

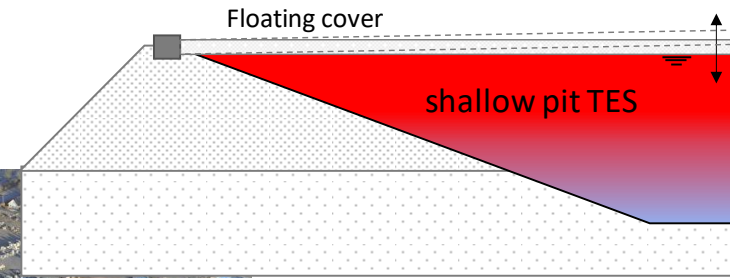
Understanding the Hygrothermal Behaviour of the Cover of Large-Scale Thermal Energy Storage Systems for Performance-oriented Design

Alice Tosatto, Fabian Ochs

Introduction

Key Issues and Design Challenges

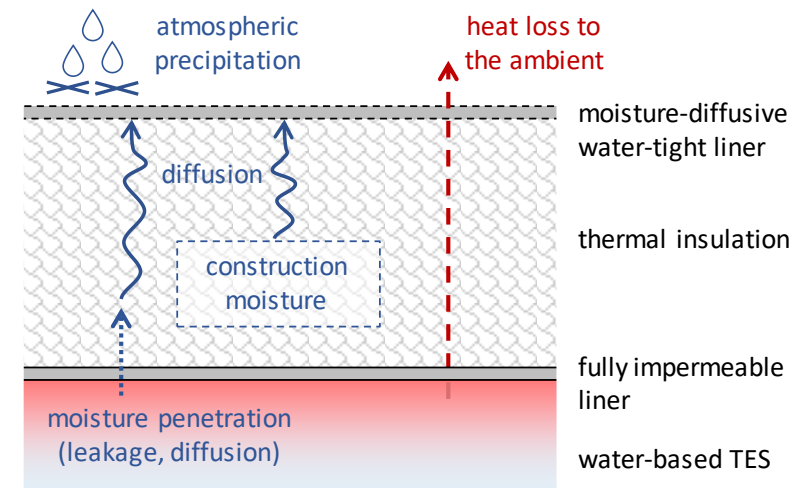
- Underground pit thermal energy storage (TES) systems present an **insulated floating cover**, to accommodate limited water level variations due to thermal expansion.
- TES cover systems require the use of materials able to withstand high temperatures and appropriate design solutions to ensure optimal operation and long service-life.



Vojens (DK)
Pit TES 200 000 m³
Source: Solar Heat Europe

Moisture penetration accelerates insulation degradation and increases local thermal losses.

- Diffusion through the liner
- Leakages due to failures
- Construction phase (transport, storage installation of the material)



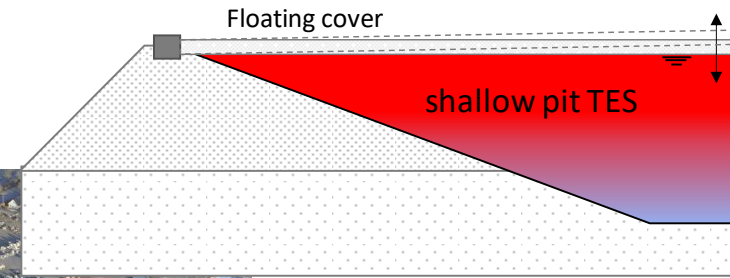
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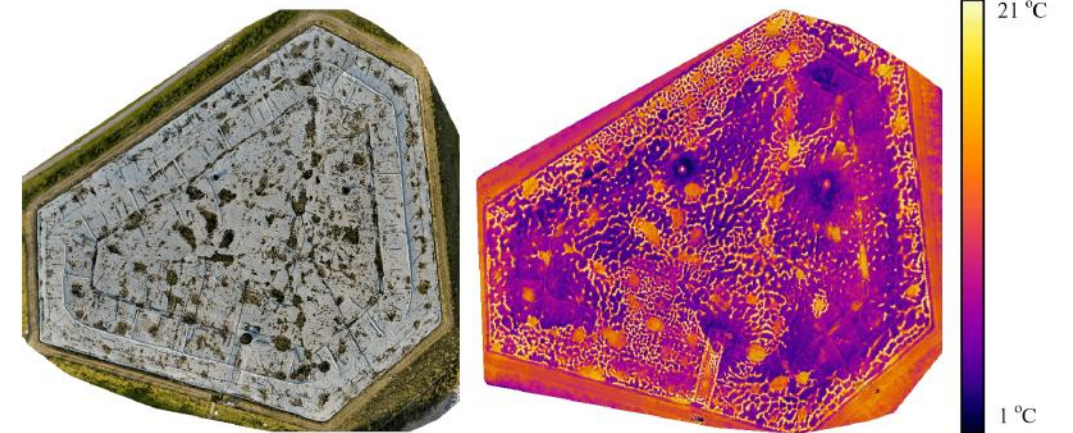
- Underground pit TESs present an **insulated floating cover**, to accommodate limited water level variations due to thermal expansion.
- TES cover systems require the use of materials able to withstand high temperatures and appropriate design solutions to ensure optimal operation and long service-life.

