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gigaTES
www.gigates.at

giga_TES: Giga-Scale Thermal Energy Storage for Renewable Districts; First Main Results

Eurosun 2020

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powered by klima+ energie fonds

This project is funded by the Austrian Climate and Energy Fund in the framework of the Energy Research Program e!MISSION.at - Energy Mission Austria.

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giga_TES: development of materials and concepts for giga-scale thermal energy storages

- Large thermal energy storages (LTES) for district heating (also enabling seasonal storage)
- At present LTES mainly realised in Denmark:

Source: Arcon-Sumark

Until now: ~200.000 m³ (Vojens, DK)

x10

Concepts up to 2.000.000 m³

- giga_TES:
  - Transforming the technology from Denmark for application in Austria and Central Europe

Project consortium

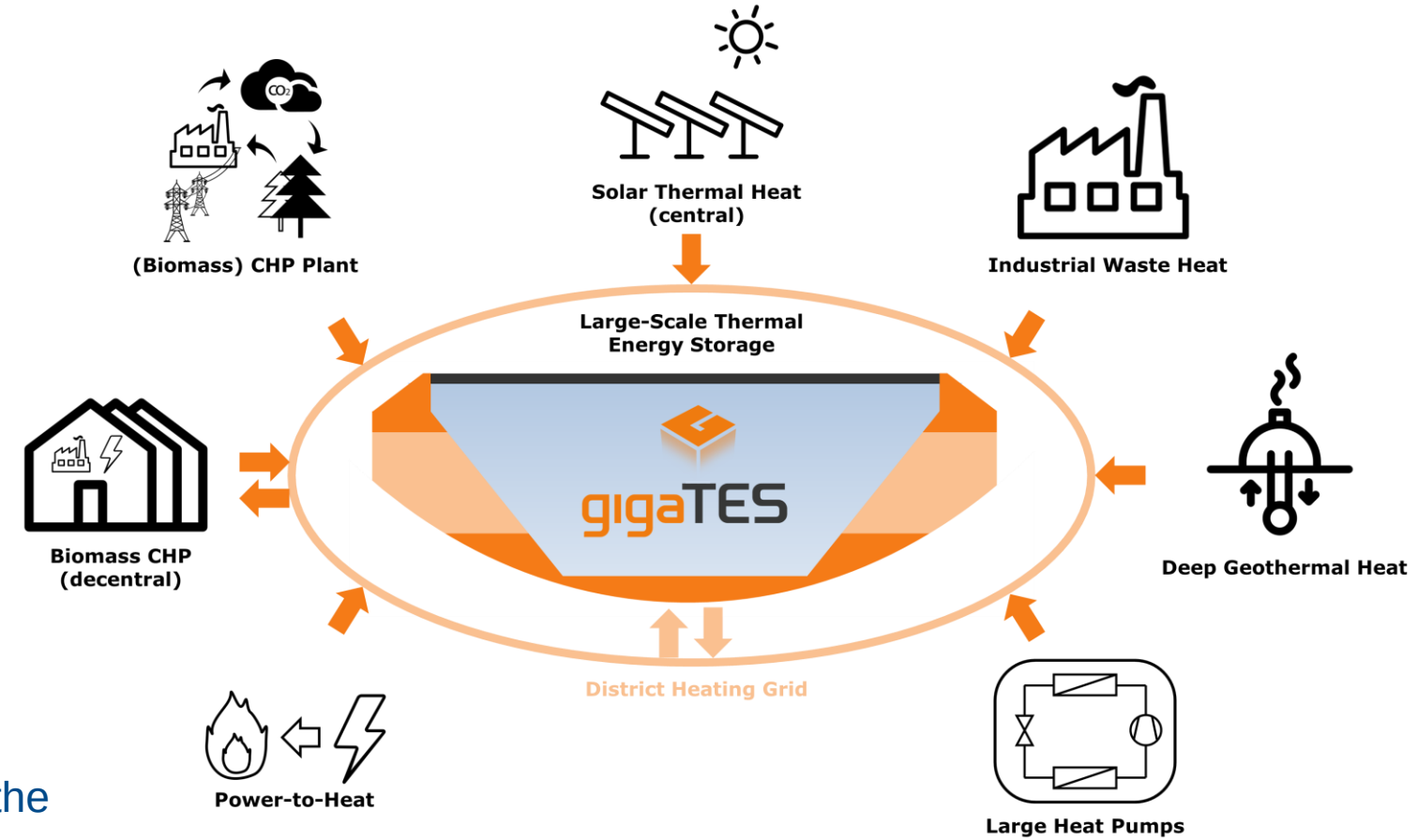
- Austrian flagship-project (01/2018 – 06/2021):

