3rd webinar by IEA-ES Task 45

Mine Thermal Energy Storage – Utilisation of flooded underground mines

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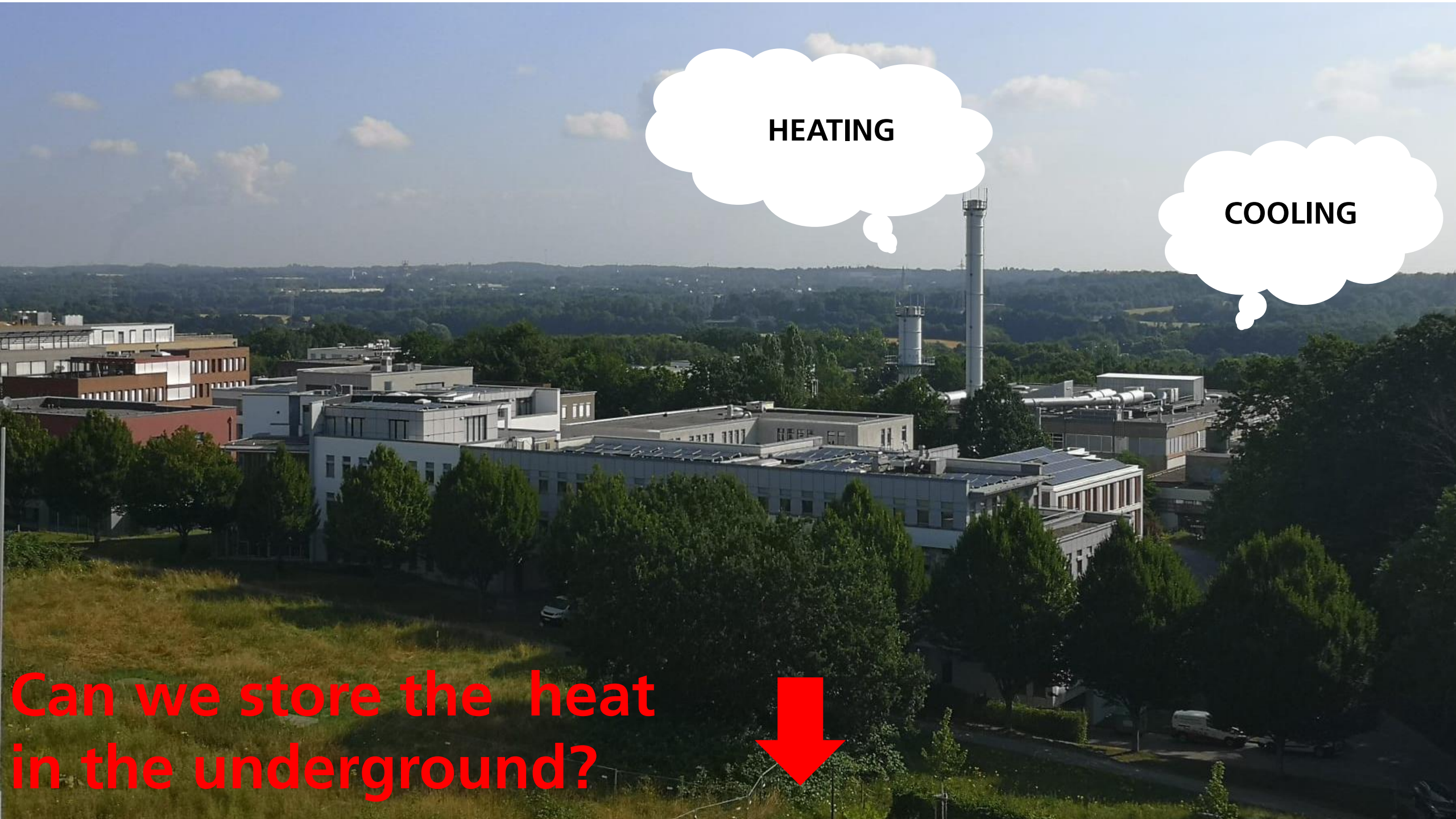
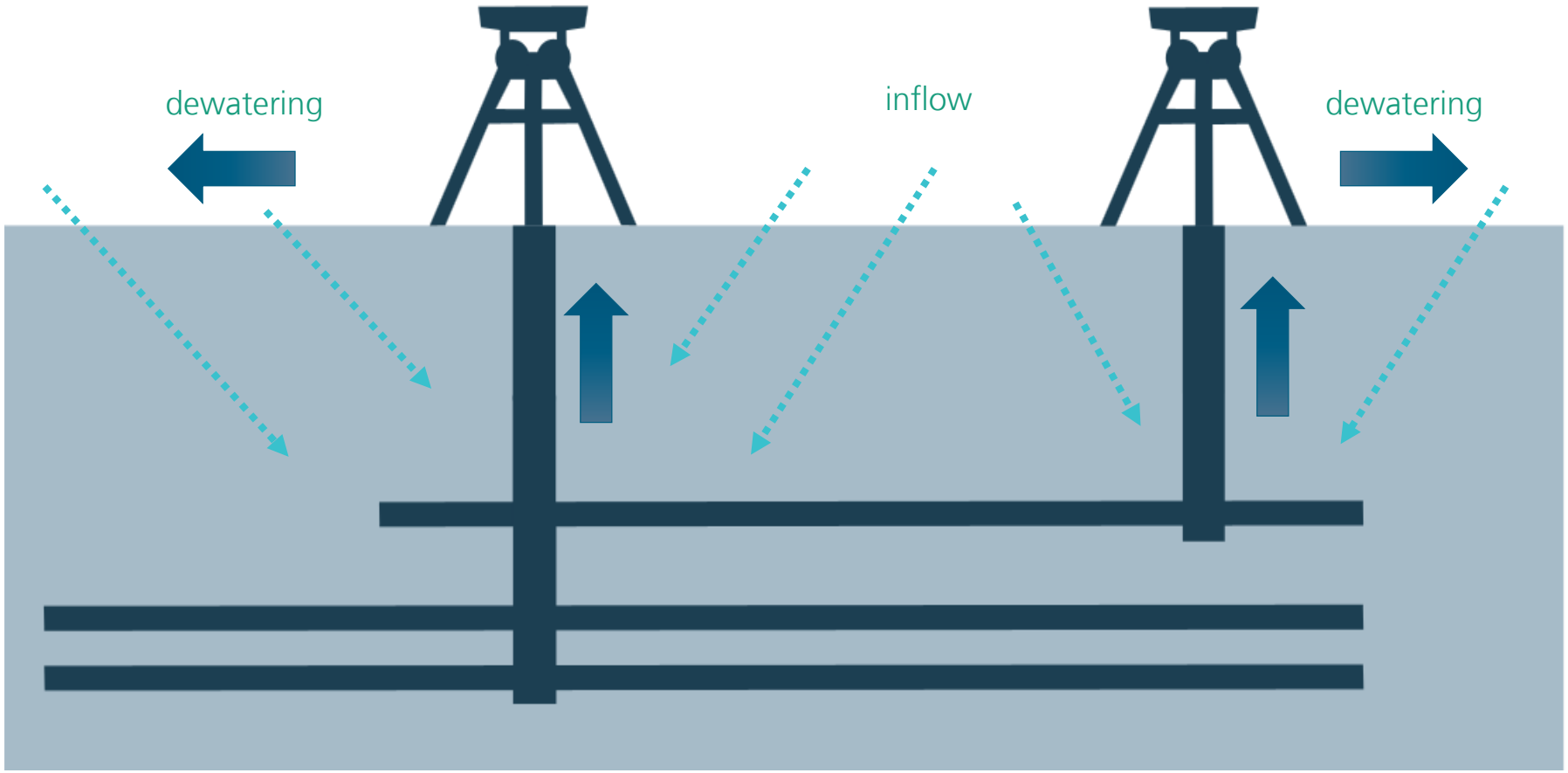
Fraunhofer Institution for Energy Infrastructures and Geotechnologies IEG
Competence Center Post-Mining Exploitation


