Domestic Hot Water (DHW)

Some technical aspects

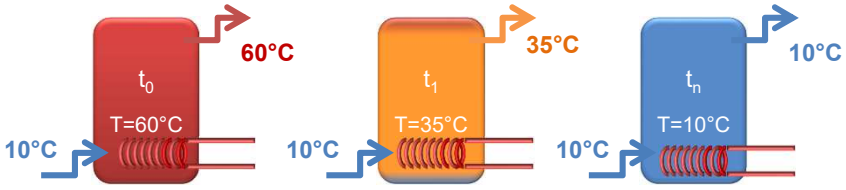
SYSTEMS FOR DHW PRODUCTION

- ***Instantaneous water heater***
- ***Stored heat:***
  - ***Direct system***
  - ***Indirect system with internal heat exchanger***
  - ***Indirect system and instantaneous water heater***

PROS AND CONS

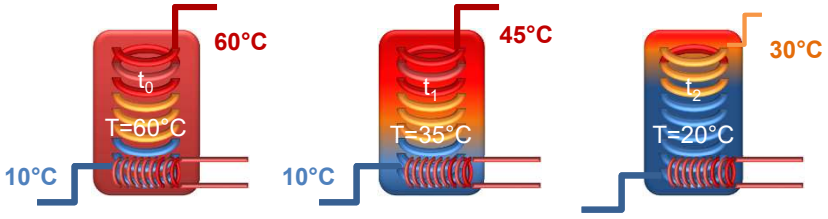
Direct heat stored

Less stratification, but lower temperature of the water stored.



Indirect heat stored with internal heat exchanger

Greater stratification of temperature within the storage, but greater temperature of the water stored.



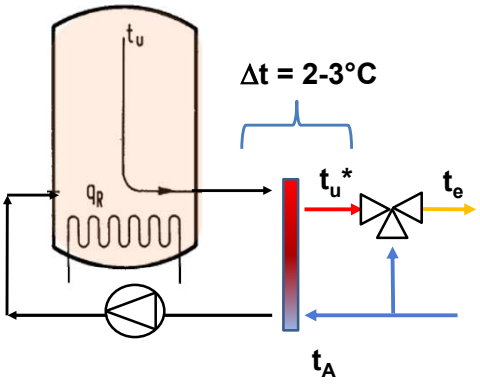
SIZING AN INDIRECT HEAT STORED SYSTEM WITH EXTERNAL HEAT EXCHANGER

In this case the water of the heat storage is separated from the hot water used in the building. The hot water of the tank heats up the fresh water through an external heat exchanger. For this purpose a pump is needed to recirculate the water of the tank.

To guarantee a suitable supply temperature t_s there is the need to provide a $t_u > t_s$.

Depending on the heat exchanger, the temperature difference can be around 2-3 °C.

The system can be hence considered an equivalent direct heat stored system with a supply temperature:



$$t_e^* = t_e + \Delta t = 42\text{-}43°C$$

COMMENTS:

The heat stored system with an internal heat exchanger compared to a similar direct hot water system require a greater thermal storage and a greater peak heat load. This is due to the intermediate internal heat exchanger.

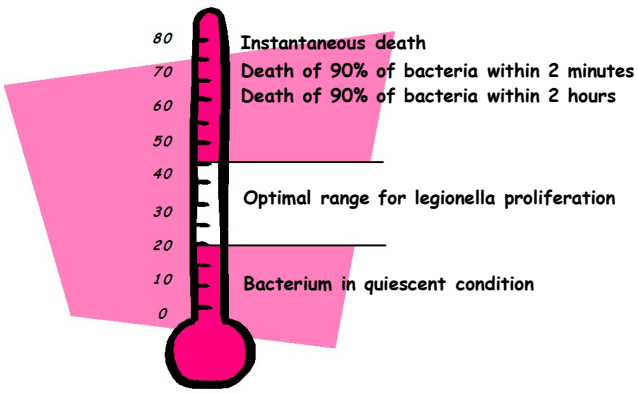
This system has also a great advantage: **Legionella** is the bacterium that causes **Legionnaires' disease** which can be caused by the presence of still water (as in the case of the direct systems).

People can get Legionnaires' disease if they breathe in water droplets containing Legionella. Certain groups of people are at increased risk for getting Legionnaires' disease, including those 50 years or older, current or former smokers, and people with chronic disease or weakened immune systems.

https://www.cdc.gov/legionella/wmp/overview/growth-and-spread.html

Good rules to minimize the risks:

- Prevent Stagnation
- Operate within the correct temperature range



Indirect systems limit the water stagnation.
Direct systems: usually there is the need of thermal cycles (above 60°C) to prevent the problem (usually one night per week with an electric resistance)

SUMMARY

As all other energy uses, also the hot water has to be properly evaluated.

For this purpose two different calculations are necessary:

- Peak load calculation
- Energy demand

Peak power calculation must consider also the peak load calculation for heating in winter. If the generator has to face the heating and the hot water, the size of the generator has to take into account the two values of peak load.

Usually the hot water need has the priority on the heating. In case of a boiler or a heat pump, when there is the need of hot water there is a switch from heating to hot water production.