In TES lids with porous bulk insulation, **natural convection**, driven by the large temperature difference, can increase the local heat transfer.

RGB (left) and thermal (right) image of the PTES in Vojens in 2020
material: LECA



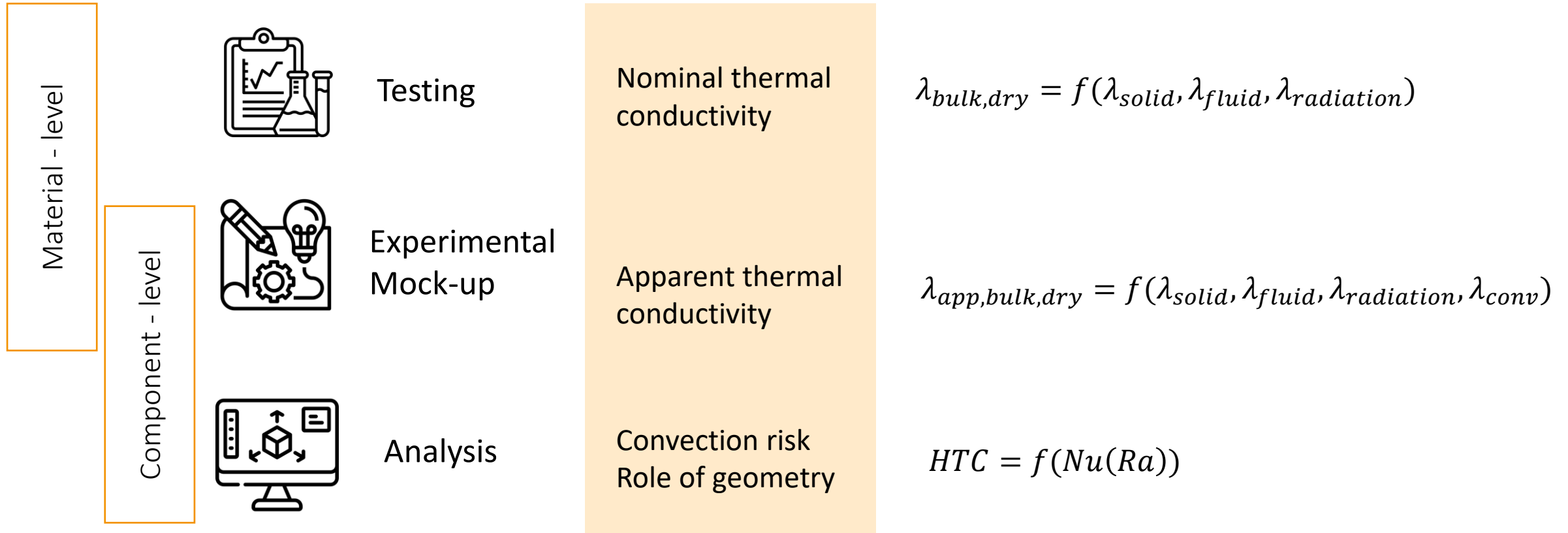
Vojens (DK)
Pit TES 200 000 m³
Source: Solar Heat Europe




Source: Sifnaios I., Dragsted J., Jensen A.R. (2021) Thermal inspection of water pit heat storages using drones, *ISES Conference Proceedings (2021)*

Open Questions and Research Needs

Integrated approach for the TES cover design



Thank you for your attention



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