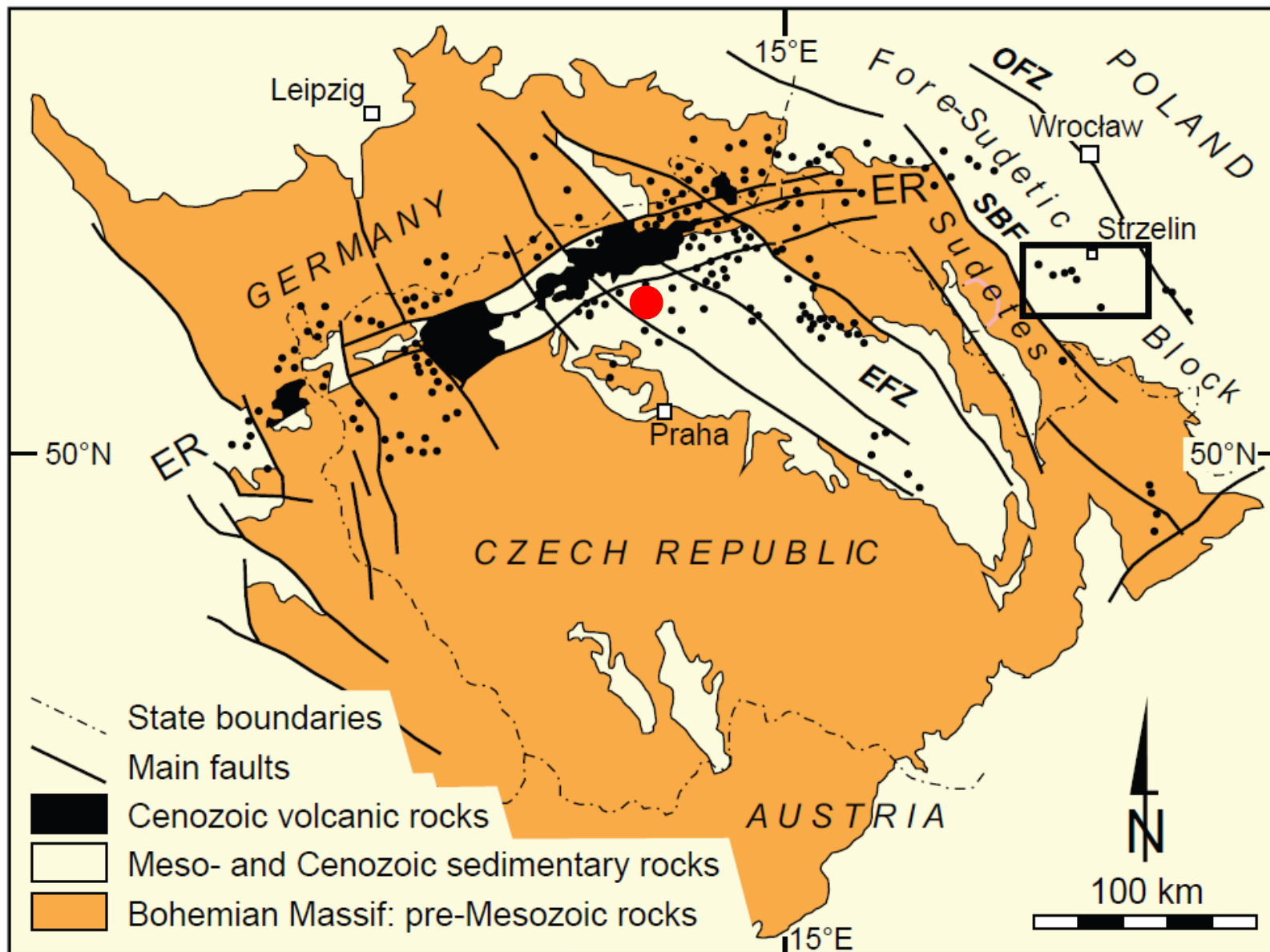


Development of a multi-technology geothermal test site at Litoměřice Czech Republic

David Bruhn

TU Delft

with material provided by the Czech Geological Survey



- Litoměřice
- ER Eger Rift
- EFZ Elbe Fault Zone
- SBF Sudetic Boundary Fault

From: AWDANKIEWICZ et al. (2016),
after Holub et al. (2010)

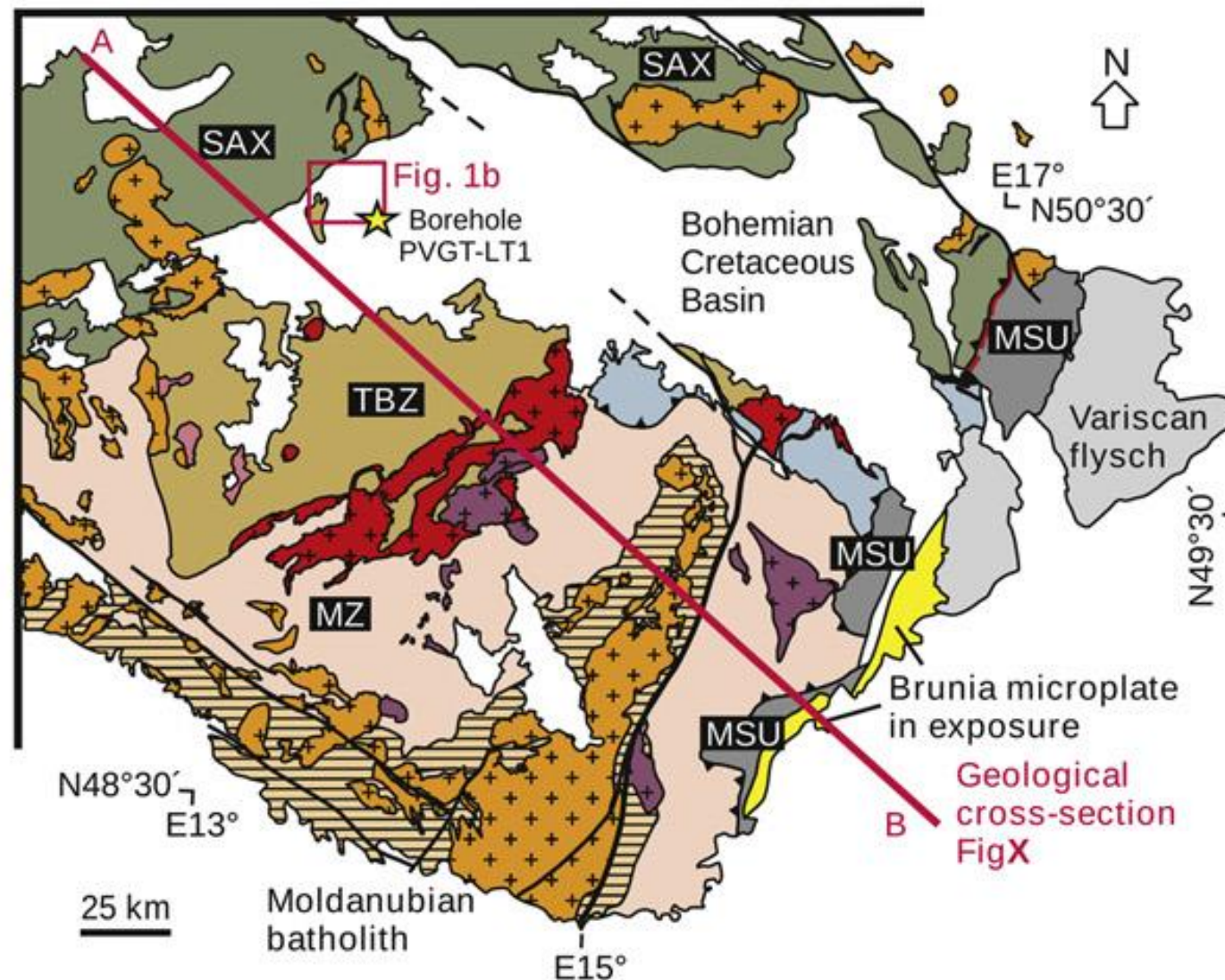
(a) Simplified geological map of the Bohemian Massif