HEATING
COOLING
Can we store the heat in the underground?

Geothermal and Post-Mining

Mine Water and Mine Flooding



active mine

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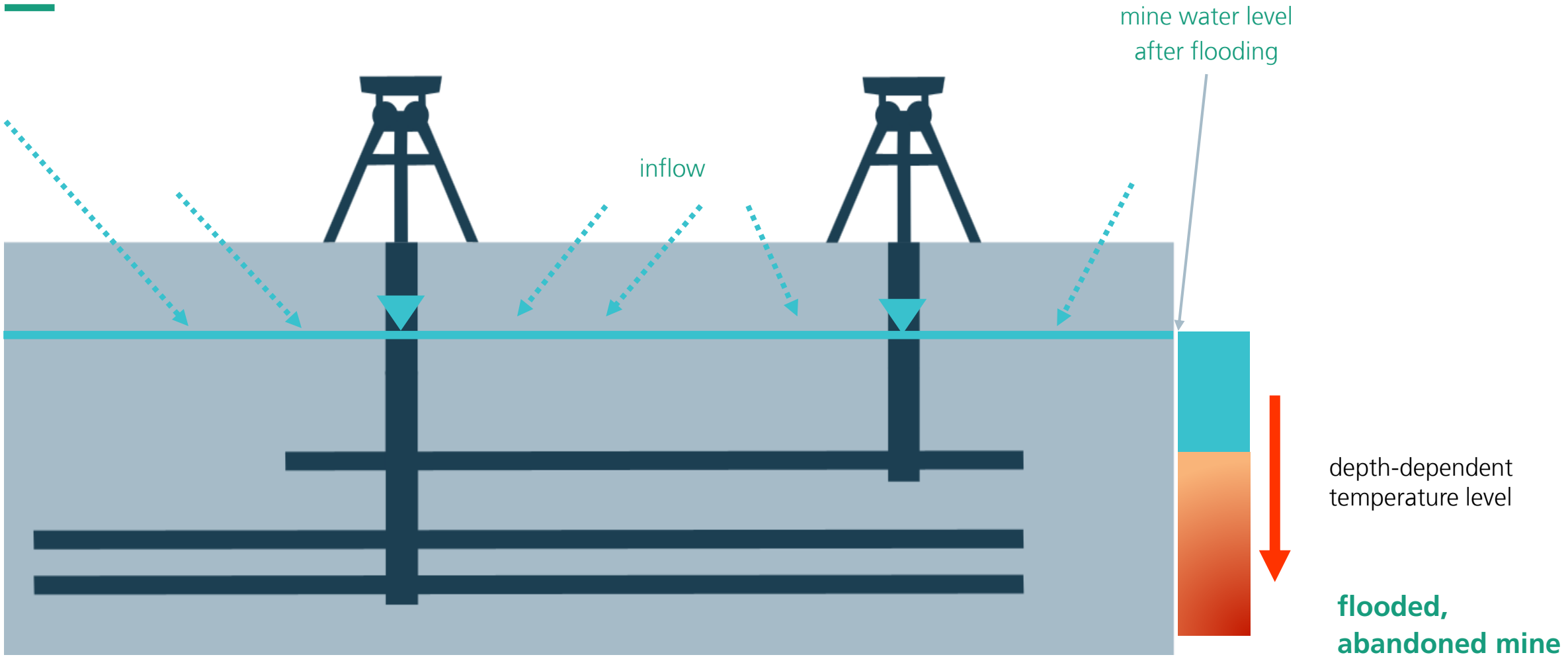
Geothermal and Post-Mining

