

*appendix B: a glossary of  
solar energy terms*

**absorbant**—the less volatile of the two working fluids in an absorption cooling device.

**absorber**—the surface in a collector that absorbs solar radiation and converts it to heat energy; generally a matte black metallic surface is best.

**absorption chiller**—air conditioning device that uses heat at 190°F or higher to generate cooling; it may be powered by solar-heated water.

**absorptivity**—the ratio of the energy absorbed by a surface to the energy absorbed by a black body at the same temperature.

**active solar energy systems**—in contrast to passive solar energy approaches, an active solar energy system uses outside energy to operate the system, to transfer the collected solar energy from the collector to storage, and to distribute it throughout the living unit. Active systems can provide space heating and cooling and domestic hot water.

**airlock entry**—a vestibule enclosed with two airtight doors; it reduces heat loss by limiting the movement of heated air.

**air-type collector**—a collector that uses air for heat transfer.

**altitude**—the angular distance from the horizon to the sun.

**ambient temperature**—the natural temperature surrounding an object; it usually refers to outdoor temperature.

**atrium**—a closed interior court to which other rooms open; it is often used for passive solar collection.

**auxiliary energy**—auxiliary heat plus the energy required to operate pumps, blowers, or other devices.

**auxiliary heat**—the heat provided by a conventional heating system for periods of cloudiness or intense cold, when a solar heating system cannot provide enough heat.

**azimuth**—the angular distance from true south to the point on the horizon directly below the sun.

**backup energy system**—a backup energy system using conventional fuels should be provided for heating and domestic hot water. This system should be capable of providing all of the energy demand during any period when the solar energy system is not operating. Components and subsystems may be used as parts of both systems where the component or sub-system is a recognized, acceptable product in the conventional building industry.

**berm**—see earth berm.

**British thermal unit (BTU)**—a unit of heat energy; the quantity needed to raise the temperature of one pound of water one degree Fahrenheit.

**building envelope**—the elements (walls, roof, floors) of a building that enclose conditioned spaces.

**calorie**—amount of heat required to raise one gram of water one degree centigrade.

**clerestory**—a window located high in a wall near the eaves, used for light, heat gain, and ventilation.

**coefficient of heat transmission**—the rate of heat transmission measured per degree of temperature difference per hour, through a square foot of wall or other building surface. It is usually called the U-value.

**collection**—the process of trapping solar radiation and converting it to heat.

**collector**—a device that collects solar radiation and converts it to heat.

**collector aperture**—the glazed opening in a collector that admits solar radiation.

**collector efficiency**—the ratio of the heat energy extracted from a collector to the solar energy striking it.

**collector tilt**—the angle between the horizontal plane and the solar collector plane, designed to maximize the collection of solar radiation.

**comfort zone**—the range of temperature and humidity in which most people feel comfortable.

**concentrating collector**—a collector with a lens or a reflector that concentrates the sun's rays on a relatively small absorber surface.

**conduction**—the flow of heat between a hotter material and a colder material that are in direct physical contact.

**conductivity**—the property of a material indicating the quantity of heat that will flow through one foot of a material for each degree of temperature difference.

**convection, forced**—commonly, the transfer of heat by the forced flow of air or water.

**convection, natural**—the motion of a gas or liquid, caused by temperature or density difference, by which heat is transported.

**cooling pond**—a large body of water that loses heat from its surface, largely by evaporation but also by convection and radiation.

**cooling tower**—a device for cooling water by evaporation.

**cover plate**—a layer of glass or transparent plastic placed above the absorber plate in a flat-plate collector to reduce heat losses.

**damper**—a control that permits, prevents, or controls the passage of air through a duct.

**degree day**—a unit of measurement for outside temperature; it is the difference between a fixed temperature (usually 65°F [18°C]) and the average temperature for the day.

**design heating load**—the total heat loss from a building under the most severe winter conditions likely to occur.

**design outside temperature**—the lowest outdoor temperature expected during a heating season.

**diffuse radiation**—indirect scattered sunlight that casts no shadow.

**direct radiation**—sunlight that casts shadows, also called beam radiation.

**direct solar gain**—a type of passive solar heating system in which solar radiation passes through the south-facing living space before being stored in the thermal mass for long-term heating.

