

Strategic and research priorities for thermal energy storage

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Technology Status

- The purpose of Thermal Energy Storage (TES) systems is to store a sizeable quantity of thermal energy (heat or cold) for long periods¹⁶
- The ability to store thermal energy is very important for using renewable energy in heating and cooling systems effectively, since it decouples the availability of renewable energy from the time when it is needed, thus increasing the degree which it can be utilised

Technology Status

- There are three major reasons for using thermal energy storage:
 - Improving system efficiency by avoiding partial load operation, or operation at other suboptimal times, or taking advantage of waste energy (e.g. heat released from chillers)
 - Shifting demand over time to reduce peak loads
 - Facilitating the greater use of renewable energy by storing energy available at a certain time, so it can better cover demand

Research priorities

- Sensible heat storage
 - Microbiology in UTES systems
 - High temperature underground storage (HT-UTES)
 - Storage container materials
 - Flexible volume tank systems
 - Optimisation of hydraulics in advanced water stores, reduction of mixing and increased stratification
 - Control strategies for integrating sensible stores into the Smart Grid

Research priorities

- Sensible heat storage
 - Reduction of heat losses (materials research)
 - New sensible TES materials for high temperature storage with high thermal conductivity
 - New methods to analyse TES materials
 - Fluids combining heat transfer and heat storage

Research priorities

- Latent heat storage
 - Optimisation of phase change heat storage
 - Integration of phase change materials in building element materials
 - Software algorithms and codes need to be adapted to take account of PCM
 - Fluids combining heat transfer and heat storage

Research priorities

- Thermochemical storage
 - Materials for thermochemical heat storage
 - Optimisation of thermochemical heat storage processes
 - Fluids combining heat transfer and heat storage
 - High temperature thermochemical systems

Research priorities

- At system level
 - Advanced monitoring of storage systems
 - Optimised integrated collector storage
 - System development of underground thermal energy storage (UTES) systems
 - Advanced control strategies
 - Distributed thermal energy storage for smart electricity grids and smart cities

Research priorities

- At system level
 - Storage of rejection heat in solar cooling process and solar power plants
 - Materials for storage containment
 - System evaluation

Research priorities

- Non-technological priorities
 - Education and training
 - Knowledge of system performance
 - Labelling or certification of thermal energy storage devices
 - Legal framework UTES (ATES/BTES)
 - Public awareness

Conclusions

- Thermal energy storage can hugely increase the technical potential of renewable energy sources by allowing heat (and cold) to be utilised when there is demand for it
- The future of TES applications depends on the achievement of two crucial strategic objectives:
 - Reducing costs
 - Improving the ability to efficiently shift energy demand over days, weeks or seasons