

Glossary of Solar Heating Terms

Absorber

The blackened surface in a collector that absorbs the solar radiation and converts it to heat energy

Absorptance

The ratio of solar energy absorbed by a surface to the solar energy striking it

Active System

A solar heating or cooling system that requires external mechanical power to move the collected heat

Air System

Solar domestic hot water systems employing air-type collectors are available. Hot air generated by these collectors is fan forced through an air-to-liquid heat exchanger with the potable water being pumped through the liquid section of the exchanger. The heated water is then circulated through the storage tank in a similar fashion to the liquid collector system. Air does not need to be protected from freezing or boiling, is non-corrosive, and is free. However, air ducts and air handling units require greater space than piping, and air leaks are difficult to detect.

Air-Type Collector

A collector that uses air as the heat transfer fluid

Altitude

The angular distance from the horizon to the sun

Ambient Temperature

The temperature of the surrounding air

ASHRAE

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

Auxiliary Heat

The extra heat provided by a conventional heating system for periods of cloudiness or intense cold when a solar heating system cannot provide enough

Azimuth

The angular distance between true south and the point on the horizon directly below the sun

British Thermal Unit (BTU)

The quantity of heat needed to raise the temperature of one pound of water one degree Fahrenheit.

Calorie

The quantity of heat needed to raise the temperature of one gram of water one degree Celsius.

Coefficient of Heat Transmission

The rate of heat loss in BTU per hour through a square foot wall or other building surface when the difference between indoor and outdoor air temperatures is one degree Fahrenheit

Collector

A device that collects solar radiation and converts it to heat

Collector Efficiency

The ratio of usable heat energy extracted from a collector to the solar energy striking the cover.

Concentrating Collector

A device which concentrates the sun's rays on an absorber surface which is significantly smaller than the overall collector area

Conductance

The rate of heat flow (in BTUs per hour) through an object when a 1° F. temperature difference is maintained between the sides of the object.

Conduction

The flow of heat due to temperature variations within a material.

Conductivity

A measure of the ability of a material to permit conduction of heat flow through it.

Convection

The motion of fluid such as gas or liquid by which heat may be transported.

Cover Plate

A sheet of glass or transparent plastic placed above the absorber in a flat plate collector.

Degree Day

A unit that represents a 1 degree F. deviation from some fixed reference point (usually 65°F.) in the mean daily outdoor temperature.

Design Heat Load

The total heat loss from a house under the most severe winter conditions likely to occur.

Design Temperature

The temperature close to the lowest expected for a location, used to determine the design heat load.

Diffuse Radiation

Indirect sunlight that is scattered from air molecules, dust and water vapor.

Direct Radiation

Solar radiation that comes straight from the sun, casting shadows on a clear day.

Drain Down System

Potable water is circulated from the storage tank through the collector loop. Freeze protection is provided by solenoid valves opening and dumping the water at a preset low temperature. Collectors and piping must be pitched so that the system can drain down, and must be assembled carefully to withstand 100 psi. city water line pressures. Pressure reducing valves are recommended when city water pressure is greater than the working pressure of the system.

Drain back System

The solar heat transfer fluid automatically drains into a tank by gravity. Drain back systems are available in one or two tank configurations. A heat exchanger is necessary, because the city inlet pressure would prevent draining. The heat transfer fluid in the collector loop may be distilled or city water if the loop plumbing is copper. If the plumbing is threaded galvanized pipe, inhibitors may be added to prevent corrosion. Most inhibitors are non-potable and require a double wall heat exchanger. The pump used must be sized to overcome static head.

Emittance

A measure of the propensity of a material to emit thermal radiation.

Eutectic Salts

A group of materials that melt at low temperatures, absorbing large quantities of heat.

Flat Plate Collector

A solar collection device in which sunlight is converted into heat on a plane surface without the aid of reflecting surfaces to concentrate the rays.

Forced Convection

The transfer of heat by the flow of fluids (such as air or water) driven by fans, blowers or pumps.

Galvanic Corrosion

A condition caused as a result of a conducting liquid making contact with two different metal which are not properly isolated physically and/or electrically.

Getters

A column or cartridge containing an active metal which will be sacrificed to protect some other metal in the system against galvanic corrosion.

Glaubers

Salts: Sodium sulfate, a eutectic salt that melts at 90°F. and absorbs about 104 Btu per pound as it does so.

Gravity Convection

The natural movement of heat that occurs when a warm fluid rises and a cool fluid sinks under the influence of gravity.

Headers

The pipe that runs across the edge of an array of solar collectors, gathering or distributing the heat transfer fluid from, or to the risers in the individual collectors. This insures that equal flow rates and pressure are maintained.

Heat Capacity

A property of a material denoting its ability to absorb heat

Heat Exchanger

A device, such as a coiled copper tube immersed in a tank of water, that is used to transfer heat from one fluid to another through a separating wall.

Heat Storage

A device or medium that absorbs collected solar heat and stores it for use during periods of inclement or cold weather.

