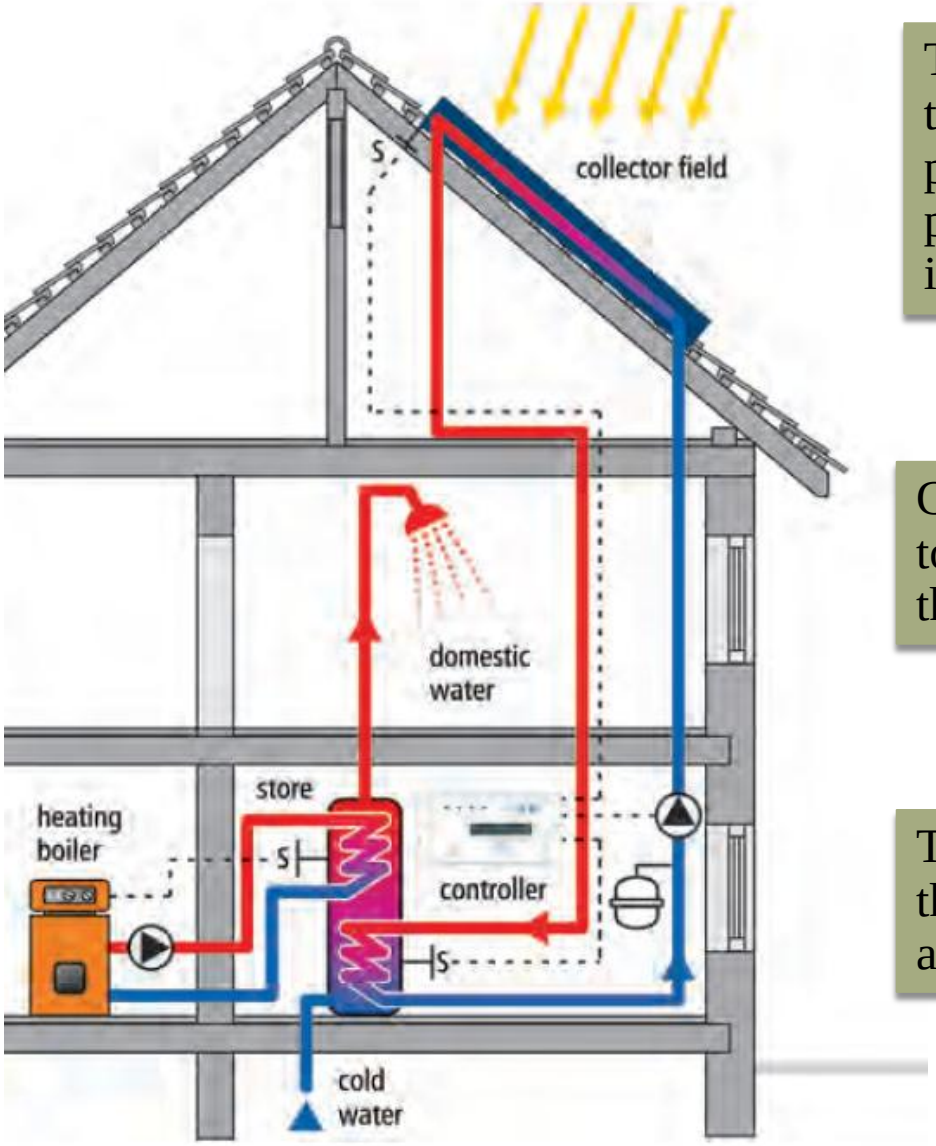
PLANT SCHEMES

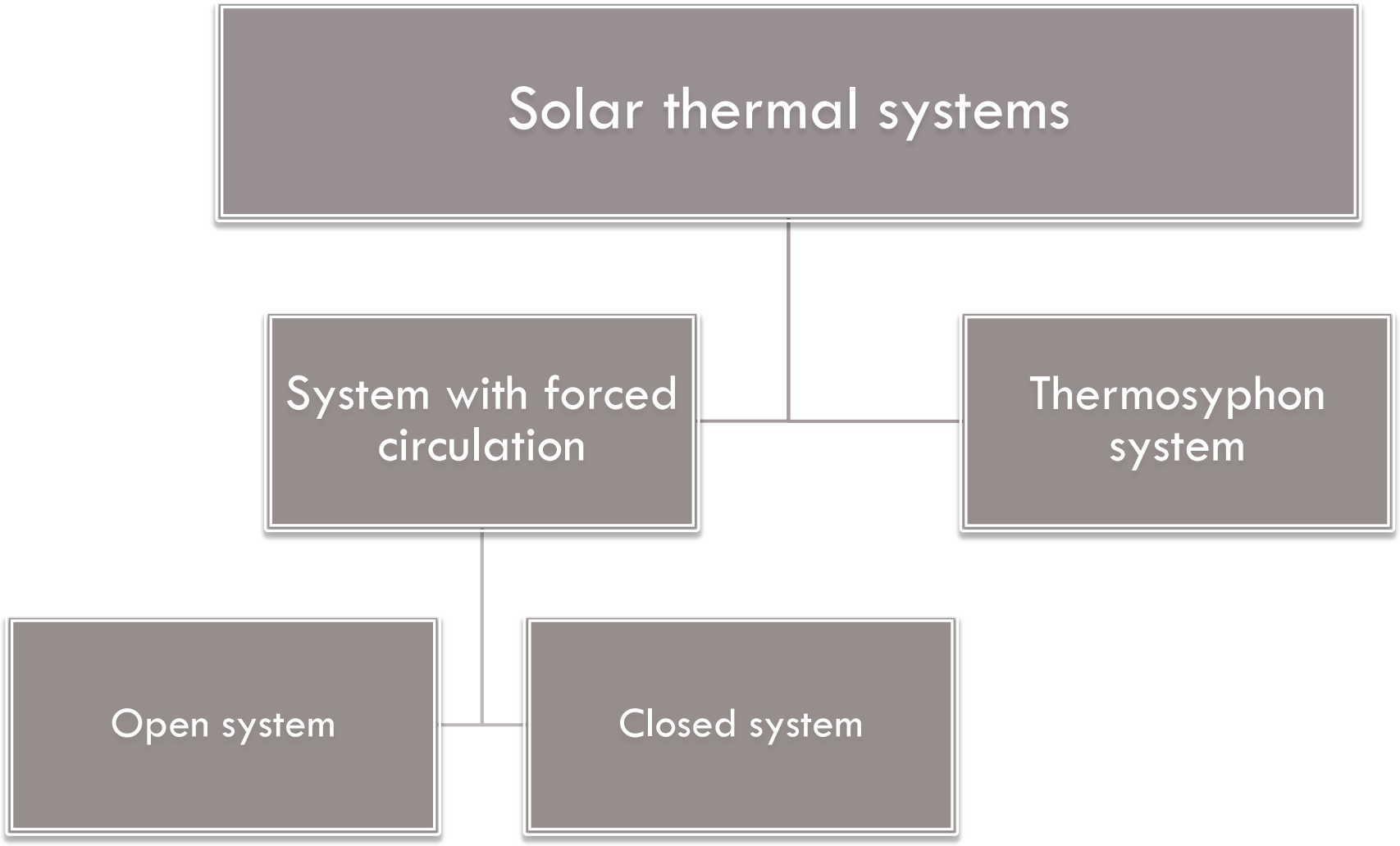


The ***solar collector*** mounted on the roof converts the light that penetrates its glass panes (short-wave radiation) into heat.

Generated heat collected together into a pipe and flow to the hot water ***storage***.

The heat is then transferred to the domestic water by means of a heat exchanger.

