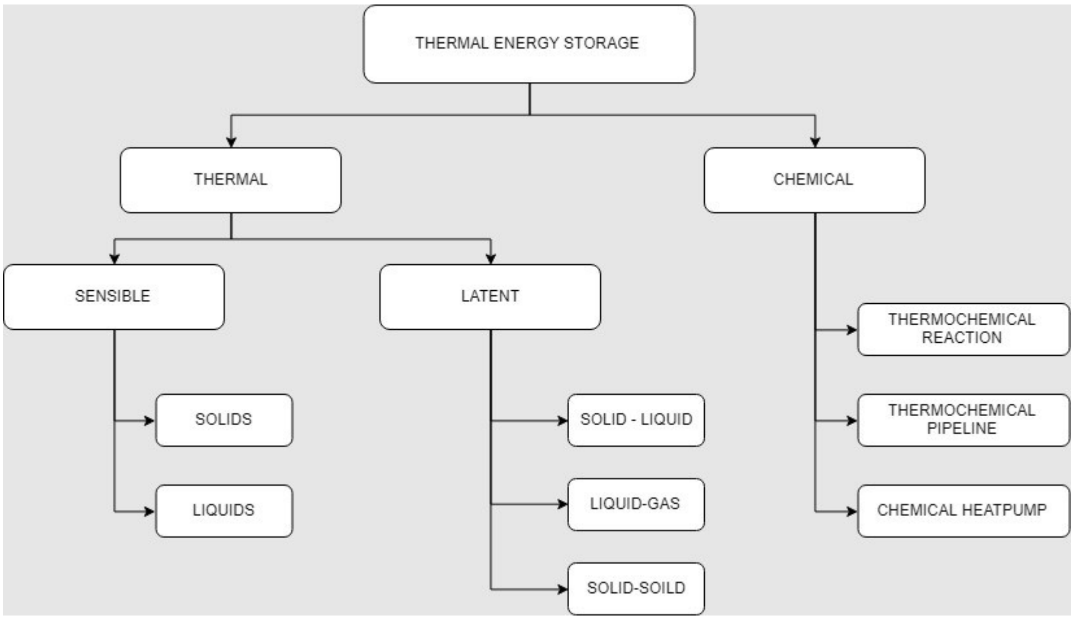

Fig. 502.12(1): Type of Thermal Storage Systems

Thermal energy storage systems are categorised into three groups namely, sensible storage, latent storage and thermo- chemical energy storage.

1. Sensible storage – Sensible storage involves no phase change, where a liquid or solid medium is used to store thermal energy by heating or cooling. Energy is absorbed and released by the storage medium as the operating temperature increases or decreases respectively. Most popular and low-cost storage medium is water, due to its high energy carrying capacity.
2. Latent storage – Latent cold storage involves phase change materials (PCMs) as storage medium. Latent storage can be achieved through solid–solid, solid–liquid, solid–gas and liquid–gas phase changes. Thermal energy is absorbed or released at almost constant temperature with a change in physical state and has the advantages of high-energy storage density. Paraffin compounds, salt hydrate, metallics, eutectic materials are commonly used PCMs.
3. Thermo-chemical energy storage – Chemical thermal storage involves absorption and thermo-chemical reactions. Thermo-chemical materials (TCMs) release or store thermal energy by reversible endothermic / exothermic reactions. TCMs have higher energy densities compared with PCMs and this higher energy density attributes to thermo-chemical TES systems providing more compact energy storage relative to latent and sensible TES.

Design factors such as thermal load profile, type of TES system, selection of storage materials, mode of operations, space availability, capital and operating costs etc., should be considered while designing TES. This ensures TES systems are operated successfully. Thermal energy demand for the building varies daily, weekly, monthly or on seasonal basis. By matching operational pattern of each application, the requirement during peak demand can be effectively met by TES.

Charging period (when plant is working to produce thermal energy and store a portion of it for future usage) and discharging period (when the stored thermal energy in TES tank is released to meet the cooling demand when the load is higher than the chiller plant capacity or the cooling load is less where the chiller plant could be shutdown), should also be considered while designing TES systems.

Though this regulation sets a limit of 20% of the designed plant capacity with TES, increasing TES capacity can further offset the cooling demand and provide additional cost savings. Typical schematic of TES in a district cooling plant is shown in fig. 502.12(2), 502.12(3), 502.12(4), for charging and discharging process.