conductor or power line that is carrying current.

## **Energy**

The capability of doing work; different forms of energy can be converted to other forms, but the total amount of energy remains the same.

### **Energy Audit**

A survey that shows how much energy you use in your house or apartment. It will help you find ways to use less energy.

### **Energy Charge**

That part of an electricity bill that is based on the amount of electrical energy consumed or supplied.

### **Energy Contribution Potential**

Recombination occurring in the emitter region of a photovoltaic cell.

### **Energy Crops**

Crops grown specifically for their fuel value. These include food crops such as corn and sugarcane, and nonfood crops such as poplar trees and switchgrass. Currently, two energy crops are under development: short-rotation woody crops, which are fast-growing hardwood trees harvested in 5 to 8 years; and herbaceous energy crops, such as perennial grasses, which are harvested annually after taking 2 to 3 years to reach full productivity.

### **Energy Efficient Mortgages**

A type of home mortgage that takes into account the energy savings of a home that has cost-effective energy saving improvements that will reduce energy costs thereby allowing the homeowner to more income to the mortgage payment. A borrower can qualify for a larger loan amount than otherwise would be possible.

## **Energy Efficiency Ratio (EER)**

The measure of the instantaneous energy efficiency of room air conditioners; the cooling capacity in Btu/hr divided by the watts of power consumed at a specific outdoor temperature (usually 95 degrees Fahrenheit).

## **Energy Density**

The ratio of available energy per pound; usually used to compare storage batteries.

## **Energy Factor (EF)**

The measure of overall efficiency for a variety of appliances. For water heaters, the energy factor is based on three factors: 1) the recovery efficiency, or how efficiently the heat from the energy source is transferred to the water; 2) stand-by losses, or the percentage of heat lost per hour from the stored water compared to the content of the water; and 3) cycling losses. For dishwashers, the energy factor is defined as the number of cycles per kWh of input power. For clothes washers, the energy factor is defined as the cubic foot capacity per kWh of input power per cycle. For clothes dryers, the energy factor is defined as the number of pounds of clothes dried per kWh of power consumed.

## **Energy End-Use Sectors**

Major energy consuming sectors of the economy. The Commercial Sector includes commercial buildings and private companies. The Industrial Sector includes manufacturers and processors. The Residential Sector includes private homes. The Transportation Sector includes automobiles, trucks, rail, ships, and aircraft.

## **Energy Guide Labels**

The labels placed on appliances to enable consumers to compare appliance energy efficiency and energy consumption under specified test conditions as required by the Federal Trade Commission.

## **Energy Intensity**

The relative extent that energy is required for a process.

## **Energy Policy Act of 1992 (EPAAct)**

A comprehensive legislative package that mandates and encourages energy efficiency standards, alternative fuel use, and the development of renewable energy technologies. Public Law 102-486, October 24th, 1992. Also authorized the Federal Energy Regulatory Commission (FERC) to order the owners of electric power transmission lines to transmit or "wheel" power for power generators including electric power providers, federal power marketing authorities, and exempt wholesale generators.

## **Energy Security Act of 1980**

Legislation authorizing a U.S. biomass and alcohol fuel program, and that authorized loan guarantees and price guarantees and purchase agreements for alcohol fuel production.

## **Energy Service Company (ESCO)**

A company that specializes in undertaking energy efficiency measures under a contractual arrangement whereby the ESCO shares the value of energy savings with their customer.

## **Energy Storage**

The process of storing, or converting energy from one form to another, for later use; storage devices and systems include batteries, conventional and pumped storage hydroelectric, flywheels, compressed gas, and thermal mass.

## **Enthalpy**

A thermodynamic property of a substance, defined as the sum of its internal energy plus the pressure of the substance times its volume, divided by the mechanical equivalent of heat. The total heat content of air; the sum of the enthalpies of dry air and water vapor, per unit

weight of dry air; measured in Btu per pound (or calories per kilogram).

### **Entrained Bed Gasifier**

A gasifier in which the feedstock (fuel) is suspended by the movement of gas to move it through the gasifier.

### **Entropy**

A measure of the unavailable or unusable energy in a system; energy that cannot be converted to another form.

### **Environment**

All the natural and living things around us. The earth, air, weather, plants, and animals all make up our environment.

### **Epitaxial Growth**

In reference to solar photovoltaic devices, the growth of one crystal on the surface of another crystal. The growth of the deposited crystal is oriented by the lattice structure of the original crystal.

### **Equinox**

The two times of the year when the sun crosses the equator and night and day are of equal length; usually occurs on March 21st (spring equinox) and September 23 (fall equinox).

### **Erg**

A unit of work done by the force of one dyne acting through a distance of one centimeter.

### **Ethanol — Ethyl alcohol (C<sub>2</sub>H<sub>5</sub>OH)**

A colorless liquid that is the product of fermentation used in alcoholic beverages, industrial processes, and as a fuel additive. Also known as grain alcohol.

## **Ethyl Tertiary Butyl Ether (ETBE)**

A chemical compound produced in a reaction between ethanol and isobutylene (a petroleum-derived by-product of the refining process). ETBE has characteristics superior to other ethers: low volatility, low water solubility, high octane value, and a large reduction in carbon monoxide and hydrocarbon emissions.

## **Eutectic**

A mixture of substances that has a melting point lower than that of any mixture of the same substances in other proportions.

## **Eutectic Salts**

Salt mixtures with potential applications as solar thermal energy storage materials.

## **Evacuated-Tube Collector**

A collector is the mechanism in which fluid (water or diluted antifreeze, for example) is heated by the sun in a solar hot water system. Evacuated-tube collectors are made up of rows of parallel, transparent glass tubes. Each tube consists of a glass outer tube and an inner tube, or absorber. The absorber is covered with a selective coating that absorbs solar energy well but inhibits radiative heat loss. The air is withdrawn ("evacuated") from the space between the tubes to form a vacuum, which eliminates conductive and convective heat loss. Evacuated-tube collectors are used for active solar hot water systems.

## **Evaporation**

The conversion of a liquid to a vapor (gas), usually by means of heat.

## **Evaporative Cooling**

The physical process by which a liquid or solid is transformed into the gaseous state. For this process a mechanical device uses the outside air's heat to evaporate water that is held by pads inside the

cooler. The heat is drawn out of the air through this process and the cooled air is blown into the home by the cooler's fan.

### **Evaporator Coil**

The inner coil in a heat pump that, during the cooling mode, absorbs heat from the inside air and boils the liquid refrigerant to a vapor, which cools the house.

### **Excitation**

The power required to energize the magnetic field of a generator.

### **Exempt Wholesale Generator**

An unregulated subsidiary of a power provider that is allowed to generate and sell wholesale power as an independent energy producer, and is exempt from the Public Utility Holding Company Act of 1935.

### **Exothermic**

A reaction or process that produces heat; a combustion reaction.

### **Expanded Polystyrene**

A type of insulation that is molded or expanded to produce coarse, closed cells containing air. The rigid cellular structure provides thermal and acoustical insulation, strength with low weight, and coverage with few heat loss paths. Often used to insulate the interior of masonry basement walls.

### **Expansion Tank**

A tank used in a closed-loop solar heating system that provides space for the expansion of the heat transfer fluid in the pressurized collector loop.

### **Expansion Valve**

The device that reduces the pressure of liquid refrigerant thereby cooling it before it enters the evaporator coil in a heat pump.

## **External Combustion Engine**

An engine in which fuel is burned (or heat is applied) to the outside of a cylinder; a Stirling engine.

## **Externality**

The environmental, social, and economic impacts of producing a good or service that are not directly reflected in the market price of the good or service.

## **Extruded Polystyrene**

A type of insulation material with fine, closed cells, containing a mixture of air and refrigerant gas. This insulation has a high R-value, good moisture resistance, and high structural strength compared to other rigid insulation materials.

## **F**

### **Fan**

A device that moves and/or circulates air and provides ventilation for a room or a building.

### **Fan Coil**

A heat exchanger coil in which a fluid such as water is circulated and a fan blows air over the coil to distribute heat or cool air to the different rooms.

### **Fan Velocity Pressure**

The pressure corresponding to the outlet velocity of a fan; the kinetic energy per unit volume of flowing air.

## **Farad**

A unit of electrical capacitance; the capacitance of a capacitor between the plates of which there appears a difference of 1 Volt when it is charged by one coulomb of electricity.

## **Feather**

In a wind energy conversion system, to pitch the turbine blades so as to reduce their lift capacity as a method of shutting down the turbine during high wind speeds.

## **Federal Energy Management Program (FEMP) Office**

An office in the U.S. Department of Energy (DOE) that implements energy legislation and presidential directives. FEMP provides project financing, technical guidance and assistance, coordination and reporting, and new initiatives for the federal government. It also helps federal agencies identify the best technologies and technology demonstrations for their use.

## **Federal Energy Regulatory Commission (FERC)**

This is an independent regulatory agency within the U.S. DOE that has jurisdiction over interstate electricity sales, wholesale electric rates, natural gas pricing, oil pipeline rates, and gas pipeline certification. It also licenses and inspects private, municipal, and state hydroelectric projects and oversees related environmental matters.

## **Federal Power Marketing Administrations (PMA)**

These are separate and distinct organizational agencies within the U.S. DOE that market power at federal multipurpose water projects at lowest possible rates to consumers consistent with sound business principles. There are five PMA's: Alaska Power Administration, Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration.

**Feeder**

A power line for supplying electricity within a specified area.

**Feedstock**

A raw material that can be converted to one or more products.

**Fenestration**

The arrangement, proportion, and design of windows in a building.

**Fermentation**

The decomposition of organic material to alcohol, methane, etc., by organisms, such as yeast or bacteria, usually in the absence of oxygen.

**Fiberglass Insulation**

A type of insulation, composed of small diameter pink, yellow, or white glass fibers, formed into blankets or batts, or used in loose-fill and blown-in applications.

**Filament**

A coil of tungsten wire suspended in a vacuum or inert gas-filled bulb. When heated by electricity the tungsten "filament" glows.

**Fill Factor**

The ratio of a photovoltaic cell's actual power to its power if both current and voltage were at their maxima. A key characteristic in evaluating cell performance.

**Filter (air)**

A device that removes contaminants, by mechanical filtration, from the fresh air stream before the air enters the living space. Filters can be installed as part of a heating/cooling system through which air flows for the purpose of removing particulates before or after the air enters the mechanical components.

**Fin**

A thin sheet of material (metal) of a heat exchanger that conducts heat to a fluid.

**Finish**

Both a noun and a verb to describe the exterior surface of building elements (walls, floors, ceilings, etc.) and furniture, and the process of applying it.

**Fire Classification**

Classifications of fires developed by the National Fire Protection Association.

**Fireplace**

A wood or gas burning appliance that is primarily used to provide ambiance to a room. Conventional, masonry fireplaces without energy saving features, often take more heat from a space than they put into it.

**Fireplace Insert**

A wood or gas burning heating appliance that fits into the opening or protrudes on to the hearth of a conventional fireplace.

**Fire-Rating**

The ability of a building construction assembly (partition, wall, floor, etc.) to resist the passage of fire. The rating is expressed in hours.

**Firewall**

A wall to prevent the spread of fire; usually made of non-combustible material.

**Firing Rate**

The amount of BTUs/hour or kW produced by a heating system from the burning of a fuel.

## **First Law of Thermodynamics**

States that energy cannot be created or destroyed, but only changed from one form to another. First Law efficiency measures the fraction of energy supplied to a device or process that it delivers in its output. Also called the law of conservation of energy.

## **Fiscal Year (FY)**

The U.S. Government's 12-month financial year, from October to September, of the following calendar year; e.g.: FY 1998 extends from Oct. 1, 1997 to Sept. 30, 1998.

## **Flame Spread Classification**

A measure of the surface burning characteristics of a material.

## **Flame Spread Rating**

A measure of the relative flame spread, and smoke development, from a material being tested. The flame spread rating is a single number comparing the flame spread of a material with red oak, arbitrarily given the number 100 and asbestos cement board with a flame spread of 0. Building codes require a maximum flame spread of 25 for insulation installed in exposed locations.

## **Flash-Steam Geothermal Plants**

When the temperature of the hydrothermal liquids is over 350 F (177 C), flash-steam technology is generally employed. In these systems, most of the liquid is flashed to steam. The steam is separated from the remaining liquid and used to drive a turbine generator. While the water is returned to the geothermal reservoir, the economics of most hydrothermal flash plants are improved by using a dual-flash cycle, which separates the steam at two different pressures. The dual-flash cycle produces 20% to 30% more power than a single-flash system at the same fluid flow.

**Flashing**

Metal, usually galvanized sheet metal, used to provide protection against infiltration of precipitation into a roof or exterior wall; usually placed around roof penetrations such as chimneys.

**Flashpoint**

The minimum temperature at which sufficient vapor is released by a liquid or solid (fuel) to form a flammable vapor-air mixture at atmospheric pressure.

**Flat-Black Paint**

Nonglossy paint with a relatively high absorptance.

**Flat Plate Solar Thermal/Heating Collectors**

Large, flat boxes with glass covers and dark-colored metal plates inside that absorb and transfer solar energy to a heat transfer fluid. This is the most common type of collector used in solar hot water systems for homes or small businesses.

**Flat Plate Solar Photovoltaic Module**

An arrangement of photovoltaic cells or material mounted on a rigid flat surface with the cells exposed freely to incoming sunlight.

**Flat Roof**

A slightly sloped roof, usually with a tar and gravel cover. Most commercial buildings use this kind of roof.

**Float-Zone Process**

In reference to solar photovoltaic cell manufacture, a method of growing a large-size, high-quality crystal whereby coils heat a polycrystalline ingot placed atop a single-crystal seed. As the coils are slowly raised the molten interface beneath the coils becomes a single crystal.

**Floor**

The upward facing structure of a building.

**Floor Space**

The interior area of a building, calculated in square feet or meters.

**Flow Condition**

In reference to solar thermal collectors, the condition where the heat transfer fluid is flowing through the collector loop under normal operating conditions.

**Flow Restrictor**

A water and energy conserving device that limits the amount of water that a faucet or shower head can deliver.

**Flue**

The structure (in a residential heating appliance, industrial furnace, or power plant) into which combustion gases flow and are contained until they are emitted to the atmosphere.

**Flue Gas**

The gas resulting from the combustion of a fuel that is emitted to the flue.

**Fluffing**

The practice of installing blow-in, loose-fill insulation at a lower density than is recommended to meet a specified R-Value.

**Fluidized Bed Combustion (FBC)**

A type of furnace or reactor in which fuel particles are combusted while suspended in a stream of hot gas.

## **Fluorescent Light**

The conversion of electric power to visible light by using an electric charge to excite gaseous atoms in a glass tube. These atoms emit ultraviolet radiation that is absorbed by a phosphor coating on the walls of the lamp tube. The phosphor coating produces visible light.

## **Fly Ash**

The fine particulate matter entrained in the flue gases of a combustion power plant.

## **Flywheel Effect**

The damping of interior temperature fluctuations by massive construction.

## **Foam (Insulation)**

A high R-value insulation product usually made from urethane that can be injected into wall cavities, or sprayed onto roofs or floors, where it expands and sets quickly.

## **Foam Board**

A plastic foam insulation product, pressed or extruded into board-like forms, used as sheathing and insulation for interior basement or crawl space walls or beneath a basement slab; can also be used for exterior applications inside or outside foundations, crawl spaces, and slab-on-grade foundation walls.

## **Foam Core Panels**

A type of structural, insulated product with foam insulation contained between two facings of drywall, or structural wood composition boards such as plywood, waferboard, and oriented strand board.

**Foot Candle**

A unit of illuminance; equal to one lumen per square foot.

**Foot Pound**

The amount of work done in raising one pound one foot.

**Force**

The push or pull that alters the motion of a moving body or moves a stationary body; the unit of force is the dyne or poundal; force is equal to mass time velocity divided by time.

**Forced Air System or Furnace**

A type of heating system in which heated air is blown by a fan through air channels or ducts to rooms.

**Forced Ventilation**

A type of building ventilation system that uses fans or blowers to provide fresh air to rooms when the forces of air pressure and gravity are not enough to circulate air through a building.

**Formaldehyde**

A chemical used as a preservative and in bonding agents. It is found in household products such as plywood, furniture, carpets, and some types of foam insulation. It is also a by-product of combustion and is a strong-smelling, colorless gas that is an eye irritant and can cause sneezing, coughing, and other health problems.

**Fossil Fuels**

Fuels formed in the ground from the remains of dead plants and animals. It takes millions of years to form fossil fuels. Oil, natural gas, and coal are fossil fuels.

**Foundation**

The supportive structure of a building.

### **Fractional Horse Power Motor**

An electric motor rated at less than one horse power (hp).

### **Frame (Window)**

The outer casing of a window that sits in a designated opening of a structure and holds the window panes in place.

### **Framing**

The structural materials and elements used to construct a wall.

### **Francis Turbine**

A type of hydropower turbine that contains a runner that has water passages through it formed by curved vanes or blades. As the water passes through the runner and over the curved surfaces, it causes rotation of the runner. The rotational motion is transmitted by a shaft to a generator.

### **Frequency**

The number of cycles through which an alternating current passes per second; in the U.S. the standard for electricity generation is 60 cycles per second (60 Hertz).

### **Freon**

A registered trademark for a chlorofluorocarbon (CFC) gas that is highly stable and that has been historically used as a refrigerant.

### **Fresnel Lens**

An optical device for concentrating light that is made of concentric rings that are faced at different angles so that light falling on any ring is focused to the same point.

## **Friction Head**

The energy lost from the movement of a fluid in a conduit (pipe) due to the disturbances created by the contact of the moving fluid with the surfaces of the conduit, or the additional pressure that a pump must provide to overcome the resistance to fluid flow created by or in a conduit.

