

International Innovation Network for the Development of
Cost- and Environmentally Efficient Seasonal Thermal Energy Storages



HEATING CAVERNS & FORMER FIREWATER BASINS: THE PROJECT INTERSTORES

al. et P. Bayer



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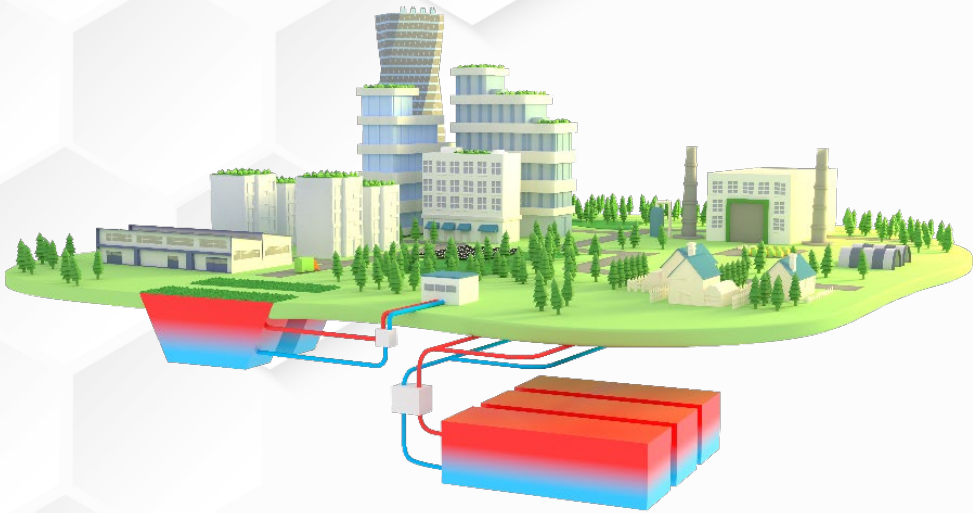


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Facts & Numbers

- **Granting authority** – CINEA
- **Type of action** – HORIZON Innovation Actions
- **Coordinator:** P. Bayer / MLU Halle



International Innovation Network for the Development of **Cost- and Environmentally Efficient Seasonal Thermal Energy Storages**



Start date **January 2024**

Duration **48 months**


Budget **11 million €**

2 demo sites
9 countries
14 partners



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Impact & Innovation



INTERSTORES project
has high innovation
potential to achieve



Lower capital costs by:

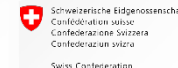
Re-use of infrastructure (Reno-sTES) that has previously served other purposes and now can be transformed in a renovated, low-cost, ground-based sTES facility

Large caverns (Giga-CTES) through boosting the efficiency and the promotion of circular economy principles, reduction of environmental impacts, and land use



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Demo site incampus, Ingolstadt, Germany

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Closed basin facility with surface use, without a fence, on an industrial/mixed-use “campus” (office buildings, data centre, vehicle safety centre, etc.)

<https://incampus.de/>

LowEx DHC with decentralized HPs

Temperatures	5-35 °C
Storage medium	water-saturated matrix
Storage volume	18,000 m ³ , 3 basins
Capacity	680 MWh
sTES type	WGTES, Reno-sTES



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Demo site incampus, Ingolstadt, Germany