The cooled medium then flows via a second pipeline back to the collector

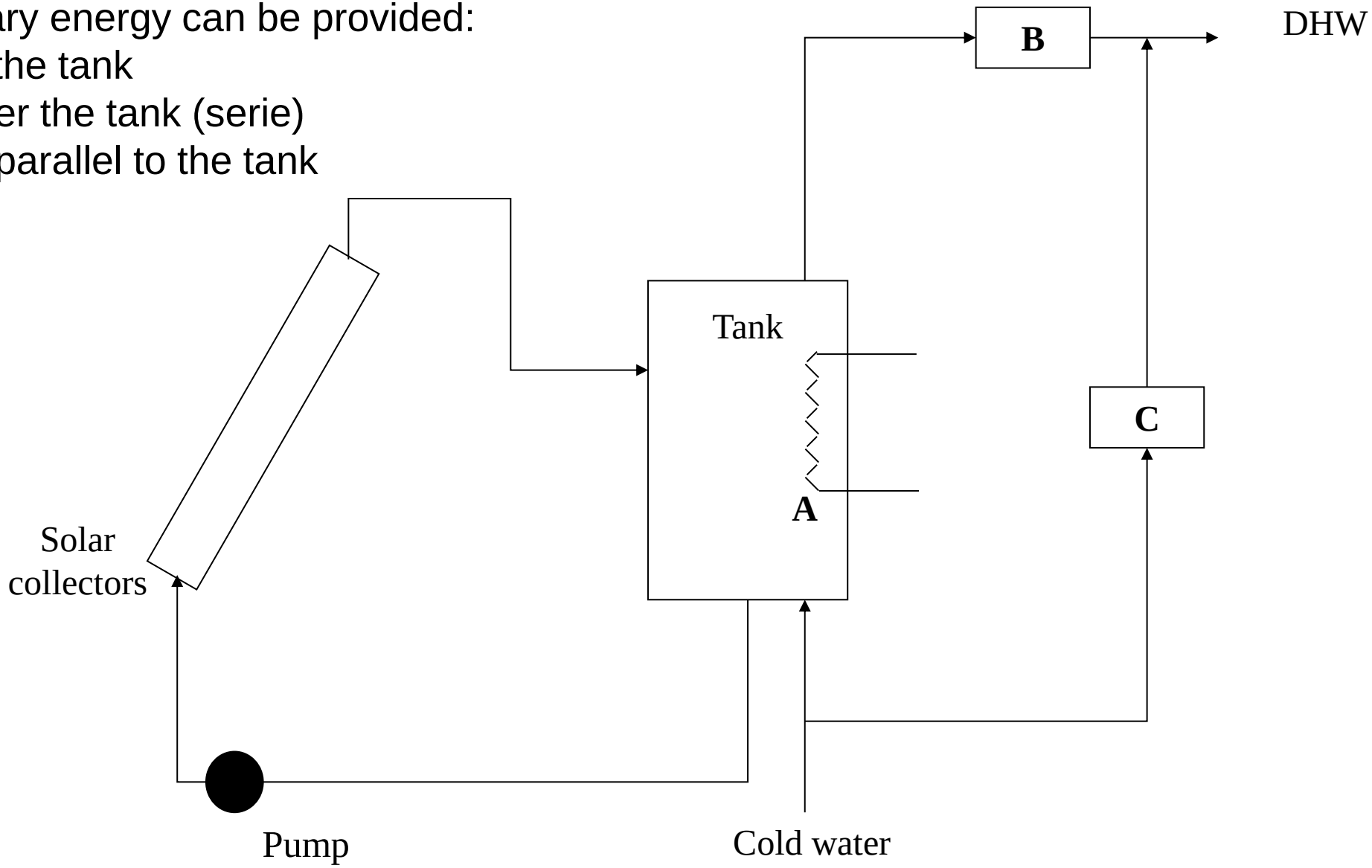

Solar thermal systems
System with forced circulation
Thermosyphon system
Open system
Closed system

Plant schemes

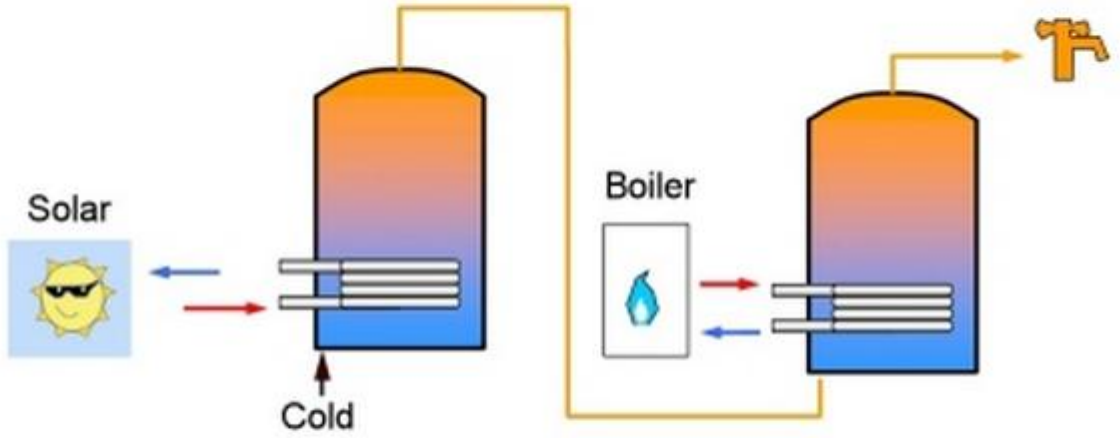
- Integration with conventional system
- Most common plant schemes
- Connection of washing machine and dish washer

Integration with conventional system

Auxiliary energy can be provided:
-A: in the tank
-B: after the tank (serie)
-C: in parallel to the tank

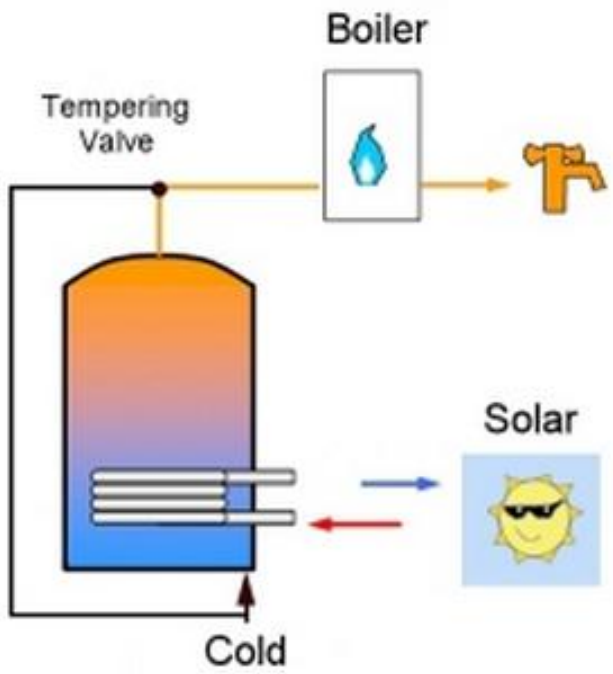


Two cylinders



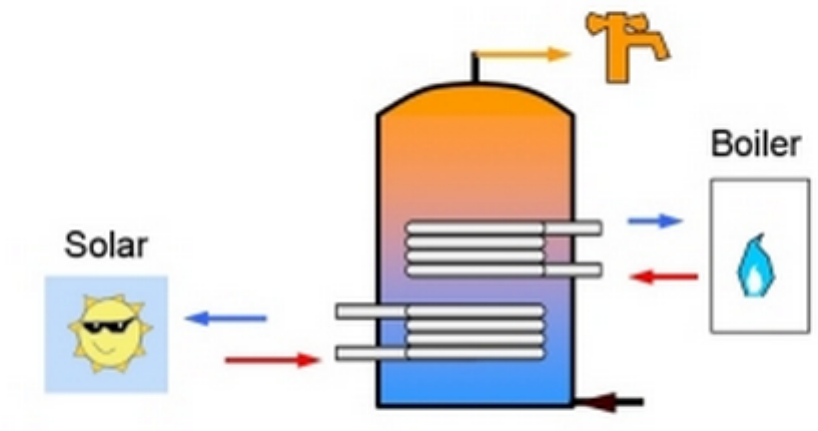
The simplest to understand is a two cylinder arrangement, where the cold feed to the conventional hot water cylinder is first taken through a cylinder that is heated by the solar panel. On good solar days, the water coming into the second cylinder will already be hot enough, and the thermostat will not call for heat - the boiler will not fire. On less good solar days, the water coming into the second cylinder will not be warm enough to use, and the thermostat will call for the boiler to heat the second cylinder.

Pre-heat for Combi boiler



A combi boiler heats water "on demand". A solar heated cylinder can be installed upstream of the combi boiler so that the boiler recieves warm water rather than cold as an input, and so has to use less fuel to heat up the water to the required temperature. A tempering valve is normally required to ensure that the temperature of the infeed water to the boiler is not too hot, as many boilers cannot accept incoming water that is too hot.