Mine Water and Mine Flooding



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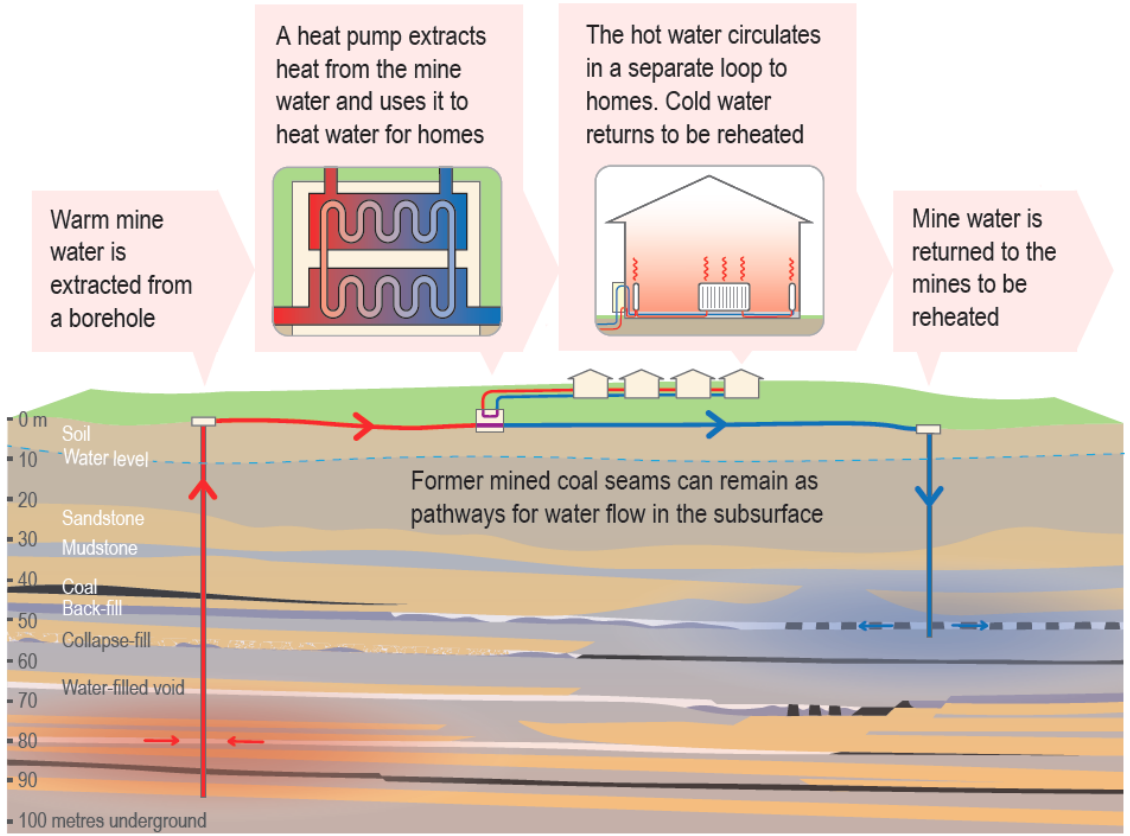
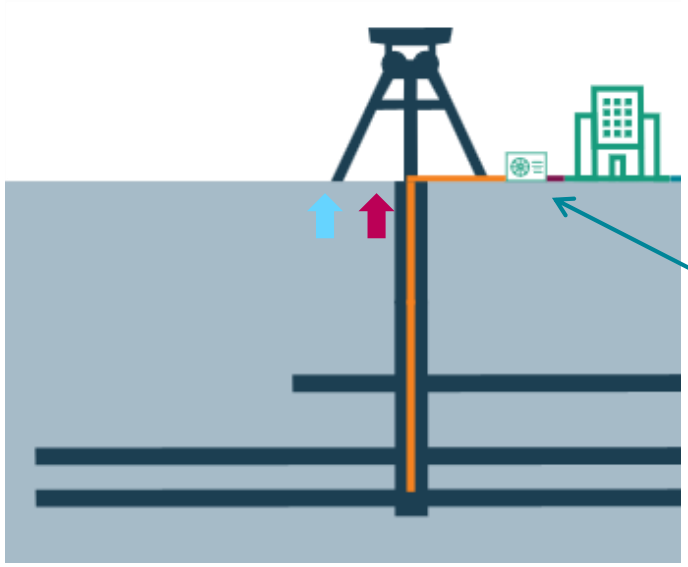
Mine water geothermal

How it works



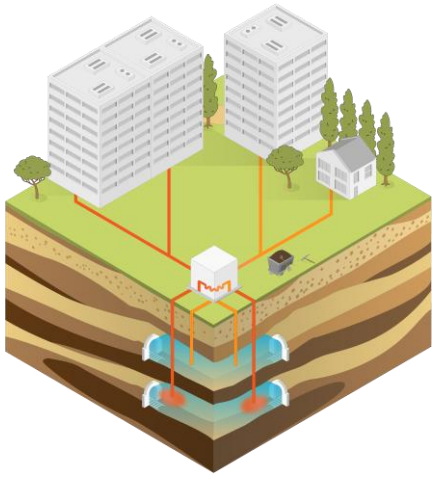
Example of mine water geothermal application in flooded coal mine
©BGS, UKRI 2021



always use of **heat pumps** and **heat exchangers**

heating and/or cooling

when surplus heat available:
MTES (Mine Thermal Energy Storage)



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Geothermal Heat Storage

EU project PUSH-IT

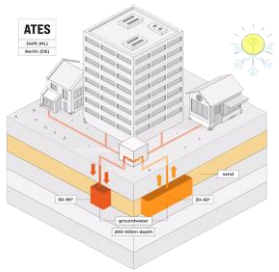
Piloting Underground Seasonal Heat Storage In geoThermal reservoirs

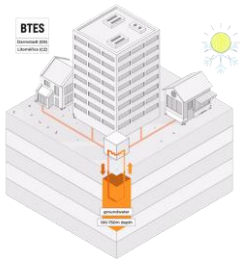
Objective

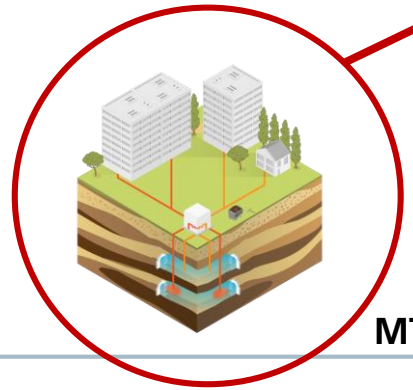
Overcoming the discrepancy between heat consumption and heat availability through intraday intermediate storage.

