

## HEAT STORAGE TECHNOLOGIES

### Resilient Energy for a Sustainable Future!

Heat storage systems utilize technologies that store thermal energy for extended periods, typically from several hours to days or weeks. These systems are used to balance energy supply and demand, optimize energy use, and provide heating and cooling across various applications.

### Heat Storage Technologies

Parameters	Sensible heat storage	Latent heat storage	Thermochemical heat storage
Temperature-Enthalpy Curve			
Energy storage principle	Thermal energy is stored as sensible heat by increasing the temperature of the material	Thermal energy is stored as the heat of fusion by changing the phase of the material	Thermal energy is stored in an endothermic / exothermic reversible chemical reaction
Key factors	Specific heat capacity and thermal conductivity of the material	Latent heat of fusion, melting/freezing point of PCM	Reaction enthalpy and reactant moles number
Materials	Solids: sand, rocks, concrete, etc. or Liquids: oil, molten metal, salts, silicon	Paraffins, polymers, gels, metal & alloys, eutectic materials	Silica gel, novel porous materials, composite materials, salt hydrates

SENSIBLE HEAT STORAGE

Sensible heat storage involves the storage of heat in a material by raising the temperature and without changing its phase. The heat stored is proportional to the temperature difference.

Energy Density: **0.1-0.5 GJ/m<sup>3</sup>**

Technology Readiness Level: **9**

Duration: **Several hours to days**

Efficiency: **30-60%**

Latent heat storage involves the utilization of phase-change materials to store and release thermal energy. The heat is stored in the material's latent heat of fusion or vaporization.

Energy Density: **0.5-2.5 GJ/m<sup>3</sup>**

Technology Readiness Level: **8**

Duration: **Several hours to days**

Efficiency: **40-70%**

LATENT HEAT STORAGE

THERMOCHEMICAL HEAT STORAGE

Thermochemical heat storage involves the transfer of heat to or from a material that undergoes a chemical reaction, such as absorption or release of a gas. This heat is stored in the material's chemical bonds.

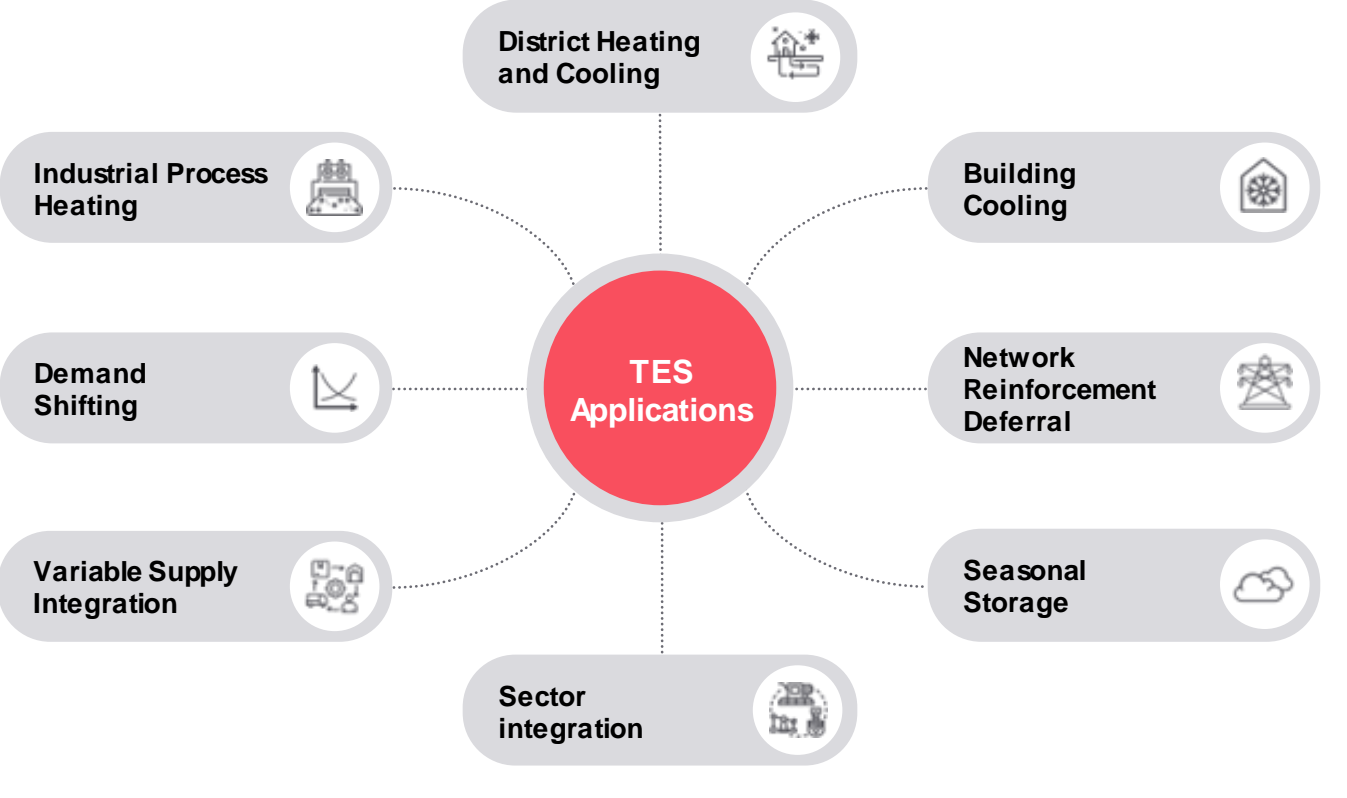
Energy Density: **3-15 GJ/m<sup>3</sup>**

Technology Readiness Level: **6**

Duration: **Several days to months**

Efficiency: **40-70%**

### Key applications of Heat Storage in Energy Systems



### Round-Trip Efficiencies

**98%**

Heat → Heat

**90%**

Power → Heat

**45-60%**

Power → Heat → Power

### Conclusion

- Heat storage technologies hold immense promise in achieving a more sustainable energy future
- These have the potential to reduce emissions from industrial processes and building heating applications, which currently account for 30% of the global CO2 emissions
- Heat storage technologies enable greater flexibility in energy supply, especially for applications that consume heat such as industrial processes, district heating, and building thermal management
- Heat storage solutions can enhance energy resilience, with grid-connected storage systems, ensuring reliable power supply during extreme weather events and grid disruptions

### About FutureBridge

FutureBridge tracks and advises on the future of industries from a 1-to-25-year perspective.

We keep you ahead on the technology curve, propel your growth, identify new opportunities, markets, and business models, answer your unknowns, and facilitate best-fit solutions and partnerships using our platforms, programs, and access to global ecosystems and players.