Legend:

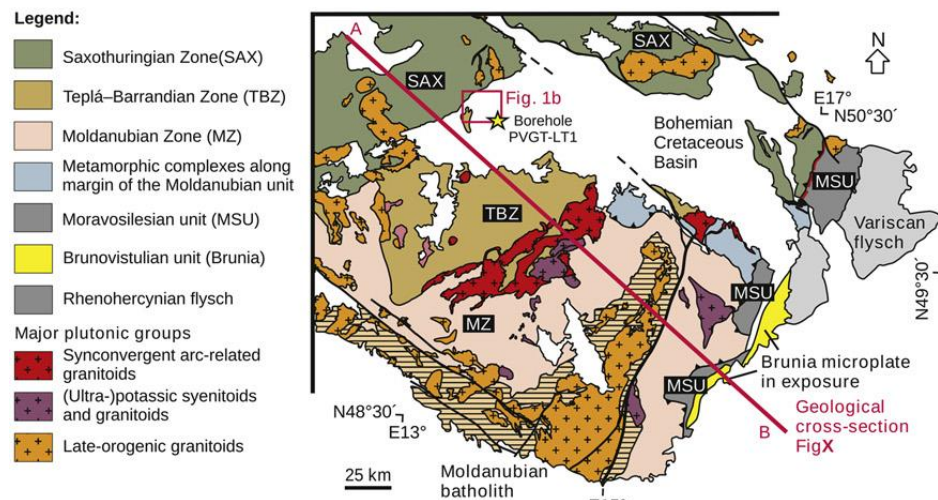
- Saxothuringian Zone(SAX)
- Teplá–Barrandian Zone (TBZ)
- Moldanubian Zone (MZ)
- Metamorphic complexes along margin of the Moldanubian unit
- Moravosilesian unit (MSU)
- Brunovistulian unit (Brunia)
- Rhenohercynian flysch

Major plutonic groups

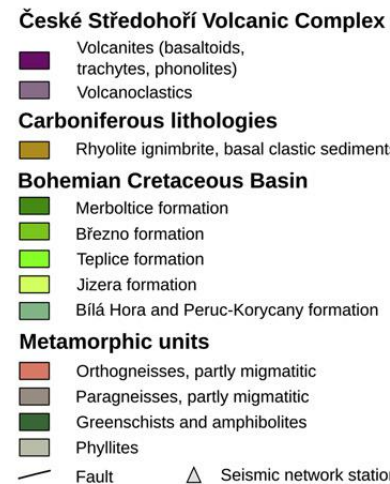
- Synconvergent arc-related granitoids
- (Ultra-)potassic syenitoids and granitoids
- Late-orogenic granitoids



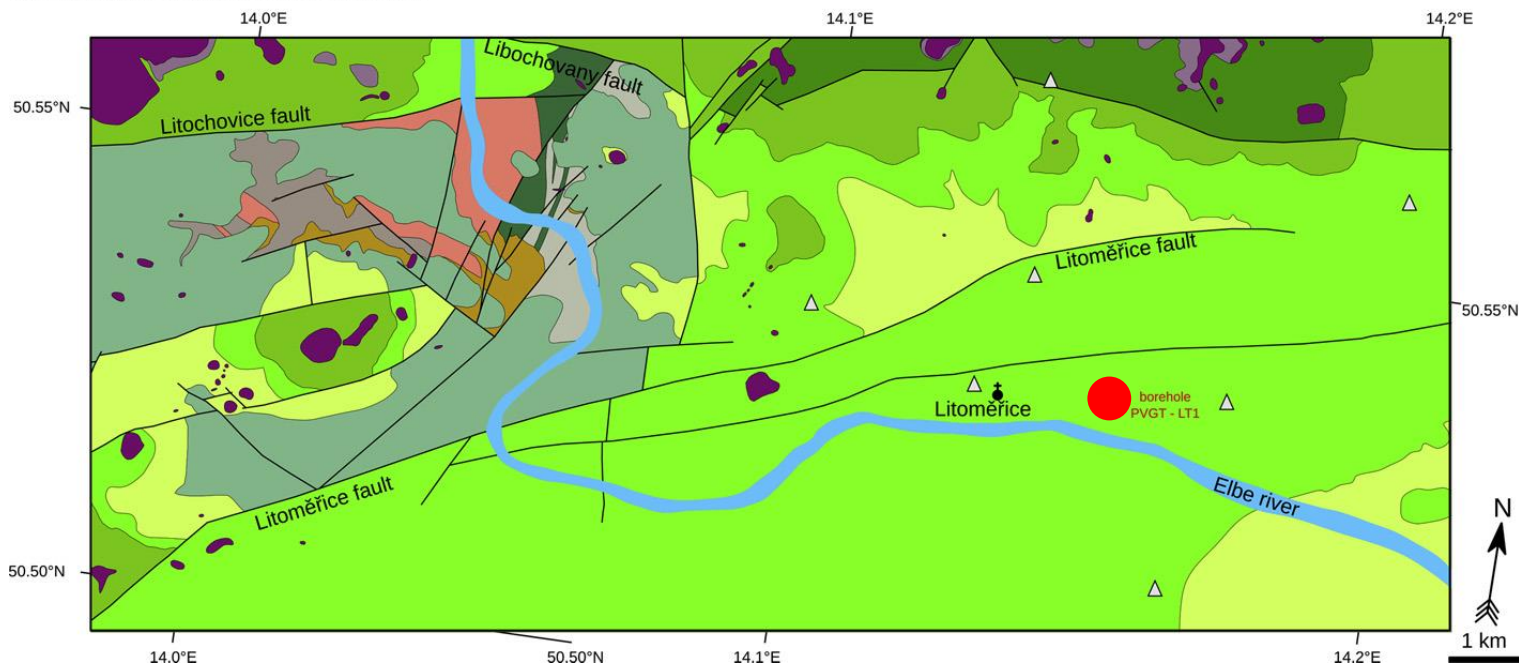
(a) Simplified geological map of the Bohemian Massif