## **Fuel**

Any material that can be burned to make energy.

## **Fuel Cell**

An electrochemical device that converts chemical energy directly into electricity.

## **Fuel Efficiency**

The ratio of heat produced by a fuel for doing work to the available heat in the fuel.

## **Fuel Grade Alcohol**

Usually refers to ethanol to 160 to 200 proof.

## **Fuel Oil**

Any liquid petroleum product burned for the generation of heat in a furnace or firebox, or for the generation of power in an engine. Domestic (residential) heating fuels are classed as Nos. 1, 2, 3; Industrial fuels as Nos. 4, 5, and 6.

## **Fuel Rate**

The amount of fuel necessary to generate one kilowatt-hour of electricity.

## **Full Sun**

The amount of power density in sunlight received at the earth's surface at noon on a clear day (about 1,000 Watts/square meter).

## **Fungi**

Plant-like organisms with cells with distinct nuclei surrounded by nuclear membranes, incapable of photosynthesis. Fungi are decomposers of waste organisms and exist as yeast, mold, or mildew.

## **Furling**

The process of forcing, either manually or automatically, a wind turbine's blades out of the direction of the wind in order to stop the blades from turning.

## **Furnace (Residential)**

A combustion heating appliance in which heat is captured from the burning of a fuel for distribution, comprised mainly of a combustion chamber and heat exchanger.

## **Fuse**

A safety device consisting of a short length of relatively fine wire, mounted in a holder or contained in a cartridge and connected as part of an electrical circuit. If the circuit source current exceeds a predetermined value, the fuse wire melts (i.e. the fuse 'blows') breaking the circuit and preventing damage to the circuit protected by the fuse.

## **G**

### **Gallium Arsenide**

A compound used to make certain types of solar photovoltaic cells.

### **Gasification**

The process in which a solid fuel is converted into a gas; also known as pyrolytic distillation or pyrolysis. Production of a clean fuel gas makes a wide variety of power options available.

**Gasifier**

A device for converting a solid fuel to a gaseous fuel.

**Gasket/Seal**

A seal used to prevent the leakage of fluids, and also maintain the pressure in an enclosure.

**Gasohol**

A registered trademark of an agency of the state of Nebraska, for an automotive fuel containing a blend of 10 percent ethanol and 90 percent gasoline.

**Gasoline**

A refined petroleum product suitable for use as a fuel in internal combustion engines.

**Gas Turbine**

A type of turbine in which combusted, pressurized gas is directed against a series of blades connected to a shaft, which forces the shaft to turn to produce mechanical energy.

**Gauss**

The unit of magnetic field intensity equal to 1 dyne per unit pole.

**Generator**

A device for converting mechanical energy to electrical energy.

**Geopressurized Brines**

These brines are hot (300 F to 400 F) (149 C to 204 C) pressurized waters that contain dissolved methane and lie at depths of 10,000 ft (3048 m) to more than 20,000 ft (6096 m) below the earth's surface. The best known geopressured reservoirs lie along the Texas and Louisiana Gulf Coast. At least three types of energy could be obtained: thermal energy from high-temperature fluids; hydraulic

energy from the high pressure; and chemical energy from burning the dissolved methane gas.

### **Geothermal Energy**

Energy produced by the internal heat of the earth; geothermal heat sources include: hydrothermal convective systems; pressurized water reservoirs; hot dry rocks; manual gradients; and magma. Geothermal energy can be used directly for heating or to produce electric power.

### **Geothermal Heat Pump**

A type of heat pump that uses the ground, ground water, or ponds as a heat source and heat sink, rather than outside air. Ground or water temperatures are more constant and are warmer in winter and cooler in summer than air temperatures. Geothermal heat pumps operate more efficiently than "conventional" or "air source" heat pumps.

### **Geothermal Power Station**

An electricity generating facility that uses geothermal energy.

### **Gigawatt (GW)**

A unit of power equal to 1 billion Watts; 1 million kilowatts, or 1,000 megawatts.

### **Gin Pole**

A pole used to assist in raising a tower.

### **Glare**

The excessive brightness from a direct light source that makes it difficult to see what one wishes to see. A bright object in front of a dark background usually will cause glare. Bright lights reflecting off a television or computer screen or even a printed page produces glare. Intense light sources—such as bright incandescent lamps—are likely to produce more direct glare than large fluorescent lamps.

However, glare is primarily the result of relative placement of light sources and the objects being viewed.

### **Glazing**

A term used for the transparent or translucent material in a window. This material (i.e. glass, plastic films, coated glass) is used for admitting solar energy and light through windows.

### **Glauber's Salt**

A salt, sodium sulfate decahydrate, that melts at 90 degrees Fahrenheit; a component of eutectic salts that can be used for storing heat.

### **Glazing**

Transparent or translucent material (glass or plastic) used to admit light and/or to reduce heat loss; used for building windows, skylights, or greenhouses, or for covering the aperture of a solar collector.

### **Global Insolation (or Solar Radiation)**

The total diffuse and direct insolation on a horizontal surface, averaged over a specified period of time.

### **Global Warming**

A popular term used to describe the increase in average global temperatures due to the greenhouse effect.

### **Governor**

A device used to regulate motor speed, or, in a wind energy conversion system, to control the rotational speed of the rotor.

### **Grain Alcohol**

Ethanol.

## **Green Certificates**

Green certificates represent the environmental attributes of power produced from renewable resources. By separating the environmental attributes from the power, clean power generators are able to sell the electricity they produce to power providers at a competitive market value. The additional revenue generated by the sale of the green certificates covers the above-market costs associated with producing power made from renewable energy sources. Also known as green tags, renewable energy certificates, or tradable renewable certificates.

## **Greenhouse Effect**

A popular term used to describe the heating effect due to the trapping of long wave (length) radiation by greenhouse gases produced from natural and human sources.

## **Greenhouse Gases**

Those gases, such as water vapor, carbon dioxide, tropospheric ozone, methane, and low level ozone that are transparent to solar radiation, but opaque to long wave radiation, and which contribute to the greenhouse effect.

## **Greenwood**

Freshly cut, unseasoned, wood.

## **Green Power**

A popular term for energy produced from clean, renewable energy resources.

## **Green Pricing**

A practice engaged in by some regulated utilities (i.e. power providers) where electricity produced from clean, renewable resources is sold at a higher cost than that produced from fossil or nuclear power plants, supposedly because some buyers are willing to pay a premium for clean power.

**Greywater**

Waste water from a household source other than a toilet. This water can be used for landscape irrigation depending upon the source of the greywater.

**Grid**

A common term referring to an electricity transmission and distribution system.

**Grid-Connected System**

Independent power systems that are connected to an electricity transmission and distribution system (referred to as the electricity grid) such that the systems can draw on the grid's reserve capacity in times of need, and feed electricity back into the grid during times of excess production.

**Gross Calorific Value**

The heat produced by combusting a specific quantity and volume of fuel in an oxygen-bomb calorimeter under specific conditions.

**Gross Generation**

The total amount of electricity produced by a power plant.

**Ground**

A device used to protect the user of any electrical system or appliance from shock.

**Ground Loop**

In geothermal heat pump systems, a series of fluid-filled plastic pipes buried in the shallow ground, or placed in a body of water, near a building. The fluid within the pipes is used to transfer heat between the building and the shallow ground (or water) in order to heat and cool the building.

## **Ground Reflection**

Solar radiation reflected from the ground onto a solar collector.

## **Ground-Source Heat Pump**

(See Geothermal Systems)

## **Guy Wire**

Cable use to secure a wind turbine tower to the ground in a safe, stable manner.

## **H**

### **Harmonic(s)**

A sinusoidal quantity having a frequency that is an integral multiple of the frequency of a periodic quantity to which it is related.

### **Head**

A unit of pressure for a fluid, commonly used in water pumping and hydro power to express height a pump must lift water, or the distance water falls. Total head accounts for friction head losses, etc.

### **Heat**

A form of thermal energy resulting from combustion, chemical reaction, friction, or movement of electricity. As a thermodynamic condition, heat, at a constant pressure, is equal to internal or intrinsic energy plus pressure times volume.

### **Heat Absorbing Window Glass**

A type of window glass that contains special tints that cause the window to absorb as much as 45% of incoming solar energy, to reduce heat gain in an interior space. Part of the absorbed heat will continue to be passed through the window by conduction and reradiation.

## **Heat Balance**

Energy output from a system that equals energy input.

## **Heat Content**

The amount of heat in a quantity of matter at a specific temperature and pressure.

## **Heat Engine**

A device that produces mechanical energy directly from two heat reservoirs of different temperatures. A machine that converts thermal energy to mechanical energy, such as a steam engine or turbine.

## **Heat Exchanger**

A device used to transfer heat from a fluid (liquid or gas) to another fluid where the two fluids are physically separated.

## **Heat Gain**

The amount of heat introduced to a space from all heat producing sources, such as building occupants, lights, appliances, and from the environment, mainly solar energy.

## **Heating Capacity (Also specific heat)**

The quantity of heat necessary to raise the temperature of a specific mass of a substance by one degree.

## **Heating Degree Day(s) (HDD)**

The number of degrees per day that the daily average temperature (the mean of the maximum and minimum recorded temperatures) is below a base temperature, usually 65 degrees Fahrenheit, unless otherwise specified; used to determine indoor space heating requirements and heating system sizing. Total HDD is the cumulative total for the year/heating season. The higher the HDD for a location, the colder the daily average temperature(s).

## **Heating Fuels**

Any gaseous, liquid, or solid fuel used for indoor space heating.

## **Heating Fuel Units**

Standardized weights or volumes for heating fuels.

## **Heating Load**

The rate of heat flow required to maintain a specific indoor temperature; usually measured in Btu per hour.

## **Heating Season**

The coldest months of the year; months where average daily temperatures fall below 65 degrees Fahrenheit creating demand for indoor space heating.

## **Heating Seasonal Performance Factor (HSPF)**

The measure of seasonal or annual efficiency of a heat pump operating in the heating mode. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of heat delivered for every watt-hour of electricity used by the heat pump over a heating season.

## **Heating Value**

The amount of heat produced from the complete combustion of a unit of fuel. The higher (or gross) heating value is that when all products of combustion are cooled to the pre-combustion temperature, water vapor formed during combustion is condensed, and necessary corrections have been made. Lower (or net) heating value is obtained by subtracting from the gross heating value the latent heat of vaporization of the water vapor formed by the combustion of the hydrogen in the fuel.

## **Heating, Ventilation, and Air-Conditioning (HVAC) System**

All the components of the appliance used to condition interior air of a building.

**Heat Loss**

The heat that flows from the building interior, through the building envelope to the outside environment.

**Heat Pipe**

A device that transfers heat by the continuous evaporation and condensation of an internal fluid.

**Heat Pump**

An electricity powered device that extracts available heat from one area (the heat source) and transfers it to another (the heat sink) to either heat or cool an interior space or to extract heat energy from a fluid.

**Heat Pump Water Heaters**

A water heater that uses electricity to move heat from one place to another instead of generating heat directly.

**Heat Rate**

The ratio of fuel energy input as heat per unit of net work output; a measure of a power plant thermal efficiency, generally expressed as Btu per net kilowatt-hour.

**Heat Recovery Ventilator**

A device that captures the heat from the exhaust air from a building and transfers it to the supply/fresh air entering the building to preheat the air and increase overall heating efficiency.

**Heat Register**

The grilled opening into a room by which the amount of warm air from a furnace can be directed or controlled; may include a damper.

**Heat Sink**

A structure or media that absorbs heat.

**Heat Source**

A structure or media from which heat can be absorbed or extracted.

**Heat Storage**

A device or media that absorbs heat for storage for later use.

**Heat Storage Capacity**

The amount of heat that a material can absorb and store.

**Heat Transfer**

The flow of heat from one area to another by conduction, convection, and/or radiation. Heat flows naturally from a warmer to a cooler material or space.

**Heat Transfer Fluid**

A gas or liquid used to move heat energy from one place to another; a refrigerant.

**Heat Transmission Coefficient**

Any coefficient used to calculate heat transmission by conduction, convection, or radiation through materials or structures.

**Heliochemical Process**

The utilization of solar energy through photosynthesis.

**Heliodon**

A device used to simulate the angle of the sun for assessing shading potentials of building structures or landscape features.

**Heliostat**

A device that tracks the movement of the sun; used to orient solar concentrating systems.

**Heliothermal**

Any process that uses solar radiation to produce useful heat.

**Heliothermic**

Site planning that accounts for natural solar heating and cooling processes and their relationship to building shape, orientation, and siting.

**Heliothermometer**

An instrument for measuring solar radiation.

**Heliotropic**

Any device (or plant) that follows the sun's apparent movement across the sky.

**Hemispherical Bowl Technology**

A solar energy concentrating technology that uses a linear receiver that tracks the focal area of a reflector or array of reflectors.

**Hertz**

A measure of the number of cycles or wavelengths of electrical energy per second; U.S. electricity supply has a standard frequency of 60 hertz.

**Heterojunction**

A region of electrical contact between two different materials.

**Higher Heating Value (HHV)**

The maximum heating value of a fuel sample, which includes the calorific value of the fuel (bone dry) and the latent heat of vaporization of the water in the fuel. (See moisture content and net (lower) heating value, below.)

## **High-Intensity Discharge Lamp**

A lamp that consists of a sealed arc tube inside a glass envelope, or outer jacket. The inner arc tube is filled with elements that emit light when ionized by electric current. A ballast is required to provide the proper starting voltage and to regulate current during operation.

## **High-Pressure Sodium Lamp**

A type of High-Intensity Discharge (HID) lamp that uses sodium under high pressure as the primary light-producing element. These high efficiency lights produce a golden white color and are used for interior industrial applications, such as in warehouses and manufacturing, and for security, street, and area lighting.

## **Hole**

The vacancy where an electron would normally exist in a solid; behaves like a positively charged particle.

## **Home Energy Rating Systems (HERS)**

A nationally recognized energy rating program that gives builders, mortgage lenders, secondary lending markets, homeowners, sellers, and buyers a precise evaluation of energy losing deficiencies in homes. Builders can use this system to gauge the energy quality in their home and also to have a star rating on their home to compare to other similarly built homes.

## **Homojunction**

The region between an n-layer and a p-layer in a single material, photovoltaic cell.

## **Horizontal-Axis Wind Turbines**

Turbines in which the axis of the rotor's rotation is parallel to the wind stream and the ground.

## **Horizontal Ground Loop**

In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are laid out in a plane parallel to the ground surface. The most common layouts either use two pipes, one buried at six feet, and the other at four feet, or two pipes placed side-by-side at five feet in the ground in a two-foot wide trench. The trenches must be at least four feet deep. Horizontal ground loops are generally most cost-effective for residential installations, particularly for new construction where sufficient land is available. Also see [closed-loop geothermal heat pump systems](#).

## **Horsepower (hp)**

A unit of rate of operation. Electrical hp: a measure of time rate of mechanical energy output; usually applied to electric motors as the maximum output; 1 electrical hp is equal to 0.746 kilowatts or 2,545 Btu per hour. Shaft hp: a measure of the actual mechanical energy per unit time delivered to a turning shaft; 1 shaft Hp is equal to 1 electrical Hp or 550 foot pounds per second. Boiler Hp: a measure to the maximum rate to heat output of a steam generator; 1 boiler Hp is equal to 33,480 Btu per hour steam output.

## **Horsepower Hour (hph)**

One horsepower provided over one hour; equal to 0.745 kilowatt-hour or 2,545 Btu.

## **Hot Air Furnace**

A heating unit where heat is distributed by means of convection or fans.

## **Hot Dry Rock**

A geothermal energy resource that consists of high temperature rocks above 300 F (150 C) that may be fractured and have little or no water. To extract the heat, the rock must first be fractured, then water is injected into the rock and pumped out to extract the heat.

In the western United States, as much as 95,000 square miles (246,050 square km) have hot dry rock potential.

### **Hot Water Heating Systems**

(See Hydronic)

### **Hub Height**

The height above the ground that a horizontal axis wind turbine's hub is located.

### **Humidifier**

A device used to maintain a specified humidity in a conditioned space.

### **Humidity**

A measure of the moisture content of air; may be expressed as absolute, mixing ratio, saturation deficit, relative, or specific.

### **Hybrid System**

A renewable energy system that includes two different types of technologies that produce the same type of energy; for e.g., a wind turbine and a solar photovoltaic array combined to meet a power demand.

### **Hydroelectric Power Plant**

A power plant that produces electricity by the force of water falling through a hydro turbine that spins a generator.

### **Hydrogen**

A chemical element that can be used as a fuel since it has a very high energy content.

## **Hydrogenated Amorphous Silicon**

Amorphous silicon with a small amount of incorporated hydrogen. The hydrogen neutralizes dangling bonds in the amorphous silicon, allowing charge carriers to flow more freely.

## **Hydronic Heating Systems**

A type of heating system where water is heated in a boiler and either moves by natural convection or is pumped to heat exchangers or radiators in rooms; radiant floor systems have a grid of tubing laid out in the floor for distributing heat. The temperature in each room is controlled by regulating the flow of hot water through the radiators or tubing.

## **Hydrothermal fluids**

These fluids can be either water or steam trapped in fractured or porous rocks; they are found from several hundred feet to several miles below the Earth's surface. The temperatures vary from about 90 F to 680 F (32 C to 360 C) but roughly 2/3 range in temperature from 150 F to 250 F (65.5 C to 121.1 C). The latter are the easiest to access and, therefore, the only forms being used commercially.

## **I**

### **Ignite**

To heat a gaseous mixture to the temperature at which combustion takes place.