Twin Coil Cylinder



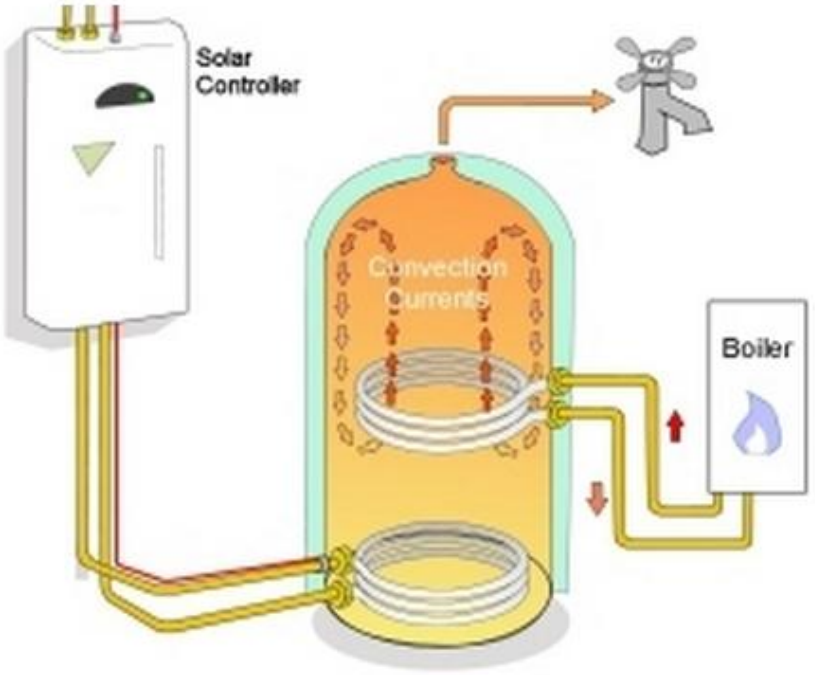
The most common, and most cost-effective is to use a cylinder with two heat exchange coils. The coils are arranged one above the other, with the solar coil at the bottom.

Because the coils heat by convection, the boiler can only heat the top part of the cylinder, where a zone of hot water will float on top of the cooler water at the bottom, a pheonomenon called stratification. This means that irrespective of the boiler controls, the solar always has a volume that it can heat.

On good solar energy days, the solar panel will heat the whole tank up to a useable temperature, and the cylinder thermostat will not call for heat from the boiler. On less good solar days, the cylinder thermostat will call for heat and the boiler will top up solar energy.

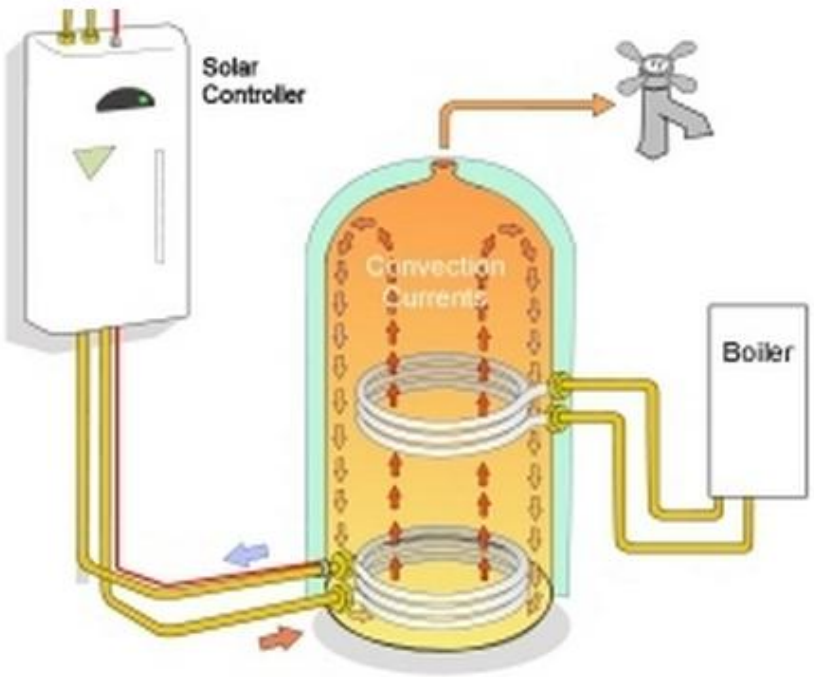
The boiler controls can be completely independent of the solar system.

When the boiler is providing heat to the cylinder a heating fluid is pumped from the boiler to the cylinder, where it flows inside the coil. The coil has thin metal walls which conduct the heat into the surrounding water. The heated water near the coil expands and becomes less dense than the surrounding cooler water, and so rises. Cooler water at the top of the cylinder falls to replace the rising hot water. This so called "convection current" means that the boiler heats the top part of the cylinder above the boiler coil.



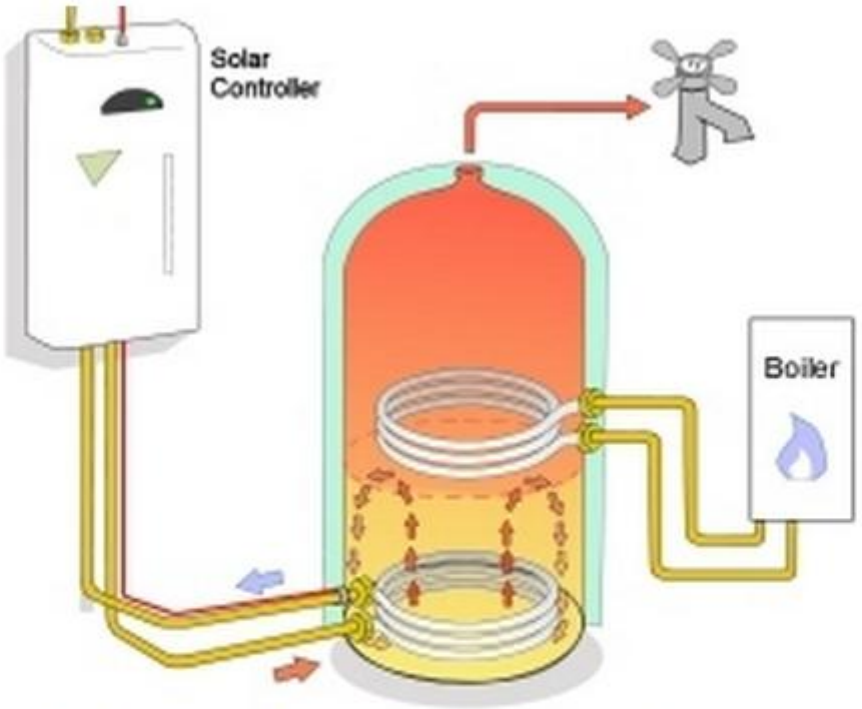
The boiler heats only the top part of the cylinder

The solar coil works in the same way, but because it is at the bottom of the cylinder, it can heat the whole height of the cylinder.



The solar panels heat the whole height of the cylinder

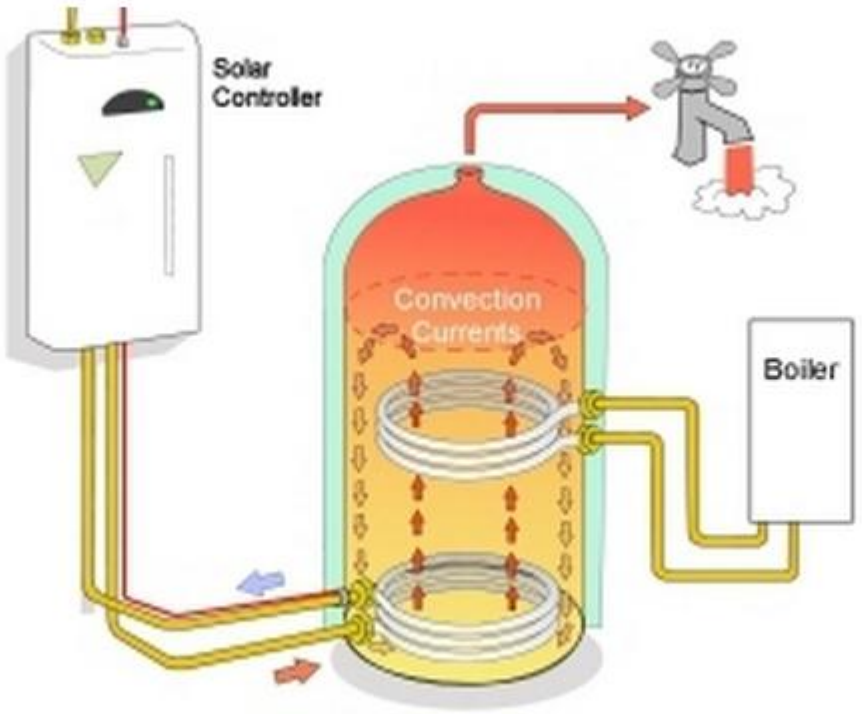
If the zone above the solar coil is already hot from the boiler, then the convection currents from the solar coil only heat the volume of water below the boiler coil. This volume is termed the "Solar Dedicated Volume". UK Building regulations requires that this volume is at least 25 litres per square metre of solar panel area, or 80% of the hot water demand of the household (whichever is the lower). The reason for setting a minimum solar dedicated volume is to ensure that the solar panels have somewhere to put the energy they collect, even if the residents run the boiler during the day. (See Case Study 001 to see the impact the user can have on the solar energy collected).