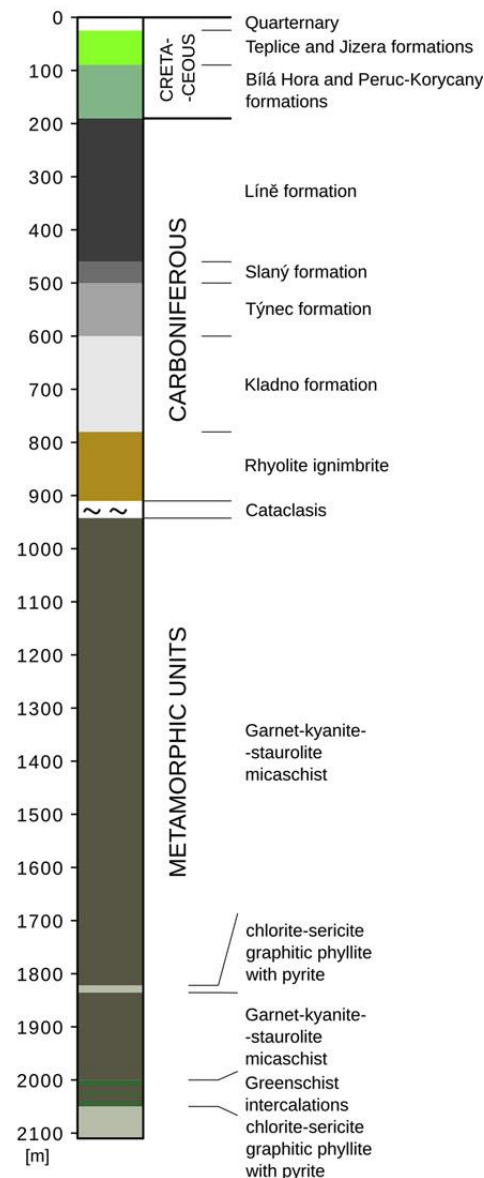
Legend



(b) Geological map of the Litoměřice area

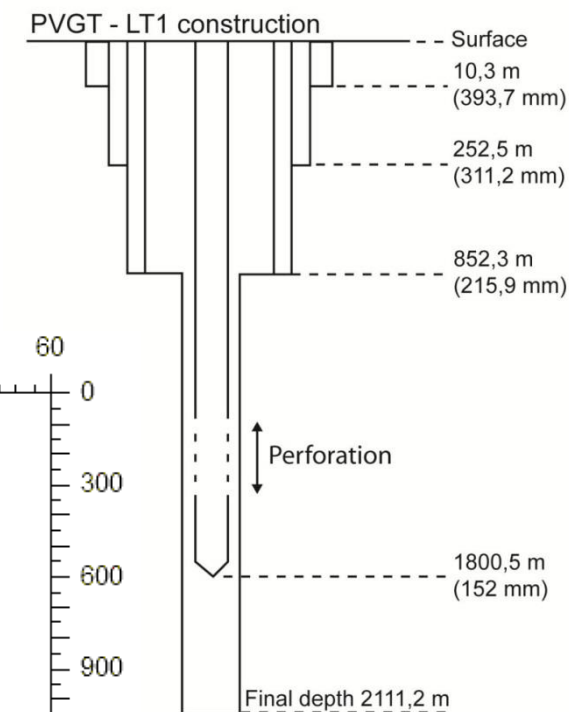
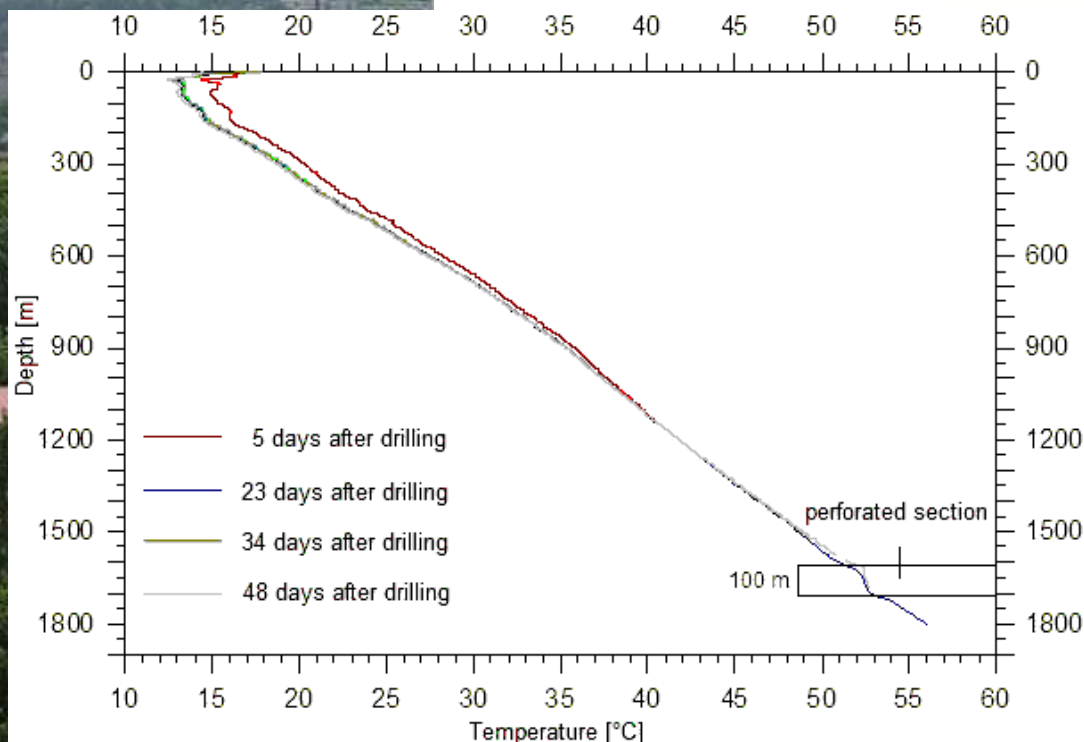
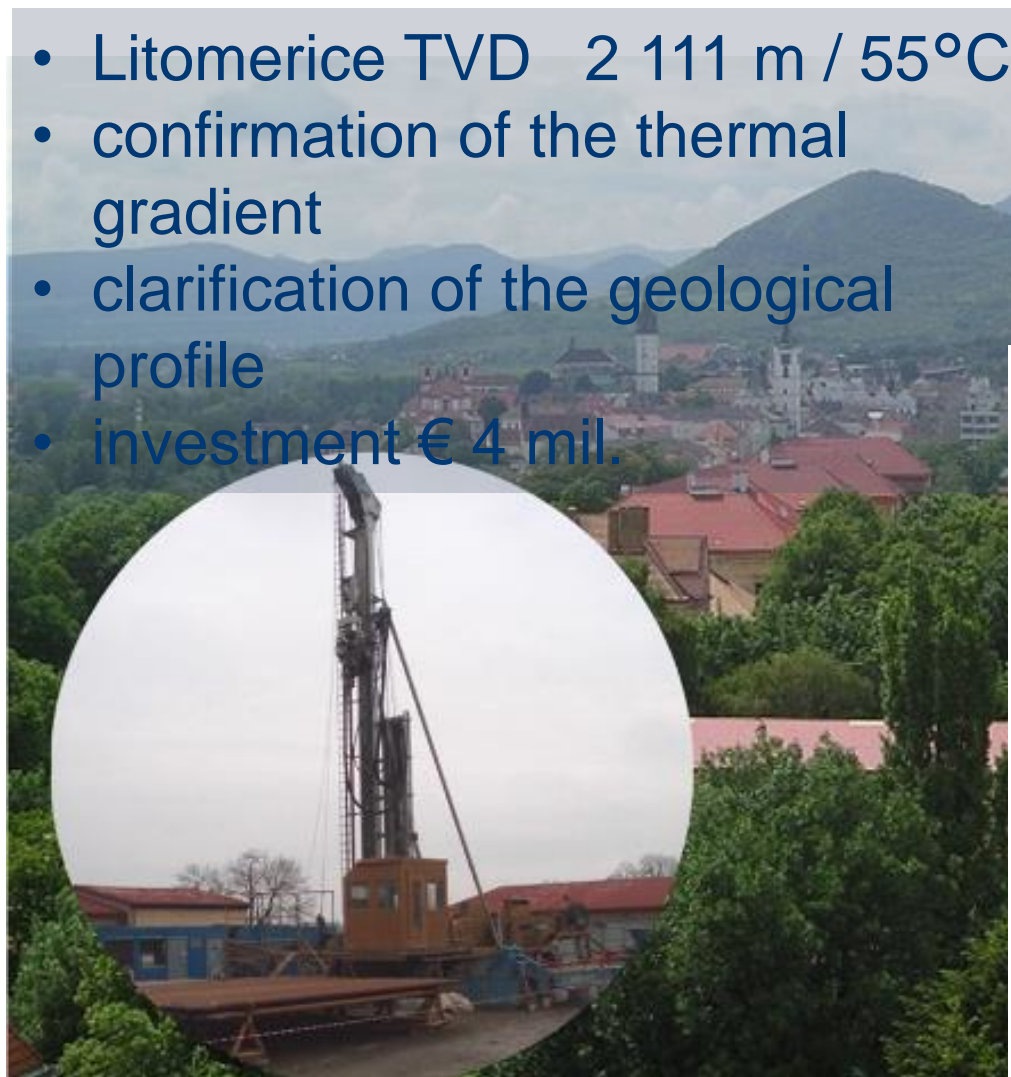