**distribution**—the movement of collected heat to the living areas from collectors or storage.

**diurnal temperature range**—the variation in outdoor temperature between day and night.

**double-glazed**—covered by two layers of glazing material (commonly glass or plastic).

**double-walled heat exchanger**—a heat exchanger that separates the collector fluid from the potable water by two surfaces; it is required if the collector fluid is nonpotable.

**drainback**—a type of liquid heating system that is designed to drain into a tank when the pump is off.

**earth berm**—a mound of dirt that abuts a building wall to stabilize interior temperature or to deflect the wind.

**emissivity**—the ratio of the energy radiated by a body to the energy radiated by a black body at the same temperature.

**energy audit**—an accounting of the forms of energy used during a designated period, such as monthly.

**eutectic salts**—a mixture of two or more pure materials that melts at a constant temperature; a material that stores large amounts of latent heat.

**evaporative cooling**—a method of space conditioning that requires the addition of bodies of water or of moisture for cooling the living spaces.

**fan coil**—a unit consisting of a fan and a heat exchanger that transfers heat from liquid to air (or vice versa); usually located in a duct.

**flat-plate collector**—a solar collection device in which sunlight is converted to heat on a flat surface; air or liquid flows through the collector to remove the heat.

**flywheel effect**—the damping of interior temperature fluctuations by massive construction. (See diurnal temperature range.)

**forced-air heat**—a conventional heating distribution system that uses a blower to circulate heated air.

**galvanic corrosion**—the deterioration of tanks, pipes, or pumps that occurs when a conducting liquid permits electrical contact between two different metals, causing the more active metal to corrode.

**Glauber's salts**—a term for sodium sulfate decahydrate, which melts at 90°F; a component of eutectic salts.

**glazing**—a material that is translucent or transparent to solar radiation.

**greenhouse**—in passive solar design, an attached glazed area from which heat is withdrawn to the living space during the day.

**heat capacity (specific heat)**—the quantity of heat required to raise the temperature of a given mass of a substance 1°F.

**heat exchanger**—a device that transfers heat from one fluid to another.

**heat gain**—as applied to heating or cooling load, that amount of heat gained by a space from all sources (including people, lights, machines, sunshine, etc.).

**heat pump**—an electrically operated machine for heating and cooling; when heating, it transfers heat from one medium at a lower temperature (called the heat source) to a medium at a higher temperature (called the heat sink), thereby cooling the source (outside air) and warming the sink (the house); when cooling, the heat pump functions much like an air conditioner—taking unwanted heat from the heat source (a building) and dumping it to the heat sink (the outside).

**heat sink**—a medium (water, earth, or air) capable of accepting heat.

**heat source**—a medium (water, earth, or air) from which heat is extracted.

**heat transfer**—conduction, convection, or radiation (or a combination of these).

**heating load**—the rate of heat flow required to maintain indoor comfort; measured in BTU per hour.

**heating season**—the period from early fall to late spring during which heat is needed to keep a house comfortable.

**heliostat**—an instrument consisting of a mirror mounted on an axis moved by clockwork; the heliostat reflects sunbeams in one direction, usually to a central absorber located in a tower.

**hybrid solar energy system**—a hybrid system is one incorporating a major passive aspect, where at least one of the significant thermal energy flows is by natural means and at least one is by forced means.

**hydronic system**—a conventional heating system that circulates hot water, usually 160°F to 180°F, through baseboard finned pipes or radiators.

**indirect gain solar**—a type of passive solar heating system in which the storage is interposed between the collecting and the distributing surfaces (e.g., Trombe wall, water wall, or roof pond).

**infiltration**—the uncontrolled movement of outdoor air into a building through leaks, cracks, windows, and doors.

**infrared radiation**—the invisible rays just beyond the red of the visible spectrum; their wavelengths are longer than those of the spectrum colors (.7 to 400 microns), and they have a penetrating heating effect.