The Solar Dedicated Volume is the volume below the boiler coil

The way to get the best out of a twin coil solar cylinder is to use a timer programmer to have the boiler come on only in the evening after the solar panels have had all day to heat the cylinder. The cylinder thermostat will ensure that the boiler will only switch on if the cylinder is not hot enough from the solar heating.

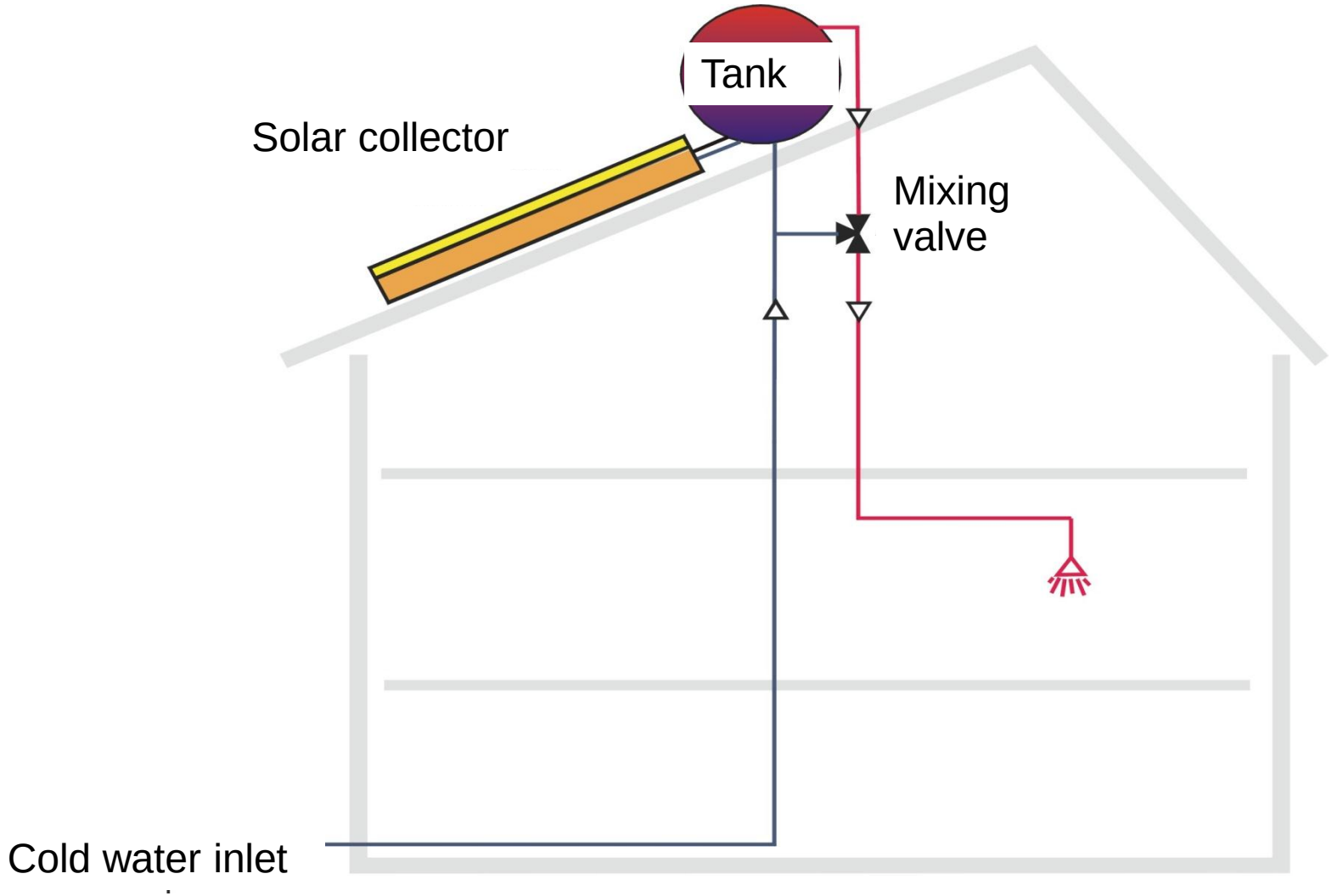
As hot water is drawn out of the cylinder for bathing in the evening and the following morning, cold water is introduced at the bottom, and the hot water layer floats on top.



As hot water is drawn off, the volume available to the solar increases

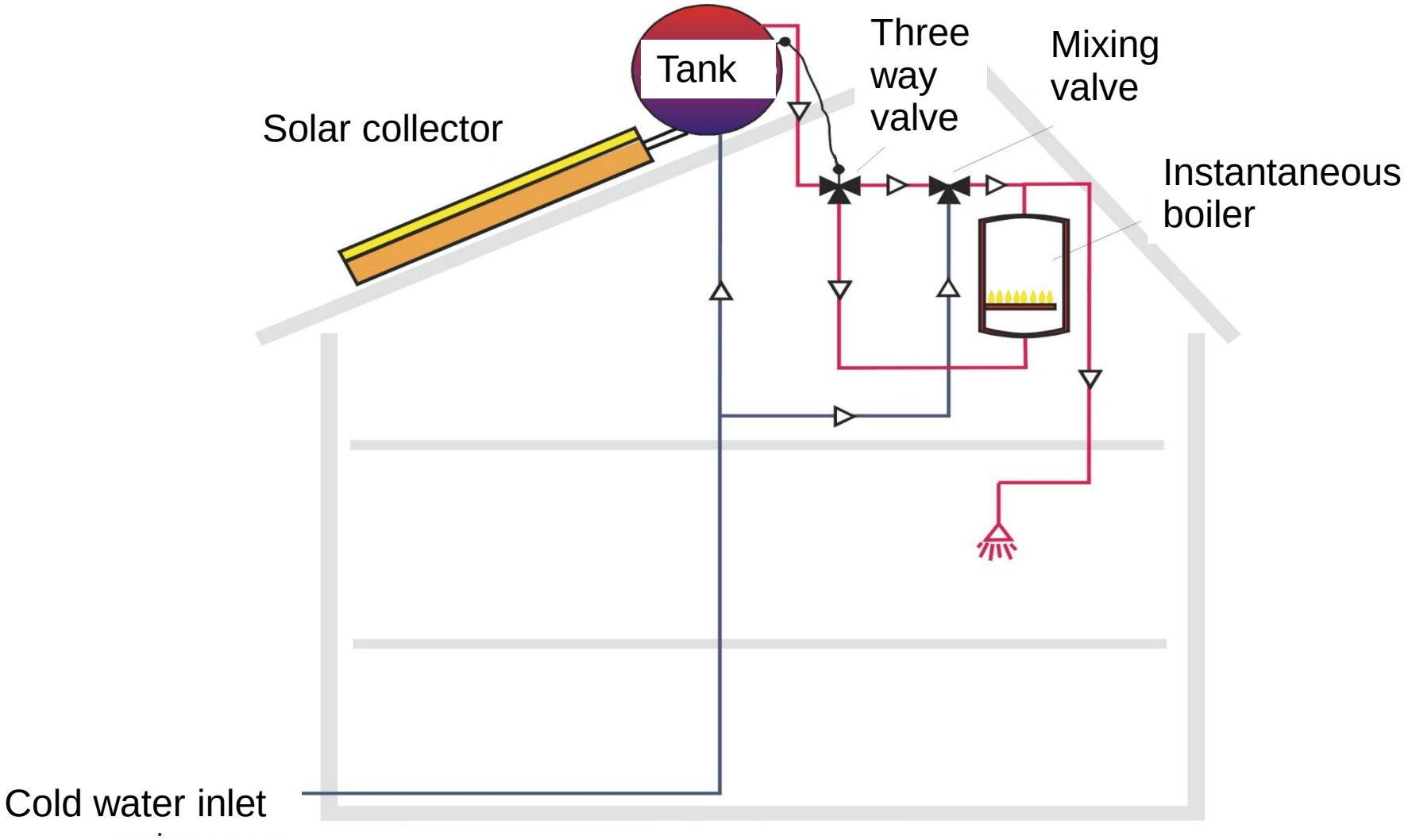
The next day, the solar panels will have a good volume of cold water to get to work on.

