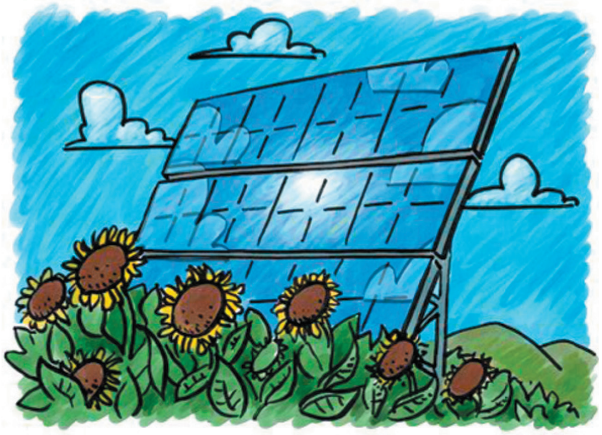
Solar energy transformation into heat



Solar radiation is the most powerful energy source on Earth. The use of this source is restricted, however, by the fact that large areas are required for situating optical systems, solar panels or heat collectors. The availability of solar radiation varies strongly, depending on site latitude, climatic and weather conditions, and other variables.

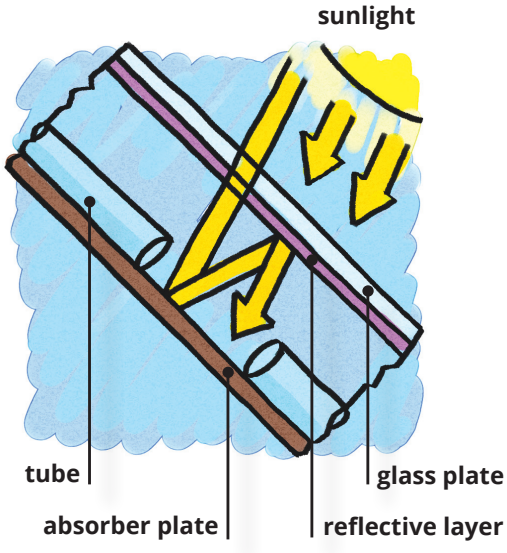
There are two main methods of utilising solar energy:

- solar energy transformation into heat; and
- solar energy transformation into electricity.

The transformation of solar energy into heat involves the installation of a boiler (solar water collector), in which water is heated by solar energy. The system absorbs infrared sunlight and transfers the heat into water that flows through a tube. The flat plate collector system is the most commonly used, and consists of a rectangular box (typically 1 to 2 metres in length and 0.8 to 1 metre wide). Small tubes attached to a black absorber plate run through the box. Water flowing through these tubes is heated via the absorption of the sun's infrared rays.

A typical solar water collector designed for domestic use comprises:

- an absorber plate, which intercepts and absorbs solar energy;
- transparent covers, which allow solar energy to pass through but reduce heat losses from the absorber;
- heat-transport fluid flowing through tubes to remove heat from the absorber; and
- a heat-insulating backing.



Ideally, the collector should be mounted to face south. The optimum angle for mounting is generally the degree of latitude plus 15 degrees.

The efficiency of such a system can be significantly increased by concentrating the sunlight with the help of movable mirrors. The steam produced by the boiler is processed in a steam turbine similar to those used in thermal and nuclear power plants. Enormous areas are needed to accommodate the construction and operation of these solar boilers. For example, one 80 megawatt power plant has 852 boilers, each occupying an area 100 metres in diameter — approximately equal to an average football stadium.