(c) Borehole profile PGVT - LT1



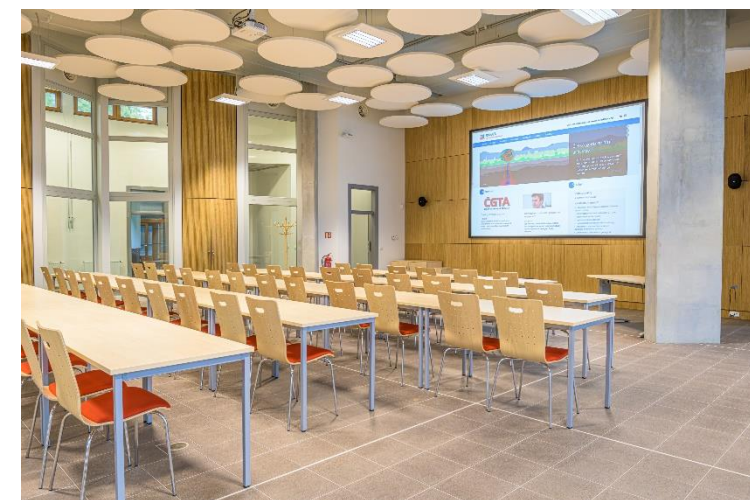
Step 1: GTE exploratory well drilled 2007-2008

- Litomerice TVD 2 111 m / 55°C
- confirmation of the thermal gradient
- clarification of the geological profile
- investment € 4 mil.



RINGEN – research centre for geothermal energy utilisation

Launched in 2020, site of decommissioned military barracks of Litoměřice



Total area of **9 ha**
6 labs of 40 to 108 m²
800 m² of storage space

&

PVGT exploratory well 2,1 km
Seismic monitoring network
(incl. boreholes)