Natural circulation system – “solar only”



Source: Ambiente Italia

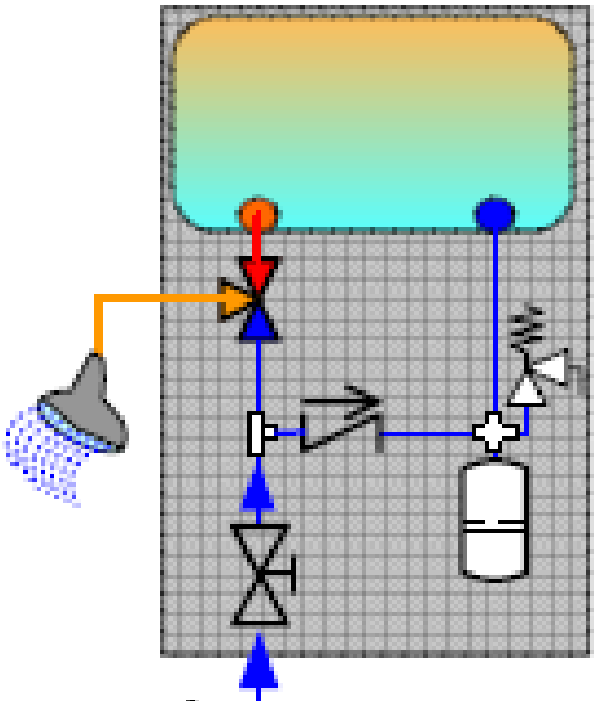
Natural circulation system – with auxiliary boiler



Source: Ambiente Italia

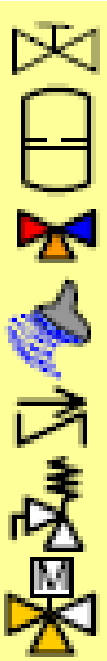
Natural circulation systems

Generic complete scheme



Cold water inlet

Essential components

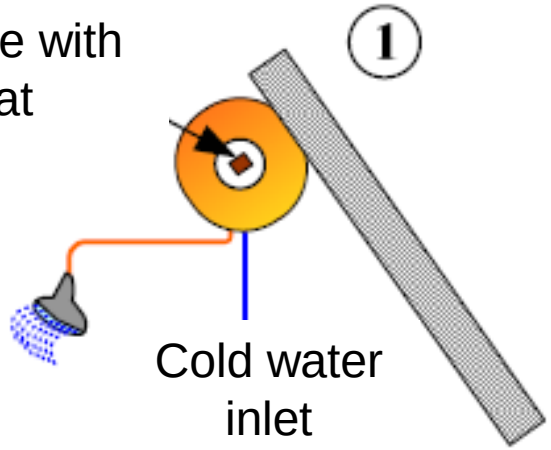


- Shut off valve
- Expansion vessel
- Thermostatic mixing valve
- Users
- Non-return valve
- Safety valve
- Motorized valve