Industry

Research

Foreign expertise

Large scale TES as pivotal element in the future district heating systems



- Further applications:
  - In industry sector to increase the share of renewables in the generation of process heat

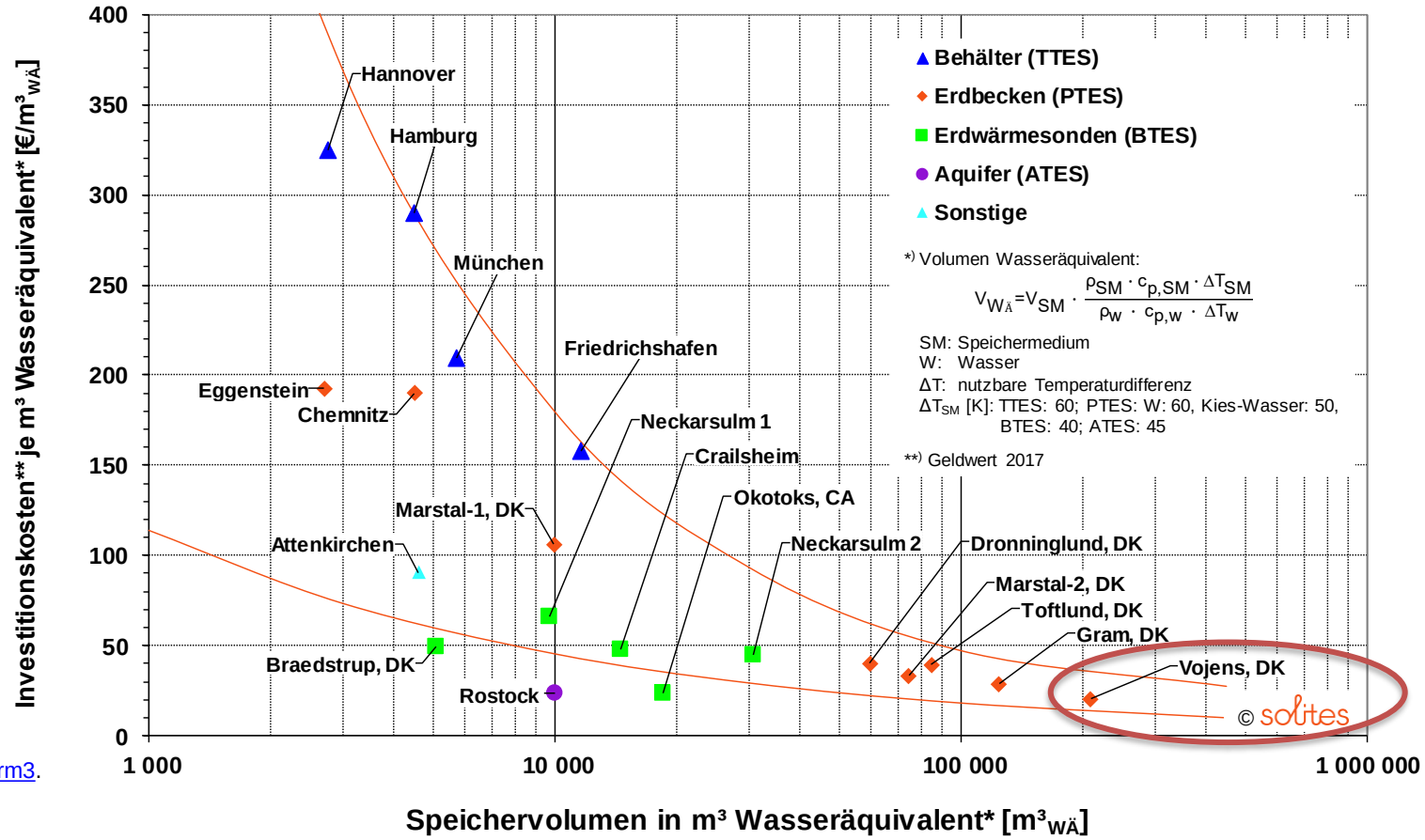
Large – Larger - Giga

- Seasonal storage requires low heat losses:
  with increasing volume, the specific heat losses decrease due to shrinking surface to volume ratio

