# Technology: Thermochemical Heat Storage by Sorption

## GENERAL DESCRIPTION

### Mode of energy intake and output

Heat-to-heat

### Summary of the storage process

Sorption processes can absorb heat and release it again at a later point in time. During charging, the reaction partners (e.g. zeolite and water) are separated. Bringing them back together causes them to react and release heat which can then be utilised.

### Storage system

A sorption storage can be built, for example, as an open sorbent (e.g. Zeolite) fixed bed with air flowing through it, carrying water vapour and heat (Fig. 1). To discharge, humid air is blown through the sorbent, causing it to adsorb water. The reaction releases heat, which is carried out of the storage by the air flow. To charge the system, hot and dry air is used in the same path to release the water from the sorbent again and carry it out of the fixed bed.

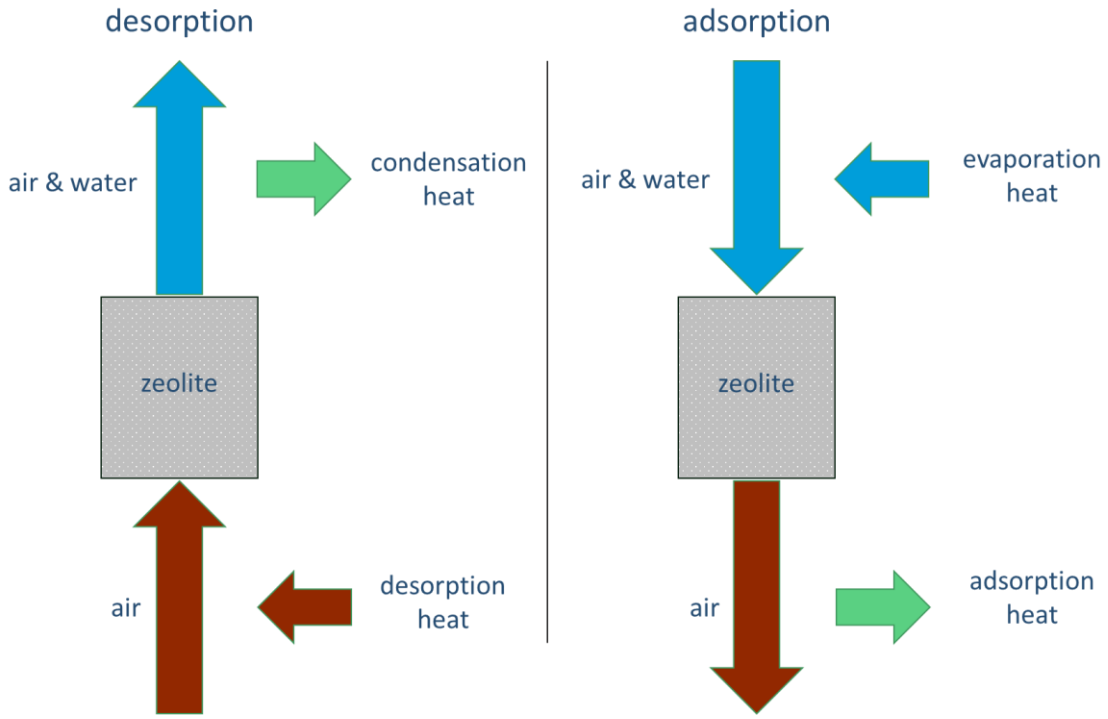


Figure 11: Schematic of an open sorption storage system with heat routes for charging (desorption) and discharging (adsorption)

### Focus on provision of power or energy

Energy

### Suitable fields of application

Recovery of industrial waste heat, buffer storage in district heating networks

### State of development/commercial availability

R&D, partly demonstration stage, TRL 5-7

## TECHNICAL SPECIFICATIONS

| | | |
|---|---|---|
| Specific energy storage density | kWh/m³ | kWh/t |
| | 120-250 | 85-175 |
| Specific power density | kW/m³ | kW/t |
| | 35-85 | 25-75 |
| Typical/feasible storage size | $kWh_{out}$ | $kW_{out}$ |
| | 2,000-4,000 | 500-1,000 |
| Storage efficiency | - | |
| Storage duration | Hours-days | |
| Response time | Minutes-hours | |
| Service life (maximum) | Cycles | Years |
| | 3,500 | - |
| Loss per time in % | Max. 15 | |

### Notes

The efficiency of sorption storages can exceed 100%, as such systems may thermodynamically be considered as heat pumps. In this sense, they store the ability to raise heat from an unusable temperature level (whose energy is not included in the efficiency balance) to a usable one.

The loss rate ranges around 15 %, which corresponds to the sensible share of the stored heat. The speed at which it is lost depends on the quality of the insulation. Thereafter, the system stops losing heat until the reaction partners are brought back together.

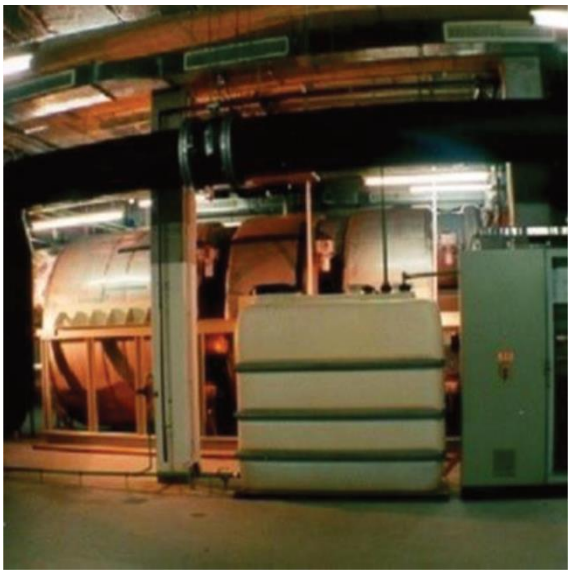

Figure 2: Zeolite sorption storage in the district heating network of Munich, Germany (© ZAE Bayern)

Figure 3: Mobile sorption storage for waste heat recovery in Hamm, Germany (© ZAE Bayern)

## ECONOMIC SPECIFICATIONS

### Investment cost per kW

500 €

### Investment cost per kWh

30-130 €

### Cost of energy provided in concrete applications

A mobile sorption storage unit containing zeolite was developed and built to recover exhaust heat from a waste incineration plant. The container can store up to 4 MWh of energy. The cost of the heat provided is about 75 €/MWh. This cost estimate is based on an assumed 200 cycles per year.