

Seasonal pit heat storages - Guidelines for materials & construction

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Subject:	Seasonal storages
Description:	Guidelines for design of seasonal pit heat storages.
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Intro

Seasonal pit heat storages has been investigated and implemented in Denmark both as pilot storages and latest also as full scale storages in Dronninglund (SUNSTORE 3) and Marstal (SUNSTORE 4). The guidelines are based on the experience from the design and implementation of the Danish pit heat storages.

Design of the storage

Guidelines are given for different important aspects in the design:

- Shape and soil balance with respect to the excavation planning.
- Lining materials, long term temperature resistance, and vapour penetration.
- Insulated floating cover.
- In-/outlet arrangement.
- Water quality.

Location of storage and geotechnical conditions

Local ground water conditions and geotechnical investigations are important and it is advised to carry out investigations before and during the implementation of a pit heat storage. The investigations are necessary to predict the suitability of a given area and also to predict the possible steepness of the storage sides and to assist the excavation work.

Calculation and optimization of pit heat storages

To design a storage that will be as beneficial as possible it is necessary to make a calculation model of the system. This way the system and the storage can be simulated and by optimization the optimal dimensions of as well the storage as other parts of an energy system can be found. In the fact sheet the simulation tool TRNSYS is given as an example.

Costs of pit heat storages

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The cost of a storage per m³ water is highly dependent of the size of the storage. The predicted costs are shown in the fact sheet going from 40 €/m³ at a size of 50 000 m³ to less than 30 €/m³ at a size of 200 000 m³.

Examples of pit heat storages

As examples of pit heat storages four Danish storages are described: The 1 500 m³ storage in Ottrupgård implemented in 1993-95, the 10 000 m³ "SUNSTORE 2" storage in Marstal 2003, the 75 000 m³ "SUNSTORE 4" storage in Marstal 2011-2012, and the 60 000 m³ "SUNSTORE 3" Storage in Dronninglund 2013.

References

For more details, see "Guidelines for design of seasonal pit heat storages", IEA-SHC TECH SHEET 45.B.3.2, <http://task45.iea-shc.org/fact-sheets>