CREATE©

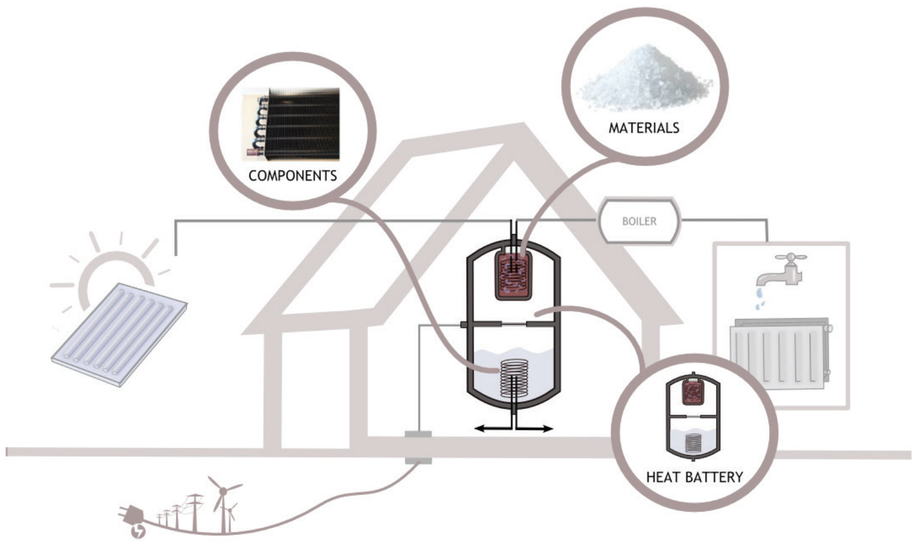
Compact **RE**trofit **A**dvanced **T**hermal **E**nergy storage

An economically affordable, compact and loss-free heat battery for existing buildings.

CREATE PROJECT INTRODUCTION

In Europe, the building sector accounts for the largest share of energy consumption. Harvesting, converting and storage of seasonal solar energy in the building sector is therefore essential to achieve the European goal of an energy-neutral built environment in 2050. The **CREATE** project aims to tackle this challenge by developing a compact thermal energy storage system which is able to provide renewable heat over the entire year.

The CREATE system is an advanced thermal storage system based on **Thermo-Chemical Materials** (TCMs), that enables economically affordable, compact and loss-free storage of heat in existing buildings. The system consists of several storage modules containing salt, which is hydrated (charged) in summer and dehydrated (discharged) in winter.



MATERIALS DEVELOPMENT

The intermediate form of the composite salt

The final shape used in the 1 kg reactor which will be used in the CREATE system

A database of approximately 600 hydrate reactions of salt hydrates was made based on material´s characteristics. From this list, K_2CO_3 was selected for further materials development. Consequently, more than twenty different TCM composites of K_2CO_3 were manufactured on lab-scale by **DOW** and **CALDIC** and extensively characterized at the **Eindhoven University of Technology** (TUE). CALDIC performed a successful production run of 100 kg scale batches, proving that industrial production is within range.

Lab scale investigations were performed at TUE to determine the optimal packing of a granule bed in order to increase the energy density as much as possible. Further, long-term accurate outgassing tests started at **TNO** in order to determine how the material will act with the vacuum of the heat battery. Finally, researchers of DOW are investigating coating options for the K_2CO_3 composite to improve the cyclic stability.

DEMOSITE

To demonstrate applicability of the thermochemical storage solution and its operation in real life conditions, a full scale solar TCS system delivered by the CREATE project will be installed into a single family house in **Warsaw, Poland**, where a land climate delivers both cold winters and warm summers.

CREATE PROJECT SUB-OBJECTIVES

Stable & compact materials
Energy density of more than 1.5 GJ/m³ (420 kWh/m³)

Efficient and high power energy discharge
As high as 5kW for a single home

Long lifetime
TCM/stabilizer composite materials & the prevention of side-reactions

Safe and reliable operation
Full validation, demonstration and testing

Affordable technology
Focus on low-cost and maintenance-free concepts for heat storage

Future value chain
To mobilize all the key players in the supply and value chain from the material level up to the system level and the energy grid

PROJECT PARTNERS

AEE INTEC
CALDIC
LUVATA
Mostostal WARSZAWA
TNO innovation for life
EDF
DOW
FENIX.TNT tvorivost nad technológií
RINA
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Where innovation starts