- Storage has to be economically viable:

  Specific costs decrease with increasing volume

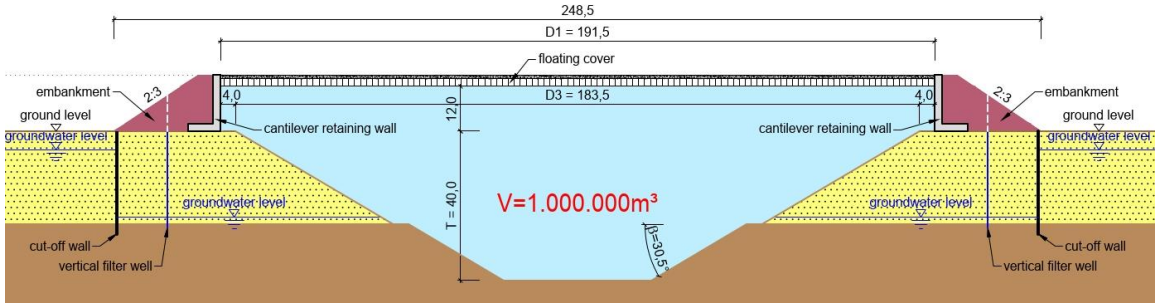
- Vojens, DK:
  ~24 €/m³ ≙ ~0,70 €/kWh
  (ΔT=30K)



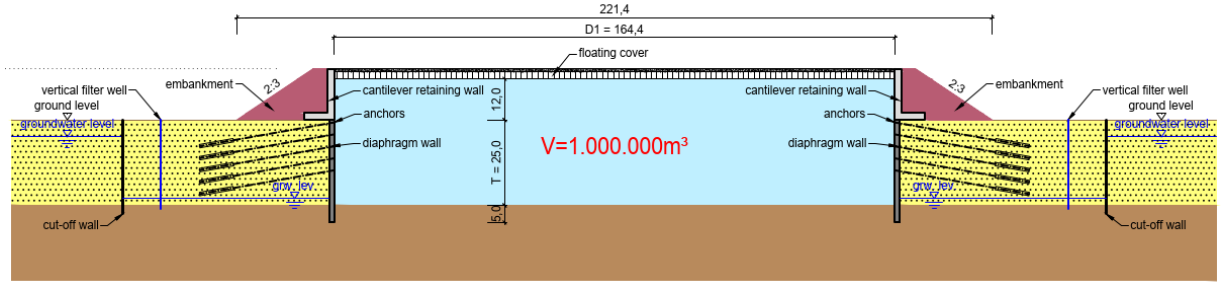
Source: Epp, Baerbel. „Seasonal pit heat storage: Cost benchmark of 30 EUR/m³ | Solarthermalworld.org“. *www.solarthermalworld.org/*, 17. Mai 2019. https://www.solarthermalworld.org/news/seasonal-pit-heat-storage-cost-benchmark-30-eurm3.