**insolation**—the amount of solar radiation (direct, diffuse, or reflected) striking a surface exposed to the sky;

measured in BTU per square foot per hour (or in watts per square meter).

**insulation**—a material that increases resistance to heat flow.

**isolated solar gain**—a type of passive solar heating system in which heat is collected in one area to be used in another (e.g., greenhouse or attic collector).

**kilowatt**—a measure of power or heat flow rate; it equals 3,413 BTU per hour.

**kilowatt-hour (kwh)**—the amount of energy equivalent to one kilowatt of power being used for one hour; 3,413 BTU.

**langley**—a measure of solar radiation; it equals one calorie per square centimeter, or 3.69 BTU per square foot.

**latent heat**—the change in heat content that occurs with a change in phase and without change in temperature; the heat stored in the material during melting or vaporization. Latent heat is recovered by freezing a liquid or by condensing a gas.

**life-cycle cost analysis**—the accounting of capital, interest, and operating costs over the useful life of the solar system compared to those costs without the solar system.

**liquid-type collector**—a collector that uses a liquid as the heat transfer fluid.

**microclimate**—the variation in regional climate at a specific site; caused by topography, vegetation, soil, water conditions, and construction.

**movable insulation**—a device that reduces heat loss at night or during cloudy periods and permits heat gain in sunny periods (e.g., Beadwall<sup>®</sup>, insulated draperies, automatic shutters); it may also be used to reduce heat gains in summer.

**nocturnal cooling**—cooling through radiation of heat from warm surfaces to a night sky.

**nonpotable**—water that is not suitable for drinking or cooking purposes.

**nonrenewable energy source**—a mineral energy source that is in limited supply, such as fossil (gas, oil, and coal) and nuclear fuels.

**passive solar energy systems and concepts**—passive solar heating applications generally involve energy collection through south-facing glazed areas; energy storage in the building mass or in special storage elements; energy distribution by natural means such as convection, conduction, or radiation with only minimal use of low-power fans or pumps; and a method controlling both high and low temperatures and energy flows. Passive cooling applications usually include methods

of shading collector areas from exposure to the summer sun and provisions to induce ventilation to reduce internal temperatures and humidity.

**payback**—the time needed to recover the investment in a solar energy system.

**peak load**—the maximum instantaneous demand for electrical power, which determines the generating capacity required by a public utility.

**percent possible sunshine**—the amount of radiation available compared to the amount that would be present if there were no cloud cover; usually measured on a monthly basis.

**phase-change**—see latent heat.

**photovoltaic cell**—a device without any moving parts that converts light directly into electricity by the excitation of electrons.

**potable**—water that is suitable for drinking or cooking purposes.

**preheat**—the use of solar energy to partially heat a substance, such as domestic potable water, prior to heating it to a higher desired temperature with auxiliary fuel.

**prompt wall**—a thin, low-mass wall similar to a Trombe wall, but designed to respond more rapidly to solar gain.

**pyranometer**—an instrument for measuring direct and diffuse solar radiation.

**pyrheliometer**—an instrument that measures the intensity of the direct radiation from the sun; the diffuse component is not measured.

**radiation**—the process by which energy flows from one body to another when the bodies are separated by a space, even when a vacuum exists between them.

**refrigerant**—fluid, such as Freon®, that is used in heating or cooling devices, such as heat pumps, air conditioners, or solar collectors.

**renewable energy source**—solar energy and certain forms derived from it, such as wind, biomass, and hydro.

**reradiation**—the emission of previously absorbed radiation.

**retrofit**—to modify an existing building by adding a solar heating system or insulation.

**rock bin or rock bed**—a heat storage container filled with rocks or pebbles, used in air-type solar heating/cooling systems.

**R-value**—see thermal resistance.

**seasonal efficiency**—the ratio of the solar energy collected and used to the solar energy striking the collector,

measured over an entire heating season.

**selective surface**—a surface that is a good absorber of sunlight but a poor emitter of thermal radiation, used as a coating for absorbers to increase collector efficiency.