### **Ignition Point**

The minimum temperature at which combustion of a solid or fluid can occur.

### **Illuminance**

A measure of the amount of light incident on a surface; measured in foot-candles or Lux.

**Illumination**

The distribution of light on a horizontal surface. The purpose of all lighting is to produce illumination.

**Impoundment**

A body of water confined by a dam, dike, floodgate or other artificial barrier.

**Impulse Turbine**

A turbine that is driven by high velocity jets of water or steam from a nozzle directed to vanes or buckets attached to a wheel. (A pelton wheel is an impulse hydro turbine).

**Incandescent**

These lights use an electrically heated filament to produce light in a vacuum or inert gas-filled bulb.

**Incident Solar Radiation**

The amount of solar radiation striking a surface per unit of time and area.

**Independent Power Producer**

A company or individual that is not directly regulated as a power provider. These entities produce power for their own use and/or sell it to regulated power providers.

**Indirect Solar Gain System**

A passive solar heating system in which the sun warms a heat storage element, and the heat is distributed to the interior space by convection, conduction, and radiation.

**Indirect Solar Water Heater**

These systems circulate fluids other than water (such as diluted antifreeze) through the collector. The collected heat is transferred to

the household water supply using a heat exchanger. Also known as "closed-loop" systems.

### **Induction**

The production of an electric current in a conductor by the variation of a magnetic field in its vicinity.

### **Induction Generator**

A device that converts the mechanical energy of rotation into electricity based on electromagnetic induction. An electric voltage (electromotive force) is induced in a conducting loop (or coil) when there is a change in the number of magnetic field lines (or magnetic flux) passing through the loop. When the loop is closed by connecting the ends through an external load, the induced voltage will cause an electric current to flow through the loop and load. Thus rotational energy is converted into electrical energy.

### **Induction Motor**

A motor in which a three phase (or any multiphase) alternating current (i.e. the working current) is supplied to iron-cored coils (or windings) within the stator. As a result, a rotating magnetic field is set up, which induces a magnetizing current in the rotor coils (or windings). Interaction of the magnetic field produced in this manner with the rotating field causes rotational motion to occur.

### **Industrial Process Heat**

The thermal energy used in an industrial process.

### **Inert Gas**

A gas that does not react with other substances; e.g. argon or krypton; sealed between two sheets of glazing to decrease the U-value (increase the R-Value) of windows.

## **Infrared Radiation**

Electromagnetic radiation whose wavelengths lie in the range from 0.75 micrometer to 1000 micrometers; invisible long wavelength radiation (heat) capable of producing a thermal or photovoltaic effect, though less effective than visible light.

## **Insolation**

The solar power density incident on a surface of stated area and orientation, usually expressed as Watts per square meter or Btu per square foot per hour.

## **Installed Capacity**

The total capacity of electrical generation devices in a power station or system.

## **Instantaneous Efficiency (of a Solar Collector)**

The amount of energy absorbed (or converted) by a solar collector (or photovoltaic cell or module) over a 15 minute period.

## **Insulation**

Materials that prevent or slow down the movement of heat.

## **Insulation Blanket**

A pre-cut layer of insulation applied around a water heater storage tank to reduce stand-by heat loss from the tank.

## **Insulator**

A device or material with a high resistance to electricity flow.

## **Integral Collector Storage System**

This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. An integral collector storage system is mounted on the ground or on the roof (make sure your roof structure is strong

enough to support it). Some systems use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit radiative loss. Also known as bread box systems or batch heaters.

### **Integrated Heating Systems**

A type of heating appliance that performs more than one function, for example space and water heating.

### **Integrated Resource Plan (IRP)**

A plan developed by an electric power provider, sometimes as required by a public regulatory commission or agency, that defines the short and long term capacity additions (supply side) and demand side management programs that it will undertake to meet projected energy demands.

### **Interconnection**

A connection or link between power systems that enables them to draw on each other's reserve capacity in time of need.

### **Intermittent Generators**

Power plants, whose output depends on a factor(s) that cannot be controlled by the power generator because they utilize intermittent resources such as solar energy or the wind.

### **Internal Combustion Electric Power Plant**

The generation of electric power by a heat engine which converts part of the heat generated by combustion of the fuel into mechanical motion to operate an electric generator.

### **Internal Gain**

The heat produced by sources of heat in a building (occupants, appliances, lighting, etc).

**Internal Mass**

Materials with high thermal energy storage capacity contained in or part of a building's walls, floors, or freestanding elements.

**Internal Rate of Return**

A widely used rate of return for performing economic analysis. This method solves for the interest rate that equates the equivalent worth of an alternative's cash receipts or savings to the equivalent worth of cash expenditures, including investments. The resultant interest rate is termed the internal rate of return (IRR).

**Interruptible Load**

Energy loads that can be shut off or disconnected at the supplier's discretion or as determined by a contractual agreement between the supplier and the customer.

**Intrinsic Layer**

A layer of semiconductor material (as used in a solar photovoltaic device) whose properties are essentially those of the pure, undoped, material.

**Inverter**

A device that converts direct current electricity (from for example a solar photovoltaic module or array) to alternating current for use directly to operate appliances or to supply power to a electricity grid.

**Investment Tax Credit**

A tax credit granted for specific types of investments.

**Investor Owned Utility (IOU)**

A power provider owned by stockholders or other investors; sometimes referred to as a private power provider, in contrast to a public power provider that is owned by a government agency or cooperative.

**Ion**

An electrically charged atom or group of atoms that has lost or gained electrons; a loss makes the resulting particle positively charged; a gain makes the particle negatively charged.

**Ionizer**

A device that removes airborne particles from breathable air. Negative ions are produced and give up their negative charge to the particles. These new negative particles are then attracted to the positive particles surrounding them. This accumulation process continues until the particles become heavy enough to fall to the ground.

**Irradiance**

The direct, diffuse, and reflected solar radiation that strikes a surface.

**Isolated Solar Gain System**

A type of passive solar heating system where heat is collected in one area for use in another.

**I-Type Semiconductor**

A semiconductor material that is left intrinsic, or undoped so that the concentration of charge carriers is characteristic of the material itself rather than of added impurities.

**I-V Curve**

A graphical plot or representation the current and voltage output of a solar photovoltaic cell or module as a load on the device is increased from short circuit (no load) condition to the open circuit condition; used to characterize cell/module performance.

## **J**

### **Jacket**

The enclosure on a water heater, furnace, or boiler.

### **Joist**

A structural, load-carrying building member with an open web system that supports floors and roofs utilizing wood or specific steels and is designed as a simple span member.

### **Joule**

A metric unit of energy or work; the energy produced by a force of one Newton operating through a distance of one meter; 1 Joule per second equals 1 Watt or 0.737 foot-pounds; 1 Btu equals 1,055 Joules.

### **Joule's Law**

The rate of heat production by a steady current in any part of an electrical circuit that is proportional to the resistance and to the square of the current, or, the internal energy of an ideal gas depends only on its temperature.

### **Junction**

A region of transition between semiconductor layers, such as a p/n junction, which goes from a region that has a high concentration of acceptors (p-type) to one that has a high concentration of donors (n-type).

## **K**

### **Kaplan Turbine**

A type of turbine that has two blades whose pitch is adjustable. The turbine may have gates to control the angle of the fluid flow into the blades.

## **Kerosene**

A type of heating fuel derived by refining crude oil that has a boiling range at atmospheric pressure from 400 degrees to 550 degrees F.

## **Kilovolt-Ampere (kVa)**

A unit of apparent power, equal to 1,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

## **Kilowatt (kW)**

A standard unit of electrical power equal to one thousand watts, or to the energy consumption at a rate of 1000 Joules per second.

## **Kilowatt-hour**

A unit or measure of electricity supply or consumption of 1,000 Watts over the period of one hour; equivalent to 3,412 Btu.

## **Kinetic Energy**

Energy available as a result of motion that varies directly in proportion to an object's mass and the square of its velocity.

## **Kneewall**

A wall usually about 3 to 4 feet high located that is placed in the attic of a home, anchored with plates between the attic floor joists and the roof joist. Sheathing can be attached to these walls to enclose an attic space.

## **L**

## **Lagoon**

In wastewater treatment or livestock facilities, a shallow pond used to store wastewater where sunlight and biological activity decompose the waste.

**Lamp**

A light source composed of a metal base, a glass tube filled with an inert gas or a vapor, and base pins to attach to a fixture.

**Landscaping**

Features and vegetation on the outside of or surrounding a building for aesthetics and energy conservation.

**Langley**

A unit or measure of solar radiation; 1 calorie per square centimeter or 3.69 Btu per square foot.

**Lattice**

The regular periodic arrangement of atoms or molecules in a crystal of semiconductor material.

**Latent Cooling Load**

The load created by moisture in the air, including from outside air infiltration and that from indoor sources such as occupants, plants, cooking, showering, etc.

**Latent Heat**

The change in heat content that occurs with a change in phase and without change in temperature.

**Latent Heat of Vaporization**

The quantity of heat produced to change a unit weight of a liquid to vapor with no change in temperature.

**Law(s) of Thermodynamics**

The first law states that energy can not be created or destroyed; the second law states that when a free exchange of heat occurs between two materials, the heat always moves from the warmer to the cooler material.

## **Lead Acid Battery**

An electrochemical battery that uses lead and lead oxide for electrodes and sulfuric acid for the electrolyte.

## **Leading Edge**

In reference to a wind energy conversion system, the area of a turbine blade surface that first comes into contact with the wind.

## **Leaking Electricity**

Related to stand-by power, leaking electricity is the power needed for electrical equipment to remain ready for use while in a dormant mode or operation. Electricity is still used by many electrical devices, such as TVs, stereos, and computers, even when you think they are turned "off."

## **Lethe**

A measure of air purity that is equal to one complete air change (in an interior space).

## **Levelized Life Cycle Cost**

A total life cycle cost divided into equal amounts.

## **Life Cycle Cost**

The sum of all the costs both recurring and nonrecurring, related to a product, structure, system, or service during its life span or specified time period.

## **Lift**

The force that pulls a wind turbine blade, as opposed to drag.

## **Light Quality**

A description of how well people in a lighted space can see to do visual tasks and how visually comfortable they feel in that space.

### **Light-Induced Defects**

Defects, such as dangling bonds, induced in an amorphous silicon semiconductor upon initial exposure to light.

### **Light Trapping**

The trapping of light inside a semiconductor material by refracting and reflecting the light at critical angles; trapped light will travel further in the material, greatly increasing the probability of absorption and hence of producing charge carriers.

### **Line Loss (or Drop)**

Electrical energy lost due to inherent inefficiencies in an electrical transmission and distribution system under specific conditions.

### **Liquid-Based Solar Heating System**

A solar heating system that uses a liquid as the heat transfer fluid.

### **Liquid-To-Air Heat Exchanger**

A heat exchanger that transfers the heat contained in a liquid heat transfer fluid to air.

### **Liquid-To-Liquid Heat Exchanger**

A heat exchanger that transfers heat contained in a liquid heat transfer fluid to another liquid.

### **Lithium-Sulfur Battery**

A battery that uses lithium in the negative electrode and a metal sulfide in the positive electrode, and the electrolyte is molten salt; can store large amounts of energy per unit weight.

### **Live Steam**

Steam available directly from a boiler under full pressure.

## **Load**

The power required to run a defined circuit or system, such as a refrigerator, building, or an entire electricity distribution system.

## **Load Analysis**

Assessing and quantifying the discrete components that comprise a load. This analysis often includes time of day or season as a variable.

## **Load Duration Curve**

A curve that displays load values on the horizontal axis in descending order of magnitude against the percent of time (on the vertical axis) that the load values are exceeded.

## **Load Factor**

The ratio of average energy demand (load) to maximum demand (peak load) during a specific period.

## **Load Forecast**

An estimate of power demand at some future period.

## **Load Leveling**

The deferment of certain loads to limit electrical power demand, or the production of energy during off-peak periods for storage and use during peak demand periods.

## **Load Management**

To influence the demand on a power source.

## **Load Profile or Shape**

A curve on a chart showing power (kW) supplied (on the horizontal axis) plotted against time of occurrence (on the vertical axis) to illustrate the variance in a load in a specified time period.

## **Load Shedding**

Turning off or disconnecting loads to limit peak demand.

## **Load Shifting**

A load management objective that moves loads from on-peak periods to off-peak periods.

## **Local Solar Time**

A system of astronomical time in which the sun crosses the true north-south meridian at 12 noon, and which differs from local time according to longitude, time zone, and equation of time.

## **Log Law**

In reference to a wind energy conversion system, the wind speed profile in which wind speeds increase with the logarithmic of the height of the wind turbine above the ground.

## **Long Ton**

A unit that equals 20 long hundredweight or 2,240 pounds. Used mainly in England.

## **Long-Wave Radiation**

Infrared or radiant heat.

## **Loose Fill Insulation**

Insulation made from rockwool fibers, fiberglass, cellulose fiber, vermiculite or perlite minerals, and composed of loose fibers or granules can be applied by pouring directly from the bag or with a blower.

## **Losses (Energy)**

A general term applied to the energy that is converted to a form that can not be effectively used (lost) during the operation of an energy producing, conducting, or consuming system.

### **Loss of Load Probability (LOLP)**

A measure of the probability that a system demand will exceed capacity during a given period; often expressed as the estimated number of days over a long period, frequently 10 years or the life of the system.

### **Low Btu Gas**

A fuel gas with a heating value between 90 and 200 Btu per cubic foot.

### **Low-E Coatings & (Window) Films**

A coating applied to the surface of the glazing of a window to reduce heat transfer through the window.

### **Low-Emissivity Windows & (Window) Films**

Energy-efficient windows that have a coating or film applied to the surface of the glass to reduce heat transfer through the window.

### **Lower (Net) Heating Value**

The lower or net heat of combustion for a fuel that assumes that all products of combustion are in a gaseous state. (See Net Heating Value below.)

### **Low-Flow Solar Water Heating Systems**

The flow rate in these systems is 1/8 to 1/5 the rate of most solar water heating systems. The low-flow systems take advantage of stratification in the storage tank and theoretically allows for the use of smaller diameter piping to and from the collector and a smaller pump.

### **Low Flush Toilet**

A toilet that uses less water than a standard one during flushing, for the purpose of conserving water resources.

## **Low-Pressure Sodium Lamp**

A type of lamp that produces light from sodium gas contained in a bulb operating at a partial pressure of 0.13 to 1.3 Pascal. The yellow light and large size make them applicable to lighting streets and parking lots.

## **Lumen**

An empirical measure of the quantity of light. It is based upon the spectral sensitivity of the photosensors in the human eye under high (daytime) light levels. Photometrically it is the luminous flux emitted with a solid angle (1 steradian) by a point source having a uniform luminous intensity of 1 candela. As reference, a 100-watt incandescent lamp emits about 1600 lumens.

## **Lumens/Watt (lpw)**

A measure of the efficacy (efficiency) of lamps. It indicates the amount of light (lumens) emitted by the lamp for each unit of electrical power (Watts) used.

## **Luminaire**

A complete lighting unit consisting of a lamp(s), housing, and connection to the power circuit.

## **Luminance**

The physical measure of the subjective sensation of brightness; measured in lumens.

## **Lux**

The unit of illuminance equivalent to 1 lumen per square meter.

## **M**

## **Magma**

Molten or partially molten rock at temperatures ranging from 1,260 F to 2,880 F (700 C to 1600 C). Some magma bodies are believed

to exist at drillable depths within the Earth's crust, although practical technologies for harnessing magma energy have not been developed. If ever utilized, magma represents a potentially enormous resource.

### **Magnetic Ballast**

A type of florescent light ballast that uses a magnetic core to regulate the voltage of a florescent lamp.

### **Make-Up Air**

Air brought into a building from outside to replace exhaust air.

### **Manual J**

The standard method for calculating residential cooling loads developed by the Air-Conditioning and Refrigeration Institute (ARI) and the Air Conditioning Contractors of America (ACCA) based largely on the American Society of Heating, Refrigeration, and Air-Conditioning Engineer's (ASHRAE) "Handbook of Fundamentals."

### **Marginal Cost**

The cost of producing one additional unit of a product.

### **Masonry**

Material such as brick, rock, or stone.

### **Masonry Stove**

A type of heating appliance similar to a fireplace, but much more efficient and clean burning. They are made of masonry and have long channels through which combustion gases give up their heat to the heavy mass of the stove, which releases the heat slowly into a room. Often called Russian or Finnish fireplaces.

### **Mass Burn Facility**

A type of municipal solid waste (MSW) incineration facility in which MSW is burned with only minor presorting to remove oversize,

hazardous, or explosive materials. Mass burn facilities can be large, with capacities of 3000 tons (2.7 million kg) of MSW per day or more. They can be scaled down to handle the waste from smaller communities, and modular plants with capacities as low as 25 tons (22.7 thousand kg) per day have been built. Mass burn technologies represent over 75% of all the MSW-to-energy facilities constructed in the United States to date. The major components of a mass burn facility include refuse receiving and handling, combustion and steam generation, flue gas cleaning, power generation (optional), condenser cooling water, residue ash hauling and landfilling.

### **MCF**

An abbreviation for one thousand cubic feet of natural gas with a heat content of 1,000,000 Btus, or 10 therms.

### **Mean Power Output (of a Wind Turbine)**

The average power output of a wind energy conversion system at a given mean wind speed based on a Raleigh frequency distribution.

### **Mean Wind Speed**

The arithmetic wind speed over a specified time period and height above the ground (the majority of U.S. National Weather Service anemometers are at 20 feet (6.1 meters)).

### **Mechanical Systems**

Those elements of building used to control the interior climate.

### **Median Wind Speed**

The wind speed with 50 percent probability of occurring.