Litoměřice geothermal project milestones

2004

introduction of the EGS geothermal concept & EU field trip

2007

drilling of exploratory well LT1 to 2,1 km

2014

RINGEN research centre established

2020

RINGEN finished & starting operation

2020

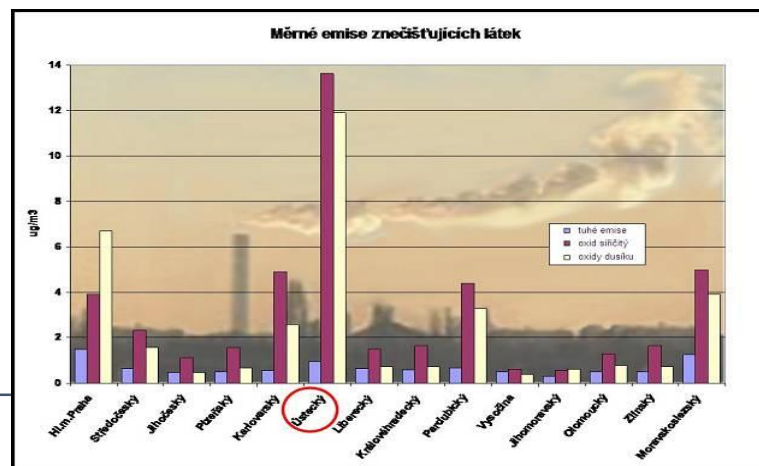
Just transition mechanism starts

2021

strategic projects in 3 regions approved

2022+

SYNERGYS full proposal preparation & submission



New R&D project

Implementation: 2023-2027

Expected budget: € 50 milion (€ 40 mil. INV costs) – EU Just Transition Fund

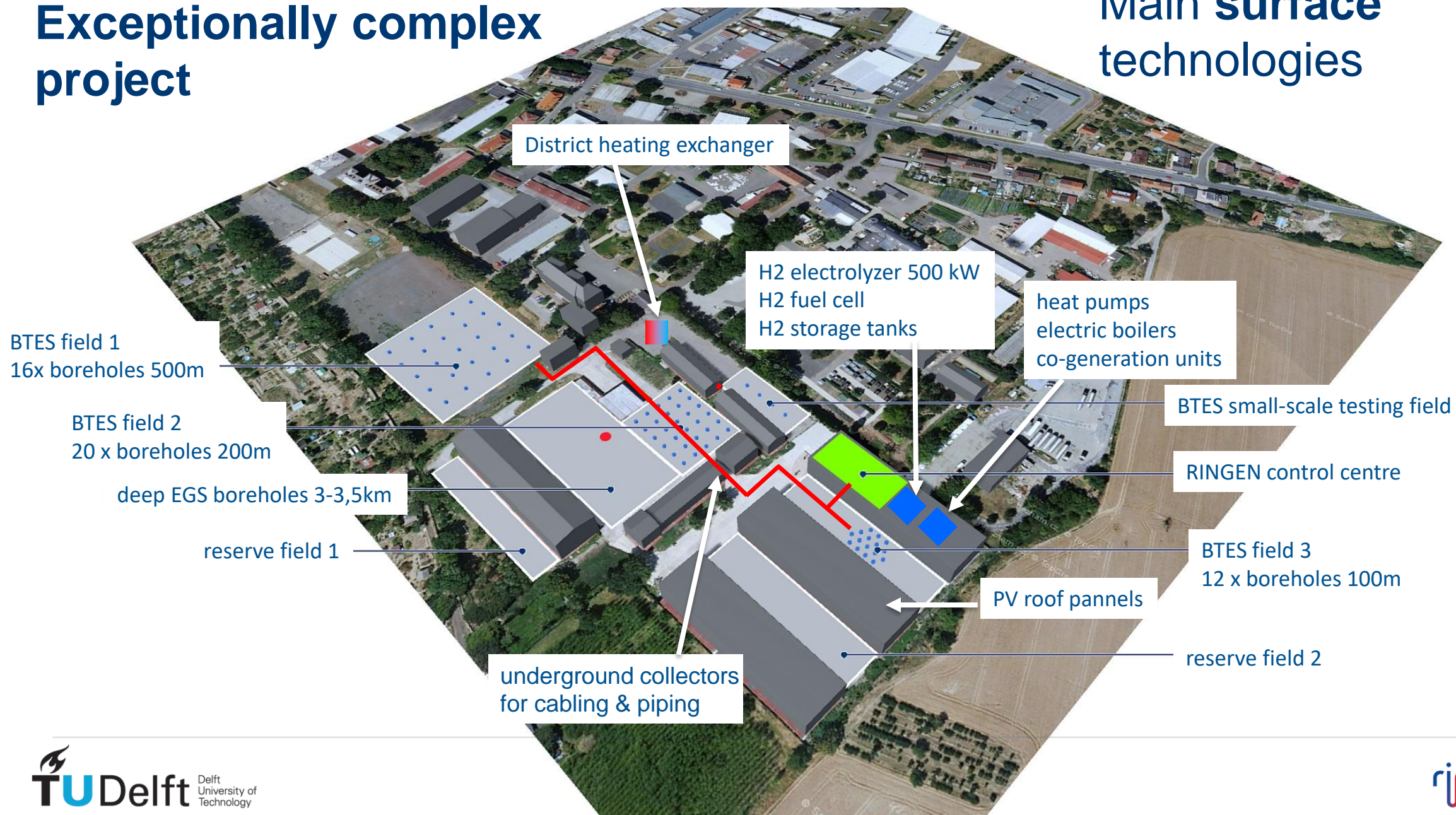


Main goals:

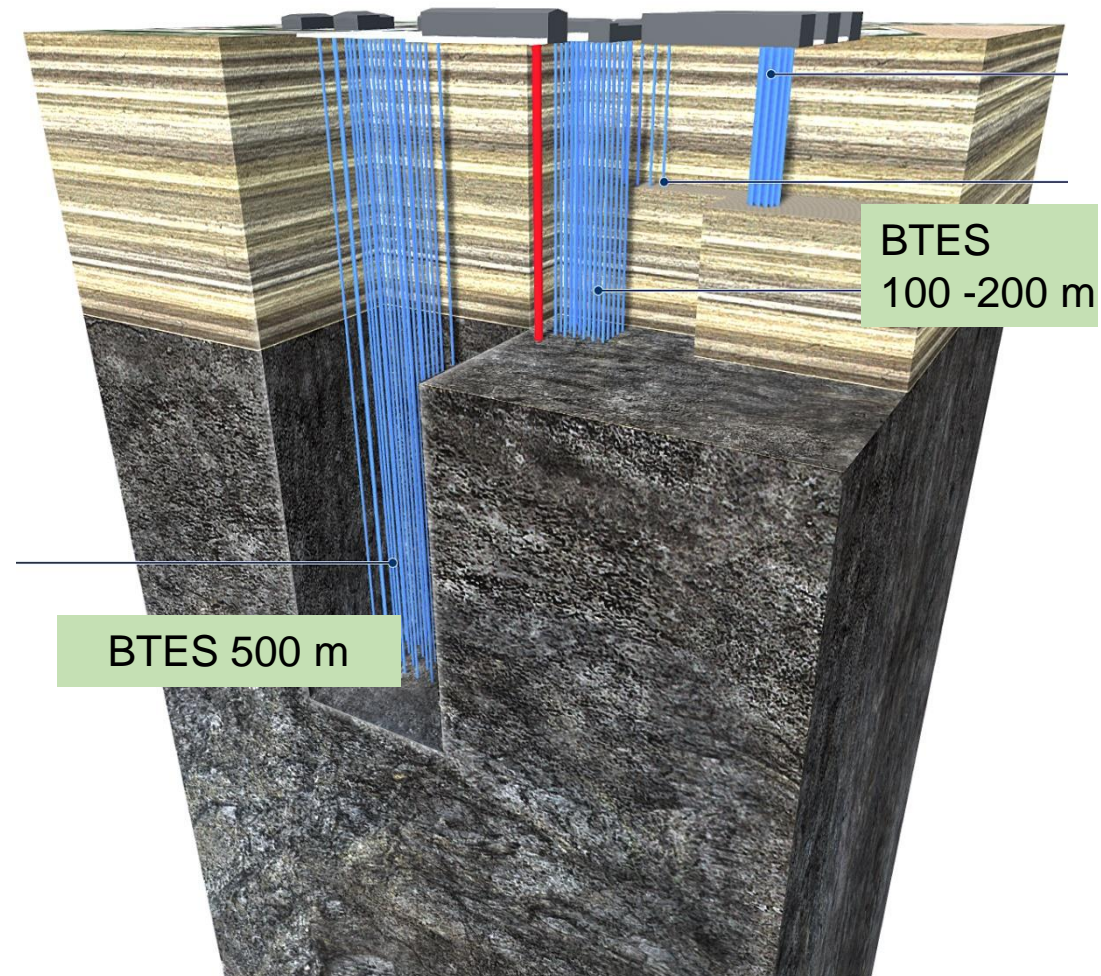
- to address problems and challenges related to **energy transition of the coal regions**
- to increase **energy efficiency** and **replace fossil fuels** in **district heating systems**
- to develop **new clean energy resources** and **underground energy storage systems** and their integration
- **complex of pilot technologies**: deep GTE source, borehole thermal energy storage (BTES) in various depths (100-500m), **green H₂** unit & **PV power plant** (1MW) & other waste energy sources
- to develop a brand **new geoenergy sector** absorbing experts from mining industry & fossil energy sector
- to expand **cooperation between public R&D and business** sector

