giga_TES: Giga-Scale Thermal Energy Storage for Renewable Districts

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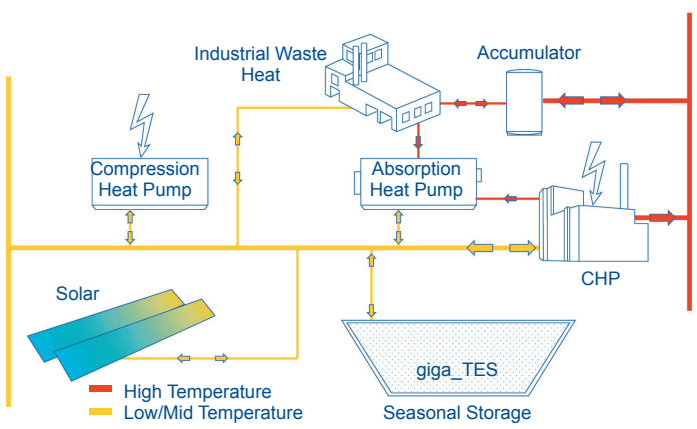
Motivation

> Target 100% renewable energies

> Large part of heat provision through District Heating and Cooling (DHC)

> Giga-scale thermal energy storages provide the required flexibility

> Large Storages need to be: Bigger – Better – Affordable



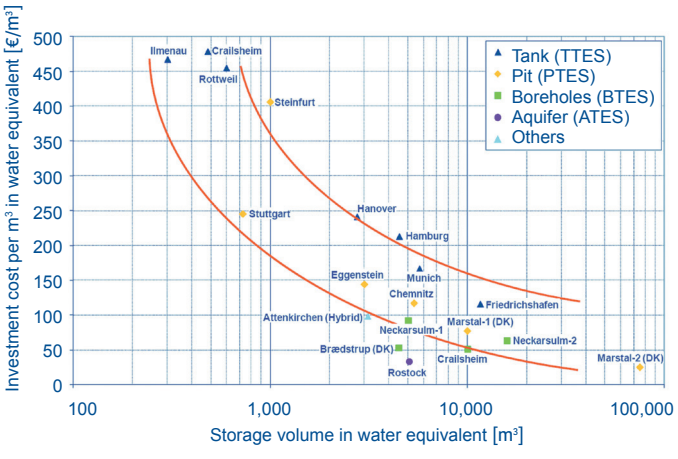
Integration of a Seasonal Storage in a District Heating System
Source: AEE INTEC, S.O.L.I.D. GmbH

Development of different, dedicated concepts for giga-scale thermal energy storages that:

- provide more storage capacity
- are energetically better than state-of-the-art solutions
- are more cost-efficient than current technologies
- are better integrated in the overall district heating system
- have increased lifetime

Why Giga-Scale Thermal Energy Storages?

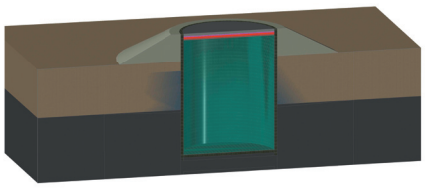
- A storage must be cheap: Economy of scales. The investment costs decrease with increasing storage size.
- A long-term storage must show low losses: The thermal losses decrease with increasing size, due to decreasing surface-to-volume ratio.



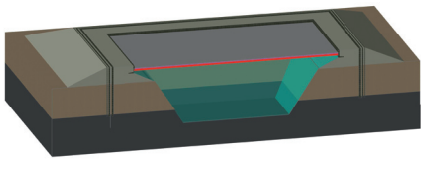
Investment costs in dependency of the storage volume
Source: solites

Giga-Scale Thermal Energy Storage Technology Development

The constructional aspects are examined for various cases with specific volumes in the range of 100,000 m³ to 2,000,000 m³. The geometries chosen are either shaft-like, with vertical walls or pit-like, with sloped walls, or a combination of both. Construction techniques are determined and a first estimate of the costs of materials and construction is made.



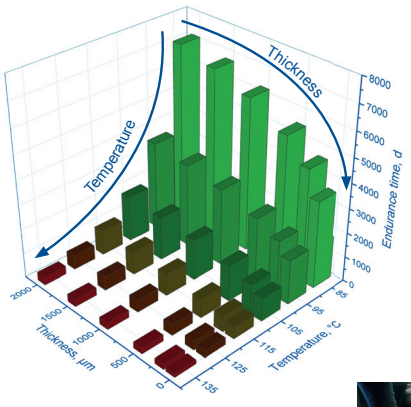
Shaft-like concept: economically and structurally efficient with volumes of up to around 100,000 m³ (with a diameter and a depth of around 50 m)
Source: ste.p ZT GmbH



Pit-like concept: preferable for volumes larger than 500,000 m³ Source: ste.p ZT GmbH

Materials Development and Testing

- Development and long-term testing of novel PolyPropylene Random Copolymers towards lower material and installation costs
- Analysis of novel concrete formulations that provide a better thermal insulation

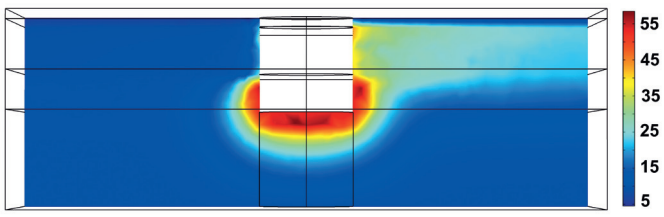


The effect of thickness and temperature on the aging behavior (endurance time) of novel PP Random Copolymers
Source: JKU Linz

Production of test samples of novel concrete foam mixtures (AIRIUM 250 of Lafarge Zementwerke GmbH)
Source: Smart Minerals

Computer Assisted Storage Optimisation

- Development of a detailed multi-physics storage model for storage design, optimization and evaluation
- Modeling of single components for system and component pre-design
- Development of an adapted and calibrated coarse structure model for system simulation



2D simulated temperature field (in °C) of the surrounding subsurface of a storage with groundwater flow
Source: Universität Innsbruck

Project Consortium

Industry

Geologie & Grundwasser GmbH · WIEN ENERGIE · GVT Verfahrenstechnik GmbH · Salzburg AG · BILFINGER · ste.p · GABRIEL-CHEMIE GROUP · Metawell metal sandwich technology · SOLID solarinstallation+design · agru · Lenzing Plastics · DORR

Research

TU WIEN · smartminerals science to design the future · AEE INTEC · JKU Johannes Kepler Universität Linz · universität innsbruck

Foreign expertise

PlanEnergi · solites

gigaTES www.gigates.at

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