### **Medium Btu Gas**

Fuel gas with a heating value of between 200 and 300 Btu per cubic foot.

**Medium Pressure**

For valves and fittings, implies that they are suitable for working pressures between 125 to 175 pounds per square inch.

**Megawatt**

One thousand kilowatts, or 1 million watts; standard measure of electric power plant generating capacity.

**Megawatt-hour**

One thousand kilowatt-hours or 1 million watt-hours.

**Mercury Vapor Lamp**

A high-intensity discharge lamp that uses mercury as the primary light-producing element. Includes clear, phosphor coated, and self-ballasted lamps.

**Met**

An approximate unit of heat produced by a resting person, equal to about 18.5 Btu per square foot per hour.

**Metal Halide Lamp**

A high-intensity discharge lamp type that uses mercury and several halide additives as light-producing elements. These lights have the best Color Rendition Index (CRI) of the High-Intensity Discharge lamps. They can be used for commercial interior lighting or for stadium lights.

**Methane**

A colorless, odorless, tasteless gas composed of one molecule of Carbon and four of hydrogen, which is highly flammable. It is the main constituent of "natural gas" that is formed naturally by methanogenic, anaerobic bacteria or can be manufactured, and which is used as a fuel and for manufacturing chemicals.

**Methanol (CH<sub>3</sub>OH; Methyl alcohol or wood alcohol)**

A clear, colorless, very mobile liquid that is flammable and poisonous; used as a fuel and fuel additive, and to produce chemicals.

**Metric Ton (Tonne)**

A unit of mass equal to 1,000 kilograms or 2,204.6 pounds.

**Microclimate**

The local climate of specific place or habitat, as influenced by landscape features.

**Microgroove**

A small groove scribed into the surface of a solar photovoltaic cell which is filled with metal for contacts.

**Micrometer**

One millionth of a meter (10<sup>-6</sup> m).

**Mill**

A common monetary measure equal to one-thousandth of a dollar or a tenth of a cent.

**Minority Carrier**

A current carrier, either an electron or a hole, that is in the minority in a specific layer of a semiconductor material; the diffusion of minority carriers under the action of the cell junction voltage is the current in a photovoltaic device.

**Minority Carrier Lifetime**

The average time a minority carrier exists before recombination.

## **Mixing Valve**

A valve operated by a thermostat that can be installed in solar water heating systems to mix cold water with water from the collector loop to maintain a safe water temperature.

## **Modified Degree-Day Method**

A method used to estimate building heating loads by assuming that heat loss and gain is proportional to the equivalent heat-loss coefficient for the building envelope.

## **Module**

The smallest self-contained, environmentally protected structure housing interconnected photovoltaic cells and providing a single dc electrical output; also called a panel.

## **Moisture Content**

The water content of a substance (a solid fuel) as measured under specified conditions being the: Dry Basis, which equals the weight of the wet sample minus the weight of a (bone) dry sample divided by the weight of the dry sample times 100 (to get percent); Wet Basis, which is equal to the weight of the wet sample minus the weight of the dry sample divided by the weight of the wet sample times 100.

## **Moisture Control**

The process of controlling indoor moisture levels and condensation.

## **Monolithic**

Fabricated as a single structure.

## **Monoculture**

The planting, cultivation, and harvesting of a single species of crop in a specified area.

**Motor**

A machine supplied with external energy that is converted into force and/or motion.

**Motor Speed**

The number of revolutions that the motor turns in a given time period (i.e. revolutions per minute, rpm).

**Movable Insulation**

A device that reduces heat loss at night and during cloudy periods and heat gain during the day in warm weather. A movable insulator could be an insulative shade, shutter panel, or curtain.

**MTBE**

Methyl Tertiary Butyl Ether (MTBE) is an ether compound used as a gasoline blending component to raise the oxygen content of gasoline. MTBE is made by combining isobutylene (from various refining and chemical processes) and methanol (usually made from natural gas).

**Multijunction Device**

A high-efficiency photovoltaic device containing two or more cell junctions, each of which is optimized for a particular part of the solar spectrum.

**Multi-Zone System**

A building heating, ventilation, and/or air conditioning system that distributes conditioned air to individual zones or rooms.

**Municipal Solid Waste (MSW)**

Waste material from households and businesses in a community that is not regulated as hazardous.

## **Municipal Waste**

As defined in the Energy Security Act (P.L. 96-294; 1980) as "any organic matter, including sewage, sewage sludge, and industrial or commercial waste, and mixtures of such matter and inorganic refuse from any publicly or privately operated municipal waste collection or similar disposal system, or from similar waste flows (other than such flows which constitute agricultural wastes or residues, or wood wastes or residues from wood harvesting activities or production of forest products)."

## **Municipal Waste to Energy Project (or Plant)**

A facility that produces fuel or energy from municipal solid waste.

## **N**

### **Nacelle**

The cover for the gear box, drive train, generator, and other components of a wind turbine.

### **Name Plate**

A metal tag attached to a machine or appliance that contains information such as brand name, serial number, voltage, power ratings under specified conditions, and other manufacturer supplied data.

## **National Electrical Code (NEC)**

The NEC is a set of regulations that have contributed to making the electrical systems in the United States one of the safest in the world. The intent of the NEC is to ensure safe electrical systems are designed and installed. The National Fire Protection Association has sponsored the NEC since 1911. The NEC changes as technology evolves and component sophistication increases. The NEC is updated every three years. Following the NEC is required in most locations.

## **National Rural Electric Cooperative Association (NRECA)**

This is a national organization dedicated to representing the interests of cooperative electric power providers and the consumers they serve. Members come from the 46 states that have an electric distribution cooperative.

## **Natural Cooling**

Space cooling achieved by shading, natural (unassisted, as opposed to forced) ventilation, conduction control, radiation, and evaporation; also called passive cooling.

## **Natural Draft**

Draft that is caused by temperature differences in the air.

## **Natural Gas**

A hydrocarbon gas obtained from underground sources, often in association with petroleum and coal deposits. It generally contains a high percentage of methane, varying amounts of ethane, and inert gases; used as a heating fuel.

## **Natural Gas Steam Reforming Production**

A two step process where in the first step natural gas is exposed to a high-temperature steam to produce hydrogen, carbon monoxide, and carbon dioxide. The second step is to convert the carbon monoxide with steam to produce additional hydrogen and carbon dioxide.

## **Natural Ventilation**

Ventilation that is created by the differences in the distribution of air pressures around a building. Air moves from areas of high pressure to areas of low pressure with gravity and wind pressure affecting the airflow. The placement and control of doors and windows alters natural ventilation patterns.

### **Net Energy Production (or Balance)**

The amount of useful energy produced by a system less the amount of energy required to produce the fuel.

### **Net Generation**

Equal to gross generation less electricity consumption of a power plant.

### **Net (Lower) Heating Value (NHV)**

The potential energy available in a fuel as received, taking into account the energy loss in evaporating and superheating the water in the fuel. Equal to the higher heating value minus  $1050W$  where  $W$  is the weight of the water formed from the hydrogen in the fuel, and 1050 is the latent heat of vaporization of water, in Btu, at 77 degrees Fahrenheit.

### **Net Metering**

The practice of using a single meter to measure consumption and generation of electricity by a small generation facility (such as a house with a wind or solar photovoltaic system). The net energy produced or consumed is purchased from or sold to the power provider, respectively.

### **Net Present Value**

The value of a personal portfolio, product, or investment after depreciation and interest on debt capital are subtracted from operating income. It can also be thought of as the equivalent worth of all cash flows relative to a base point called the present.

### **Nitrogen Dioxide**

This compound of nitrogen and oxygen is formed by the oxidation of nitric oxide (NO) which is produced by the combustion of solid fuels.

**Nitrogen Oxides (NO<sub>x</sub>)**

The products of all combustion processes formed by the combination of nitrogen and oxygen.

**Nominal Capacity**

The approximate energy producing capacity of a power plant, under specified conditions, usually during periods of highest load.

**Nominal Price**

The price paid for goods or services at the time of a transaction; a price that has not been adjusted to account for inflation.

**Nocturnal Cooling**

The effect of cooling by the radiation of heat from a building to the night sky.

**Nonrenewable Fuels**

Fuels that cannot be easily made or "renewed," such as oil, natural gas, and coal.

**Non-Utility Generator/Power Producer**

A class of power generator that is not a regulated power provider and that has generating plants for the purpose of supplying electric power required in the conduct of their industrial and commercial operations.

**Normal Recovery Capacity**

A characteristic applied to domestic water heaters that is the amount of gallons raised 100 degrees Fahrenheit per hour (or minute) under a specified thermal efficiency.

**N-Type Semiconductor**

A semiconductor produced by doping an intrinsic semiconductor with an electron-donor impurity (e.g., phosphorous in silicon).

## **Nuclear Energy**

Energy that comes from splitting atoms of radioactive materials, such as uranium, and which produces radioactive wastes.

## **O**

### **Occupancy Sensor**

An optical, ultrasonic, or infrared sensor that turns room lights on when they detect a person's presence and off after the space is vacated.

### **Occupied Space**

The space within a building or structure that is normally occupied by people, and that may be conditioned (heated, cooled and/or ventilated).

### **Ocean Energy Systems**

Energy conversion technologies that harness the energy in tides, waves, and thermal gradients in the oceans.

### **Ocean Thermal Energy Conversion (OTEC)**

The process or technologies for producing energy by harnessing the temperature differences (thermal gradients) between ocean surface waters and that of ocean depths. Warm surface water is pumped through an evaporator containing a working fluid in a closed Rankine-cycle system. The vaporized fluid drives a turbine/generator. Cold water from deep below the surface is used to condense the working fluid. Open-Cycle OTEC technologies use ocean water itself as the working fluid. Closed-Cycle OTEC systems circulate a working fluid in a closed loop. A working 10 kilowatt, closed-cycle prototype was developed by the Pacific International Center for High Technology Research in Hawaii with U.s. Department of Energy funding, but was not commercialized.

**Off-Peak**

The period of low energy demand, as opposed to maximum, or peak, demand.

**Ohms**

A measure of the electrical resistance of a material equal to the resistance of a circuit in which the potential difference of 1 volt produces a current of 1 ampere.

**Ohm's Law**

In a given electrical circuit, the amount of current in amperes ( $i$ ) is equal to the pressure in volts ( $V$ ) divided by the resistance, in ohms ( $R$ ).

**Oil (fuel)**

A product of crude oil that is used for space heating, diesel engines, and electrical generation.

**One-Axis Tracking**

A system capable of rotating about one axis.

**One Sun**

The maximum value of natural solar insolation.

**On-Peak Energy**

Energy supplied during periods of relatively high system demands as specified by the supplier.

**On-Site Generation**

Generation of energy at the location where all or most of it will be used.

## **Open Access**

The ability to send or wheel electric power to a customer over a transmission and distribution system that is not owned by the power generator (seller).

## **Open-Circuit Voltage**

The maximum possible voltage across a photovoltaic cell; the voltage across the cell in sunlight when no current is flowing.

## **Open-Loop Geothermal Heat Pump System**

Open-loop (also known as "direct") systems circulate water drawn from a ground or surface water source. Once the heat has been transferred into or out of the water, the water is returned to a well or surface discharge (instead of being recirculated through the system). This option is practical where there is an adequate supply of relatively clean water, and all local codes and regulations regarding groundwater discharge are met.

## **Operating Cycle**

The processes that a work input/output system undergoes and in which the initial and final states are identical.

## **Orientation**

The alignment of a building along a given axis to face a specific geographical direction. The alignment of a solar collector, in number of degrees east or west of true south.

## **Outage**

A discontinuance of electric power supply.

## **Outgassing**

The process by which materials expel or release gasses.

**Outside Air**

Air that is taken from the outdoors.

**Outside Coil**

The heat-transfer (exchanger) component of a heat pump, located outdoors, from which heat is collected in the heating mode, or expelled in the cooling mode.

**Overhang**

A building element that shades windows, walls, and doors from direct solar radiation and protects these elements from precipitation.

**Overload**

To exceed the design capacity of a device.

**Ovonic**

A device that converts heat or sunlight directly to electricity, invented by Stanford Ovshinsky, that has a unique glass composition that changes from an electrically non-conducting state to a semiconducting state.

**Oxygenates**

Gasoline fuel additives such as ethanol, ETBE, or MTBE that add extra oxygen to gasoline to reduce carbon monoxide pollution produced by vehicles.

**P****Packing Factor**

The ratio of solar collector array area to actual land area.

**Pane (Window)**

The area of glass that fits in the window frame.

## **Panel (Solar)**

A term generally applied to individual solar collectors, and typically to solar photovoltaic collectors or modules.

## **Panel Radiator**

A mainly flat surface for transmitting radiant energy.

## **Panemone**

A drag-type wind machine that can react to wind from any direction.

## **Parabolic Aluminized Reflector Lamp**

A type of lamp having a lens of heavy durable glass that focuses the light. They have longer lifetimes with less lumen depreciation than standard incandescent lamps.

## **Parabolic Dish**

A solar energy conversion device that has a bowl shaped dish covered with a highly reflective surface that tracks the sun and concentrates sunlight on a fixed absorber, thereby achieving high temperatures, for process heating or to operate a heat (Stirling) engine to produce power or electricity.

## **Parabolic Trough**

A solar energy conversion device that uses a trough covered with a highly reflective surface to focus sunlight onto a linear absorber containing a working fluid that can be used for medium temperature space or process heat or to operate a steam turbine for power or electricity generation.

## **Parallel**

A configuration of an electrical circuit in which the voltage is the same across the terminals. The positive reference direction for each resistor current is down through the resistor with the same voltage across each resistor.

## **Particulates**

The fine liquid or solid particles contained in combustion gases. The quantity and size of particulates emitted by cars, power and industrial plants, wood stoves, etc are regulated by the U.S. Environmental Protection Agency.

## **Parallel Connection**

A way of joining photovoltaic cells or modules by connecting positive leads together and negative leads together; such a configuration increases the current, but not the voltage.

## **Passivation**

A chemical reaction that eliminates the detrimental effect of electrically reactive atoms on a photovoltaic cell's surface.

## **Passive/Natural Cooling**

To allow or augment the natural movement of cooler air from exterior, shaded areas of a building through or around a building.

## **Passive Solar (Building) Design**

A building design that uses structural elements of a building to heat and cool a building, without the use of mechanical equipment, which requires careful consideration of the local climate and solar energy resource, building orientation, and landscape features, to name a few. The principal elements include proper building orientation, proper window sizing and placement and design of window overhangs to reduce summer heat gain and ensure winter heat gain, and proper sizing of thermal energy storage mass (for example a Trombe wall or masonry tiles). The heat is distributed primarily by natural convection and radiation, though fans can also be used to circulate room air or ensure proper ventilation.

## **Passive Solar Heater**

A solar water or space-heating system in which solar energy is collected, and/or moved by natural convection without using pumps

or fans. Passive systems are typically integral collector/storage (ICS; or batch collectors) or thermosyphon systems. The major advantage of these systems is that they do not use controls, pumps, sensors, or other mechanical parts, so little or no maintenance is required over the lifetime of the system.

### **Passive Solar Home**

A house built using passive solar design techniques.

### **Payback Period**

The amount of time required before the savings resulting from your system equal the system cost.

### **Peak Clipping/Shaving**

The process of implementing measures to reduce peak power demands on a system.

### **Peak Demand/Load**

The maximum energy demand or load in a specified time period.

### **Peaking Capacity**

Power generation equipment or system capacity to meet peak power demands.

### **Peaking Hydropower**

A hydropower plant that is operated at maximum allowable capacity for part of the day and is either shut down for the remainder of the time or operated at minimal capacity level.

### **Peak Power**

Power generated that operates at a very low capacity factor; generally used to meet short-lived and variable high demand periods.

## **Peak Shifting**

The process of moving existing loads to off-peak periods.

## **Peak Sun Hours**

The equivalent number of hours per day when solar irradiance averages 1 kW/m<sup>2</sup>. For example, six peak sun hours means that the energy received during total daylight hours equals the energy that would have been received had the irradiance for six hours been 1 kW/m<sup>2</sup>.

## **Peak Watt**

A unit used to rate the performance of a solar photovoltaic (PV) cells, modules, or arrays; the maximum nominal output of a PV device, in Watts (Wp) under standardized test conditions, usually 1000 Watts per square meter of sunlight with other conditions, such as temperature specified.

## **Peak Wind Speed**

The maximum instantaneous wind speed (or velocity) that occurs within a specific period of time or interval.

## **Pellets**

Solid fuels made from primarily wood sawdust that is compacted under high pressure to form small (about the size of rabbit feed) pellets for use in a pellet stove.

## **Pellet Stove**

A space heating device that burns pellets; are more efficient, clean burning, and easier to operate relative to conventional cord wood burning appliances.

## **Pelton Turbine**

A type of impulse hydropower turbine where water passes through nozzles and strikes cups arranged on the periphery of a runner, or wheel, which causes the runner to rotate, producing mechanical

energy. The runner is fixed on a shaft, and the rotational motion of the turbine is transmitted by the shaft to a generator. Generally used for high head, low flow applications.

### **Penstock**

A component of a hydropower plant; a pipe that delivers water to the turbine.

### **Perfluorocarbon Tracer Gas Technique (PFT)**

An air infiltration measurement technique developed by the Brookhaven National Laboratory to measure changes over time (one week to five months) when determining a building's air infiltration rate. This test cannot locate exact points of infiltration, but it does reveal long-term infiltration problems.

### **Performance Ratings**

Solar collector thermal performance ratings based on collector efficiencies, usually expressed in Btu per hour for solar collectors under standard test or operating conditions for solar radiation intensity, inlet working fluid temperatures, and ambient temperatures.