First results: basic construction concepts

Constructional aspects for shaft-like, pit-like with sloped walls or a combination of the two. First cost estimates have been made.



100.000m³ 1.000.000m³ 2.000.000m³



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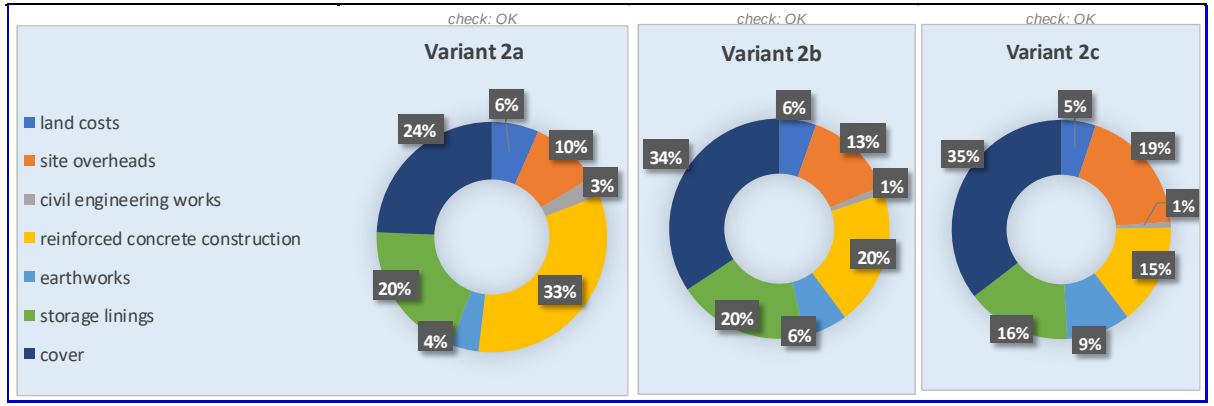
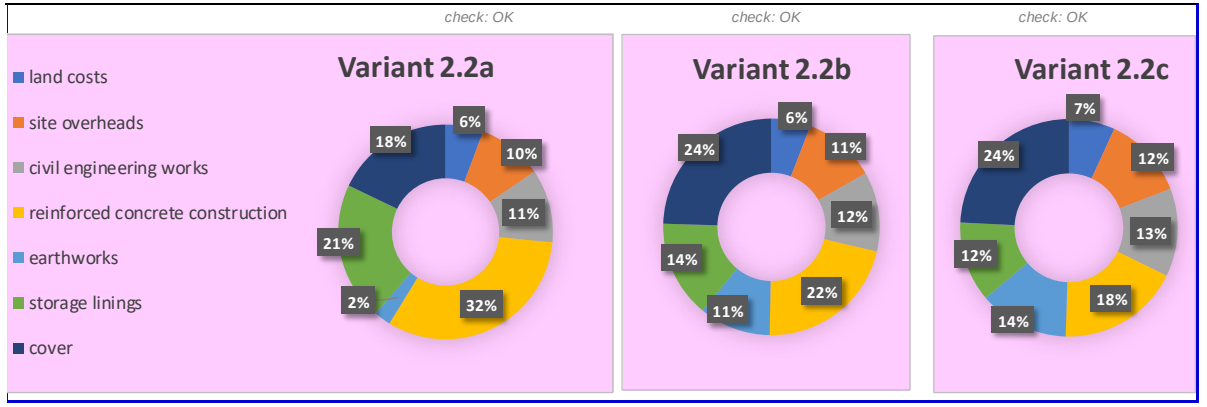
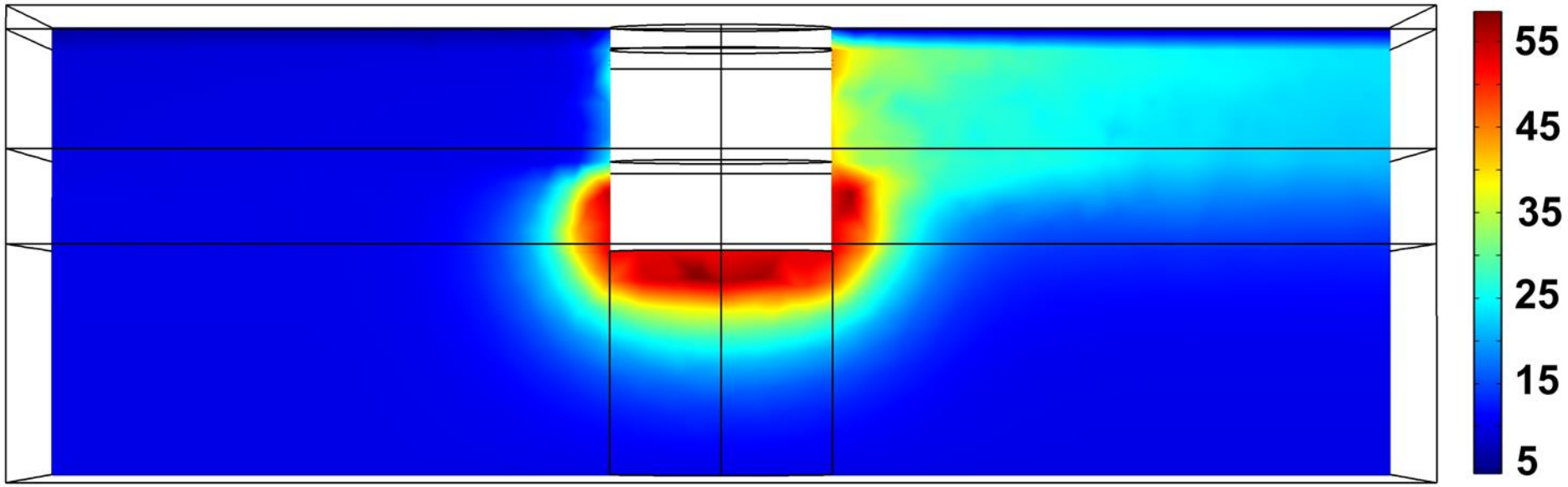




