**Module label**  | Thermal Energy Storage  
**Module code**  | pre364  
**Credit points**  | 4.0 KP  
**Workload**  | 120 h  
**Used in course of study**  | Master's Programme European Master in Renewable Energy (EUREC) > Mastermodule  
**Contact person**  |  
**Entry requirements**  |  
**Skills to be acquired in this module**  
- be familiar with main storage materials and technologies and will be able to choose which one is the most adapted to a specific solar application.  
- have an understanding of the basic physical phenomena relevant to the principles of operation and design of thermal energy storages.  
- have an understanding of the principles of operation and design of thermal energy storages.  
- have an understanding of the need to define properly the functionalities of the TES.  
- acquire the knowledge of the main technologies and materials used in TES.  
- acquire the awareness of the importance of considering the relevant integration of TES in the whole process of application.  
- acquire the awareness of the importance of strategy and management in the use of TES.  
- acquire the knowledge of the main companies involved in the various aspects of TES (material, envelopes, fluids).  
- have a critical understanding of the physical principles used in TES.  
- be able to compare the design, operation and performances of the main types of TES.  
- be able to choose the relevant TES for a particular application.  
- be able to highlight the main limitations of a TES.  
- be able to avoid the usual mistakes encountered in TES.  
- be able to propose companies providing the various components of TES.  
  
**Module contents**  
1. Overview on Thermal Energy Storage (TES)  
- TES definitions  
- TES functionalities  
- TES basic principles  
- TES technologies  
- ES hybridations  
- ES bottlenecks and current research areas  
2. Needs of TES in solar applications  
- Resource/demand shift management  
- Thermal protection  
- Thermal regulation  
- Production optimisation  
- Process design optimisation  
- Process management  
3. Available technologies (sensible, latent heat, thermochemical)  
- Sensible heat based TES, direct mode.  
- Sensible heat based TES, indirect mode.  
- Latent heat based TES (organic, inorganic)  
- Thermochemical based TES  
4. Related materials  
- Low temperature TES materials (sensible heat, latent heat, thermochemical, classifications and properties, characterizations)  
- High temperature TES materials (sensible heat, latent heat, thermochemical, classifications and properties, characterizations)  
5. Heat transfer interfaces and fluids  
- Envelops for TES units  
- Insulating materials for TES units  
- Heat transfer fluids for TES  
6. Implementation of TS  
- TES integration  
- TES instrumentation  
- TES charge/discharge assessments  
7. Management and strategy of TS  
- TES management  
- TES strategy  
- LTA of TES in Solar Applications  
8. Related companies and products  
- Companies and products for sensible heat based TES  
- Companies and products for latent heat based TES  
- Companies and products for thermochemical TES
- Companies and products for envelopes and connections

**Reader’s advisory**


**Links**

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Modulelevel**
MM (Mastermodul)

**Modulart**
Pflicht

**Lern-/Lehrform / Type of program**
Lecture, Tutorial

**Vorkenntnisse / Previous knowledge**

**Examination**

**Time of examination**
End of the Semester

**Type of examination**
Written exam: 2 hours

**Course type**
Seminar

**SWS**

**Frequency**

**Workload attendance**
0 h