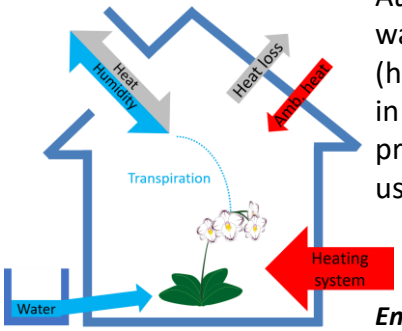
TheGreeFa principles

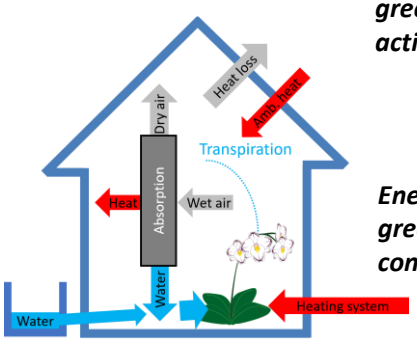
The **reduction of the energy** required for **heating** is reached in TheGreeFa **recirculating the air** inside the greenhouse **avoiding the exchange with the external air**. At the same time, the **latent heat** of the humid air **is reconverted in sensible heat** used for heating purpose.

In TheGreeFa greenhouse, it is **not necessary to regulate the humidity opening the windows**. The thermochemical fluid (TCF) removes the excess of humidity produced by the transpiration of the plants, so the **thermal energy losses can strongly be reduced**.



At the same time, the water vapour of the air (humidity) condenses in the absorption process releasing useful heat.

Energy and mass flow in a greenhouse without an active humidity control



Energy and mass flow in a greenhouse with TCF air conditioning

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Work Programme topic addressed:
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Thermochemical Fluids in Greenhouse Farming

TheGreeFa aims to **reduce the overall energy consumption in the greenhouses** and **maximise** at the same time **the quote of renewable energy** used for **cooling**, **heating** and **humidity control** and to **water recovery** in hot and dry climate zones.

Two different concepts for greenhouse systems will be developed and demonstrated in Continental and Mediterranean climate.

The EU Framework Programme for Research and Innovation

www.thegreefa.eu
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Why TheGreeFa

Today, greenhouse horticulture is related to the **highest productivity of all common methods in agriculture**. The **energy consumption**, especially for heating purposes in Central Europe **are still high**, while in Southern Europe, **growing water shortages** will force to **use seawater desalination**, which may also cause **a quantum leap in energy demand**.

Increase of energy efficiency

Large use of renewable energy

Cost savings

TheGreeFa proposes for greenhouse farming three **innovative solutions** driven by renewable energies, that **recover the latent heat** and **water from air humidity**.

- Solution 1: Humidity control, heating and cooling in one system through a single process.
- Solution 2: Drying processes for herbs and foods at low temperature to preserve their quality and aroma.
- Solution 3: Water recovery by evapo-condensation strategies, including sorptive drying and evaporative cooling with saline water.

Ways to achieve TheGreeFa's goals

Reduction of energy consumption

- **Reduction** of the amount of the **energy** required for the temperature control through the **recovery of the latent heat** of the humid air.
- **Reduction of the heat losses** by **humidity control through absorption** instead by ventilation and air exchange with the outside.
- **Water recovery** from air humidity, **without water purification and pumping**.

Large use of renewable energy

- **Low temperature heat is enough** as the driving energy, e.g. solar heat or residual heat.
- Integration of **free-loss thermal storages**, effective **usage of renewable energy** with seasonal shifting.

Cost effectivness

- Use of **mainly plastic component**, no thermal isolation is required.
- The only rotating machines are standard pumps and air fans **limiting required maintenance**.
- Thermochemical fluid (TCF) has an energy density up to 10 times higher than water, **reducing the volume required for storages**.

Project's structure

The work in TheGreeFa has been broken down into **five work packages** to achieve the overall project goals within the foreseen time frame.

WP1

In **WP1**, the **concept is before tested and optimised in prototype** before the installation in demonstrators will be explored.

WP2

In **WP2**, the **concept is modelled in a software environment** in order to analyse different operation and control modes as well as for the integration of different renewable energy sources.

WP3

In **WP3**, **case studies are carried out**. They are **providing data for the modelling** of TheGreeFa concept as whole systems (WP2) as well as they **produce data for the potential assessment** (WP3) of TheGreeFa.

WP4

WP4 disseminates the result of TheGreeFa, **gaining stakeholders** and **preparing the future exploitation** on the market.

WP5

WP5 builds the framework and management infrastructure to achieve goals in the envisage time frame. It monitors all activities, resources and risks to ensure smooth implementation.