First results: detailed numerical simulation

Simulation of storage:

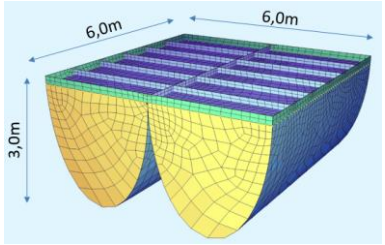
- To determine influence of soil and groundwater

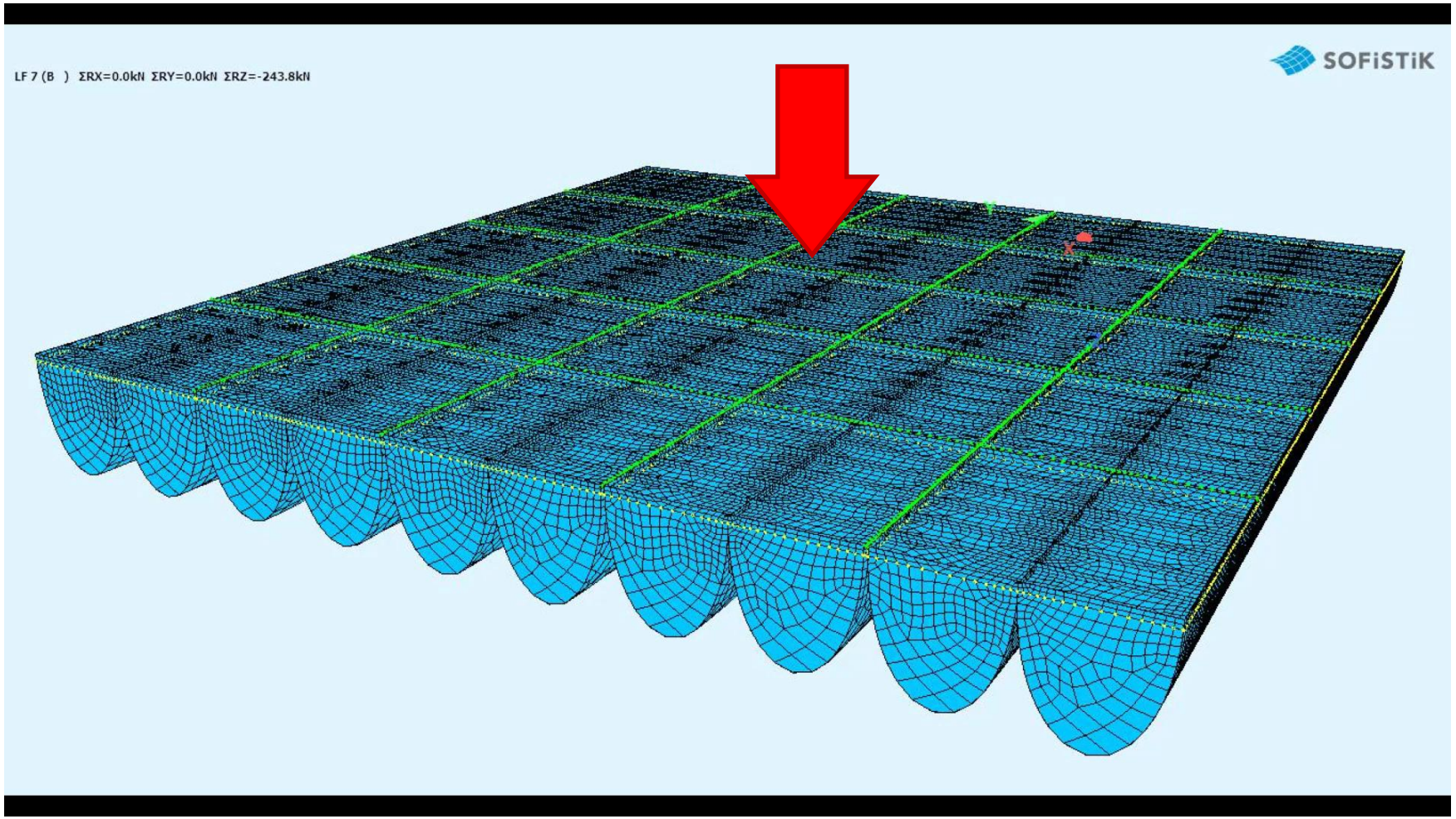


Example: temperature distribution due to flowing groundwater (COMSOL)