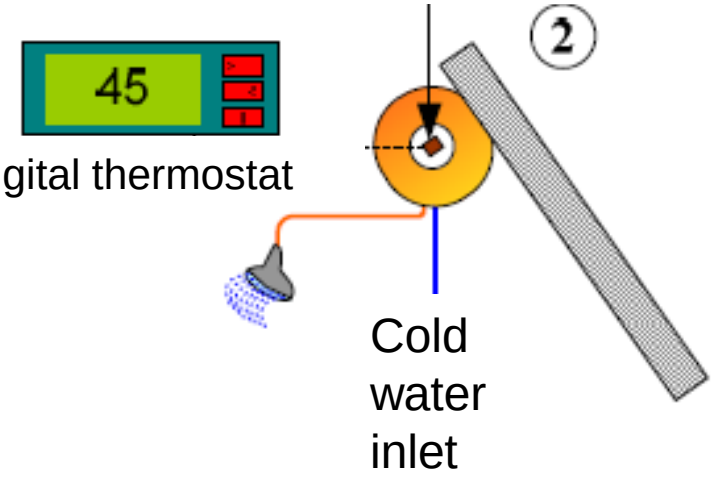
Natural circulation systems

Auxiliaryelectricity

Electrical resistance with thermostat

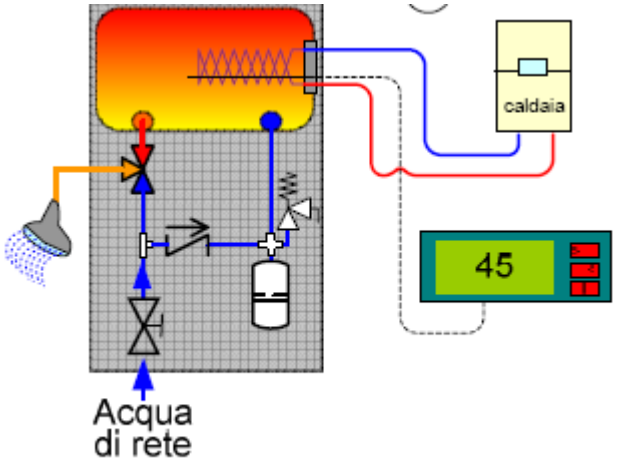


Temperature sensor



Digital thermostat

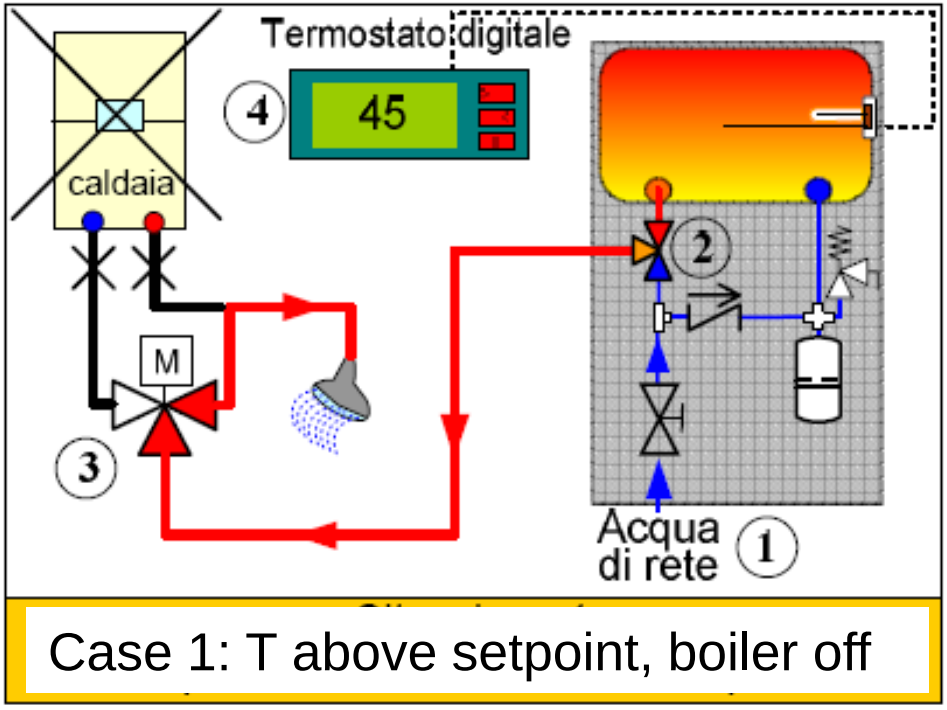
Auxiliary gas boiler



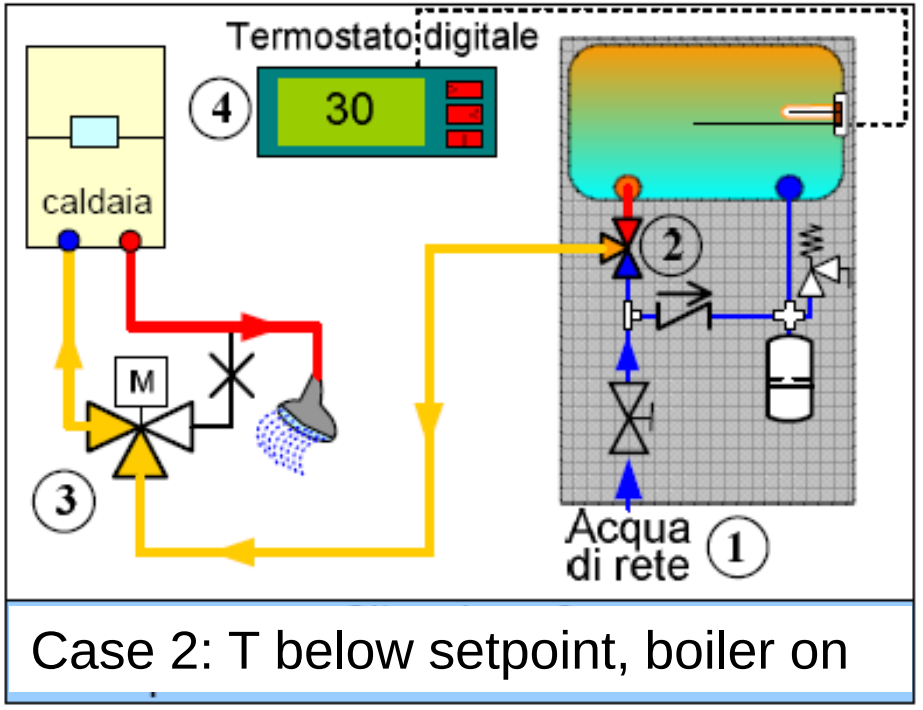
Cold water inlet

Natural circulation systems

Auxiliary instantaneous boiler