### **Perimeter Heating**

A term applied to warm-air heating systems that deliver heated air to rooms by means of registers or baseboards located along exterior walls.

### **Permeance**

A unit of measurement for the ability of a material to retard the diffusion of water vapor at 73.4 F (23 C). A perm, short for permeance, is the number of grains of water vapor that pass through a square foot of material per hour at a differential vapor pressure equal to one inch of mercury.

## **Phantom Load**

Any appliance that consumes power even when it is turned off. Examples of phantom loads include appliances with electronic clocks or timers, appliances with remote controls, and appliances with wall cubes (a small box that plugs into an AC outlet to power appliances).

## **Phase**

Alternating current is carried by conductors and a ground to residential, commercial, or industrial consumers. The waveform of the phase power appears as a single continuous sine wave at the system frequency whose amplitude is the rated voltage of the power.

## **Phase Change**

The process of changing from one physical state (solid, liquid, or gas) to another, with a necessary or coincidental input or release of energy.

## **Phase-Change Material**

A material that can be used to store thermal energy as latent heat. Various types of materials have been and are being investigated such as inorganic salts, eutectic compounds, and paraffins, for a variety of applications, including solar energy storage (solar energy heats and melts the material during the day and at night it releases the stored heat and reverts to a solid state).

## **Photobiological Hydrogen Production**

A hydrogen production process that process uses algae. Under certain conditions, the pigments in certain types of algae absorb solar energy. An enzyme in the cell acts as a catalyst to split water molecules. Some of the bacteria produces hydrogen after they grow on a substrate.

**Photocurrent**

An electric current induced by radiant energy.

**Photoelectric Cell**

A device for measuring light intensity that works by converting light falling on, or reach it, to electricity, and then measuring the current; used in photometers.

**Photoelectrochemical Cell**

A type of photovoltaic device in which the electricity induced in the cell is used immediately within the cell to produce a chemical, such as hydrogen, which can then be withdrawn for use.

**Photoelectrolysis Hydrogen Production**

The production of hydrogen using a photoelectrochemical cell.

**Photogalvanic Processes**

The production of electrical current from light.

**Photon**

A particle of light that acts as an individual unit of energy.

**Photovoltaic (Conversion) Efficiency**

The ratio of the electric power produced by a photovoltaic device to the power of the sunlight incident on the device.

**Photovoltaic (PV; Solar) Array**

A group of solar photovoltaic modules connected together.

**Photovoltaic (Solar) Cell**

Treated semiconductor material that converts solar irradiance to electricity.

## **Photovoltaic Device**

A solid-state electrical device that converts light directly into direct current electricity of voltage-current characteristics that are a function of the characteristics of the light source and the materials in and design of the device. Solar photovoltaic devices are made of various semi-conductor materials including silicon, cadmium sulfide, cadmium telluride, and gallium arsenide, and in single crystalline, multi-crystalline, or amorphous forms.

## **Photovoltaic (Solar) Module or Panel**

A solar photovoltaic product that generally consists of groups of PV cells electrically connected together to produce a specified power output under standard test conditions, mounted on a substrate, sealed with an encapsulant, and covered with a protective glazing. Maybe further mounted on an aluminum frame. A junction box, on the back or underside of the module is used to allow for connecting the module circuit conductors to external conductors.

## **Photovoltaic Peak Watt**

see Peak Watt.

## **Photovoltaic (Solar) System**

A complete PV power system composed of the module (or array), and balance-of-system (BOS) components including the array supports, electrical conductors/wiring, fuses, safety disconnects, and grounds, charge controllers, inverters, battery storage, etc.

## **Photovoltaic-Thermal (PV/T) Systems**

A solar energy system that produces electricity with a PV module, and collects thermal energy from the module for heating. There are no commercially available systems available (as of 11/97).

## **Physical Vapor Deposition**

A method of depositing thin semiconductor photovoltaic) films. With this method, physical processes, such as thermal evaporation or

bombardment of ions, are used to deposit elemental semiconductor material on a substrate.

### **Pitch Control**

A method of controlling a wind turbine's speed by varying the orientation, or pitch, of the blades, and thereby altering its aerodynamics and efficiency.

### **P-I-N**

A semiconductor (photovoltaic) device structure that layers an intrinsic semiconductor between a p-type semiconductor and an n-type semiconductor; this structure is most often used with amorphous silicon PV devices.

### **P/N**

A semiconductor (photovoltaic) device structure in which the junction is formed between a p-type layer and an n-type layer.

### **Plenum**

The space between a hanging ceiling and the floor above or roof; usually contains HVAC ducts, electrical wiring, fire suppression system piping, etc.

### **Plug Flow Digester**

A type of anaerobic digester that has a horizontal tank in which a constant volume of material is added and forces material in the tank to move through the tank and be digested.

### **Point-Contact Cell**

A high efficiency silicon photovoltaic concentrator cell that employs light trapping techniques and point-diffused contacts on the rear surface for current collection.

**Polycrystalline**

A semiconductor (photovoltaic) material composed of variously oriented, small, individual crystals.

**Polyethylene**

A registered trademark for plastic sheeting material that can be used as a vapor retarder. This plastic is used to make grocery bags. It is a long chain of carbon atoms with 2 hydrogen atoms attached to each carbon atom.

**Polystyrene**

(See Foam Insulation)

**Porous Media**

A solid that contains pores; normally, it refers to interconnected pores that can transmit the flow of fluids. (The term refers to the aquifer geology when discussing sites for CAES.)

**Portfolio Standard**

The requirement that an electric power provider generate or purchase a specified percentage of the power it supplies/sells from renewable energy resources, and thereby guarantee a market for electricity generated from renewable energy resources.

**Potable Water**

Water that is suitable for drinking, as defined by local health officials.

**Potential Energy**

Energy available due to position.

**Pound of Steam**

One pound of water in vapor phase; is NOT steam pressure, which is expressed as pounds per square inch (psi).

## **Pound Per Square Inch Absolute (psia)**

A unit of pressure [hydraulic (liquid) or pneumatic (gas)] that does not include atmospheric pressure.

## **Power**

Energy that is capable or available for doing work; the time rate at which work is performed, measured in horsepower, Watts, or Btu per hour. Electric power is the product of electric current and electromotive force.

## **Power Coefficient**

The ratio of power produced by a wind energy conversion device to the power in a reference area of the free windstream.

## **Power Conditioning**

The process of modifying the characteristics of electrical power (for e.g., inverting dc to ac).

## **Power (Output) Curve**

A plot of a wind energy conversion device's power output versus wind speed.

## **Power Density**

The amount of power per unit area of a free windstream.

## **Power Factor (PF)**

The ratio of actual power being used in a circuit, expressed in watts or kilowatts, to the power that is apparently being drawn from a power source, expressed in volt-amperes or kilovolt-amperes.

## **Power Generation Mix**

The proportion of electricity distributed by a power provider that is generated from available sources such as coal, natural gas, petroleum, nuclear, hydropower, wind, or geothermal.

## **Power Provider**

A company or other organizational unit that sells and distributes electrical power (e.g., private or public electrical utility), either to other distribution and wholesale businesses or to end-users. Sometimes power providers also generate the power they sell.

## **Power (Solar) Tower**

A term used to describe solar thermal, central receiver, power systems, where an array of reflectors focus sunlight onto a central receiver and absorber mounted on a tower.

## **Power Transmission Line**

An electrical conductor/cable that carries electricity from a generator to other locations for distribution.

## **Preheater (Solar)**

A solar heating system that preheats water or air that is then heated more by another heating appliance.

## **Present Value**

The amount of money required to secure a specified cash flow at a future date at a specified return.

## **Pressure Drop**

The loss in static pressure of a fluid (liquid or gas) in a system due to friction from obstructions in pipes, from valves, fittings, regulators, burners, etc, or by a breach or rupture of the system.

## **Pressurization Testing**

A technique used by energy auditors, using a blower door, to locate areas of air infiltration by exaggerating the defects in the building shell. This test only measures air infiltration at the time of the test. It does not take into account changes in atmospheric pressure, weather, wind velocity, or any activities the occupants conduct that may affect air infiltration rates over a period of time.

**Primary Air**

The air that is supplied to the combustion chamber of a furnace.

**Prime Mover**

Any machine capable of producing power to do work.

**Process Heat**

Thermal energy that is used in agricultural and industrial operations.

**Products of Combustion**

The elements and compounds that result from the combustion of a fuel.

**Producer Gas**

Low or medium Btu content gas, composed mainly of carbon monoxide, nitrogen(2), and hydrogen(2) made by the gasification of wood or coal.

**Programmable Thermostat**

A type of thermostat that allows the user to program into the devices' memory a pre-set schedule of times (when certain temperatures occur) to turn on HVAC equipment.

**Projected Area**

The net south-facing glazing area projected on a vertical plane. Also, the solid area covered at any instant by a wind turbine's blades from the perspective of the direction of the windstream (as opposed to the swept area).

**Propane**

A hydrocarbon gas,  $C_3H_8$ , occurring in crude oil, natural gas, and refinery cracking gas. It is used as a fuel, a solvent, and a

refrigerant. Propane liquefies under pressure and is the major component of liquefied petroleum gas (LPG).

### **Propeller (Hydro) Turbine**

A turbine that has a runner with attached blades similar to a propeller used to drive a ship. As water passes over the curved propeller blades, it causes rotation of the shaft.

### **Proximate Analysis**

A commonly used analysis for reporting fuel properties; may be on a dry (moisture free) basis, as "fired", or on an ash and moisture free basis. Fractions usually reported include: volatile matter, fixed carbon, moisture, ash, and heating value (higher heating value).

### **Psi**

Pounds of pressure per square inch.

### **Psia**

Pounds/force per square inch absolute.

### **Psig**

Pounds/force per square inch gauge.

### **Psychrometer**

An instrument for measuring relative humidity by means of wet and dry-bulb temperatures.

### **Psychrometrics**

The analysis of atmospheric conditions, particularly moisture in the air.

### **P-Type Semiconductor**

A semiconductor in which holes carry the current; produced by doping an intrinsic semiconductor with an electron acceptor impurity (e.g., boron in silicon).

### **Public Utility Holding Company Act (PUHCA) of 1935**

A law to protect consumers and investors. It placed geographic restrictions on mergers and limitations on diversification into non-utility lines of business and takeovers of electric and gas utilities, and also established regulated monopoly markets or service territories for utilities.

### **Public Utilities Regulatory Policy Act (PURPA) of 1978**

A law that requires electric utilities to purchase electricity produced from qualifying power producers that use renewable energy resources or are cogenerators. Power providers are required to purchase power at a rate equal to the avoided cost of generating the power themselves. (See Avoided Costs and Qualifying Facility)

### **Public Utility or Services Commissions (PUC or PSC)**

These are state government agencies responsible for the regulation of public utilities within a state or region. A state legislature oversees the PUC by reviewing changes to power generator laws, rules and regulations and approving the PUC's budget. The commission usually has five Commissioners appointed by the Governor or legislature. PUCs typically regulate: electric, natural gas, water, sewer, telephone services, trucks, buses, and taxicabs within the commission's operating region. The PUC tries to balance the interests of consumers, environmentalists, utilities, and stockholders. The PUC makes sure a region's citizens are supplied with adequate, safe power provider service at reasonable rates.

### **Pulse-Width-Modulated (PWM) Wave Inverter**

A type of power inverter that produce a high quality (nearly sinusoidal) voltage, at minimum current harmonics.

## **Pumped Storage Facility**

A type of power generating facility that pumps water to a storage reservoir during off-peak periods, and uses the stored water (by allowing it to fall through a hydro turbine) to generate power during peak periods. The pumping energy is typically supplied by lower cost base power capacity, and the peaking power capacity is of greater value, even though there is a net loss of power in the process.

## **Pyranometer**

A device used to measure total incident solar radiation (direct beam, diffuse, and reflected radiation) per unit time per unit area.

## **Pyrheliometer**

A device that measures the intensity of direct beam solar radiation.

## **Pyrolysis**

The transformation on a compound or material into one or more substances by heat alone (without oxidation). Often called destructive distillation. Pyrolysis of biomass is the thermal degradation of the material in the absence of reacting gases, and occurs prior to or simultaneously with gasification reactions in a gasifier. Pyrolysis products consist of gases, liquids, and char generally. The liquid fraction of pyrolyzed biomass consists of an insoluble viscous tar, and pyroligneous acids (acetic acid, methanol, acetone, esters, aldehydes, and furfural). The distribution of pyrolysis products varies depending on the feedstock composition, heating rate, temperature, and pressure.

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## **Q**

### **Quad**

One quadrillion Btu. (1,000,000,000,000,000 Btu)

## **Qualifying Facility**

A category of electric power producer established under the Public Utility Regulatory Policy Act (PURPA) of 1978, that includes small-power producers (SPP) who use renewable sources of energy such as biomass, geothermal, hydroelectricity, solar (thermal and photovoltaic), and wind, or cogenerators who produce both heat and electricity using any type of fuel. PURPA requires utilities to purchase electricity from these power producers at a rate approved by a state utility regulatory agency under Federal guidelines. PURPA also requires power providers to sell electricity to these producers. Some states have developed their own programs for SPPs and utilities.

## **R**

### **Radiant Barrier**

A thin, reflective foil sheet that exhibits low radiant energy transmission and under certain conditions can block radiant heat transfer; installed in attics to reduce heat flow through a roof assembly into the living space.

### **Radiant Ceiling Panels**

Ceiling panels that contain electric resistance heating elements embedded within them to provide radiant heat to a room.

### **Radiant Energy**

Energy that transmits away from its source in all directions.

### **Radiant Floor**

A type of radiant heating system where the building floor contains channels or tubes through which hot fluids such as air or water are circulated. The whole floor is evenly heated. Thus, the room heats from the bottom up. Radiant floor heating eliminates the draft and dust problems associated with forced air heating systems.

## **Radiant Heating System**

A heating system where heat is supplied (radiated) into a room by means of heated surfaces, such as electric resistance elements, hot water (hydronic) radiators, etc.

## **Radiation**

The transfer of heat through matter or space by means of electromagnetic waves.

## **Radiative Cooling**

The process of cooling by which a heat absorbing media absorbs heat from one source and radiates the heat away.

## **Radiator**

A room heat delivery (or exchanger) component of a hydronic (hot water or steam) heating system; hot water or steam is delivered to it by natural convection or by a pump from a boiler.

## **Radiator Vent**

A device that releases pressure within a radiator when the pressure inside exceeds the operating limits of the vent.

## **Radioactive Waste**

Materials left over from making nuclear energy. Radioactive waste can harm living organisms if it is not stored safely.

## **Radon**

A naturally occurring radioactive gas found in the U.S. in nearly all types of soil, rock, and water. It can migrate into most buildings. Studies have linked high concentrations of radon to lung cancer.

## **Rafter**

A construction element used for ceiling support.

## **Rammed Earth**

A construction material made by compressing earth in a form; used traditionally in many areas of the world and widely throughout North Africa and the Middle East.

## **Rankine Cycle**

The thermodynamic cycle that is an ideal standard for comparing performance of heat-engines, steam power plants, steam turbines, and heat pump systems that use a condensable vapor as the working fluid; efficiency is measured as work done divided by sensible heat supplied.

## **Rated Life**

The length of time that a product or appliance is expected to meet a certain level of performance under nominal operating conditions; in a luminaire, the period after which the lumen depreciation and lamp failure is at 70% of its initial value.

## **Rated Power**

The power output of a device under specific or nominal operating conditions.

## **Rate Schedule**

A mechanism used by electric utilities to determine prices for electricity; typically defines rates according to amounts of power demanded/consumed during specific time periods.

## **Rayleigh Frequency Distribution**

A mathematical representation of the frequency or ratio that specific wind speeds occur within a specified time interval.

## **Reactive Power**

The electrical power that oscillates between the magnetic field of an inductor and the electrical field of a capacitor. Reactive power is never converted to non-electrical power. Calculated as the square

root of the difference between the square of the kilovolt-amperes and the square of the kilowatts. Expressed as reactive volt-amperes.

### **Real Price**

The unit price of a good or service estimated from some base year in order to provide a consistent means of comparison.

### **Recirculation Systems**

A type of solar heating system that circulate warm water from storage through the collectors and exposed piping whenever freezing conditions occur; obviously a not very efficient system when operating in this mode.

### **Receiver**

The component of a central receiver solar thermal system where reflected solar energy is absorbed and converted to thermal energy.

### **Recirculated Air**

Air that is returned from a heated or cooled space, reconditioned and/or cleaned, and returned to the space.

### **Rectifier**

An electrical device for converting alternating current to direct current. The chamber in a cooling device where water is separated from the working fluid (for example ammonia).

### **Recuperator**

A heat exchanger in which heat is recovered from the products of combustion.

### **Recurrent Costs**

Costs that are repetitive and occur when an organization produces similar goods or services on a continuing basis.

## **Recycling**

The process of converting materials that are no longer useful as designed or intended into a new product.

## **Reflectance**

The amount (percent) of light that is reflected by a surface relative to the amount that strikes it.

## **Reflective Coatings**

Materials with various qualities that are applied to glass windows before installation. These coatings reduce radiant heat transfer through the window and also reflects outside heat and a portion of the incoming solar energy, thus reducing heat gain. The most common type has a sputtered coating on the inside of a window unit. The other type is a durable "hard-coat" glass with a coating, baked into the glass surface.

## **Reflective Window Films**

A material applied to window panes that controls heat gain and loss, reduces glare, minimizes fabric fading, and provides privacy. These films are retrofitted on existing windows.

## **Reflective Glass**

A window glass that has been coated with a reflective film and is useful in controlling solar heat gain during the summer.

## **Reflective Insulation (see also radiant barrier)**

An aluminum foil fabricated insulator with backings applied to provide a series of closed air spaces with highly reflective surfaces.