First results: floating lid designs

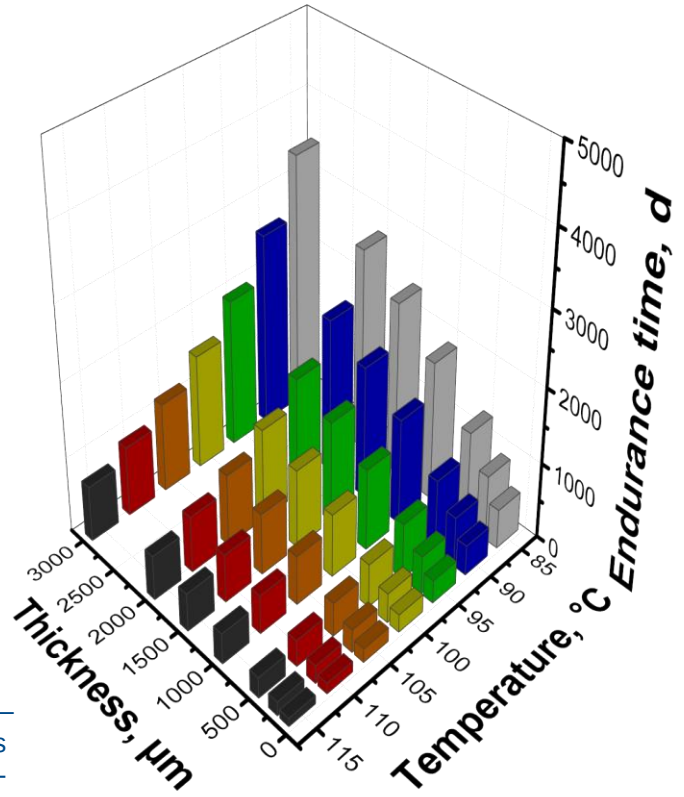
Simulation of floating lid deformation by weight of truck





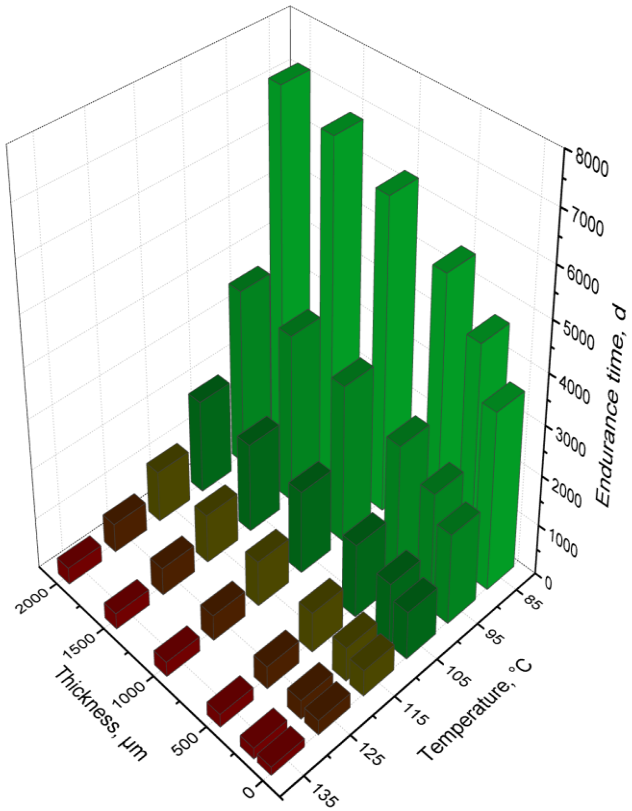
First results: novel polymer liner materials

Polyethylene → polypropylene; accelerated lifetime tests



Grabmann, M.K., Wallner, G.M., Buchberger, W., Nitsche, D. (2017). Aging and Lifetime Assessment of Polyethylene Liners for Heat Storages – Effect of Liner Thick-ness, Proceedings ISES Solar World Congress 2017, 753-760 (doi: 10.18086/swc.2017.31.02).

