



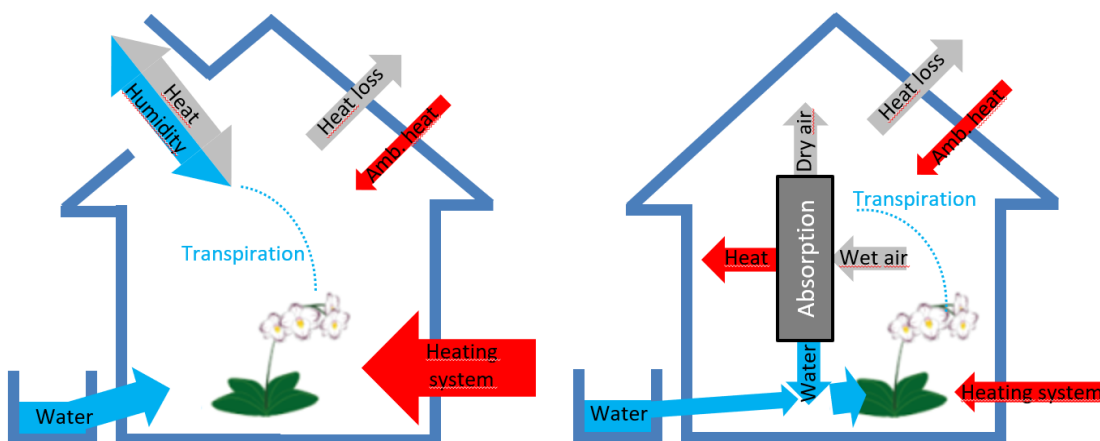
# Thermochemical Fluids in Greenhouse Farming

## Use of crop's transpiration for heating

Crops transpiration produces water vapour inside greenhouses which needs to be removed to maintain suitable humidity. In continental climate, the excess humidity is removed venting the indoor air opening windows and simultaneously heated to compensate the heat losses due to the venting and to reduce relative humidity increasing air temperature, but without modifying absolute humidity. This system is very energy intensive.

The use of hygroscopic salt solutions (called thermo-chemical fluid, TCF) allows to reduce the energy consumption:

- 1) the TCF reduces the absolute air humidity absorbing the water vapour of the air. There will be a zeroing of the heat loss for ventilation because the air is recirculated, and the humidity removed by the TCF;
- 2) furthermore, during this absorption process the water vapour is converted in its liquid form releasing heat used for heating the greenhouse.



**Energy and mass flow in a greenhouse without an active humidity control (left) and a greenhouse with TCF air conditioning**

A further advantage of the TCF's use is the control of the air temperature independently from the control of the air humidity: the temperature of the TCF determinates the air temperature, while its content of salt (concentration of TCF) determinates the air humidity

Different TCFs are available, the main aspects to be considered are their hygroscopic properties, cost, availability, crystallisation point and toxicity. The main candidate for greenhouse air conditioning is the aqueous magnesium chloride solution ( $MgCl_2$ ); the hygroscopic potential of  $MgCl_2$ -solution allows to dehumidify the air down to 30% relative humidity at 20°C. The calcium chloride solution ( $CaCl_2$ ) has similar properties of  $MgCl_2$ , but a more complicated production process. The aqueous magnesium chloride solution has been used in TheGreefa project (better performance/cost ratio) for the air control in the greenhouses.



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