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Ongoing construction

start of operation expected for spring 2026

Planned operation mode

indirect charging/discharging

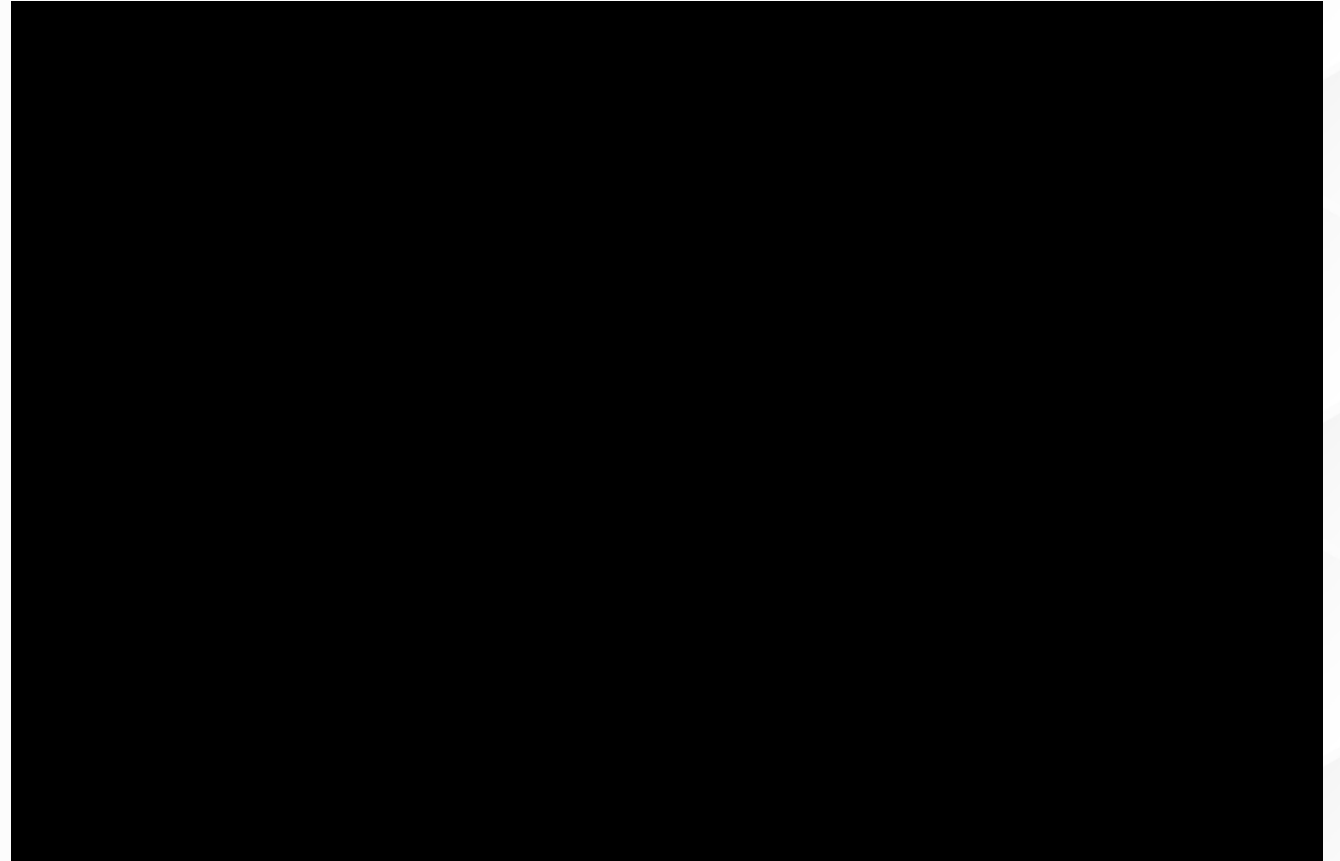
via heat exchanger coils

enhanced thermal exploitation via “wells”

Monitoring


distributed Thermal Sensing (DTS)

Pt100 in observation wells



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Demo site incampus, Ingolstadt, Germany

Heat exchanger coils

PE pipes
72 loops á 260 m

Insulation

XPS Styrodur (60 mm)