EU funded project **PUSH-IT** Funded by the European Union

The project aims to demonstrate the **large-scale application** of **high-temperature heat storage** in **geothermal reservoirs** using three different technologies at six different locations.







MTES

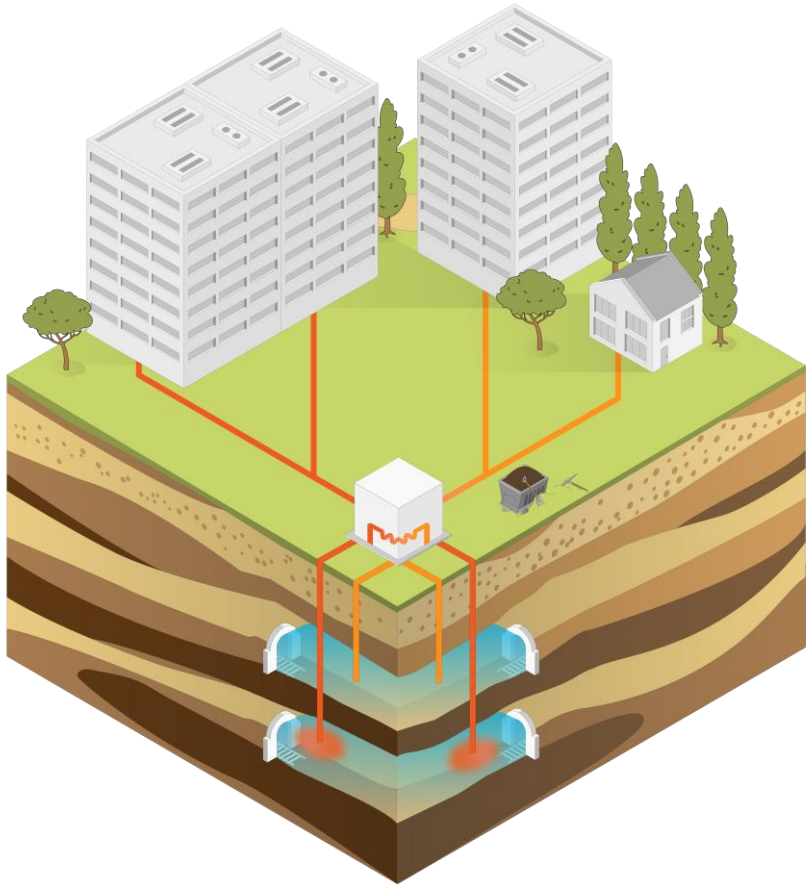
Bochum (DE) Demo site for Mine Thermal Energy Storage (MTES).	**Darmstadt (DE)** Demo site for Borehole Thermal Energy Storage (BTES).	**United Downs (UK)** Follower site for Mine Thermal Energy Storage (MTES).
Delft (NL) Demo site for Aquifer Thermal Energy Storage (ATES).	**Berlin (DE)** Follower site for Aquifer Thermal Energy Storage (ATES).	**Litoměřice (CZ)** Follower site for Borehole Thermal Energy Storage (BTES)