Exceptionally complex project

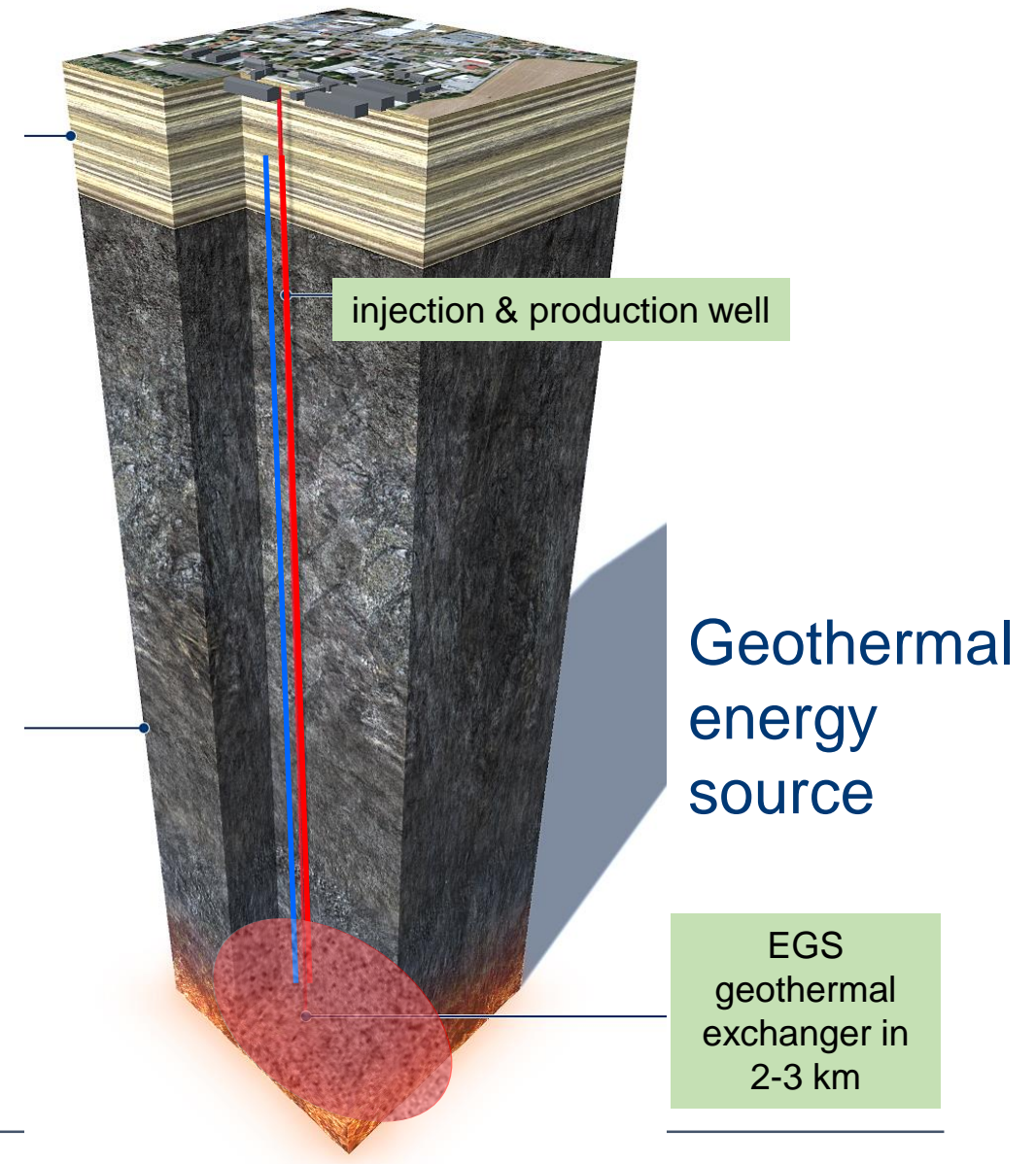
Main surface technologies



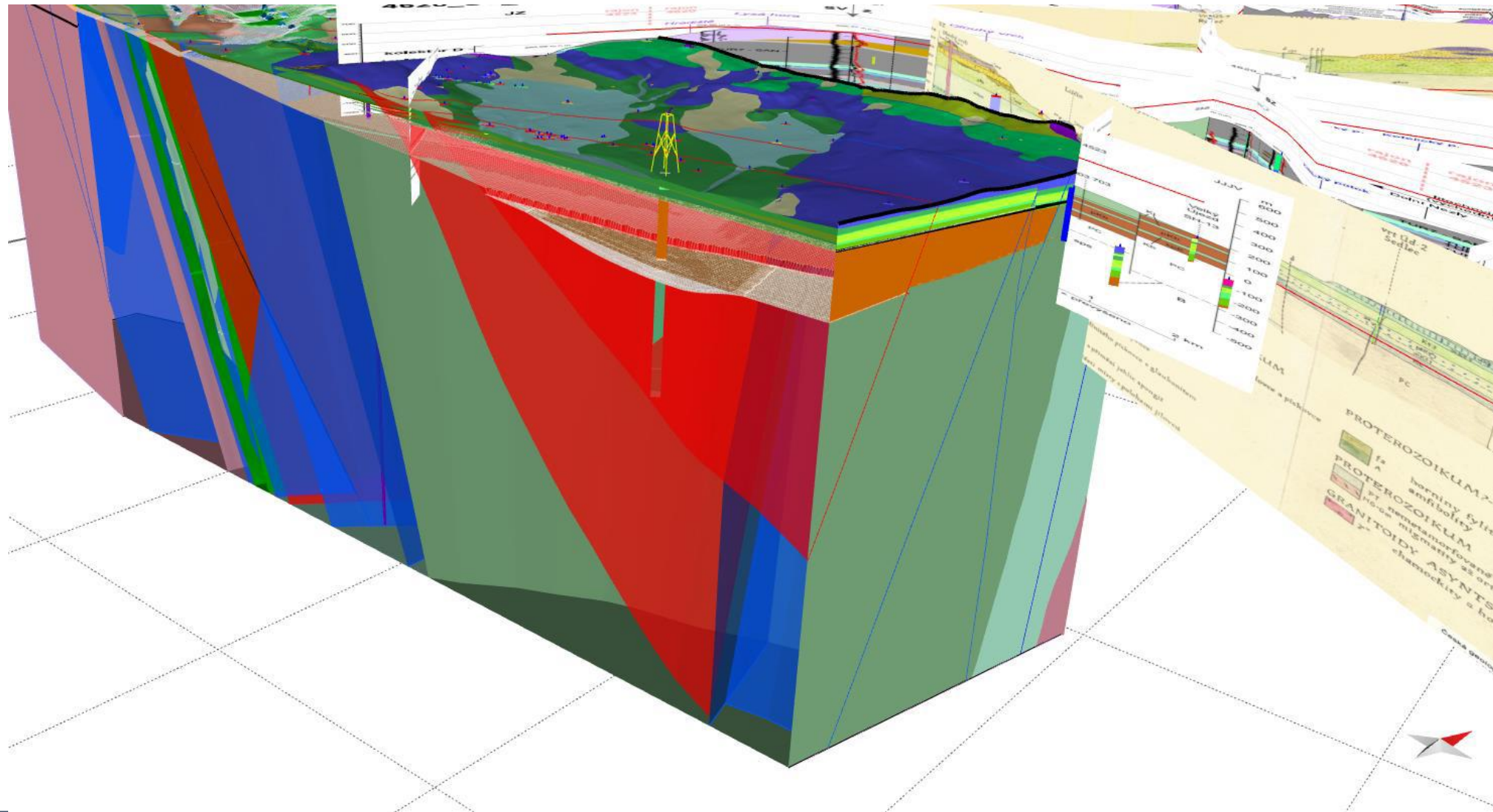
Main subsurface technologies



Borehole thermal energy storage



Geological Model



Main subsurface technologies:

Enhanced Geothermal System - EGS

- **Target production rate: >20 L/s**
 - Flow rate of DH network, winter: ~100 L/s (350m³/hr)
 - Flow rate of DH network, summer: ~ 20 L/s (75m³/hr)
 - Comparison: Soultz-sous-Forêts: ~ 30 L/s
 - **Target temperature: ~85° C @ DHS**
 - For a modern district heating network sufficient for winter
 - Target reservoir temperature: ~100 C to achieve ~85 C @ DHS•
 - Heat pumps can be used to increase temperature as required
- > First time EGS used for heating**
- > Can provide the complete heating demand of Litoměřice DHS in the summer**

