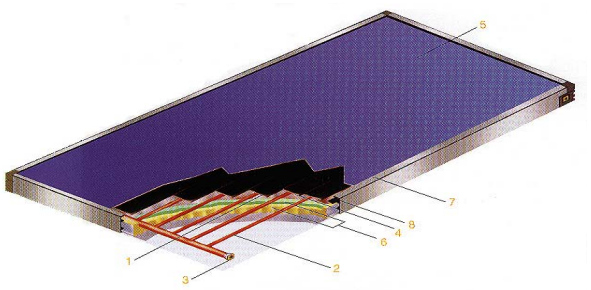
SOLAR THERMAL SYSTEMS

In Europe there is currently a great number of solar thermal systems. They have been used since 1993 and their annual growth rate is 15%.

1 - APPLICATIONS

The most current application of solar thermal collectors is the solar-fired heater. It can also be used to heat water or air (the least expensive solution).
The solar systems are also used for the heating of the swimming pools, the water-heaters of the hotels, hospitals, the cooling of the air or system replacing the heating (instead of the air conditioning), the desalination of sea water in the places where the drinking water is rare.



1 – ABSORPTION SURFACE
2 – PIPES
3 – PIPE CONNECTION
4 – ALUMINUM PROFILE
5 – SOLAR COLLECTOR
6 – ISOLATION
7 – FRAME
8 – SEALING
9 – BACK SIDE

2 - ADVANTAGES

This product has multiple advantages. Easy to install and integrate, this type of system (solar-fired heater) reduce the domestic costs of approximately 50%, avoids the emission of a ton of CO2. The panels face south the closer possible to south in order to maximize the sun entry. A roof covered by solar panels can provide all the needs of hot water for a family. The thermal solar systems have one period of return on investment of approximately 10 years, this period tending to decrease thanks to various subsidies and incentives giving encourage to the development of renewable energies.

3 – DESCRIPTION

A domestic hot water generation system is composed of solar collectors in form of finite elements integrated or fixed at the roof or the ground, - with a tank - called also accumulating or water-heater -. The tank is equipped with an electric or thermal complementary heating, a water circuit including the conduits, the circulator pump, the valves and surge tank.

Minimal maintenance, sturdiness and long life are the main features of these systems.

A ***Composition***: a thermal solar collector is composed of an opaque body which absorbs the solar radiation while warming up, a system of cooling by the coolant, a heat insulator (non exposed backs and sides), a transparent cover (front face, exposed to the radiation) which ensures the greenhouse effect, a subsidiary watertight enclosure with water and a system of mechanical stand of the unit.

The flat-plate collectors perform three main functions:
1. To absorb the solar radiation, 2. To transform it into heat, 3. To transmit this heat to the thermal fluid.

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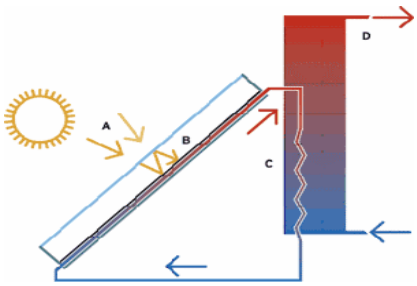
B - ***Principle of operation of a traditional thermal panel***



The solar radiation (A) (direct or diffuse) crosses the glass. In the solar panel box, an absorbent surface catches the infrared. This surface is treated to emit the less possible. Anyway, the infrared radiance is catched by the glass (B). Between the absorbent sheet and the isolation at the back of the panel, a water circuit collects the heat. This circuit exchanges the heat in a boiler via an exchanger (C). A secondary circuit distribute the hot water or provide the heating (D).

The solar radiation crossing the glazing reaches the absorber where it is converted into heat. This heat is then conveyed to the water-heater through a glycoled water circuit (to avoid freezing in the event of great cold without sun). The regulator has the role of comparing the temperature in the accumulator (A) with that of the sensors (C). When (C) is higher than (A), the pump engages. The circulation of the fluid makes it possible to transmit heat to the accumulator by means of an insulated piping and a heat exchanger. In case of insufficient solar contribution, the auxiliary heating is connected.

4 - DIMENSIONING OF THE SYSTEM

The size of the solar installation must initially take into account possible consumption according to the number of people living in the dwelling. This criterion makes it possible to determine the surface of sensors and the volume of the tank.

A - **Water consumption**: the average domestic hot water consumption, per day and per person, is approximately 50 litres at a temperature of 55°C. Surface of sensors: for suitably directed glazed plane sensors, advised surface is between 0.5-1.5 m2/person (small individual installation) and 0.3-0.5 m2/person (installation serving more than 100 people).

B - **Volume of the water-heater**: volumes are given according to the surface of the sensors and the availability of auxiliary energy (conventional energy source). The volume of the solar-fired heater varies between 100 l/person (small installation) and 60 l/person (large installation).

C - **Note**: in case of important sunning (summer) and reduced consumption (holidays) could appear a risk of overheating in the sensors which could cause the vaporization of the liquid (thermal fluid), which imposes technical care at the time of design -the installation of a safety valve prevents any danger-.

This technology is primarily used to produce domestic hot water but can also concern certain professional sectors, such as the laundries, using hot water for their activities. It is profitable so much for the collective sets (building, hospitals) as for the individual habitat, where it can also feed a heating system, complementing the photovoltaic applications.

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