Basic Knowledge

Thermal Storage

Thermal storage is used for heat and cold. The storage and release of the heat and/or cold may be direct or indirect. Indirect storage can be classified by the aggregate states of the heat-storage medium.

Liquid and solid storage media are used in order to keep the required space low. A particularly high energy density is achieved in thermal storage systems with phase change, known as latent heat storage systems. The technical effort required is increased significantly for systems with a phase change. Another advantage is the isothermal loading and discharge temperature of a latent heat storage system, which is particularly relevant to process engineering.

Thermal storage systems with liquid and solid materials without phase change are also called sensitive thermal storage systems. The concept is to heat and cool a material by means of a heat medium. This heat medium may be a hydraulic oil or brine for example, which enables the entire indirect storage process by being pumped around between source, consumer and storage.

Different storage systems have to be used depending on the desired application. The selection criteria for a storage concept are the level and consistency of the required temperature level, the desired storage time, the losses and the technical effort with the associated costs under consideration of the load.

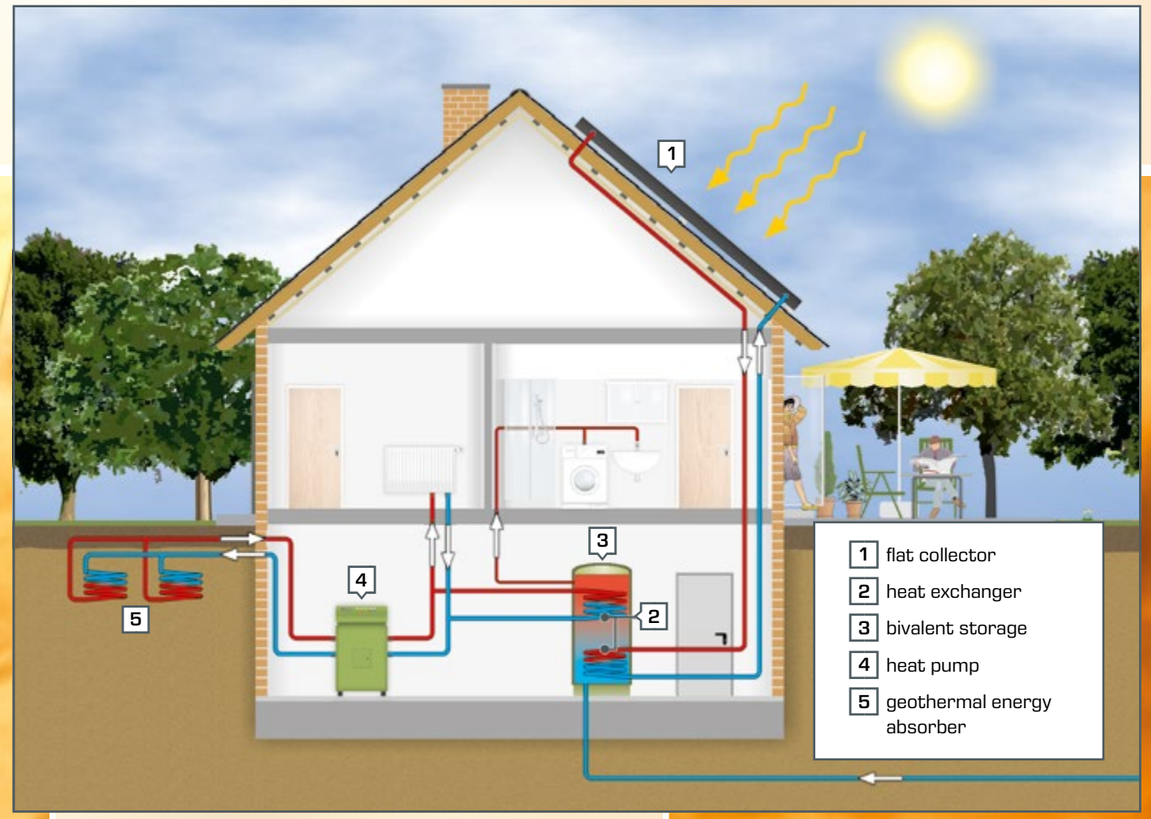
Thermal storage concepts

- Direct storage
  - Liquid storage
  - Variable pressure storage
- Indirect storage
  - Liquid (sensitive)
    - Molten salt storage
    - Hot water storage
  - Solid (sensitive)
    - with phase change
      - Ice store
      - Salt store
    - Concrete storage
    - Aquifer storage

Example: Heat from renewable energies in the home

In many cases doing away with a conventional heating system represents a genuine alternative for modern residential buildings with good thermal insulation. The combination of solar thermal collectors with a heat pump very often guarantees significant savings with reliable year-round supply.

The use of a thermal storage system allows particularly good use of the solar thermal energy. During the day, the storage system is loaded with surplus heat in order to heat the house in the evening and morning hours, or to provide hot water for everyday needs.



The illustration shows a system for room heating and domestic water heating. The flat collector **(1)** supports the heat generation, thus reducing the energy consumption of the brine heat pump **(4)**. Heat is supplied for the heat pump by the geothermal heat absorber **(5)**. The bivalent storage **(3)** enables integration of different heat sources and creates a balance between heat supply and demand.

Subject Areas

Storage in Energy Systems

Renewable energy systems produce different amounts of energy depending on the available wind power or changing solar radiation. Coverage of the energy demand from evening to morning therefore requires suitable intermediate storage of the surplus energy from the day, if no constant supply of energy is possible, for example from a biogas plant.

There are already various technologies available for storage, with differing efficiencies. The current state of the art includes pumped-storage power stations, which pump water to an elevated reservoir during periods of surplus electricity. If more energy is required again, the water is released to drive a generator with turbines.

Thermal storage systems are common in the field of refrigeration engineering, for example an ice store. The refrigeration system is operated at the optimal operating point and enables surplus refrigeration capacity during the night to cover the higher daytime demand with the ice store.

Subject Areas	2E0 Products
Compressed air storage	**ET 513** Single-Stage Compressor
Water storage reservoir	**HM 143** Transient Drainage Processes in Storage Reservoirs
Thermal storage	**HL 320.05** Central Storage Module with Controller **ET 420** Ice Stores in Refrigeration
Electrochemical storage	**ET 255** Using Photovoltaics: Grid connected or Stand-alone **ET 220** Energy Conversion in a Wind Power Plant **ET 220.01** Wind Power Plant