Sealing, other

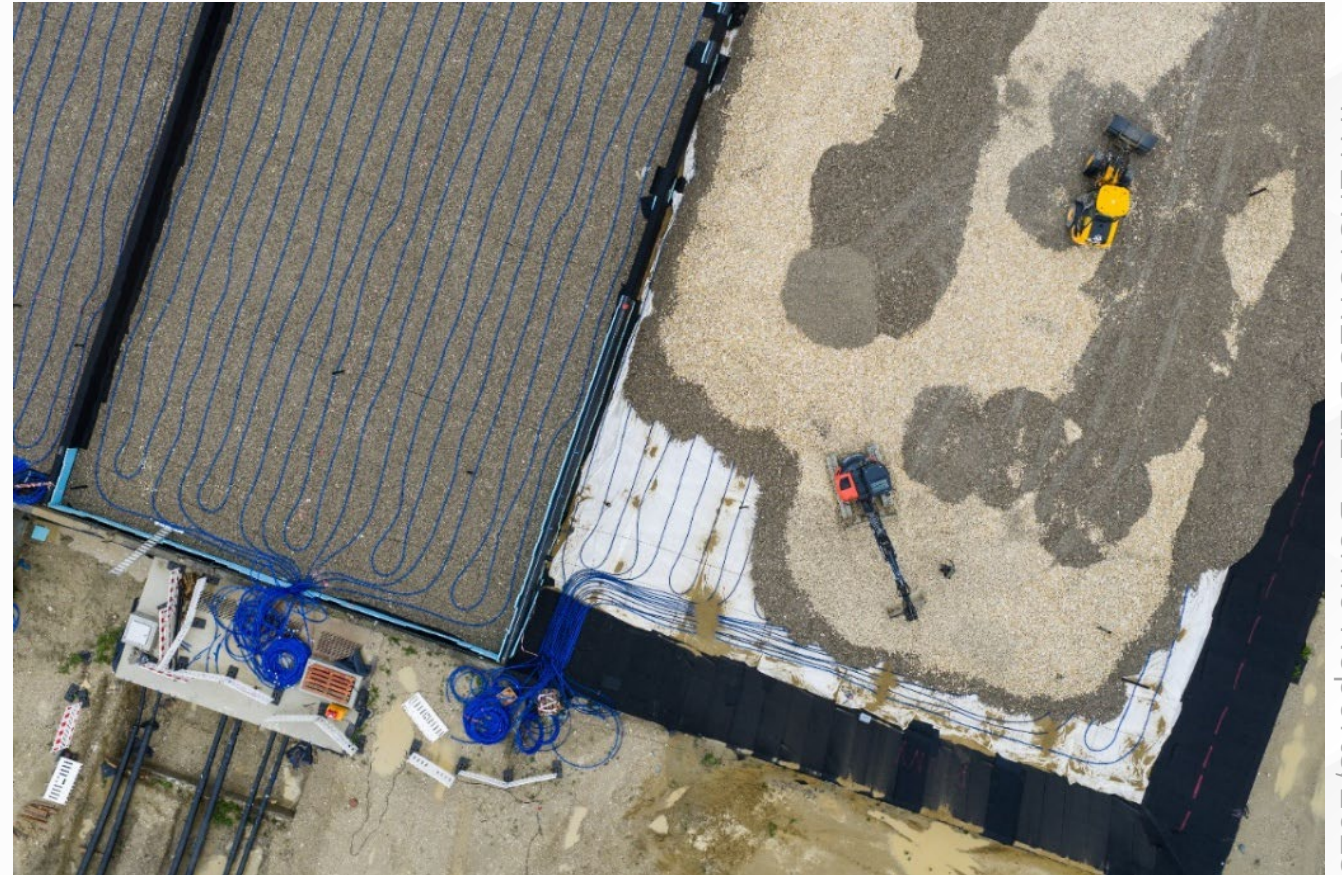
HDPE foils, geotextiles

Top layer planned

0.5-1 m of gravel/soil
with protective PUR mats
and polyester fleece

Geometries & individualization

each basin has key features



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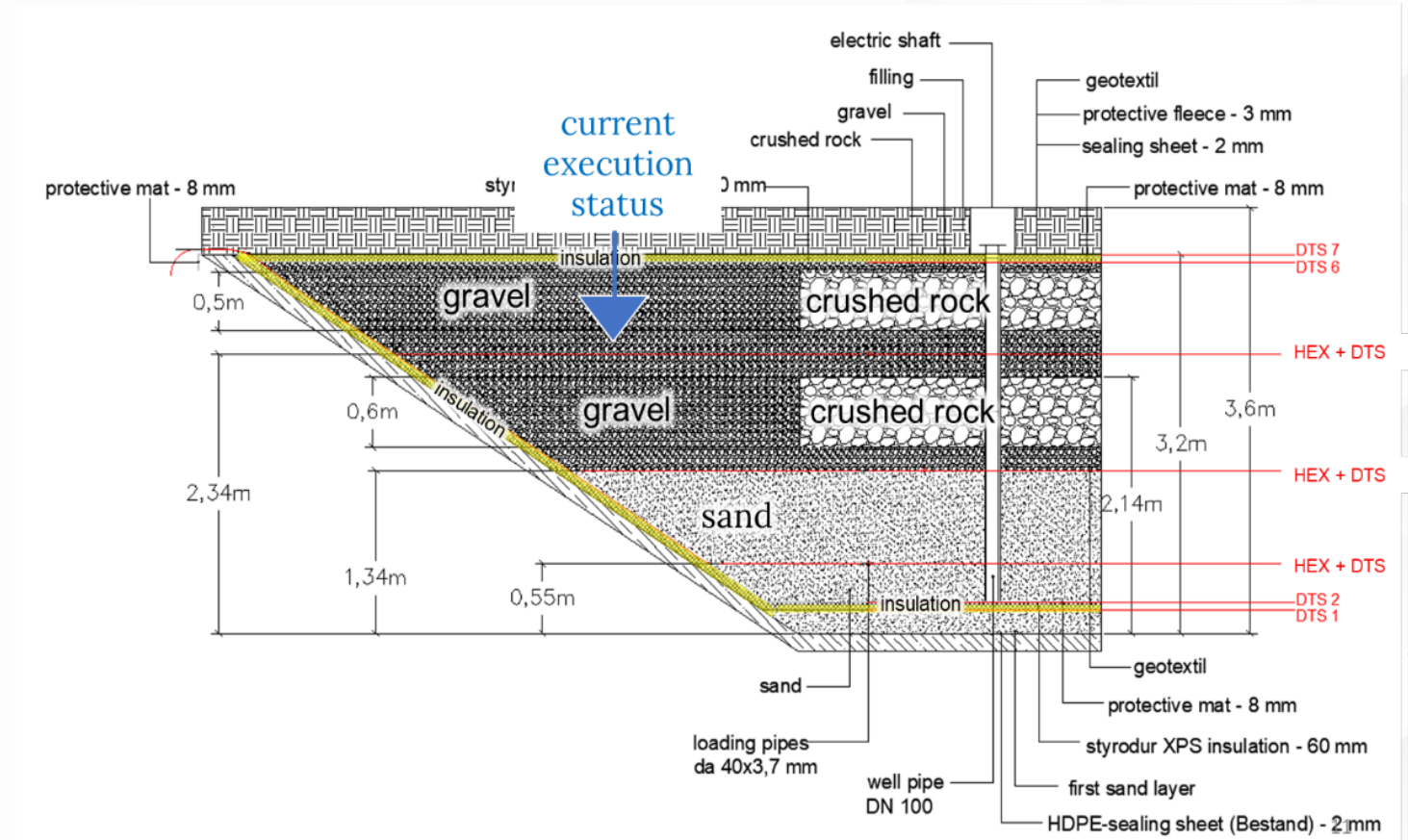
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Geometries & individualization

each basin has key features

Example: storage basin C



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Demo site incampus, Ingolstadt, Germany

Further R&D activities

Geothermal trench

planned as downgradient heat loss collector

Multi-storage – soil – groundwater - model

e.g., component-based physical process simulation
& AI Emulator / Reduced Order Model