Main subsurface technologies: EGS development concept

1) Drill and
complete
vertical GT1

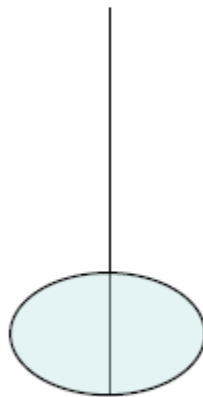
GT1



12 1/4" drill bit
9 5/8" casing

2) Test-
stimulation
in vertical GT1

GT1



In 10-20 m open hole

3) Drill deviated
side-track
of GT1

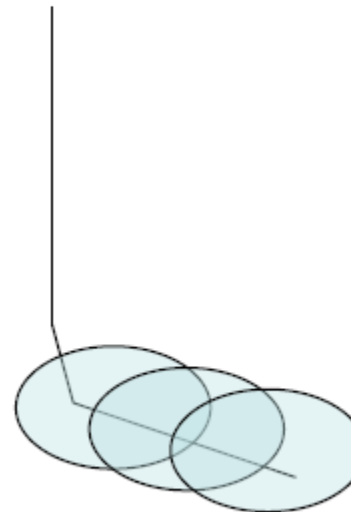
GT1



8 1/2" drill bit
7" casing

4) Multi-stage
Stimulation & testing
of GT1

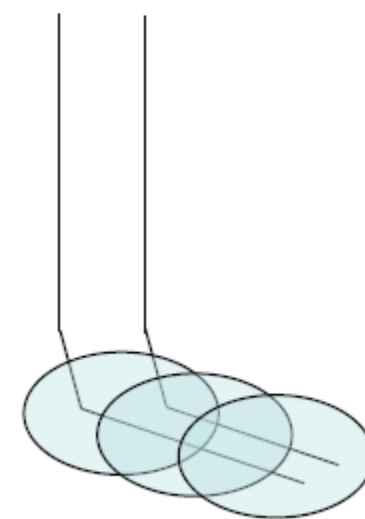
GT1



Plug and perf

5) Drill GT2
parallel
to GT1

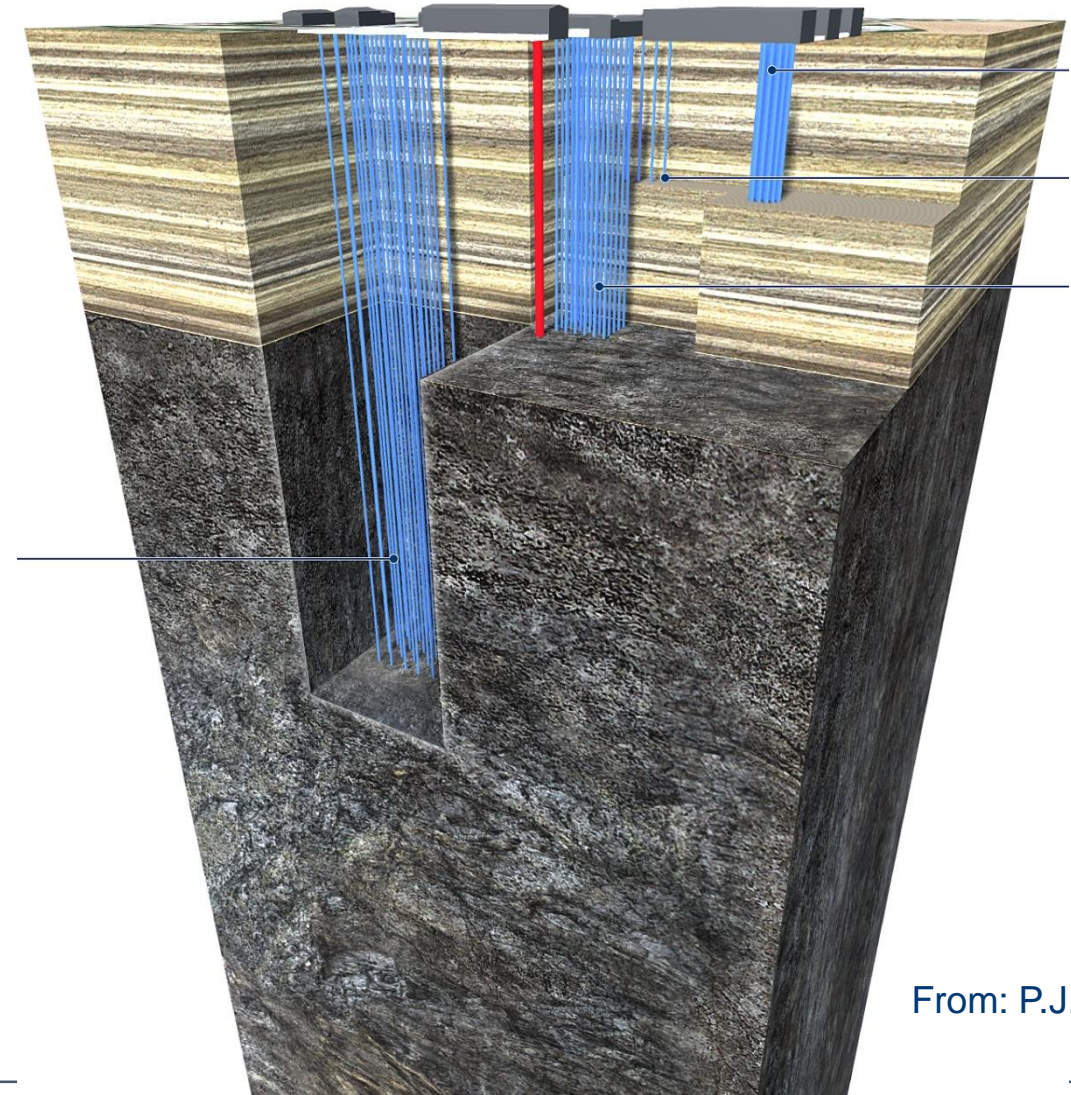
GT1 GT2



Slotted liner, potential
stimulation of GT2

Main subsurface technologies: **BTES**

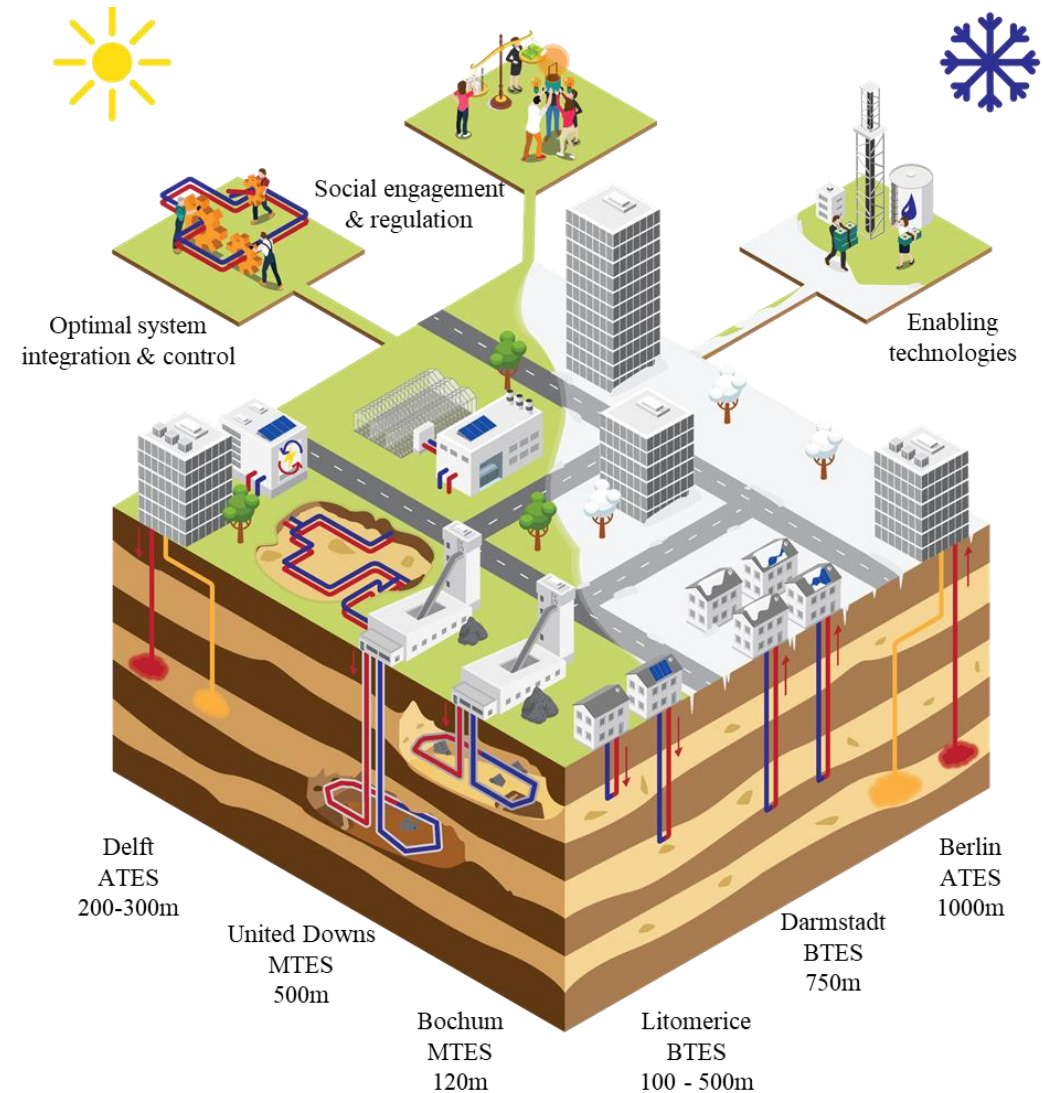
- 3 borehole fields:
 - LT: ~100m, 5-15°C
 - MT: ~200m, 15-30°C
 - HT: ~500m, 30-70 or 80+°C
- Store heat efficiently and support overall energy system



From: P.J. Vardon

BTES @PUSH-IT: early start

- Technical demonstration
- Integration into heating system: demand and supply control
- Litoměřice: First 2 BTES wells in early 2023
 - Testing of coring and drilling method



Project consortium members

- **Czech Geological Survey** - leader
- University Centre for Energy Efficient Buildings, Czech Technical University in Prague (UCEEB)
- Faculty of Science /RINGEN, Charles University
- University J.E. Purkyně in Ústí n.L.

in cooperation with:

- Energie holding & Town of Litoměřice as strategic partners