## **Reflector Lamps**

A type of incandescent lamp with an interior coating of aluminum that reflects light to the front of the bulb. They are designed to spread light over specific areas.

**Refraction**

The change in direction of a ray of light when it passes through one media to another with differing optical densities.

**Refrigerant**

The compound (working fluid) used in air conditioners, heat pumps, and refrigerators to transfer heat into or out of an interior space. This fluid boils at a very low temperature enabling it to evaporate and absorb heat.

**Refrigeration**

The process of the absorption of heat from one location and its transfer to another for rejection or recuperation.

**Refrigeration Capacity**

A measure of the effective cooling capacity of a refrigerator, expressed in Btu per hour or in tons, where one (1) ton of capacity is equal to the heat required to melt 2,000 pounds of ice in 24 hours or 12,000 Btu per hour.

**Refrigeration Cycle**

The complete cycle of stages (evaporation and condensation) of refrigeration or of the refrigerant.

**Refuse-Derived Fuel (RDF)**

A solid fuel produced by shredding municipal solid waste (MSW). Noncombustible materials such as glass and metals are generally removed prior to making RDF. The residual material is sold as-is or compressed into pellets, bricks, or logs. RDF processing facilities are typically located near a source of MSW, while the RDF combustion facility can be located elsewhere. Existing RDF facilities process between 100 and 3,000 tons per day.

## **Regenerative Cooling**

A type of cooling system that uses a charging and discharging cycle with a thermal or latent heat storage subsystem.

## **Regenerative Heating**

The process of using heat that is rejected in one part of a cycle for another function or in another part of the cycle.

## **Relamping**

The replacement of a non-functional or ineffective lamp with a new, more efficient lamp.

## **Relative Humidity**

A measure of the percent of moisture actually in the air compared with what would be in it if it were fully saturated at that temperature. When the air is fully saturated, its relative humidity is 100 percent.

## **Reliability**

This is the concept of how long a device or process can operate properly without needing maintenance or replacement.

## **Renewable Energy**

Energy derived from resources that are regenerative or for all practical purposes can not be depleted. Types of renewable energy resources include moving water (hydro, tidal and wave power), thermal gradients in ocean water, biomass, geothermal energy, solar energy, and wind energy. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

## **Resistance**

The inherent characteristic of a material to inhibit the transfer of energy. In electrical conductors, electrical resistance results in the generation of heat. Electrical resistance is measured in Ohms. The

heat transfer resistance properties of insulation products are quantified as the R-value.

### **Resistance Heating**

A type of heating system that provides heat from the resistance of an electrical current flowing through a conductor.

### **Resistive Voltage Drop**

The voltage developed across a cell by the current flow through the resistance of the cell.

### **Resistor**

An electrical device that resists electric current flow.

### **Resource Recovery**

The process of converting municipal solid waste to energy and/or recovering materials for recycling.

### **Restructuring**

The process of changing the structure of the electric power industry from one of guaranteed monopoly over service territories, as established by the Public Utility Holding Company Act of 1935, to one of open competition between power suppliers for customers in any area.

### **Retrofit**

The process of modifying a building's structure.

### **Return Air**

Air that is returned to a heating or cooling appliance from a heated or cooled space.

## **Return Duct**

The central heating or cooling system contains a fan that gets its air supply through these ducts, which ideally should be installed in every room of the house. The air from a room will move towards the lower pressure of the return duct.

## **Retail Wheeling**

A term for the process of transmitting electricity over transmission lines not owned by the supplier of the electricity to a retail customer of the supplier. With retail wheeling, an electricity consumer can secure their own supply of electricity from a broker or directly from the generating source. The power is then wheeled at a fixed rate, or at a regulated "non-discriminatory" rate set by a utility commission.

## **Reverse Thermosiphoning**

When heat seeks to flow from a warm area (e.g., heated space) to a cooler area, such as a solar air collector at night without a reverse flow damper.

## **Reversing Valve**

A component of a heat pump that reverses the refrigerant's direction of flow, allowing the heat pump to switch from cooling to heating or heating to cooling.

## **R-Factor**

See R-Value.

## **Ribbon (Photovoltaic) Cells**

A type of solar photovoltaic device made in a continuous process of pulling material from a molten bath of photovoltaic material, such as silicon, to form a thin sheet of material.

## **Rigid Insulation Board**

An insulation product made of a fibrous material or plastic foams, pressed or extruded into board-like forms. It provides thermal and

acoustical insulation strength with low weight, and coverage with few heat loss paths.

### **Rock Bin**

A container that holds rock used as the thermal mass to store solar energy in a solar heating system.

### **Rock Wool**

A type of insulation made from virgin basalt, an igneous rock, and spun into loose fill or a batt. It is fire resistant and helps with soundproofing.

### **Roof**

A building element that provides protection against the sun, wind, and precipitation.

### **Roof Pond**

A solar energy collection device consisting of containers of water located on a roof that absorb solar energy during the day so that the heat can be used at night or that cools a building by evaporation at night.

### **Roof Ventilator**

A stationary or rotating vent used to ventilate attics or cathedral ceilings; usually made of galvanized steel, or polypropylene.

### **Rotor**

An electric generator consists of an armature and a field structure. The armature carries the wire loop, coil, or other windings in which the voltage is induced, whereas the field structure produces the magnetic field. In small generators, the armature is usually the rotating component (rotor) surrounded by the stationary field structure (stator). In large generators in commercial electric power plants the situation is reversed. In a wind energy conversion device, the blades and rotating components.

## **Run-of-River Hydropower**

A type of hydroelectric facility that uses the river flow with very little alteration and little or no impoundment of the water.

## **Rural Electrification Administration (REA)**

An agency of the U.S. Dept. of Agriculture that makes loans to states and territories in the U.S. for rural electrification and the furnishing of electric energy to persons in rural areas who do not receive central station service. It also furnishes and improves electric and telephone service in rural areas, assists electric borrowers to implement energy conservation programs and on-grid and off-grid renewable energy systems, and studies the condition and progress of rural electrification.

## **R-Value**

A measure of the capacity of a material to resist heat transfer. The R-Value is the reciprocal of the conductivity of a material (U-Value). The larger the R-Value of a material, the greater its insulating properties.

## **S**

### **Sacrificial Anode**

A metal rod placed in a water heater tank to protect the tank from corrosion. Anodes of aluminum, magnesium, or zinc are the more frequently metals. The anode creates a galvanic cell in which magnesium or zinc will be corroded more quickly than the metal of the tank giving the tank a negative charge and preventing corrosion.

### **Safety Disconnect**

An electronic (automatic or manual) switch that disconnects one circuit from another circuit. These are used to isolate power generation or storage equipment from conditions such as voltage spikes or surges, thus avoiding potential damage to equipment.

## **Salt Gradient Solar Ponds**

Consist of three main layers. The top layer is near ambient and has low salt content. The bottom layer is hot, typically 160 F to 212 F (71 C to 100 C), and is very salty. The important gradient zone separates these zones. The gradient zone acts as a transparent insulator, permitting the sunlight to be trapped in the hot bottom layer (from which useful heat is withdrawn). This is because the salt gradient, which increases the brine density with depth, counteracts the buoyancy effect of the warmer water below (which would otherwise rise to the surface and lose its heat to the air). An organic Rankine cycle engine is used to convert the thermal energy to electricity.

## **Scribing**

The cutting of a grid pattern of grooves in a semiconductor material, generally for the purpose of making interconnections.

## **Sealed Combustion Heating System**

A heating system that uses only outside air for combustion and vents combustion gases directly to the outdoors. These systems are less likely to backdraft and to negatively affect indoor air quality.

## **Seasonal Energy Efficiency Ratio (SEER)**

A measure of seasonal or annual efficiency of a central air conditioner or air conditioning heat pump. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of cooling delivered for every watt-hour of electricity used by the heat pump over a cooling season.

## **Seasonal Performance Factor (SPF)**

Ratio of useful energy output of a device to the energy input, averaged over an entire heating season.

## **Seasoned Wood**

Wood, used for fuel, that has been air dried so that it contains 15 to 20 percent moisture content (wet basis).

## **Seebeck Effect**

The generation of an electric current, when two conductors of different metals are joined at their ends to form a circuit, with the two junctions kept at different temperatures.

## **Second Law Efficiency**

The ratio of the minimum amount of work or energy required to perform a task to the amount actually used.

## **Second Law of Thermodynamics**

This law states that no device can completely and continuously transform all of the energy supplied to it into useful energy.

## **Selectable Load**

Any device, such as lights, televisions, and power tools, which is plugged into your central power source and used only intermittently.

## **Selective Absorber**

A solar absorber surface that has high absorbance at wavelengths corresponding to that of the solar spectrum and low emittance in the infrared range.

## **Selective Surface Coating**

A material with high absorbance and low emittance properties applied to or on solar absorber surfaces.

## **Semiconductor**

Any material that has a limited capacity for conducting an electric current. Certain semiconductors, including silicon, gallium arsenide,

copper indium diselenide, and cadmium telluride, are uniquely suited to the photovoltaic conversion process.

### **Sensible Cooling Effect**

The difference between the total cooling effect and the dehumidifying effect.

### **Sensible Cooling Load**

The interior heat gain due to heat conduction, convection, and radiation from the exterior into the interior, and from occupants and appliances.

### **Sensible Heat**

The heat absorbed or released when a substance undergoes a change in temperature.

### **Sensible Heat Storage**

A heat storage system that uses a heat storage medium, and where the additional or removal of heat results in a change in temperature.

### **Series**

A configuration of an electrical circuit in which the positive lead is connected to the negative lead of another energy producing, conducting, or consuming device. The voltages of each device are additive, whereas the current is not.

### **Series Connection**

A way of joining photovoltaic cells by connecting positive leads to negative leads; such a configuration increases the voltage.

### **Series Resistance**

Parasitic resistance to current flow in a cell due to mechanisms such as resistance from the bulk of the semiconductor material, metallic contacts, and interconnections.

### **Setback Thermostat**

A thermostat that can be set to automatically lower temperatures in an unoccupied house and raise them again before the occupant returns.

### **Shading Coefficient**

A measure of window glazing performance that is the ratio of the total solar heat gain through a specific window to the total solar heat gain through a single sheet of double-strength glass under the same set of conditions; expressed as a number between 0 and 1.

### **Sheathing**

A construction element used to cover the exterior of wall framing and roof trusses.

### **Short Circuit**

An electric current taking a shorter or different path than intended.

### **Short Circuit Current**

The current flowing freely through an external circuit that has no load or resistance; the maximum current possible.

### **Shunt Load**

An electrical load used to safely use excess generated power when not needed for its primary uses. A shunt load in a residential photovoltaic system might be domestic water heating, such that when power is not needed for typical building loads, such as operating lights or running HVAC system fans and pumps, it still provides value and is used in a constructive, safe manner.

### **Shutter**

An interior or exterior movable panel that operates on hinges or slides into place, used to protect windows or provide privacy.

## **Siding**

A construction element applied to the outermost surface of an exterior wall.

## **Sigma Heat**

The sum of sensible heat and latent heat in a substance above a base temperature, typically 32 degrees Fahrenheit.

## **Silicon**

A chemical element, of atomic number 14, that is semi-metallic, and an excellent semiconductor material used in solar photovoltaic devices; commonly found in sand.

## **Simple CS (Caulk and Seal)**

A technique for insulating and sealing exterior walls that reduces vapor diffusion through air leakage points by installing pre-cut blocks of rigid foam insulation over floor joists, sheet subfloor, and top plates before drywall is installed.

## **Sine Wave**

The type of alternative current generated by alternating current generators, rotary inverters, and solid-state inverters.

## **Single-Crystal Material**

In reference to solar photovoltaic devices, a material that is composed of a single crystal or a few large crystals.

## **Single Glaze or Pane**

One layer of glass in a window frame. It has very little insulating value (R-1) and provides only a thin barrier to the outside and can account for considerable heat loss and gain.

## **Single-Package System**

A year 'round heating and air conditioning system that has all the components completely encased in one unit outside the home. Proper matching of components can mean more energy-efficient operation compared to components purchased separately.

## **Single-Phase**

A generator with a single armature coil, which may have many turns and the alternating current output consists of a succession of cycles.

## **Sizing**

The process of designing a solar system to meet a specified load given the solar resource and the nominal or rated energy output of the solar energy collection or conversion device.

## **Skylight**

A window located on the roof of a structure to provide interior building spaces with natural daylight, warmth, and ventilation.

## **Slab**

A concrete pad that sits on gravel or crushed rock, well-compacted soil either level with the ground or above the ground.

## **Slab on Grade**

A slab floor that sits directly on top of the surrounding ground.

## **Slinky™ Ground Loop**

In this type of closed-loop, horizontal geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are coiled like a Slinky™ to allow more pipe in a shorter trench. This type of installation cuts down on installation costs and makes horizontal installation possible in areas it would not be with conventional horizontal applications.

## **Smart Window**

A term used to describe a technologically advanced window system that contains glazing that can change or switch its optical qualities when a low voltage electrical signal is applied to it, or in response to changes in heat or light.

## **Sodium Lights**

A type of high intensity discharge light that has the most lumens per watt of any light source.

## **Soffit**

A panel which covers the underside of an roof overhang, cantilever, or mansard.

## **Solar Access or Rights**

The legal issues related to protecting or ensuring access to sunlight to operate a solar energy system, or use solar energy for heating and cooling.

## **Solar Altitude Angle**

The angle between a line from a point on the earth's surface to the center of the solar disc, and a line extending horizontally from the point.

## **Solar Air Heater**

A type of solar thermal system where air is heated in a collector and either transferred directly to the interior space or to a storage medium, such as a rock bin.

## **Solar Array**

A group of solar collectors or solar modules connected together.

## **Solar Azimuth**

The angle between the sun's apparent position in the sky and true south, as measured on a horizontal plane.

## **Solar Cell**

A solar photovoltaic device with a specified area.

## **Solar Collector**

A device used to collect, absorb, and transfer solar energy to a working fluid. Flat plate collectors are the most common type of collectors used for solar water or pool heating systems. In the case of a photovoltaics system, the solar collector could be crystalline silicon panels or thin-film roof shingles, for example.

## **Solar Constant**

The average amount of solar radiation that reaches the earth's upper atmosphere on a surface perpendicular to the sun's rays; equal to 1353 Watts per square meter or 492 Btu per square foot.

## **Solar Cooling**

The use of solar thermal energy or solar electricity to power a cooling appliance. There are five basic types of solar cooling technologies: absorption cooling, which can use solar thermal energy to vaporize the refrigerant; desiccant cooling, which can use solar thermal energy to regenerate (dry) the desiccant; vapor compression cooling, which can use solar thermal energy to operate a Rankine-cycle heat engine; and evaporative coolers ("swamp" coolers), and heat-pumps and air conditioners that can be powered by solar photovoltaic systems.

## **Solar Declination**

The apparent angle of the sun north or south of the earth's equatorial plane. The earth's rotation on its axis causes a daily change in the declination.

## **Solar Distillation**

The process of distilling (purifying) water using solar energy. Water can be placed in an air tight solar collector with a sloped glazing material, and as it heats and evaporates, distilled water condenses on the collector glazing, and runs down where it can be collected in a tray.

## **Solar Energy**

Electromagnetic energy transmitted from the sun (solar radiation). The amount that reaches the earth is equal to one billionth of total solar energy generated, or the equivalent of about 420 trillion kilowatt-hours.

## **Solar Energy Collector**

See [solar collector](#).

## **Solar Energy Industries Association (SEIA)**

A national trade association of solar energy equipment manufacturers, retailers, suppliers, installers, and consultants.

## **Solar Energy Research Institute (SERI)**

A federally funded institute, created by the Solar Energy Research, Development and Demonstration Act of 1974, that conducted research and development of solar energy technologies. Became the National Renewable Energy Laboratory (NREL) in 1991.

## **Solar Film**

A window glazing coating, usually tinted bronze or gray, used to reduce building cooling loads, glare, and fabric fading.

## **Solar Fraction**

The percentage of a building's seasonal energy requirements that can be met by a solar energy device(s) or system(s).

## **Solar Furnace**

A device that achieves very high temperatures by the use of reflectors to focus and concentrate sunlight onto a small receiver.

### **Solar Gain**

The amount of energy that a building absorbs due to solar energy striking its exterior and conducting to the interior or passing through windows and being absorbed by materials in the building.

### **Solar Irradiation**

The amount of solar radiation, both direct and diffuse, received at any location.

### **Solarium**

A glazed structure, such as greenhouse or "sunspace."

### **Solar Mass**

A term used for materials used to absorb and store solar energy.

### **Solar Module (Panel)**

A solar photovoltaic device that produces a specified power output under defined test conditions, usually composed of groups of solar cells connected in series, in parallel, or in series-parallel combinations.

### **Solar Noon**

The time of the day, at a specific location, when the sun reaches its highest, apparent point in the sky; equal to true or due, geographic south.

### **Solar One**

A solar thermal electric central receiver power plant ("power tower") located in Barstow, California, and completed in 1981. The Solar One had a design capacity of 10,000 peak kilowatts, and was composed of a receiver located on the top of a tower surrounded by

a field of reflectors. The concentrated sunlight created steam to drive a steam turbine and electric generator located on the ground.

### **Solar Pond**

A body of water that contains brackish (highly saline) water that forms layers of differing salinity (stratifies) that absorb and trap solar energy. Solar ponds can be used to provide heat for industrial or agricultural processes, building heating and cooling, and to generate electricity.

### **Solar Power Satellite**

A solar power station investigated by NASA that entailed a satellite in geosynchronous orbit that would consist of a very large array of solar photovoltaic modules that would convert solar generated electricity to microwaves and beam them to a fixed point on the earth.