Operation mode testing program

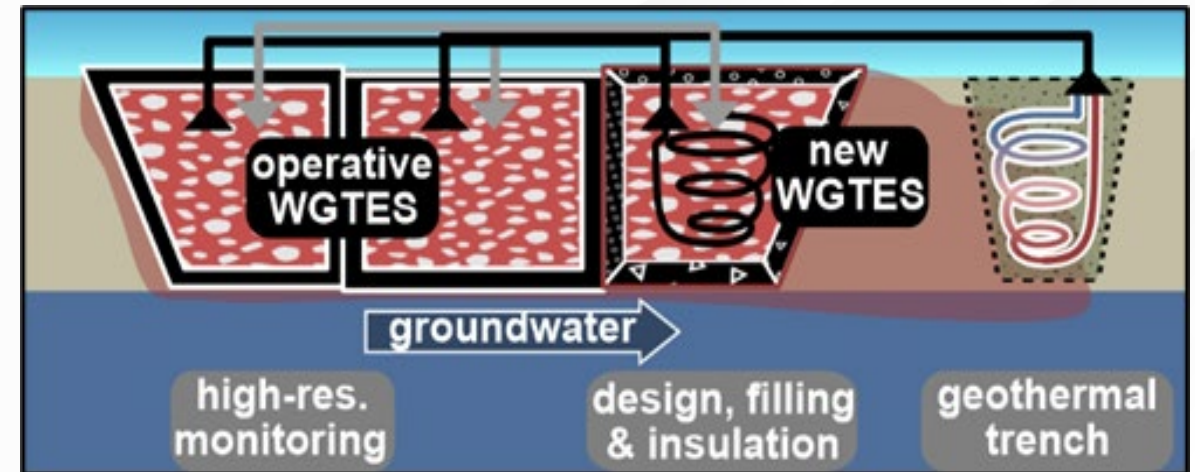
storage model calibration & validation

Digital Twin

mirroring operation & control of storage basins

Transfer

“copy & paste” to potential transfer site across EU



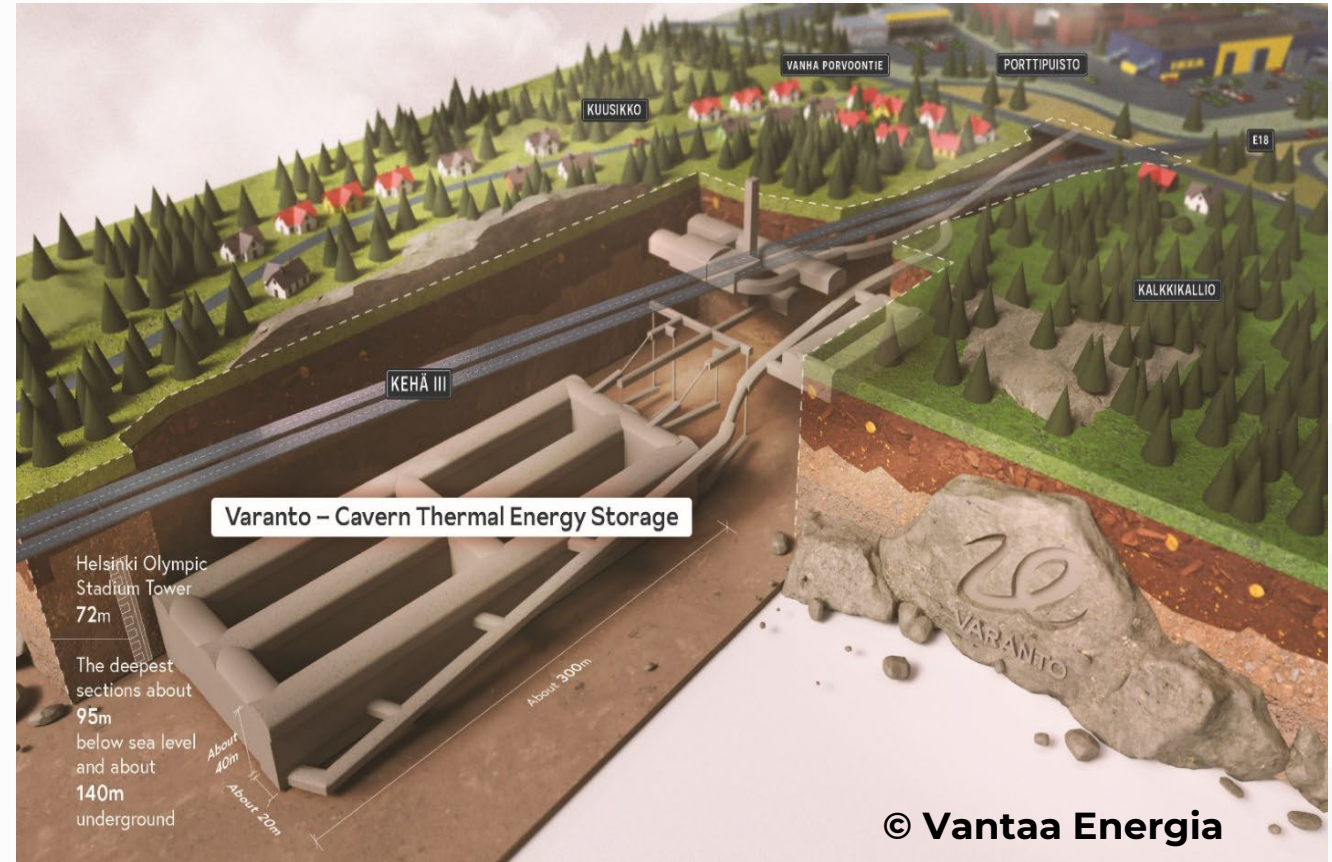
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Demo site Varanto, Vantaa, Finland

Varanto will be the world's largest constructed sTES facility in terms of size and capacity.