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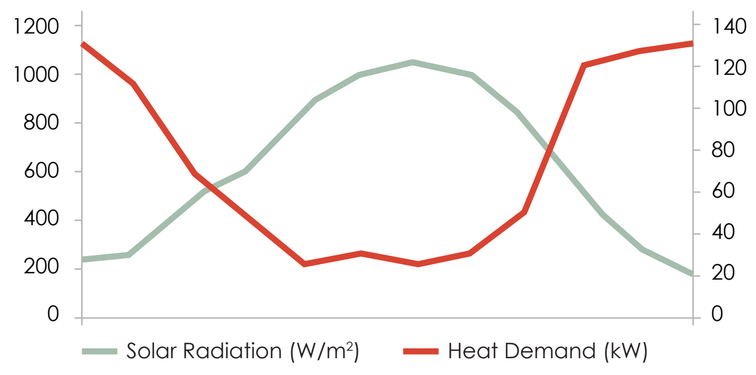
THERMOCHEMICAL HEAT STORAGE

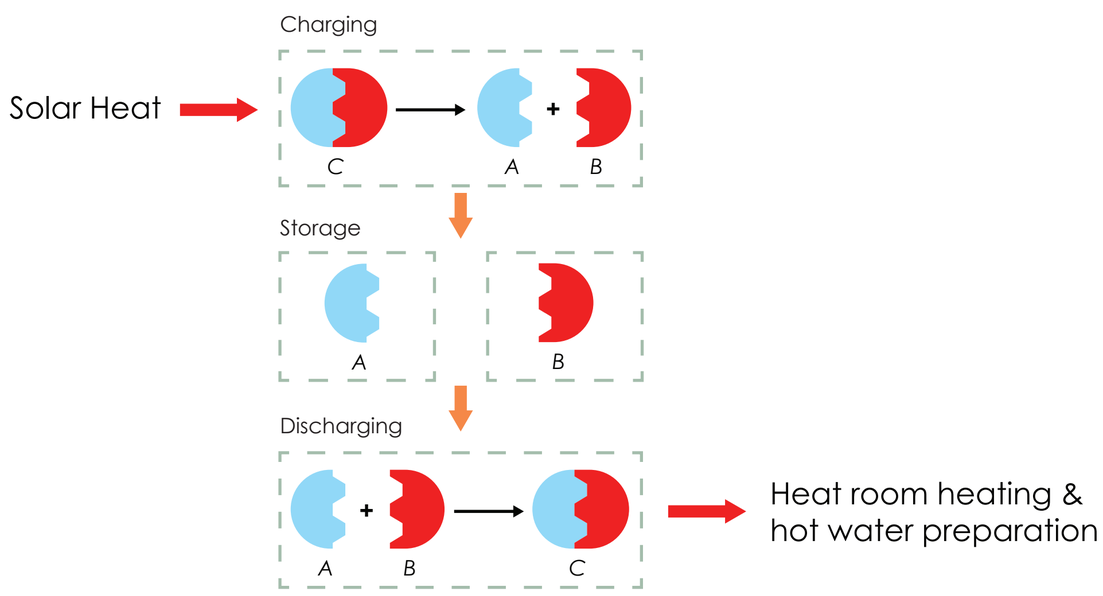
Heat Storage without Heat Loss

BACKGROUND

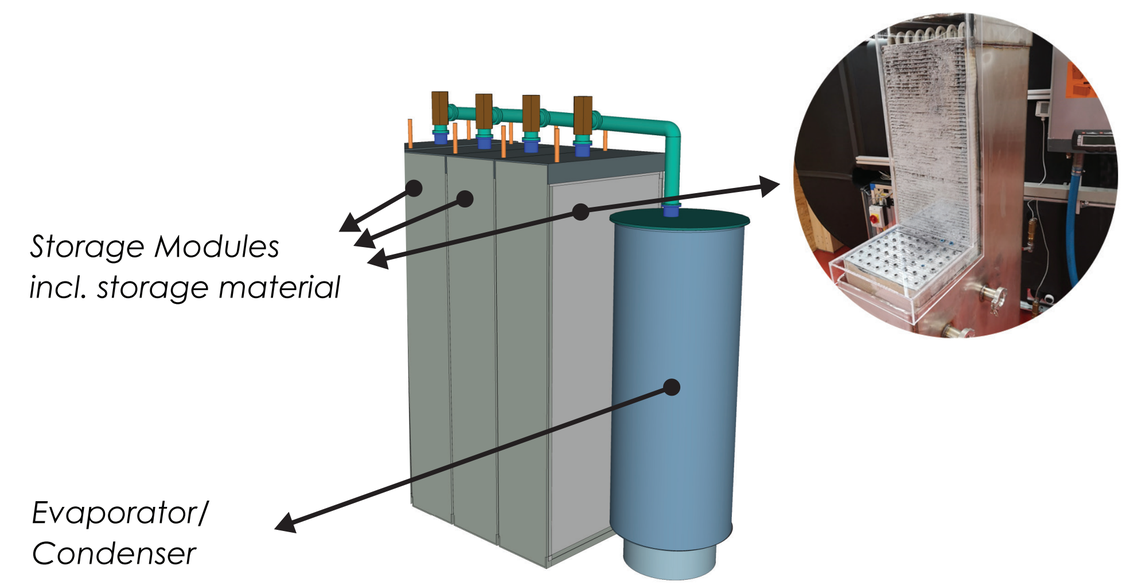
In achieving the international goals of saving fossil fuels, reducing CO_2 emissions and protecting the climate, the cross-cutting technology of energy storage is of particular importance. Thermochemical energy storage, which is characterised by extremely high capacity and performance as well as low-loss and long-term stable heat storage, can make a significant contribution to this.