### **Solar Panel**

See [Photovoltaic Module](#).

### **Solar Radiation**

A general term for the visible and near visible (ultraviolet and near-infrared) electromagnetic radiation that is emitted by the sun. It has a spectral, or wavelength, distribution that corresponds to different energy levels; short wavelength radiation has a higher energy than long-wavelength radiation.

### **Solar Simulator**

An apparatus that replicates the solar spectrum, and used for testing solar energy conversion devices.

### **Solar Space Heater**

A solar energy system designed to provide heat to individual rooms in a building.

## **Solar Spectrum**

The total distribution of electromagnetic radiation emanating from the sun. The different regions of the solar spectrum are described by their wavelength range. The visible region extends from about 390 to 780 nanometers (a nanometer is one billionth of one meter). About 99 percent of solar radiation is contained in a wavelength region from 300 nm (ultraviolet) to 3,000 nm (near-infrared). The combined radiation in the wavelength region from 280 nm to 4,000 nm is called the broadband, or total, solar radiation.

## **Solar Thermal Electric Systems**

Solar energy conversion technologies that convert solar energy to electricity, by heating a working fluid to power a turbine that drives a generator. Examples of these systems include central receiver systems, parabolic dish, and solar trough.

## **Solar Thermal Parabolic Dishes**

A solar thermal technology that uses a modular mirror system that approximates a parabola and incorporates two-axis tracking to focus the sunlight onto receivers located at the focal point of each dish. The mirror system typically is made from a number of mirror facets, either glass or polymer mirror, or can consist of a single stretched membrane using a polymer mirror. The concentrated sunlight may be used directly by a Stirling, Rankine, or Brayton cycle heat engine at the focal point of the receiver or to heat a working fluid that is piped to a central engine. The primary applications include remote electrification, water pumping, and grid-connected generation.

## **Solar Thermal Systems**

Solar energy systems that collect or absorb solar energy for useful purposes. Can be used to generate high temperature heat (for electricity production and/or process heat), medium temperature heat (for process and space/water heating and electricity generation), and low temperature heat (for water and space heating and cooling).

## **Solar Time**

The period marked by successive crossing of the earth's meridian by the sun; the hour angle of the sun at a point of observance (apparent time) is corrected to true (solar) time by taking into account the variation in the earth's orbit and rate of rotation. Solar time and local standard time are usually different for any specific location.

## **Solar Trough Systems (see also Parabolic Trough, above)**

A type of solar thermal system where sunlight is concentrated by a curved reflector onto a pipe containing a working fluid that can be used for process heat or to produce electricity. The world's largest solar thermal electric power plants use solar trough technology. They are located in California, and have a combined electricity generating capacity of 240,000 kilowatts.

## **Solar Transmittance**

The amount of solar energy that passes through a glazing material, expressed as a percentage.

## **Solar Two**

Solar Two is a retrofit of the Solar One project (see above). It is demonstrating the technical feasibility and power potential of a solar power tower using advanced molten-salt technology to store energy. Solar Two retains several of the main components of Solar One, including the receiver tower, turbine, generator, and the 1,818 heliostats.

## **Solenoid**

An electromechanical device composed of a coil of wire wound around a cylinder containing a bar or plunger, that when a current is applied to the coil, the electromotive force causes the plunger to move; a series of coils or wires used to produce a magnetic field.

## **Solenoid Valve**

An automatic valve that is opened or closed by an electromagnet.

## **Solid Fuels**

Any fuel that is in solid form, such as wood, peat, lignite, coal, and manufactured fuels such as pulverized coal, coke, charcoal, briquettes, pellets, etc.

## **Solidity**

In reference to a wind energy conversion device, the ratio of rotor blade surface area to the frontal, swept area that the rotor passes through.

## **Solstice**

The two times of the year when the sun is apparently farthest north and south of the earth's equator; usually occurring on or around June 21 (summer solstice in northern hemisphere, winter solstice for southern hemisphere) and December 21 (winter solstice in northern hemisphere, summer solstice for the southern hemisphere).

## **Space Heater**

A movable or fixed heater used to heat individual rooms.

## **Spacer (Window)**

Strips of material used to separate multiple panes of glass within the windows.

## **Specific Heat**

The amount of heat required to raise a unit mass of a substance through one degree, expressed as a ratio of the amount of heat required to raise an equal mass of water through the same range.

### **Specific Heat Capacity**

The quantity of heat required to change the temperature of one unit weight of a material by one degree.

### **Specific Humidity**

The weight of water vapor, per unit weight of dry air.

### **Specific Volume**

The volume of a unit weight of a substance at a specific temperature and pressure.

### **Spectral Energy Distribution**

A curve illustrating the variation of spectral irradiance with wavelength.

### **Spectral Irradiance**

The monochromatic irradiance of a surface per unit bandwidth at a particular wavelength, usually expressed in Watts per square meter-nanometer bandwidth.

### **Spectral Reflectance**

The ratio of energy reflected from a surface in a given waveband to the energy incident in that waveband.

### **Spectrum**

see Solar Spectrum above.

### **Spectrally Selective Coatings**

A type of window glazing films used to block the infrared (heat) portion of the solar spectrum but admit a higher portion of visible light.

## **Spillway**

A passage for surplus water to flow over or around a dam.

## **Spinning Reserve**

Electric power provider capacity on line and running at low power in excess of actual load.

## **Split Spectrum Photovoltaic Cell**

A photovoltaic device where incident sunlight is split into different spectral regions, with an optical apparatus, that are directed to individual photovoltaic cells that are optimized for converting that spectrum to electricity.

## **Split System Air Conditioner**

An air conditioning system that comes in two to five pieces: one piece contains the compressor, condenser, and a fan; the others have an evaporator and a fan. The condenser, installed outside the house, connects to several evaporators, one in each room to be cooled, mounted inside the house. Each evaporator is individually controlled, allowing different rooms or zones to be cooled to varying degrees.

## **Spray Pyrolysis**

A deposition process whereby heat is used to break molecules into elemental sources that are then spray deposited on a substrate.

## **Spreader Stocker**

A type of furnace in which fuel is spread, automatically or mechanically, across the furnace grate.

## **Sputtering**

A process used to apply photovoltaic semi-conductor material to a substrate by a physical vapor deposition process where high-energy ions are used to bombard elemental sources of semiconductor

material, which eject vapors of atoms that are then deposited in thin layers on a substrate.

### **Square Wave Inverter**

A type of inverter that produces square wave output.; consists of a DC source, four switches, and the load. The switches are power semiconductors that can carry a large current and withstand a high voltage rating. The switches are turned on and off at a correct sequence, at a certain frequency. The square wave inverter is the simplest and the least expensive to purchase, but it produces the lowest quality of power.

### **Squirrel Cage Motor**

This is another name for an induction motor. The motors consist of a rotor inside a stator. The rotor has laminated, thin flat steel discs, stacked with channels along the length. If the casting composed of bars and attached end rings were viewed without the laminations the casting would appear similar to a squirrel cage.

### **Staebler-Wronski effect**

The tendency of the sunlight to electricity conversion efficiency of amorphous silicon photovoltaic devices to degrade (drop) upon initial exposure to light.

### **Stack**

A smokestack or flue for exhausting the products of combustion from a combustion appliance.

### **Stack (Heat) Loss**

Sensible and latent heat contained in combustion gases and vapor emitted to the atmosphere.

### **Stagnation Temperature**

A condition that can occur in a solar collector if the working fluid does not circulate when sun is shining on the collector.

## **Stall**

In reference to a wind turbine, a condition when the rotor stops turning.

## **Stand-Alone Generator**

A power source/generator that operates independently of or is not connected to an electric transmission and distribution network; used to meet a load(s) physically close to the generator.

## **Stand-Alone Inverter**

An inverter that operates independent of or is not connected to an electric transmission and distribution network.

## **Stand-Alone System**

An system that operates independent of or is not connected to an electric transmission and distribution network.

## **Standard Air**

Air with a weight of 0.075 pounds per cubic foot with an equivalent density of dry air at a temperature of 86 degrees Fahrenheit and standard barometric pressure of 29.92 inches of mercury.

## **Standard Conditions**

In refrigeration, an evaporating temperature of 5 degrees Fahrenheit (F), a condensing temperature of 86 degrees F., liquid temperature before expansion of 77 degrees F., and suction temperature of 12 degrees F.

## **Standard Cubic Foot**

A column of gas at standard conditions of temperature and pressure (32 degrees Fahrenheit and one atmosphere).

## **Standard Industrial Classification (SIC) Code**

Standardized codes used to classify businesses by type of activity they engage in.

## **Stand-by Heat Loses**

A term used to describe heat energy lost from a water heater tank.

## **Stand-By Power**

For the consumer, this is the electricity that is used by your TVs, stereos, and other electronic devices that use remote controls. When you press "off" to turn off your device, minimal power (dormant mode) is still being used to maintain the internal electronics in a ready, quick-response mode. This way, your device can be turned on with your remote control and be immediately ready to operate.

## **Static Pressure**

The force per unit area acting on the surface of a solid boundary parallel to the flow.

## **Starting Surge**

Power, often above an appliance's rated wattage, required to bring any appliance with a motor up to operating speed.

## **Starting Torque**

The torque at the bottom of a speed (rpm) versus torque curve. The torque developed by the motor is a percentage of the full-load or rated torque. At this torque the speed, the rotational speed of the motor as a percentage of synchronous speed is zero. This torque is what is available to initially get the load moving and begin its acceleration.

## **Steam**

Water in vapor form; used as the working fluid in steam turbines and heating systems.

## **Steam Boiler**

A type of furnace in which fuel is burned and the heat is used to produce steam.

## **Steam Turbine**

A device that converts high-pressure steam, produced in a boiler, into mechanical energy that can then be used to produce electricity by forcing blades in a cylinder to rotate and turn a generator shaft.

## **Stirling Engine**

A heat engine of the reciprocating (piston) where the working gas and a heat source are independent. The working gas is compressed in one region of the engine and transferred to another region where it is expanded. The expanded gas is then returned to the first region for recompression. The working gas thus moves back and forth in a closed cycle.

## **Stoichiometry**

Chemical reactions, typically associated with combustion processes; the balancing of chemical reactions by providing the exact proportions of reactant compounds to ensure a complete reaction; all the reactants are used up to produce a single set of products.

## **Stoichiometric Ratio**

The ratio of chemical substances necessary for a reaction to occur completely.

## **Storage Capacity**

The amount of energy an energy storage device or system can store.

## **Storage Hydropower**

A hydropower facility that stores water in a reservoir during high-inflow periods to augment water during low-inflow periods. Storage projects allow the flow releases and power production to be more

flexible and dependable. Many hydropower project operations use a combination of approaches.

### **Storage Tank**

The tank of a water heater.

### **Storage Water Heater**

A water heater that releases hot water from the top of the tank when a hot water tap is opened. To replace that hot water, cold water enters the bottom of the tank to ensure a full tank.

### **Storm Door**

An exterior door that protects the primary door.

### **Storm Windows**

Glass, plastic panels, or plastic sheets that reduce air infiltration and some heat loss when attached to either the interior or exterior of existing windows.

### **Stranded Investment (Costs and Benefits)**

An investment in a power plant or demand side management measures or programs, that become uneconomical due to increased competition in the electric power market. For example, an electric power plant may produce power that is more costly than what the market rate for electricity is, and the power plant owner may have to close the plant, even though the capital and financing costs of building the plant have not been recovered through prior sales of electricity from the plant. This is considered a Stranded Cost. Stranded Benefits are those power provider investments in measures or programs considered to benefit consumers by reducing energy consumption and/or providing environmental benefits that have to be curtailed due to increased competition and lower profit margins.

**Stud**

A popular term used for a length of wood or steel used in or for wall framing.

**Substation**

An electrical installation containing power conversion (and sometimes generation) equipment, such as transformers, compensators, and circuit breakers.

**Substrate**

The physical material upon which a photovoltaic cell is applied.

**Sun Path Diagram**

A circular projection of the sky vault onto a flat diagram used to determine solar positions and shading effects of landscape features on a solar energy system.

**Sunspace**

A room that faces south (in the northern hemisphere), or a small structure attached to the south side of a house.

**Sun Tempered Building**

A building that is elongated in the east-west direction, with the majority of the windows on the south side. The area of the windows is generally limited to about 7% of the total floor area. A sun-tempered design has no added thermal mass beyond what is already in the framing, wall board, and so on. Insulation levels are generally high.

**Superconducting Magnetic Energy Storage (SMES)**

SMES technology uses the superconducting characteristics of low-temperature materials to produce intense magnetic fields to store energy. SMES has been proposed as a storage option to support large-scale use of photovoltaics and wind as a means to smooth out fluctuations in power generation.

## **Superconductivity**

The abrupt and large increase in electrical conductivity exhibited by some metals as the temperature approaches absolute zero.

## **Super Insulated Houses**

A type of house that has massive amounts of insulation, airtight construction, and controlled ventilation without sacrificing comfort, health, or aesthetics.

## **Super Window**

A popular term for highly insulating window with a heat loss so low it performs better than an insulated wall in winter, since the sunlight that it admits is greater than its heat loss over a 24 hour period.

## **Supplementary Heat**

A heat source, such as a space heater, used to provide more heat than that provided by a primary heating source.

## **Supply Duct**

The duct(s) of a forced air heating/cooling system through which heated or cooled air is supplied to rooms by the action of the fan of the central heating or cooling unit.

## **Supply Side**

Technologies that pertain to the generation of electricity.

## **Surface Water Loop**

In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are coiled into circles and submerged at least eight feet below the surface of a body of surface water, such as a pond or lake. The coils should only be placed in a water source that meets minimum volume, depth, and quality criteria. Also see [closed-loop geothermal heat pump systems](#).

## **Swamp Cooler**

A popular term used for an evaporative cooling device.

## **Swept Area**

In reference to a wind energy conversion device, the area through which the rotor blades spin, as seen when directly facing the center of the rotor blades.

## **Synchronous Generator**

An electrical generator that runs at a constant speed and draws its excitation from a power source external or independent of the load or transmission network it is supplying.

## **Synchronous Inverter**

An electrical inverter that inverts direct current electricity to alternating current electricity, and that uses another alternating current source, such as an electric power transmission and distribution network (grid), for voltage and frequency reference to provide power in phase and at the same frequency as the external power source.

## **Synchronous Motor**

A type of motor designed to operate precisely at the synchronous speed with no slip in the full-load speeds (rpm).

## **System Mix**

The proportion of electricity distributed by a power provider that is generated from available sources such as coal, natural gas, petroleum, nuclear, hydropower, wind, or geothermal.

## **T**

### **Tankless Water Heater**

A water heater that heats water before it is directly distributed for end use as required; a demand water heater.

### **Task Lighting**

Any light source designed specifically to direct light a task or work performed by a person or machine.

### **Temperature Coefficient (of a solar photovoltaic cell)**

The amount that the voltage, current, and/or power output of a solar cell changes due to a change in the cell temperature.

### **Temperature Humidity Index**

An index that combines sensible temperature and air humidity to arrive at a number that closely responds to the effective temperature; used to relate temperature and humidity to levels of comfort.

### **Temperature/Pressure Relief Valve**

A component of a water heating system that opens at a designated temperature or pressure to prevent a possible tank, radiator, or delivery pipe rupture.

### **Temperature Zones**

Individual rooms or zones in a building where temperature is controlled separately from other rooms or zones.

### **Tempering Valve**

A valve used to mix heated water with cold in a heating system to provide a desired water temperature for end use.

## **Tennessee Valley Authority (TVA)**

A federal agency established in 1933 to develop the Tennessee river valley region of the southeastern U.S., and which is now nation's largest power producer.

## **Termite Shield**

A construction element that inhibits termites from entering building foundations and walls.

## **Therm**

A unit of heat containing 100,000 British thermal units (Btu).

## **Thermal Balance Point**

The point or outdoor temperature where the heating capacity of a heat pump matches the heating requirements of a building.

## **Thermal Capacitance**

The ability of a material to absorb and store heat for use later.

## **Thermal Efficiency**

A measure of the efficiency of converting a fuel to energy and useful work; useful work and energy output divided by higher heating value of input fuel times 100 (for percent).

## **Thermal Energy**

The energy developed through the use of heat energy.

## **Thermal Energy Storage**

The storage of heat energy during power provider off-peak times at night, for use during the next day without incurring daytime peak electric rates.

## **Thermal Envelope Houses**

An architectural design (also known as the double envelope house), sometimes called a "house-within-a-house," that employs a double envelope with a continuous airspace of at least 6 to 12 inches on the north wall, south wall, roof, and floor, achieved by building inner and outer walls, a crawl space or sub-basement below the floor, and a shallow attic space below the weather roof. The east and west walls are single, conventional walls. A buffer zone of solar-heated, circulating air warms the inner envelope of the house. The south-facing airspace may double as a sunspace or greenhouse.

## **Thermal Mass**

Materials that store heat.

## **Thermal Storage Walls (Masonry or Water)**

A thermal storage wall is a south-facing wall that is glazed on the outside. Solar heat strikes the glazing and is absorbed into the wall, which conducts the heat into the room over time. The walls are at least 8 in thick. Generally, the thicker the wall, the less the indoor temperature fluctuates.

## **Thermal Resistance (R-Value)**

This designates the resistance of a material to heat conduction. The greater the R-value the larger the number.

## **Thermocouple**

A device consisting of two dissimilar conductors with their ends connected together. When the two junctions are at different temperatures, a small voltage is generated.

## **Thermodynamic Cycle**

An idealized process in which a working fluid (water, air, ammonia, etc) successively changes its state (from a liquid to a gas and back to a liquid) for the purpose of producing useful work or energy, or transferring energy.