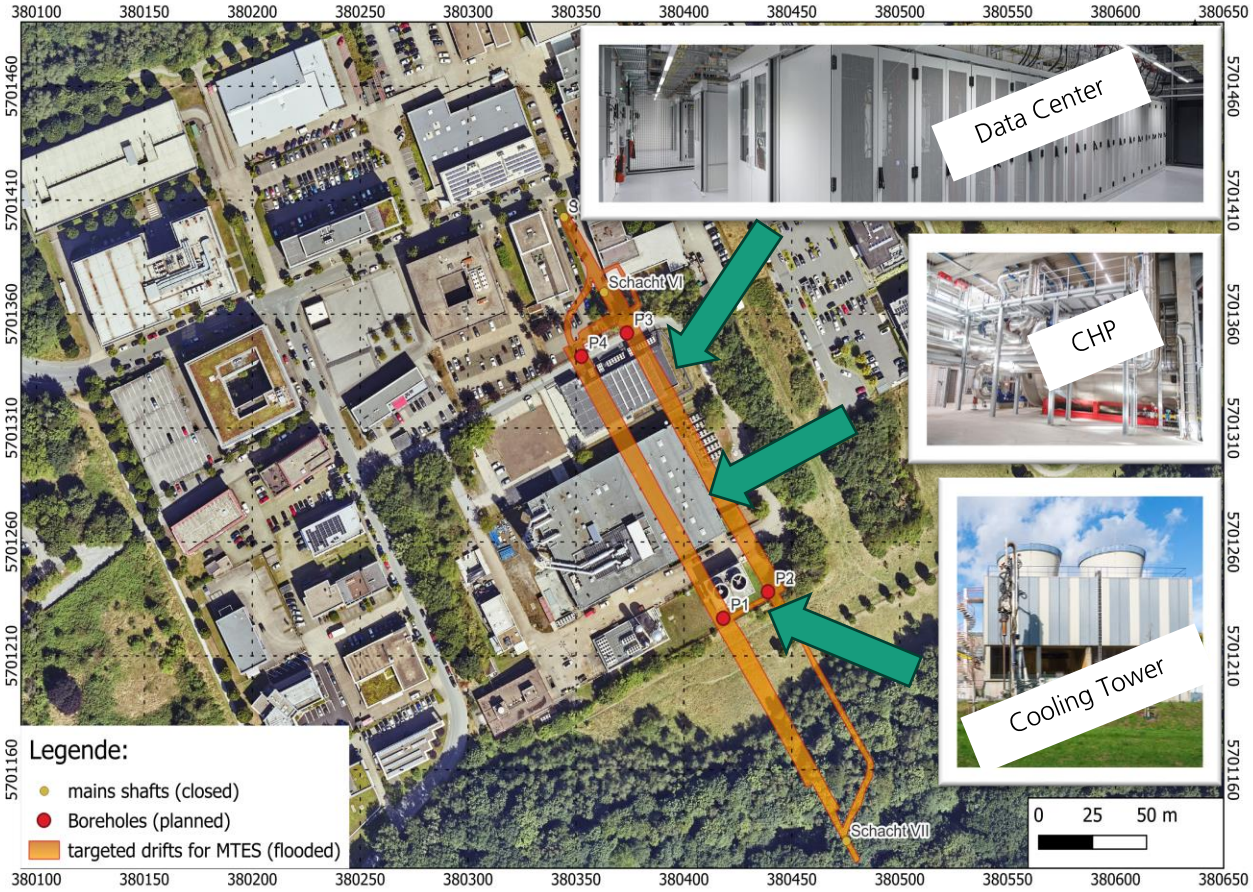
PUSH IT pilot site for MTES

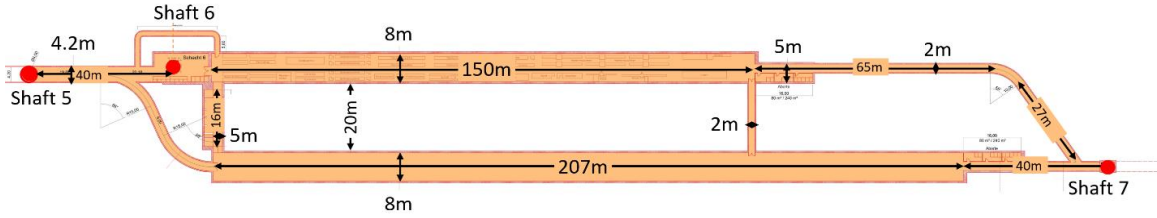
Mansfeld colliery and University technical centre

Bochum site: **MTES pilot**

Mine Thermal Energy Storage







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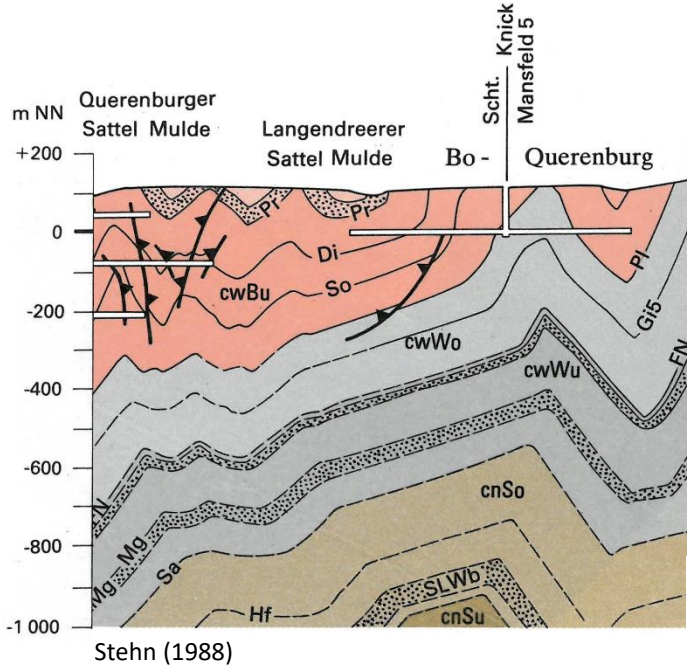
Geological site assessment