- international expert network: GFZ Potsdam, **TU Delft**, Fraunhofer institute IEG, TU Darmstadt, ETH Zurich, EOST Strasbourg



Litoměřice – main plans

- a **large test area** with experimental novel energy sources and scientific background with up to 50 shallow wells (100-500m) and 2 deep wells (~ 3 km)
- enhanced **geothermal (EGS) plant** up to 5 MWth output/35 GWh
- underground **thermal energy storage** BTES – up to 5 GWh capacity/1,5MW
- integrated **geoenergy laboratory**
- photovoltaic system **hybrid PV panels** (~250 kW) (combined heat&electricity)
- **H₂ unit** (0,5MW/10t) & **fuel cell unit** (100 kW) for all-year electricity coverage
- first CZ **training centre for geoenergy** and related fields
- **unique data** and information available **in open access** regime
- many other technologies integrated (HT heat pumps, co-generation units etc.)

Test and Demonstration Site Litoměřice – RINGEN

- Exceptionally complex project, integrating
 - Next generation EGS with most advanced stimulation concept
 - Most up-to-date BTES for seasonal heat storage
 - Multiple heat sources
 - Multiple heat usage – buildings, various storage systems, local grid

- International cooperation

PUSH-IT (19 partners in Horizon Europe project)

Geoenergie Suisse, leading technology developer

leading European geothermal research institutions

**-> World Class Research Infrastructure for geothermal applications
and system integration**

Thank you for your attention