Explain solar thermal energy applications

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Some of the major application of solar energy are as follows: (a) Solar water heating (b) Solar heating of buildings (c) Solar distillation (d) Solar pumping (e) Solar drying of agricultural and animal products (f) Solar furnaces (g) Solar cooking (h) Solar electric power generation (i) Solar thermal power production (j) Solar green houses.

A solar water heating unit comprises a blackened flat plate metal collector with an associated metal tubing facing the general direction of the sun. The plate collector has a transparent glass cover above and a layer of thermal insulation beneath it.

The metal tubing of the collector is connected by a pipe to an insulated tank that stores hot water during cloudy days. The collector absorbs solar radiations and transfers the heat to the water circulating through the tubing either by gravity or by a pump.

When the building requires heat then from these collectors or storage devices, the heat is transferred by conventional equipment such as fan, ducts, air outlets, radiators and hot air registers etc. to warm up the living spaces of a building.

When the building does not require heat, the heated air or water from the collector can be moved to the heat storage device such as well insulated water tank or other heat holding material. For inclement days, an auxiliary heating system using gas, oil or electricity is required as a backup system.

In arid semi and or coastal areas there is scarcity of potable water. The abundant sunlight in these areas can be used for converting saline water into potable distilled water by the method of solar distillation. In this method, solar radiation is admitted through a transparent air tight glass cover into a shallow blackened basin containing saline water.

Solar radiation passes through the covers and is absorbed and converted into heat in the blackened surface causing the water to evaporate from the brine (impure saline water). The vapors produced get condensed to form purified water in the cool interior of the roof.

The condensed water flows down the sloping roof and is collected in the troughs placed at the bottom and from there into a water storage tank to supply potable distilled water in areas of scarcity, in colleges, school science laboratories, defense labs, petrol pumps, hospitals and pharmaceutical industries. Per liter distilled water cost obtained by this system is cheaper than distilled water obtained by other electrical energy-based processes.

In solar pumping, the power generated by solar-energy is utilized for pumping water for irrigation purposes.

The requirement for water pumping is greatest in the hot summer months which coincide with the increased solar radiations during this period and so this method is most appropriate for irrigation purpose. During periods of inclement weather when solar radiations are low then the requirement for water pumping is also relatively less as the transpiration losses from the crops are also low.

This is a traditional method of utilising solar energy for drying of agricultural and animal products. Agricultural products are dried in a simple cabinet dryer which consists of a box insulated at the base, painted black on the inner side and covered with an inclined transparent sheet of glass.

At the base and top of the sides ventilation holes are provided to facilitate the flow of air over the drying material which is placed on perforated trays inside the cabinet. These perforated trays or racks are carefully designed to provide controlled exposure to solar radiations.

Solar drying, especially of fruits improves fruit quality as the sugar concentration increases on drying. Normally soft fruits are particularly vulnerable to insect attack as the sugar content increases on drying but in a fruit dryer considerable time is saved by quicker drying --minimizing gap the chances of insect attack.