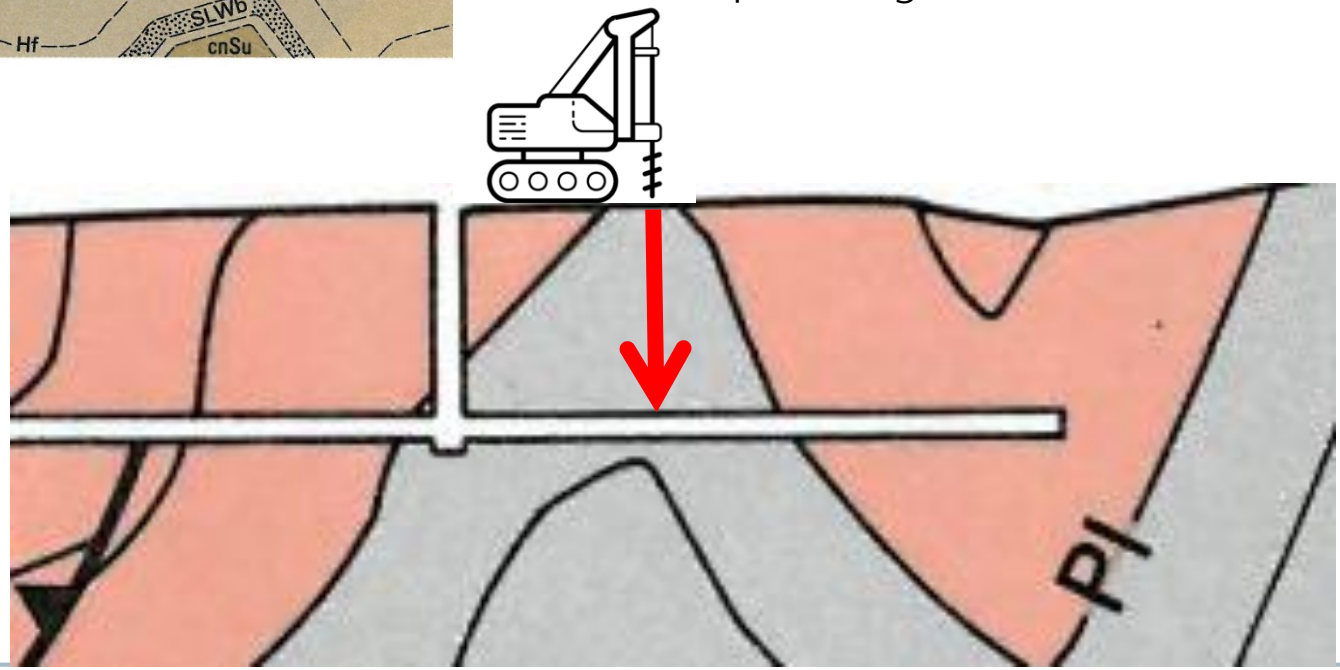
Area of the former Mansfeld colliery

- Alternating layers of the Upper Carboniferous
  - Local saddle and basin structures **with steeply dipping claystones** (≥70°)
  - interbedded sandstone layers with isolated, soft (laminar to thin-banked) coal seams
- Large-diameter borehole (12 ¾")
- **Goal of the project: drill into flooded mine and run demo test**



Stehn (1988)

Drilling **120 m deep** into two parallel galleries



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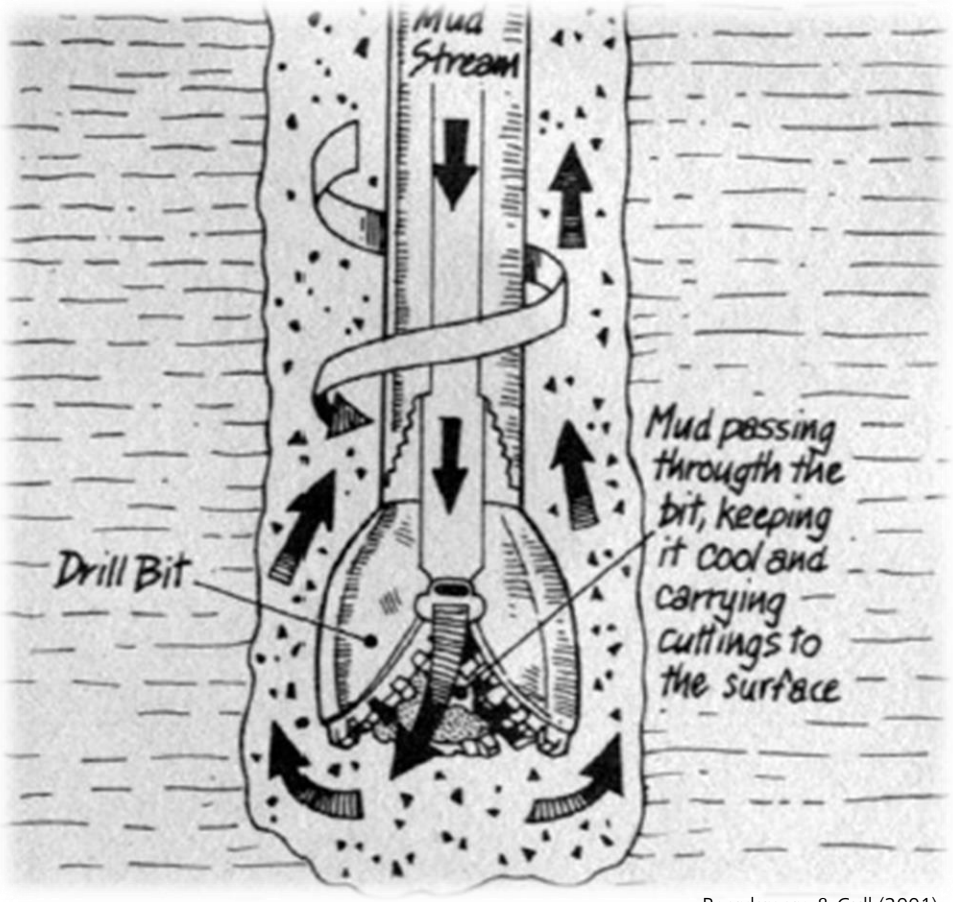
Drilling work

Hütte HBR 207 GT

Double Rotary Drilling

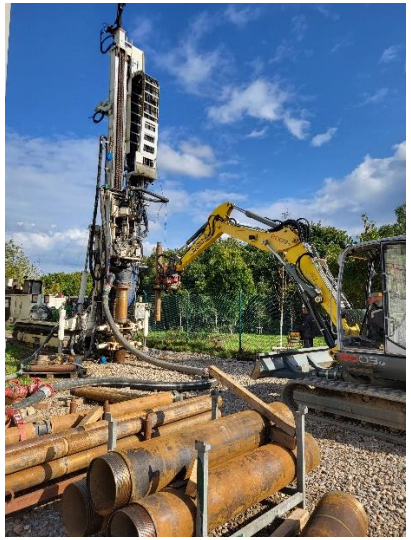


Beardsmore & Cull (2001)

Sampling Cuttings

Drilling and borehole completion

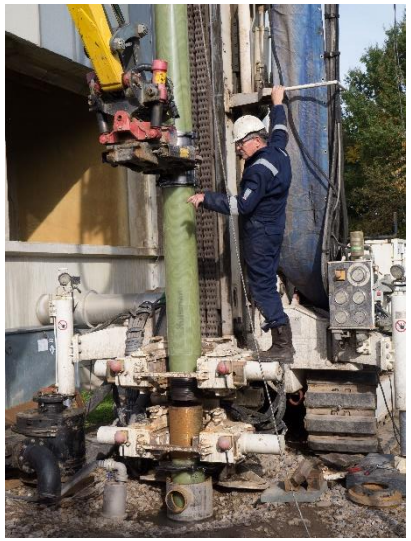
- Drilling work since September 2024 → one monitoring well, three boreholes (**120 m depth**) into flooded mine



Drill rig with conductor and drill pipes

Wire wrapped screen tubes for MTES well P2

Installation PVC filter screen (in observation well P1)