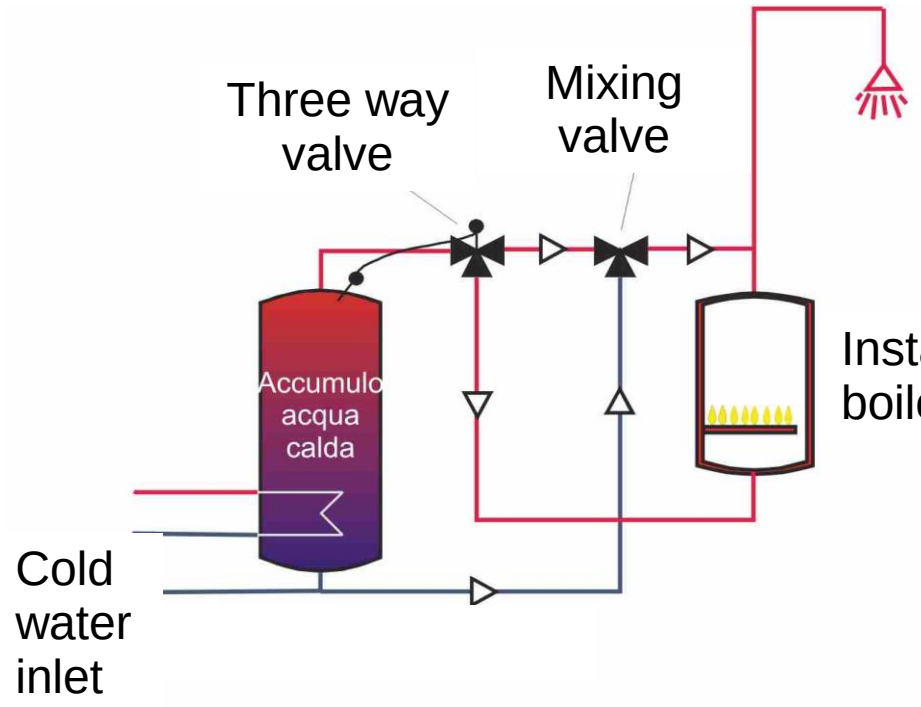
Case 1: T above setpoint, boiler off



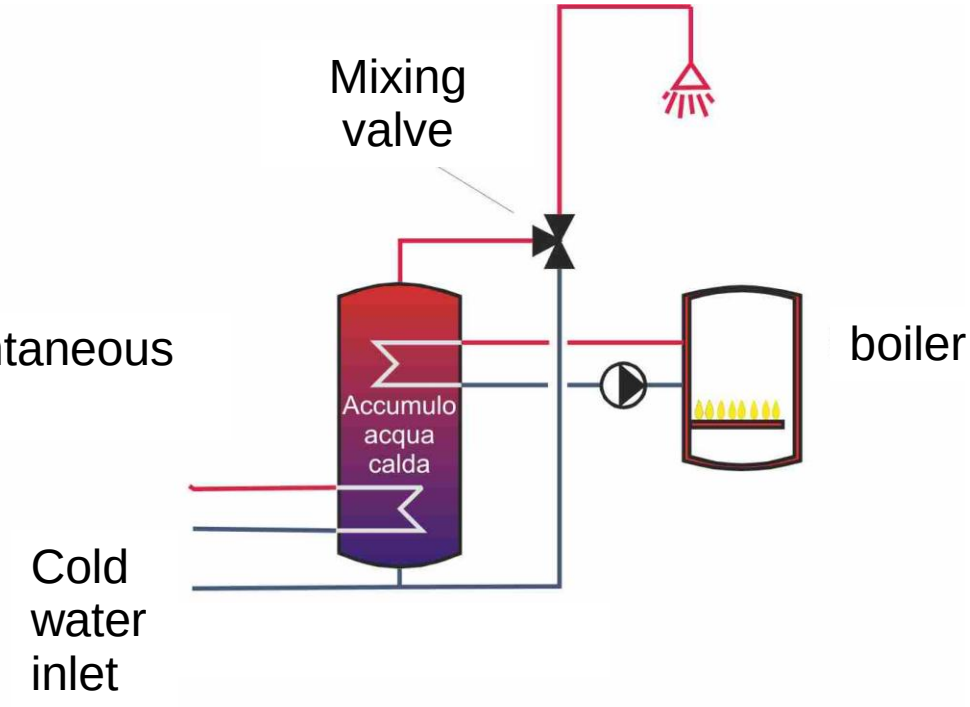
Case 2: T below setpoint, boiler on

Source: CMG Solari

Forced circulation system for DHW
Integration with gas boiler



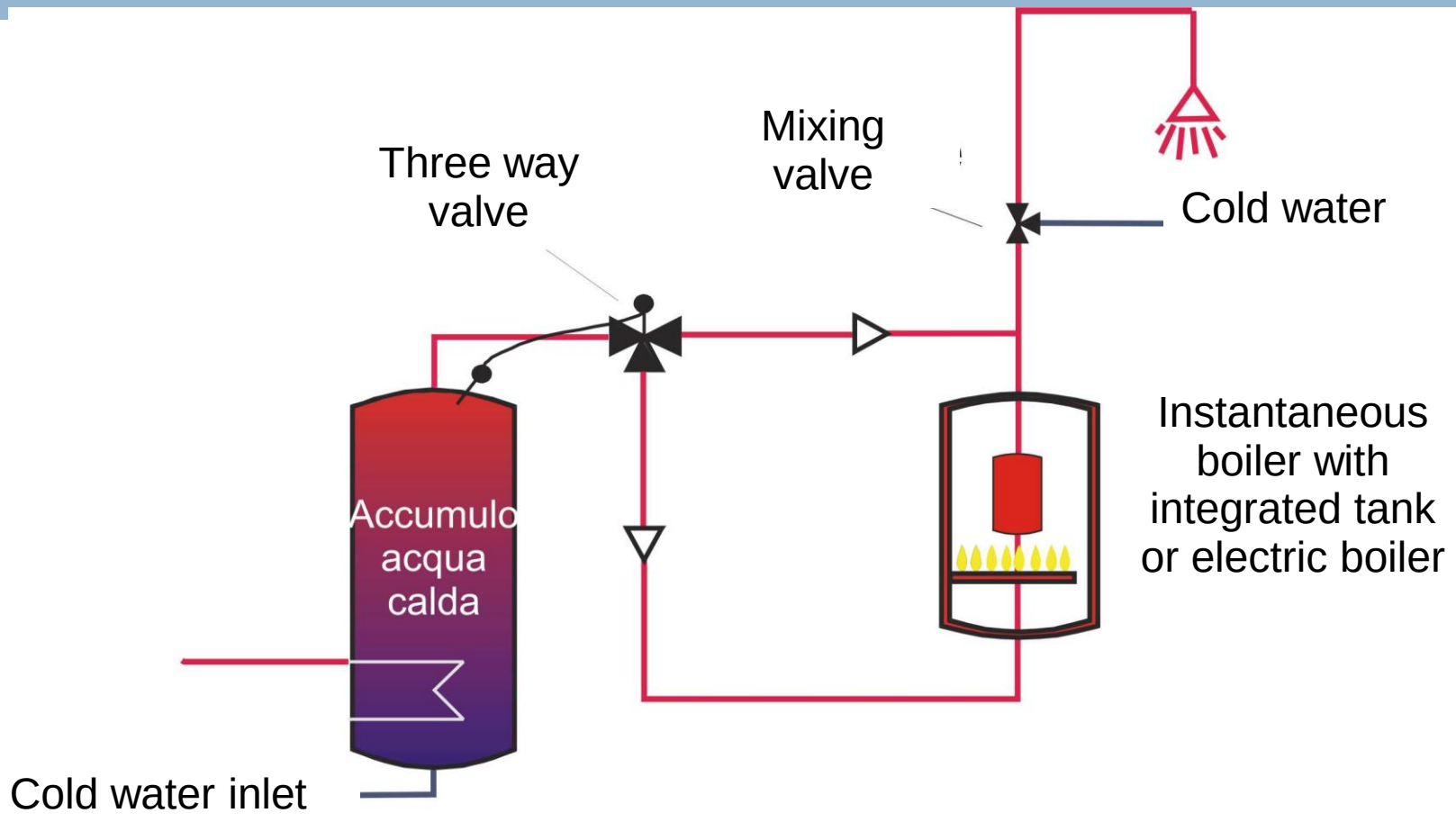
Instantaneous boiler



Boiler with heat exchanger

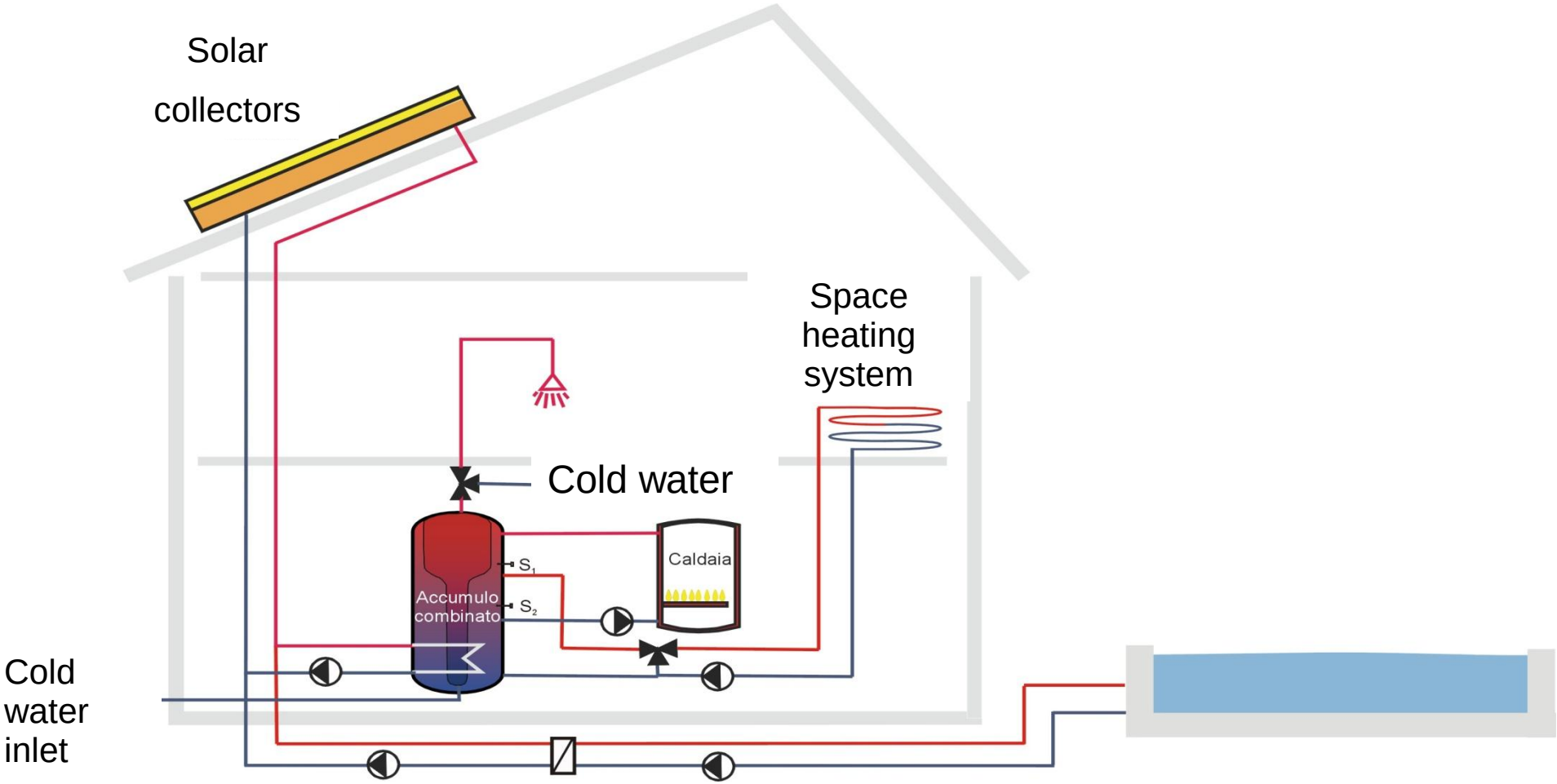
Source: Ambiente Italia

Boiler with integrated tank or electric boiler