## **Thermodynamics**

A study of the transformation of energy from one form to another, and its practical application. (see Law(s) of Thermodynamics above).

## **Thermoelectric Conversion**

The conversion of heat into electricity by the use of thermocouples.

## **Thermography**

A building energy auditing technique for locating areas of low insulation in a building envelope by means of a thermographic scanner.

## **Thermophotovoltaic Cell**

A device where sunlight concentrated onto a absorber heats it to a high temperature, and the thermal radiation emitted by the absorber is used as the energy source for a photovoltaic cell that is designed to maximize conversion efficiency at the wavelength of the thermal radiation.

## **Thermopile**

A large number of thermocouples connected in series.

## **Thermosiphon System**

This passive solar hot water system consists relies on warm water rising, a phenomenon known as natural convection, to circulate water through the collectors and to the tank. In this type of installation, the tank must be above the collector. As water in the collector heats, it becomes lighter and rises naturally into the tank above. Meanwhile, cooler water in the tank flows down pipes to the bottom of the collector, causing circulation throughout the system. The storage tank is attached to the top of the collector so that thermosiphoning can occur.

## **Thermosiphon**

The natural, convective movement of air or water due to differences in temperature. In solar passive design a thermosyphon collector can be constructed and attached to a house to deliver heat to the home by the continuous pattern of the convective loop (or thermosyphon).

## **Thermostat**

A device used to control temperatures; used to control the operation of heating and cooling devices by turning the device on or off when a specified temperature is reached.

## **Thin-Film**

A layer of semiconductor material, such as copper indium diselenide or gallium arsenide, a few microns or less in thickness, used to make solar photovoltaic cells.

## **Three-phase Current**

Alternating current in which three separate pulses are present, identical in frequency and voltage, but separated 120 degrees in phase.

## **Tidal Power**

The power available from the rise and fall of ocean tides. A tidal power plant works on the principal of a dam or barrage that captures water in a basin at the peak of a tidal flow, then directs the water through a hydroelectric turbine as the tide ebbs.

## **Tilt Angle (of a Solar Collector or Module)**

The angle at which a solar collector or module is set to face the sun relative to a horizontal position. The tilt angle can be set or adjusted to maximize seasonal or annual energy collection.

## **Time-of-Use (TOU) Rates**

The pricing of electricity based on the estimated cost of electricity during a particular time block. Time-of-use rates are usually divided into three or four time blocks per twenty-four hour period (on-peak, mid-peak, off-peak and sometimes super off-peak) and by seasons of the year (summer and winter). Real-time pricing differs from TOU rates in that it is based on actual (as opposed to forecasted) prices which may fluctuate many times a day and are weather-sensitive, rather than varying with a fixed schedule.

### **Timer**

A device that can be set to automatically turn appliances (lights) off and on at set times.

### **Timer (Water Heater)**

This device can automatically turn the heater off at night and on in the morning.

### **Tip Speed Ratio**

In reference to a wind energy conversion device's blades, the difference between the rotational speed of the tip of the blade and the actual velocity of the wind.

### **Ton (of Air Conditioning)**

A unit of air cooling capacity; 12,000 Btu per hour.

### **Topping-cycle**

A means to increase the thermal efficiency of a steam electric generating system by increasing temperatures and interposing a device, such as a gas turbine, between the heat source and the conventional steam-turbine generator to convert some of the additional heat energy into electricity.

### **Torque (Motor)**

The turning or twisting force generated by an electrical motor in order for it to operate.

### **Total Harmonic Distortion**

The measure of closeness in shape between a waveform and it's fundamental component.

### **Total Heat**

The sum of the sensible and latent heat in a substance or fluid above a base point, usually 32 degrees Fahrenheit.

### **Total Incident Radiation**

The total radiation incident on a specific surface area over a time interval.

### **Total Internal Reflection**

The trapping of light by refraction and reflection at critical angles inside a semiconductor device so that it cannot escape the device and must be eventually absorbed by the semiconductor.

### **Tracking Solar Array**

A solar energy array that follows the path of the sun to maximize the solar radiation incident on the PV surface. The two most common orientations are (1) one axis where the array tracks the sun east to west and (2) two-axis tracking where the array points directly at the sun at all times. Tracking arrays use both the direct and diffuse sunlight. Two-axis tracking arrays capture the maximum possible daily energy.

### **Trailing Edge**

The part of a wind energy conversion device blade, or airfoil, that is the last to contact the wind.

### **Transformer**

An electromagnetic device that changes the voltage of alternating current electricity. It consists of an induction coil having a primary and secondary winding and a closed iron core.

## **Transmission**

The process of sending or moving electricity from one point to another; usually defines that part of an electric power provider's electric power lines from the power plant buss to the last transformer before the customer's connection.

## **Transmission and Distribution Losses**

The losses that result from inherent resistance in electrical conductors and transformation inefficiencies in distribution transformers in a transmission and distribution network.

## **Transmission Lines**

Transmit high-voltage electricity from the transformer to the electric distribution system.

## **Traveling Grate**

A furnace grate that moves fuel through the combustion chamber.

## **Trellis**

An architectural feature used to shade exterior walls; usually made of a lattice of metal or wood; often covered by vines to provide additional summertime shading.

## **Trickle (Solar) Collector**

A type of solar thermal collector in which a heat transfer fluid drips out of header pipe at the top of the collector, runs down the collector absorber and into a tray at the bottom where it drains to a storage tank.

## **Triple Pane (Window)**

This represents three layers of glazing in a window with an airspace between the middle glass and the exterior and interior panes.

## **Trombe Wall**

A wall with high thermal mass used to store solar energy passively in a solar home. The wall absorbs solar energy and transfers it to the space behind the wall by means of radiation and by convection currents moving through spaces under, in front of, and on top of the wall.

## **True Power**

The actual power rating that is developed by a motor before losses occur.

## **True South**

The direction, at any point on the earth that is geographically in the northern hemisphere, facing toward the South Pole of the earth. Essentially a line extending from the point on the horizon to the highest point that the sun reaches on any day (solar noon) in the sky.

## **Tube (Fluorescent Light)**

A fluorescent lamp that has a tubular shape.

## **Tube-In-Plate-Absorber**

A type of solar thermal collector where the heat transfer fluid flows through tubes formed in the absorber plate.

## **Tube-Type Collector**

A type of solar thermal collector that has tubes (pipes) that the heat transfer fluid flows through that are connected to a flat absorber plate.

## **Tungsten Halogen Lamp**

A type of incandescent lamp that contains a halogen gas in the bulb, which reduces the filament evaporation rate increasing the lamp life. The high operating temperature and need for special fixtures

limits their use to commercial applications and for use in projector lamps and spotlights.

### **Turbine**

A device for converting the flow of a fluid (air, steam, water, or hot gases) into mechanical motion.

### **Turn Down Ratio**

The ratio of a boiler's or gasifier's maximum output to its minimum output.

### **Two-Tank Solar System**

A solar thermal system that has one tank for storing solar heated water to preheat the water in a conventional water heater.

### **Two-Axis Tracking**

A solar array tracking system capable of rotating independently about two axes (e.g., vertical and horizontal).

## **U**

### **Ultimate Analysis**

A procedure for determining the primary elements in a substance (carbon, hydrogen, oxygen, nitrogen, sulfur, and ash).

### **Ultraviolet**

Electromagnetic radiation in the wavelength range of 4 to 400 nanometers.

### **Unglazed Solar Collector**

A solar thermal collector that has an absorber that does not have a glazed covering. Solar swimming pool heater systems usually use unglazed collectors because they circulate relatively large volumes of water through the collector and capture nearly 80 percent of the solar energy available.

## **Underground Home**

A house built into the ground or slope of a hill, or which has most or all exterior surfaces covered with earth.

## **Unitary Air Conditioner**

An air conditioner consisting of one or more assemblies that move, clean, cool, and dehumidify air.

## **Unvented Heater**

A combustion heating appliance that vents the combustion by-products directly into the heated space. The latest models have oxygen-sensors that shut off the unit when the oxygen level in the room falls below a safe level.

## **Useful Heat**

Heat stored above room temperature (in a solar heating system).

## **Utility**

A regulated entity which exhibits the characteristics of a natural monopoly (also referred to as a power provider). For the purposes of electric industry restructuring, "utility" refers to the regulated, vertically-integrated electric company. "Transmission utility" refers to the regulated owner/operator of the transmission system only. "Distribution utility" refers to the regulated owner/operator of the distribution system which serves retail customers.

## **U-Value (see Coefficient of Heat Transmission)**

The reciprocal of R-Value. The lower the number, the greater the heat transfer resistance (insulating) characteristics of the material.

## **V**

## **Vacuum Evaporation**

The deposition of thin films of semiconductor material by the evaporation of elemental sources in a vacuum.

## **Valence Band**

The highest energy band in a semiconductor that can be filled with electrons.

## **Vapor Retarder**

A material that retards the movement of water vapor through a building element (walls, ceilings) and prevents insulation and structural wood from becoming damp and metals from corroding. Often applied to insulation batts or separately in the form of treated papers, plastic sheets, and metallic foils.

## **Variable-Speed Wind Turbines**

Turbines in which the rotor speed increases and decreases with changing wind speed, producing electricity with a variable frequency.

## **Vent**

A component of a heating or ventilation appliance used to conduct fresh air into, or waste air or combustion gases out of, an appliance or interior space.

## **Vent Damper**

A device mounted in the vent connector that closes the vent when the heating unit is not firing. This traps heat inside the heating system and house rather than letting it draft up and out the vent system.

## **Vented Heater**

A type of combustion heating appliance in which the combustion gases are vented to the outside, either with a fan (forced) or by natural convection.

## **Ventilation**

The process of moving air (changing) into and out of an interior space either by natural or mechanically induced (forced) means.

## **Ventilation Air**

That portion of supply air that is drawn from outside, plus any recirculated air that has been treated to maintain a desired air quality.

## **Vent Pipe**

A tube in which combustion gases from a combustion appliance are vented out of the appliance to the outdoors.

## **Vertical-Axis Wind Turbine (VAWT)**

A type of wind turbine in which the axis of rotation is perpendicular to the wind stream and the ground.

## **Vertical Ground Loop**

In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are laid out in a plane perpendicular to the ground surface. For a vertical system, holes (approximately four inches in diameter) are drilled about 20 feet apart and 100 to 400 feet deep. Into these holes go two pipes that are connected at the bottom with a U-bend to form a loop. The vertical loops are connected with horizontal pipe (i.e., manifold), placed in trenches, and connected to the heat pump in the building. Large commercial buildings and schools often use vertical systems because the land area required for horizontal ground loops would be prohibitive. Vertical loops are also used where the soil is too shallow for trenching, or for existing buildings, as they minimize the disturbance to landscaping. Also see [closed-loop geothermal heat pump systems](#).

## **Visible Light Transmittance**

The amount of visible light that passes through the glazing material of a window, expressed as a percentage.

**Visible Radiation**

The visible portion of the electromagnetic spectrum with wavelengths from 0.4 to 0.76 microns

**Volt**

A unit of electrical force equal to that amount of electromotive force that will cause a steady current of one ampere to flow through a resistance of one ohm.

**Voltage**

The amount of electromotive force, measured in volts, that exists between two points.

**Volt-Ampere**

A unit of electrical measurement equal to the product of a volt and an ampere.

**W****Wafer**

A thin sheet of semiconductor (photovoltaic material) made by cutting it from a single crystal or ingot.

**Wall**

A vertical structural element that holds up a roof, encloses part or all of a room, or stands by itself to hold back soil.

**Wall Orientation**

The geographical direction that the primary or largest exterior wall of a building faces.

**Water Jacket**

A heat exchanger element enclosed in a boiler. Water is circulated with a pump through the jacket where it picks up heat from the

combustion chamber after which the heated water circulates to heat distribution devices. A water jacket is also an enclosed water-filled chamber in a tankless coiled water heater. When a faucet is turned on water flows into the water heater heat exchanger. The water in the chamber is heated and transfers heat to the cooler water in the heat exchanger and is sent through the hot water outlet to the appropriate faucet.

### **Water Source Heat Pump**

A type of (geothermal) heat pump that uses well (ground) or surface water as a heat source. Water has a more stable seasonal temperature than air thus making for a more efficient heat source.

### **Water Turbine**

A turbine that uses water pressure to rotate its blades; the primary types are the Pelton wheel, for high heads (pressure); the Francis turbine, for low to medium heads; and the Kaplan for a wide range of heads. Primarily used to power an electric generator.

### **Water Wall**

An interior wall made of water filled containers for absorbing and storing solar energy.

### **Water Wheel**

A wheel that is designed to use the weight and/or force of moving water to turn it, primarily to operate machinery or grind grain.

### **Watt**

The rate of energy transfer equivalent to one ampere under an electrical pressure of one volt. One watt equals 1/746 horsepower, or one joule per second. It is the product of Voltage and Current (amperage).

**Watt-hour**

A unit of electricity consumption of one Watt over the period of one hour.

**Wattmeter**

A device for measuring power consumption.

**Wave Form**

The shape of the phase power at a certain frequency and amplitude.

**Wavelength**

The distance between similar points on successive waves.

**Wave Power**

The concept of capturing and converting the energy available in the motion of ocean waves to energy.

**Weatherization**

Caulking and weatherstripping to reduce air infiltration and exfiltration into/out of a building.

**Weatherstripping**

A material used to seal gaps around windows and exterior doors.

**Wheeling**

The process of transmitting electricity over one or more separately owned electric transmission and distribution systems. (See Wholesale and Retail Wheeling.)

**Whole House Fan**

A mechanical/electrical device used to pull air out of an interior space; usually located in the highest location of a building, in the ceiling, and venting to the attic or directly to the outside.

## **Wholesale Wheeling**

The wheeling of electric power in amounts and at prices that generally have been negotiated in long term contracts between the power provider and a distributor or very large power customer.

## **Wind Energy**

Energy available from the movement of the wind across a landscape caused by the heating of the atmosphere, earth, and oceans by the sun.

## **Wind Energy Conversion System (WECS) or Device**

An apparatus for converting the energy available in the wind to mechanical energy that can be used to power machinery (grain mills, water pumps) and to operate an electrical generator.

## **Wind Generator**

A WECS designed to produce electricity.

## **Windmill**

A WECS that is used to grind grain, and that typically has a high-solidity rotor; commonly used to refer to all types of WECS.

## **Window**

A generic term for a glazed opening that allows daylight to enter into a building and can be opened for ventilation.

## **Windpower Curve**

A graph representing the relationship between the power available from the wind and the wind speed. The power from the wind increases proportionally with the cube of the wind speed.

## **Wind Power Plant**

A group of wind turbines interconnected to a common power provider system through a system of transformers, distribution

lines, and (usually) one substation. Operation, control, and maintenance functions are often centralized through a network of computerized monitoring systems, supplemented by visual inspection. This is a term commonly used in the United States. In Europe, it is called a generating station.

### **Windpower Profile**

The change in the power available in the wind due to changes in the wind speed or velocity profile; the windpower profile is proportional to the cube of the wind speed profile.

### **Wind Resource Assessment**

The process of characterizing the wind resource, and its energy potential, for a specific site or geographical area.

### **Wind Rose**

A diagram that indicates the average percentage of time that the wind blows from different directions, on a monthly or annual basis.

### **Wind Speed**

The rate of flow of the wind undisturbed by obstacles.

### **Wind Speed Duration Curve**

A graph that indicates the distribution of wind speeds as a function of the cumulative number of hours that the wind speed exceeds a given wind speed in a year.

### **Wind Speed Frequency Curve**

A curve that indicates the number of hours per year that specific wind speeds occur.

### **Wind Speed Profile**

A profile of how the wind speed changes with height above the surface of the ground or water.

## **Wind Turbine**

A term used for a wind energy conversion device that produces electricity; typically having one, two, or three blades.

## **Wind Turbine Rated Capacity**

The amount of power a wind turbine can produce at its rated wind speed, e.g., 100 kW at 20 mph. The rated wind speed generally corresponds to the point at which the conversion efficiency is near its maximum. Because of the variability of the wind, the amount of energy a wind turbine actually produces is a function of the capacity factor (e.g., a wind turbine produces 20% to 35% of its rated capacity over a year).

## **Wind Velocity**

The wind speed and direction in an undisturbed flow.

## **Wingwall**

A building structural element that is built onto a building's exterior along the inner edges of all the windows, and extending from the ground to the eaves. Wingwalls help ventilate rooms that have only one exterior wall which leads to poor cross ventilation. Wingwalls cause fluctuations in the natural wind direction to create moderate pressure differences across the windows. They are only effective on the windward side of the building.

## **Wire (Electrical)**

A generic term for an electrical conductor.

## **Wood Stove**

A wood-burning appliance for space and/or water heating and/or cooking.

## **Working Fluid**

A fluid used to absorb and transfer heat energy.

## **Wound Rotor Motors**

A type of motor that has a rotor with electrical windings connected through slip rings to the external power circuit. An external resistance controller in the rotor circuit allows the performance of the motor to be tailored to the needs of the system and to be changed with relative ease to accommodate system changes or to vary the speed of the motor.

**X**

**Y**

## **Yaw**

The rotation of a horizontal axis wind turbine around its tower or vertical axis.

## **Yurt**

An octagonal shaped shelter that originated in Mongolia, and traditionally made from leather or canvas for easy transportation.

**Z**

## **Zone**

An area within the interior space of a building, such as an individual room(s), to be cooled, heated, or ventilated. A zone has its own thermostat to control the flow of conditioned air into the space.

## **Zoning**

The combining of rooms in a structure according to similar heating and cooling patterns. Zoning requires using more than one thermostat to control heating, cooling, and ventilation equipment.