Installation of GRE casings at P2

Geophysical logging and camera inspection

- **Well path / deviation survey** (x, y, z, φ, i)
- **Gamma Ray**
- **ABI** (Acoustical Borehole Televiewer)
- **OBI** (Optical Borehole Televiewer)
- **BHFS** (Borehole Fluid Sampler
- **Camera** inspection

borehole camera with centralizers

Here you can watch our **sampling video**!

optical televiewer

Camera inspection and water sampling

Tapping into flooded mine void (via camera inspection)

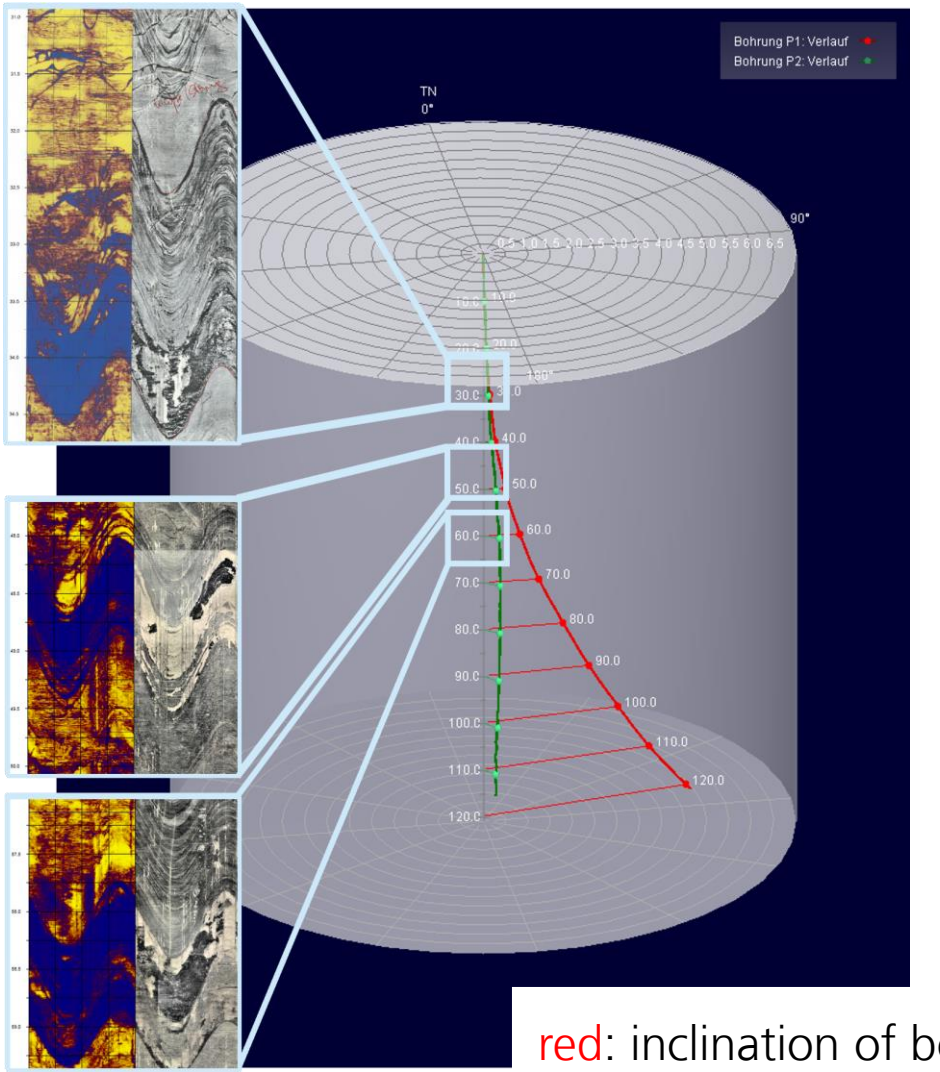
Well P2

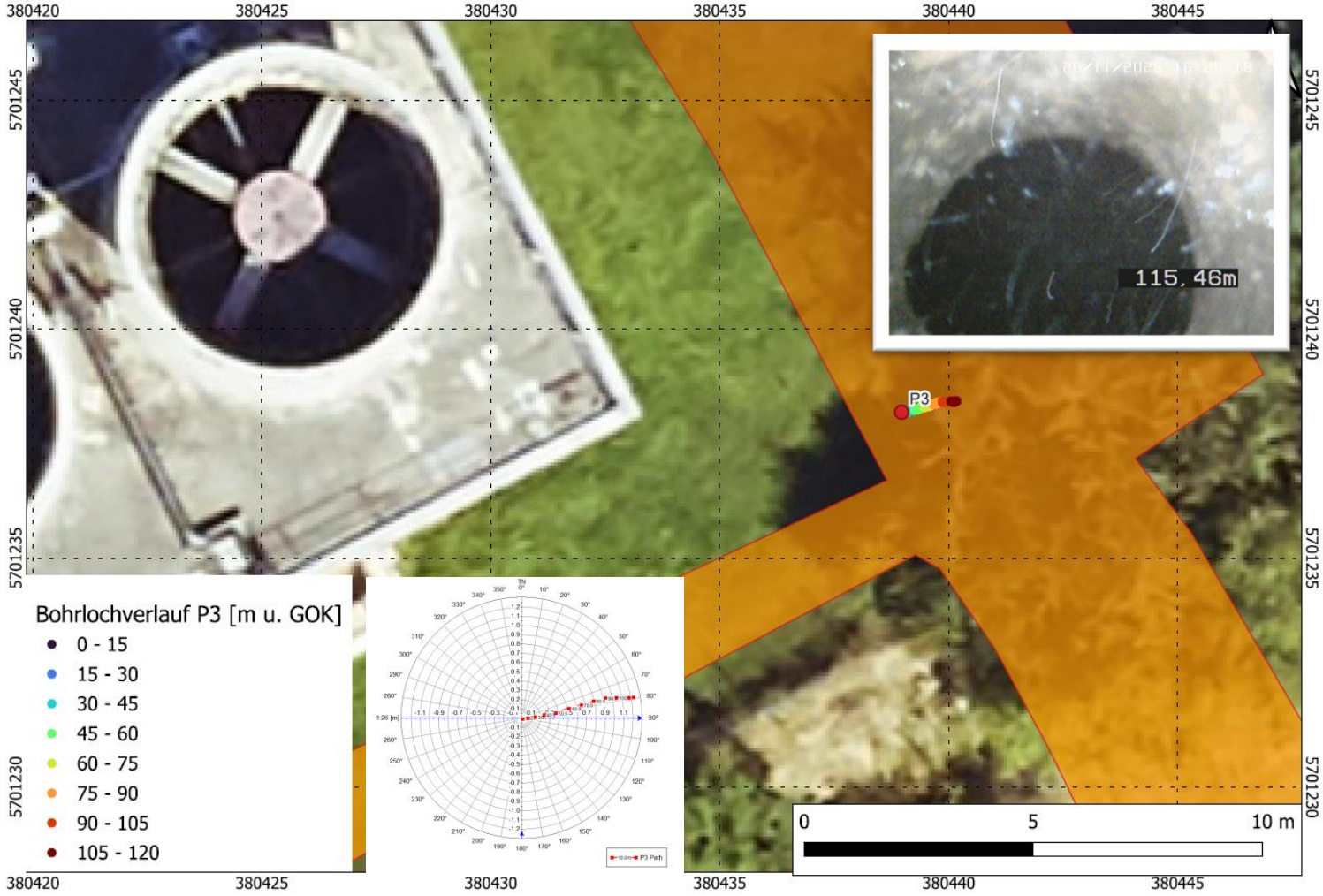
T 12.6°C
EC 850 µS/cm
O2 5.0 mg/L
pH 7

mine water sampling

camera inspection through borehole with underwater drone

Lessons learned drilling





borehole P3

red: inclination of borehole P1
green: inclination of borehole P2

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PUSH IT pilot site for MTES

Next steps and lessons learned

2026

Drilling and completion of all 4 boreholes, followed by in-situ tests (geophysical logging, camera runs, microbiological and geochemical sampling, tracer test, pumping and injection tests)