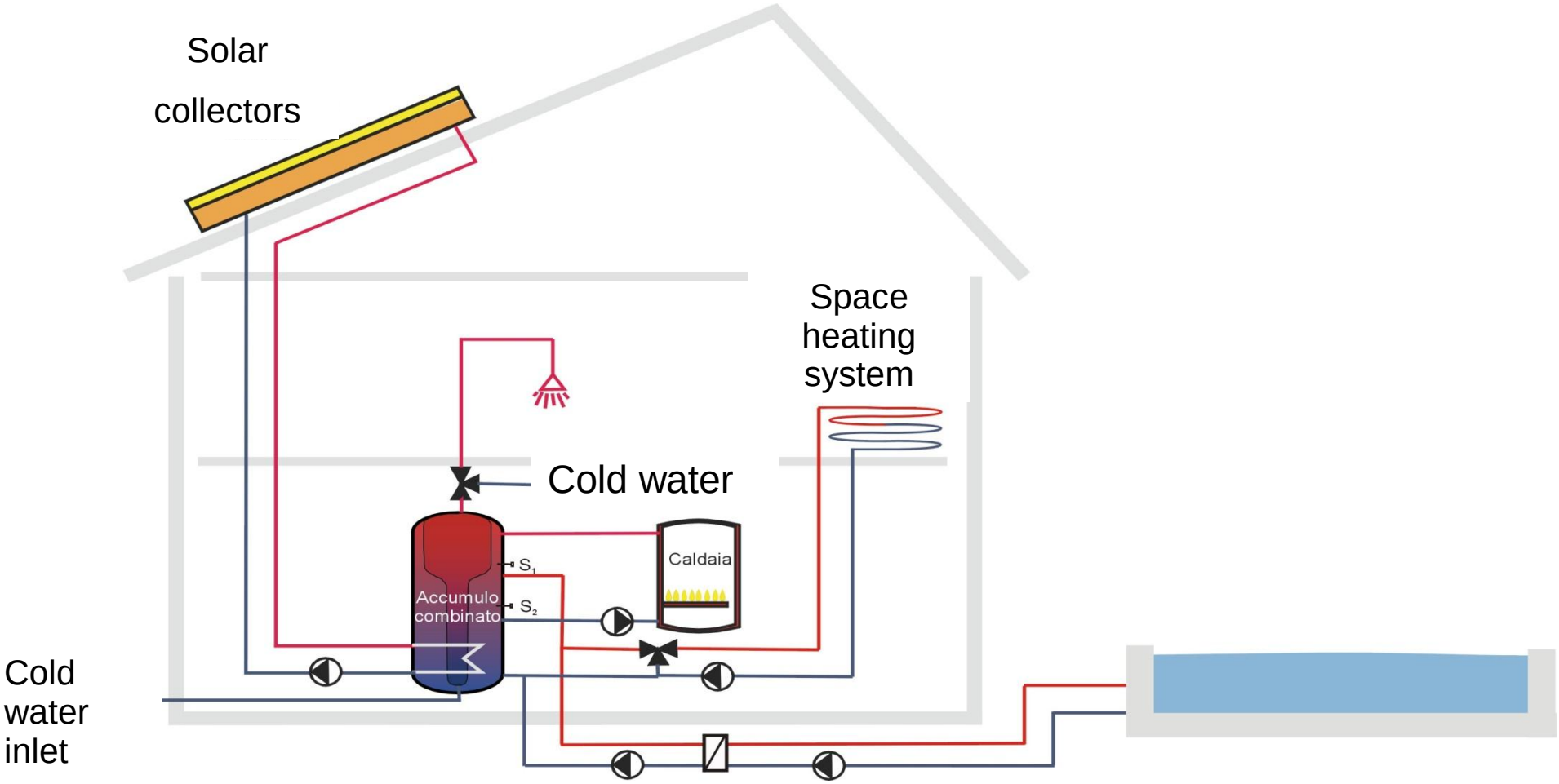
Source: Ambiente Italia

DHW, space and pool heating – scheme 1



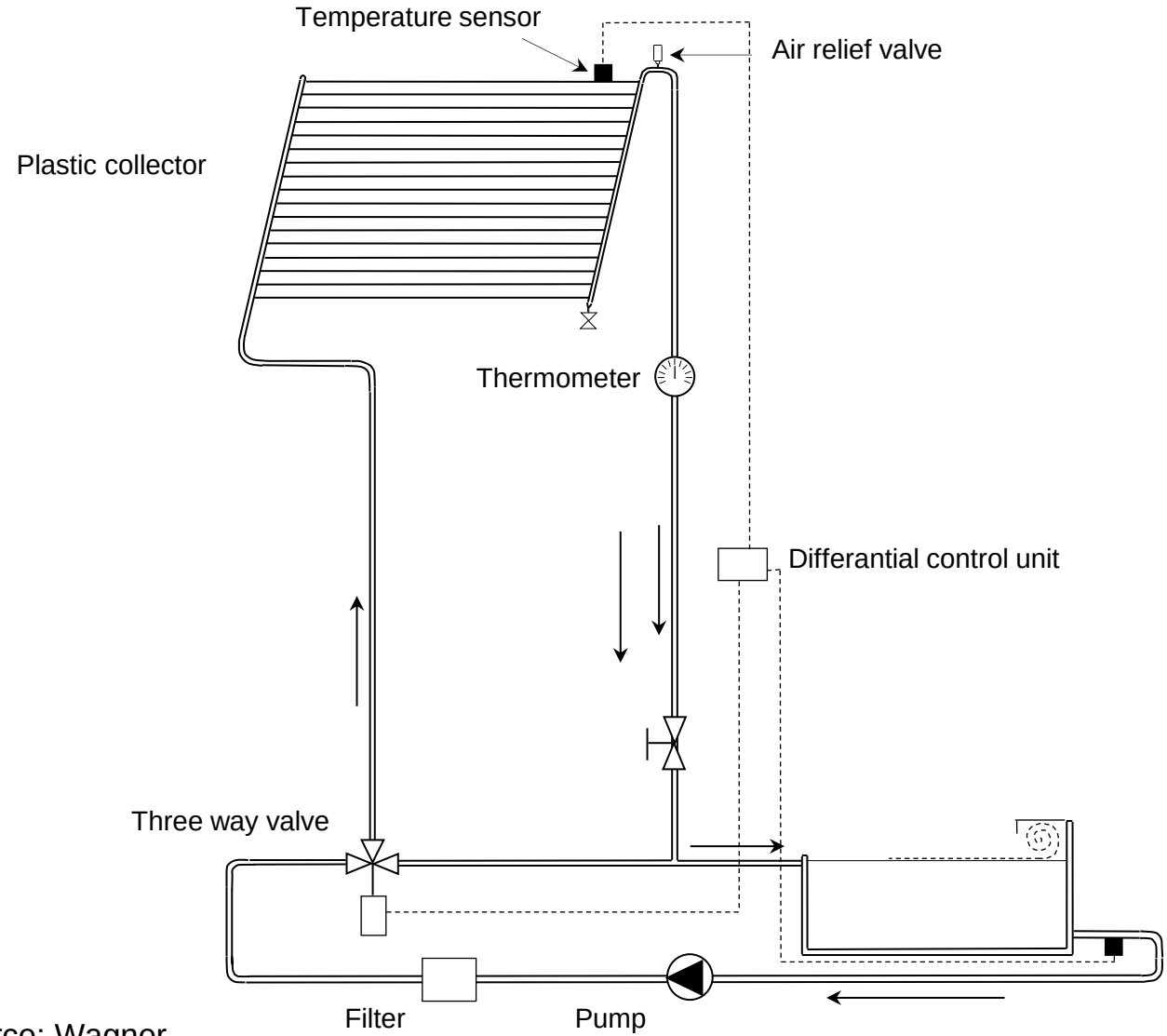
Source: Ambiente Italia

DHW, space and pool heating – scheme 2

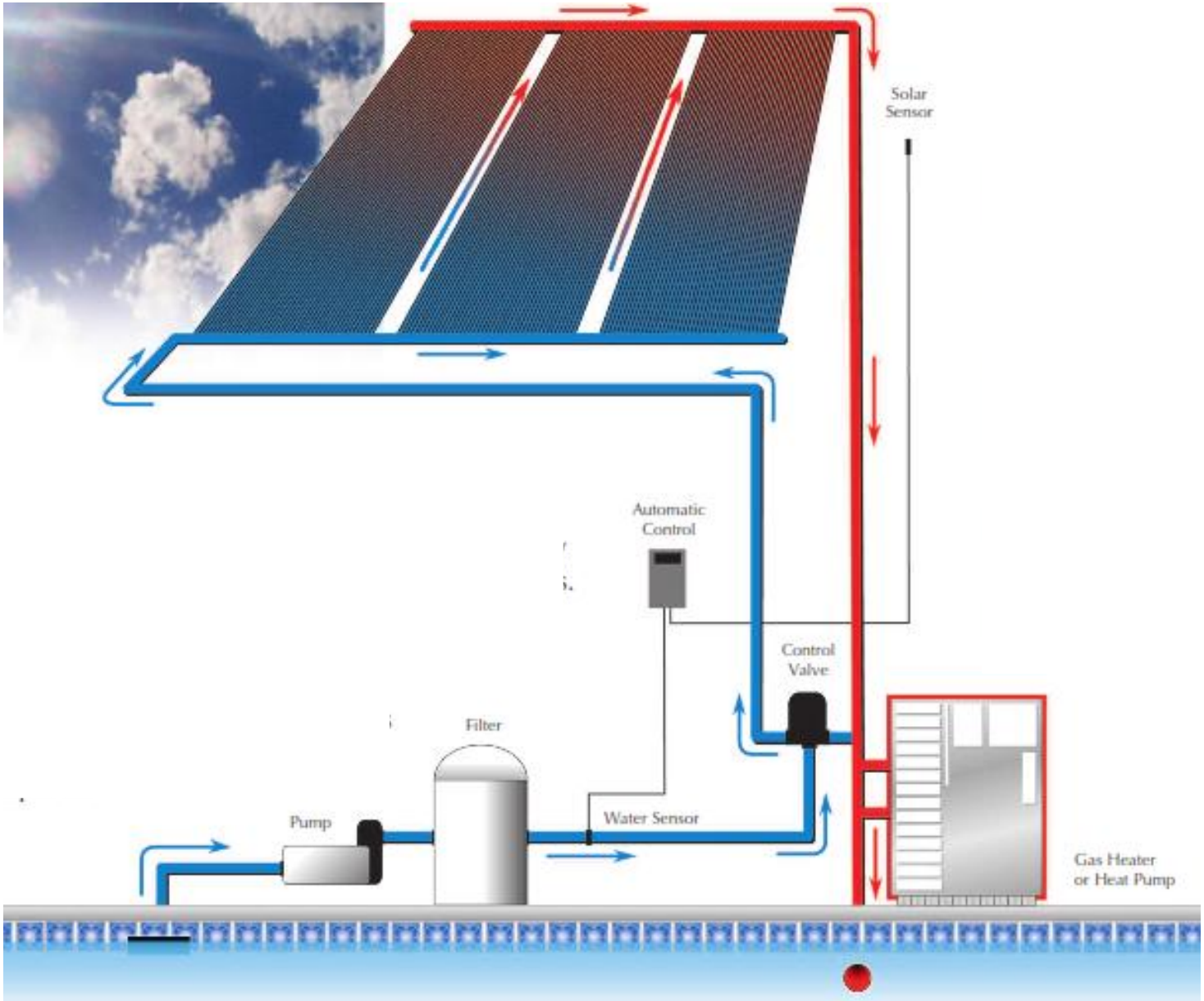


Source: Ambiente Italia

Pool heating



Source: Wagner


Solar
Sensor
Automatic
Control
Control
Valve
Filter
Pump
Water Sensor
Gas Heater
or Heat Pump