Heat Storage Capacity

The amount of heat which can be stored by a material

Heating Season

Te period from early fall to late spring (in the northern hemisphere) during which additional heat is needed to keep a house comfortable for its occupants

Heat Pump

A mechanical device that transfers heat from one medium to another, thereby cooling the first and warming the second

Heat Sink

A medium or container to which heat flows

Heat Source

A medium or container from which heat flows

Hybrid Solar Energy System

A system that uses both active and passive methods in its operation

Indirect System

A solar heating or cooling system in which the solar heat is collected exterior to the building and transferred inside using ducts or piping and, usually fans or ducts.

Infrared Radiation

Electromagnetic radiation from the sun that has wavelengths slightly longer than visible light

Insolation (see Solar Irradiation)

The total amount of solar radiation direct, diffused and reflected-striking a surface exposed to the sky over the course of a day, usually expressed in $\text{Wh/m}^2/\text{Day}$ or $\text{kWh/m}^2/\text{Day}$. Derived from three words: INcident, SOLar, radiATION

Insulation

A material with high resistance (R-value) to heat flow

Langley

A measure of solar radiation; equal to one calorie per square centimeter.

Liquid Type Collector

A collector using a liquid as the heat transfer fluid.

Natural Convection

See Gravity Convection.

Nocturnal Cooling

The cooling of a building or heat storage device by the radiation of excess heat into the night sky

One-Tank Closed-Loop System

A conventional DHW tank, usually electrically heated, is converted to a solar DHW storage tank by installing an external heat exchanger coil. The lower electrical element is removed, leaving the uppermost of the usual two elements to provide auxiliary water heating and to achieve good stratification (layering of hotter water over progressively colder water).

Open System

Some part of the System is open to the atmosphere, or system contains fresh or changeable water.

Passive System

A solar heating or cooling system that uses no external mechanical power to move the collected solar heat

Percentage of Possible Sunshine

The percentage of daytime hours during which there is enough direct solar radiation to cast a shadow

Photosynthesis

The conversion of solar energy to chemical energy, by the action of chlorophyll in plants and algae.

Photovoltaic Cells

Semi-conductor devices that convert solar energy into electricity.

Pyranometer

An instrument for measuring solar radiation.

Radiant Panels

Panels with integral passages for the flow of warm fluids, either air or liquids. Heat from the fluid is conducted through the metal and transferred to the rooms by thermal radiation.

Radiation

The flow of energy through open space via electromagnetic waves, such as visible light.

Reflected Radiation

Sunlight that is reflected from surrounding trees, terrain or buildings onto a surface exposed to the sky.

Refrigerant

A liquid such as Freon that is use in cooling devices to absorb heat from surrounding air or liquids as it evaporates.

Resistance, or R Value

The tendency of a material to retard the flow of heat.

Retrofitting

The application of a solar heating or cooling system to an existing building.

Risers

The flow channels or pipes that distribute the heat transfer liquid across the face of an absorber.

Seasonal Efficiency

The ratio, over an entire heating season, of solar energy collected and used to the solar energy striking the collector.

Selective Surface

A surface that absorbs radiation of one wavelength (for example, sunlight) but emits little radiation of another wavelength (for example, infrared); used as a coating for absorber plates.

Shading Coefficient

The ratio of the solar heat gain through a specific glazing system to the total solar heat gain through a single layer of clear double-strength glass.

Solar Constant

The average intensity of solar radiation reaching the earth outside the atmosphere; accounting to two langleys or 1.94 gram-calories per square centimeter, equal to 442.4 BTU/hr/ft.², or 1395 watts/m².

Solar Irradiance (Solar Power)

The measure of the momentary intensity of solar **power**, expressed in W/m² or kW/m²

Solar Irradiation (Solar Energy)

The measure of the total amount of solar **energy** accumulated on an area over time, usually expressed in Wh/m² or kWh/m²

Solar Radiation (Solar Energy)

Electromagnetic radiation emitted by the sun.

Solar Rights

A legal issue concerning the right of access to sunlight.

Specific Heat

The quantity of heat, in BTU, needed to raise the temperature of one pound of a material 1°F.

Standby Heat

Loss Heat lost though storage tank and piping walls.

Sun Path Diagram

A circular projection of the sky vault, similar to a map, that can be used to determine solar positions and to calculate shading.

Thermal Capacity

The quantity of heat needed to warm a collector up to its operating temperature.

Thermal Mass or Thermal Inertia

The tendency of a building with large quantities of heavy materials to remain at the same temperature or to fluctuate only very slowly; also the overall heat storage capacity of the building.

Thermal Radiation

Electromagnetic radiation emitted by a warm body.

Thermistor

Sensing device which changes its electrical resistance according to temperature. Used in the control system to generate input data on collector and storage temperatures.

Thermosyphoning

The process that makes water circulate automatically between a warm collector and a cooler storage tank above it. (See Gravity Convection).

Tilt Angle

The angle that a flat plate collector surface forms with the horizontal plane.

Trickle Type Collector

A collector in which the heat transfer liquid flows through metal tubes which are fastened to the absorber plate by solder, clamps or other means. (See Collector).

Tube-in-Plate-Absorber

A metal absorber plate in which the heat transfer fluid flows through passages formed in the plate itself.

Tube-Type Collector

A collector in which the heat transfer fluid flows through metal tubes that are fastened to the absorber plate with solder, clamps or other means. (See Collector).