MTES circulation and performance test

If applicable, connection (ground)works to the technical centre and system testing

On going

Co-Simulation, Numerical Model (Spring®)

Engagement and Communication

Fence banners

Childrens book about MTES

„Lessons learned“

Stakeholder management is essential

Planning is very time-consuming

Early consultation with the responsible authorities

Adjust drilling method if necessary, ensure horizontal drilling, avoid deflection

Further improvement of camera inspection

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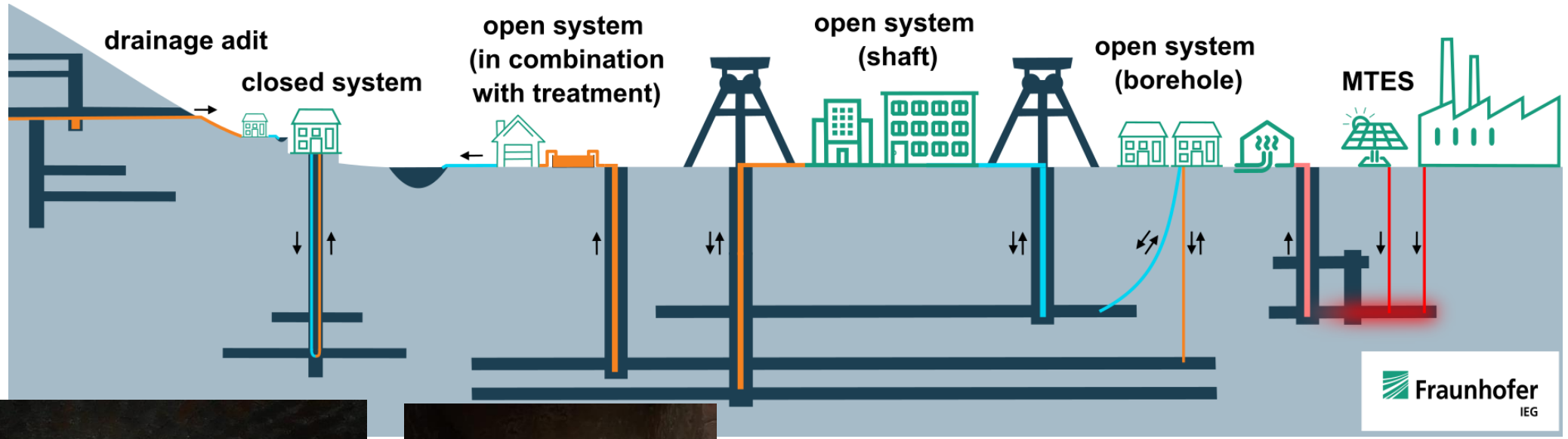
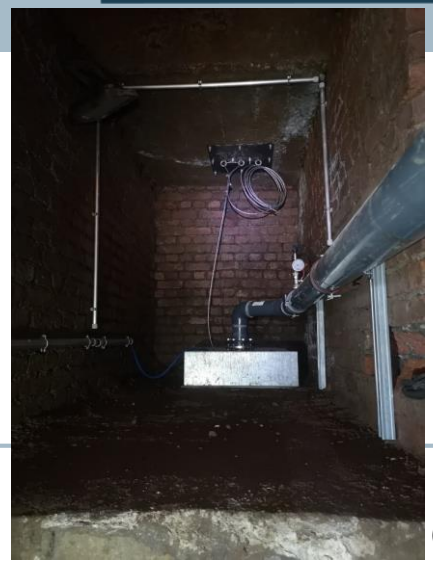
Future of Mine Water Geothermal – Heating, Cooling and Storage

Access to the mine



Bad Ems (Germany), photo T. Gökpinar



Herdorf
(Germany)

Pozo Barredo
(Spain), photo F. Hahn

Mine Water Geothermal

From eternal burdens to long lasting assets.

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