PE-HD: 15 years

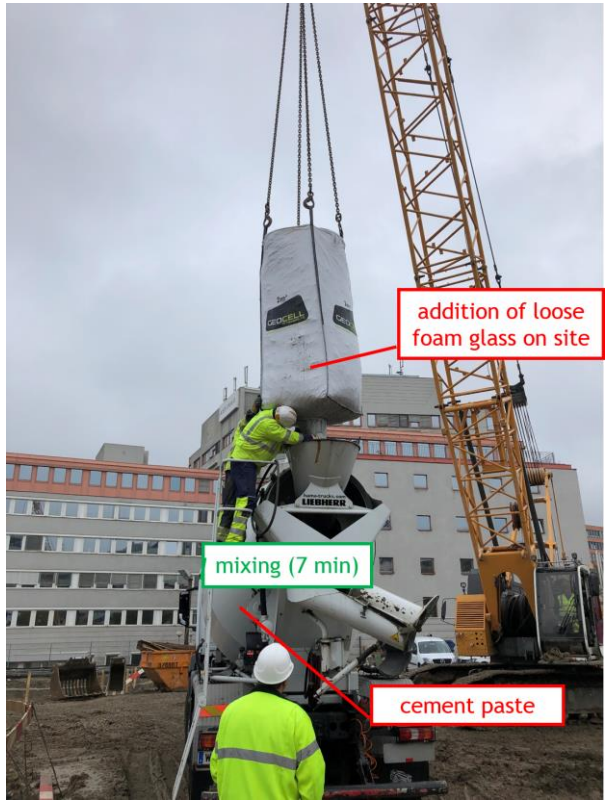


Grabmann, M.K., Wallner, G.M., Grabmayer, K., Buchberger, W., Nitsche, D. (2018). Effect of thickness and temperature on the global aging behavior of polypropylene random copolymers for seasonal thermal energy storages, Solar Energy, 172, 152-157. (doi: 10.1016/j.solener.2018.05.080)

PP-R: 34 years (Factor > 2 better)

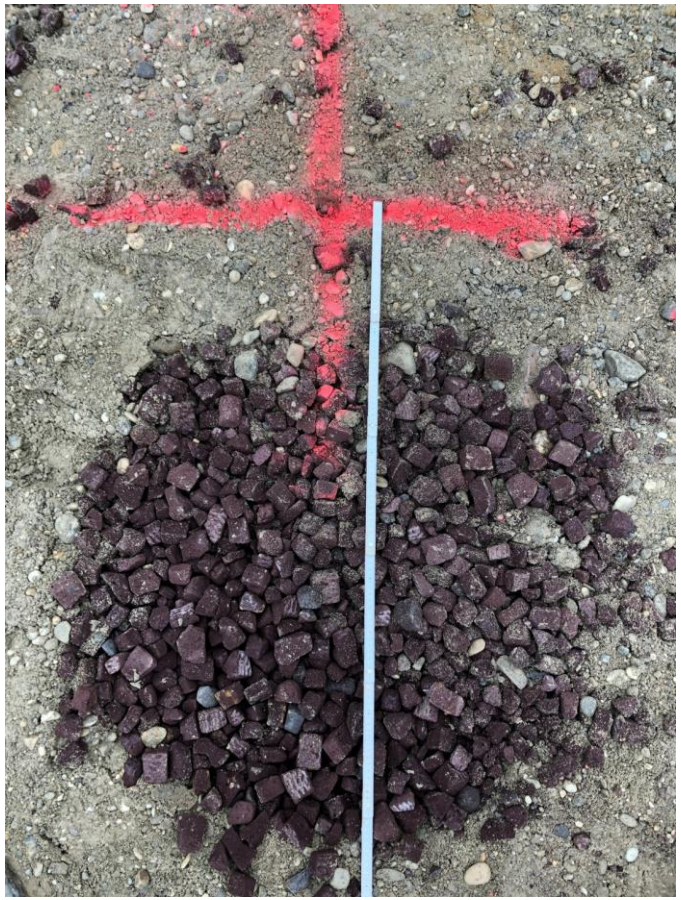
First results: novel insulating pile

First mock-up: shallow trench filled with cement-bound foam glass



Novel insulating pile (2)

Second mock-up: shallow borepiles; dry foam glass



Results of second mock-up satisfactory

→ Third mock-up with deep insulating piles in preparation

Giga_TES first conclusions

- Novel concepts for storage construction and floating lid
- Numerical simulations for components, storage and system integration
- Novel polymer liners with longer lifetime
- Novel ground constructions for thermal insulation

- More detailing until June 2021
- Project website: gigates.at

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IDEA TO ACTION

Your reaction is welcome

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