<https://www.vantaanenergia.fi/en/projects/heatstorage/>

Temperature	145 °C
Storage medium	pressurized water
Storage volume	1,000,000 m ³ , three caverns
Capacity	90 GWh
sTES type	CTES (Giga-)



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Demo site Varanto, Vantaa, Finland

Energy source

waste Incineration plant

Integration

DH of the city of Vantaa/Helsinki

Current status

construction site prepared
final design
geological characterization

Key milestone achieved

first blast carried out
start of access tunnels excavation



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Demo site Varanto, Vantaa, Finland



Construction schedule
excavation work until 2028




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Demo site Varanto, Vantaa, Finland



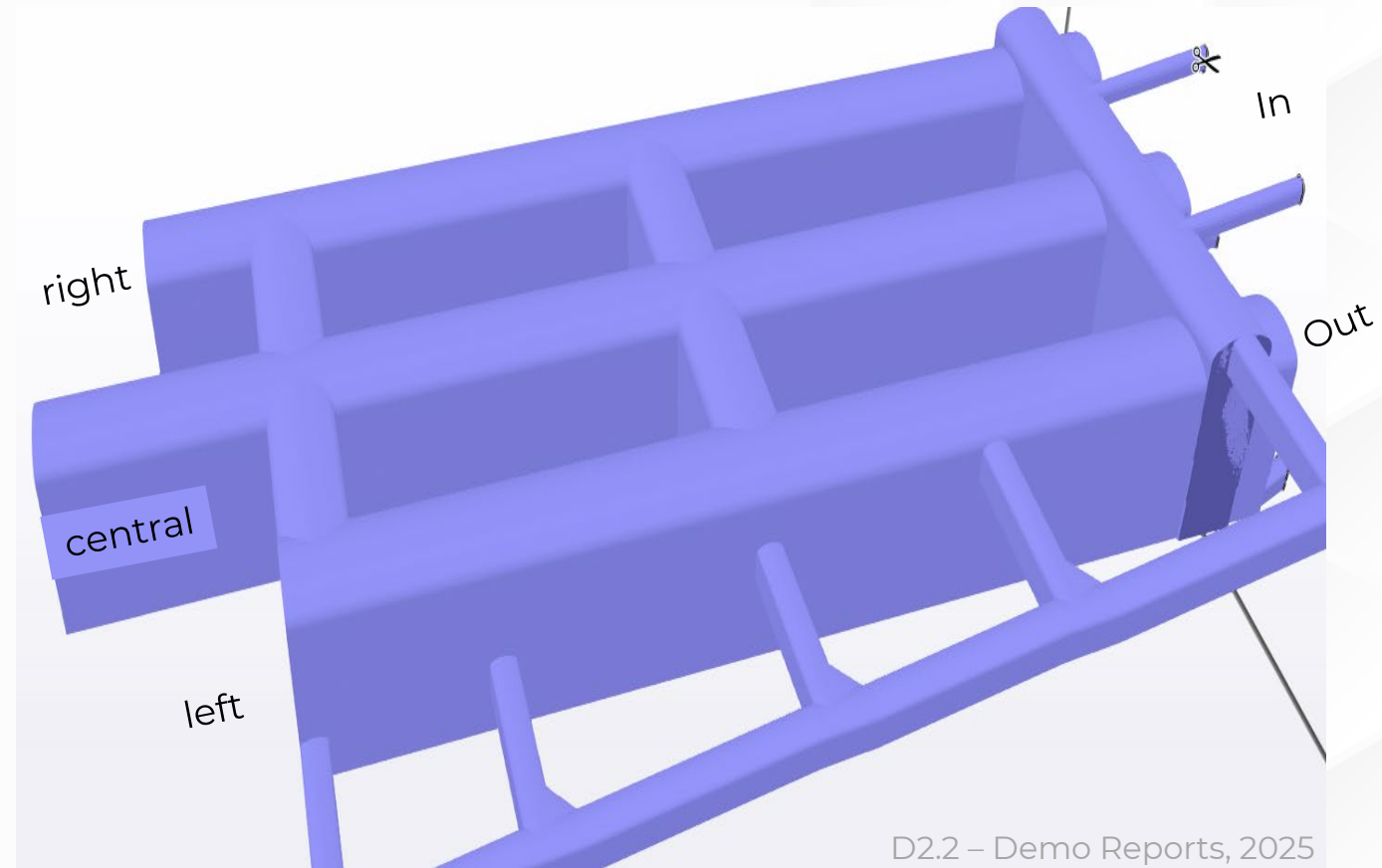
Construction schedule

excavation work until 2028

Further R&D activities

development of resistant devices and materials
(shotcrete, diffuser, etc.)