PRINCIPLE



STORAGE SYSTEM



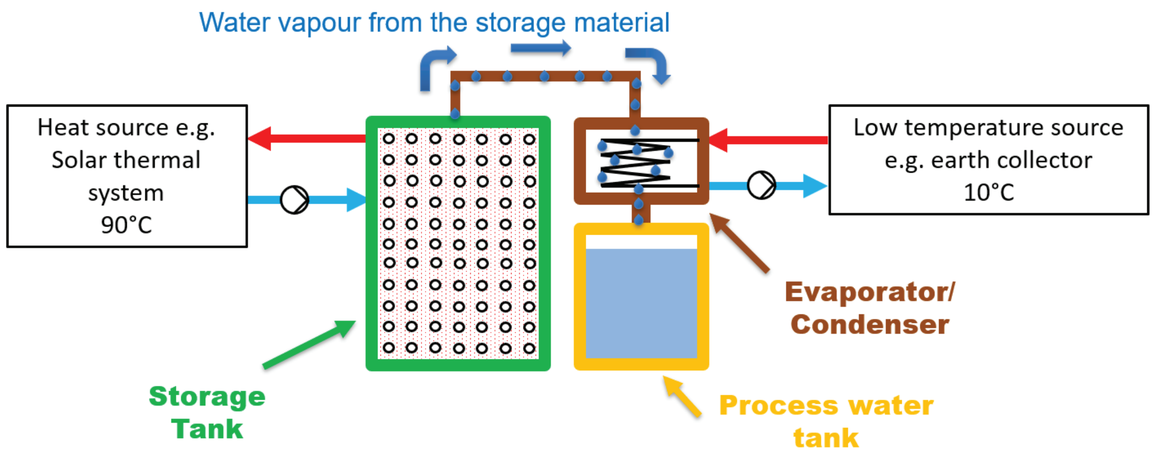
Thermochemical storage

A thermochemical storage is a reversible system which releases or absorbs thermal energy when two substances/components are combined or separated. If the components are stored separately, the corresponding reaction can be used to store heat. The basis for thermochemical heat storage is therefore the selection of a reaction system suitable for the desired storage temperature.

Advantages

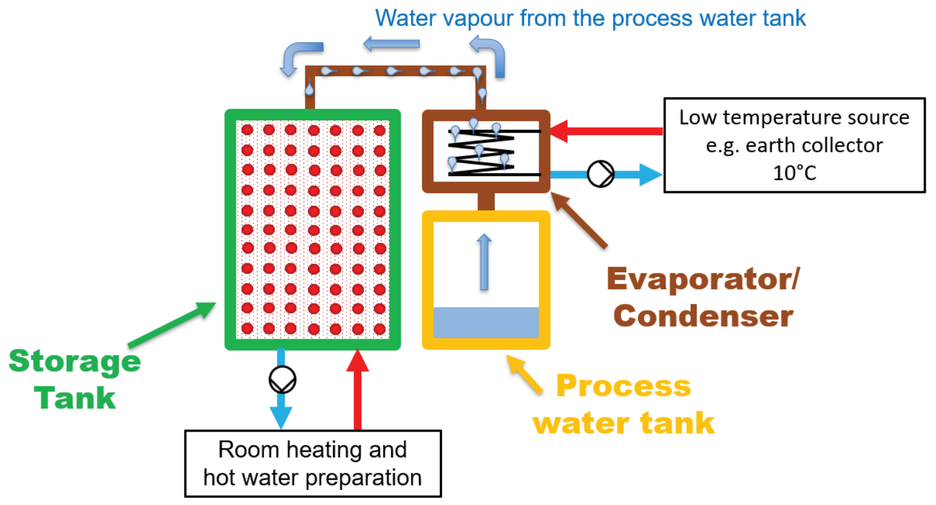
- Energy density considerably higher in comparison to conventional heat storage systems and correspondingly more compact
- No heat loss during the storage period
- Adaptation of the stored energy depending on the useful temperature and the energy source
- Possibility of cold storage as well as heat and cold transport

STORAGE OF SOLAR HEAT IN SUMMER



Charging the storage system through the solar collectors: In a closed system, the sorption material is dried using the heat supplied by the solar system. The water vapour released during the charging of the storage system is condensed and stored separately from the desorbed, i.e. dried material.

UTILIZATION OF HEAT IN WINTER



Discharge of the heat storage system: Before the reverse reaction, the water is evaporated and then absorbed by the dry sorption material. During this process, heat is released which can be used for room heating and hot water preperation.

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