**sensible heat**—heat which, when gained or lost, results in a change in temperature.

**shading coefficient**—the ratio of the amount of sunlight transmitted through a window under specific conditions to the amount of sunlight transmitted through a single layer of common window glass under the same conditions.

**solar access or solar rights**—the ability to receive direct sunlight that has passed over land located to the south; the protection of solar access is a legal issue.

**solar cell**—see photovoltaic cell.

**solar collector**—a device that collects solar radiation and converts it to heat.

**solar constant**—the average intensity of solar radiation reaching the earth outside the atmosphere; 429.2 BTU per square foot per hour (or 1,354 watts per square meter).

**solar fraction**—the percentage of a building's seasonal heating requirement provided by a solar system.

**solar furnace**—a solar concentrator used to produce very high temperatures; also a trade name for a modular air heating system, usually ground mounted, with rock storage.

**solar gain**—the part of a building's heating or an additional cooling load that is provided by solar radiation striking the building or passing into the building through windows.

**solar noon**—the time of day when the sun is due south; halfway between sunrise and sunset.

**solar radiation**—energy radiated from the sun in the electromagnetic spectrum; visible light and infrared light are used by solar energy systems.

**solar thermal electric power**—the indirect conversion of solar energy into electricity by solar collectors, a heat engine, and electrical generators.

**solarium**—a living space enclosed by glazing; a greenhouse.

**specific heat capacity**—the quantity of heat needed to change the temperature of one pound of a material by one degree Fahrenheit (or one kilogram of a material by one degree centigrade).

**stack effect**—the rising of heated air over a dark surface by natural convection to create a draft, used to provide

summer ventilation in some passive houses.

**stagnation**—a high-temperature condition obtained in a solar collector when the sun is shining and no fluid is flowing through the collector; temperatures range from 250°F to 400°F, depending on collector design. Any condition under which a collector is losing as much heat as it gains.

**storage**—the device or medium that absorbs collected solar heat and stores it for later use.

**storage capacity**—the quantity of heat that can be contained in a storage device.

**sunspace**—a living space enclosed by glazing; a solarium or greenhouse.

**sun tempering**—a method that involves a significant daytime solar gain and an effective distribution system but generally lacks a storage system.

**therm**—a quantity of heat equal to 100,000 BTU; approximately 100 cubic feet of natural gas.

**thermal lag**—in an indirect gain system, the time delay for heat to move from the outer collecting surface to the inner radiating surface.

**thermal mass**—the heat capacity of a building material (brick, concrete, adobe, or water containers).

**thermal radiation**—see infrared radiation.

**thermal resistance (R-value)**—the tendency of a material to retard the flow of heat; the reciprocal of the coefficient of heat transmission.

**thermosiphoning**—heat transfer through a fluid (such as air or liquid) by currents resulting from the natural fall of heavier, cool fluid and rise of lighter, warm fluid.

**tilt angle**—see collector tilt.

**tracking**—for a collector, a device that causes the panel to follow the sun.

**transfer medium**—the substance that carries heat from the solar collector to storage or from storage to the living areas.

**trickle-type collector**—a collector in which the heat transfer fluid flows in open channels on the absorber.

**Trombe wall**—masonry, typically 8 to 16 inches thick, blackened and exposed to the sun behind glazing; a passive solar heating system in which a masonry wall collects, stores, and distributes heat.

**tromped wall**—a fanciful name for a hybrid low-mass wall that is useful as a convector of solar heating. It is similar in effect to a prompt wall yet it has more mass and is conceptually similar to a Trombe wall, so the term

“tromped” wall (Trombe + prompt = tromped) was coined.

**U-value**—see coefficient of heat transmission.

**vapor barrier**—a waterproof liner used to prevent passage of moisture through the building structure. Vapor barriers in walls and ceilings should be located on the heated side of the building.

**wet-bulb temperature**—the lowest temperature attainable by evaporating water in the air; a measure of humidity.

**zoned heating**—the control of the temperature in a room or a group of rooms independently of other rooms.