THM interaction with host rock



D2.2 – Demo Reports, 2025



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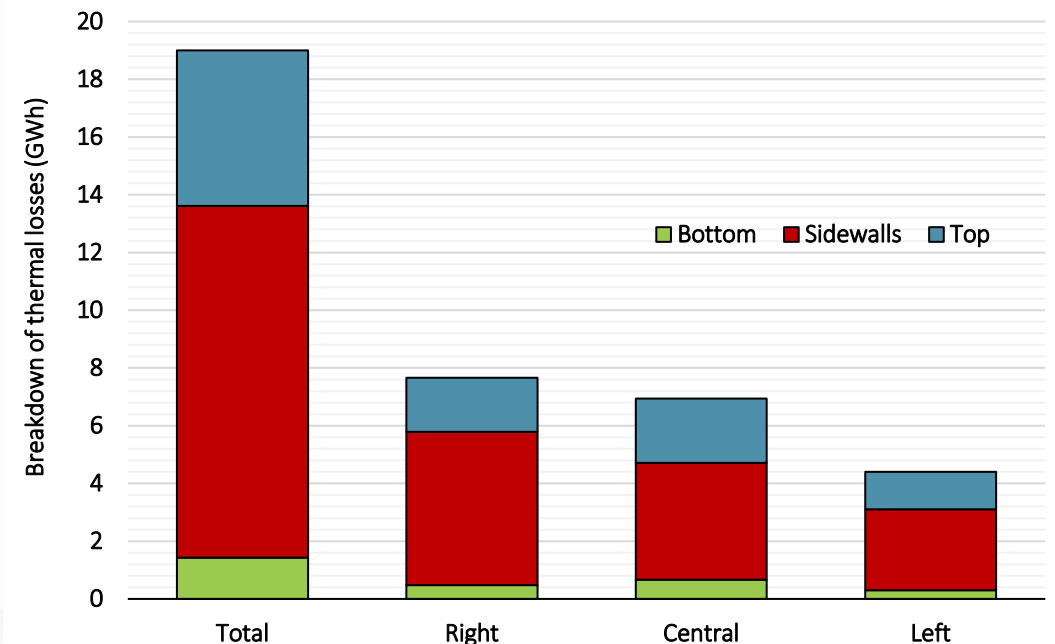
development of resistant devices and materials
(shotcrete, diffuser, etc.)

THM interaction with host rock

operation mode optimization support

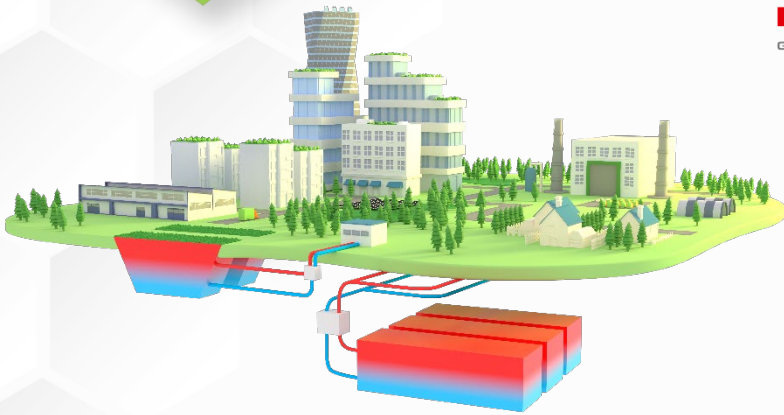
integration into regional DH and national
energy network (“backbone” model)

Example calculations for Varanto layout option





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HALLE-WITTENBERG



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ti
Technische Hochschule
Ingolstadt
Institute of
new Energy Systems



energie sprong
global alliance



GreenFlex



GTK



HSLU Lucerne University
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Challoch
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