TRANSGEO

Transforming abandoned wells for geothermal energy production

Interreg CENTRAL EUROPE
Co-funded by the European Union

TRANSGEO

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What is the potential for development of green energy from abandoned oil and gas wells in central Europe?

Interreg CENTRAL EUROPE

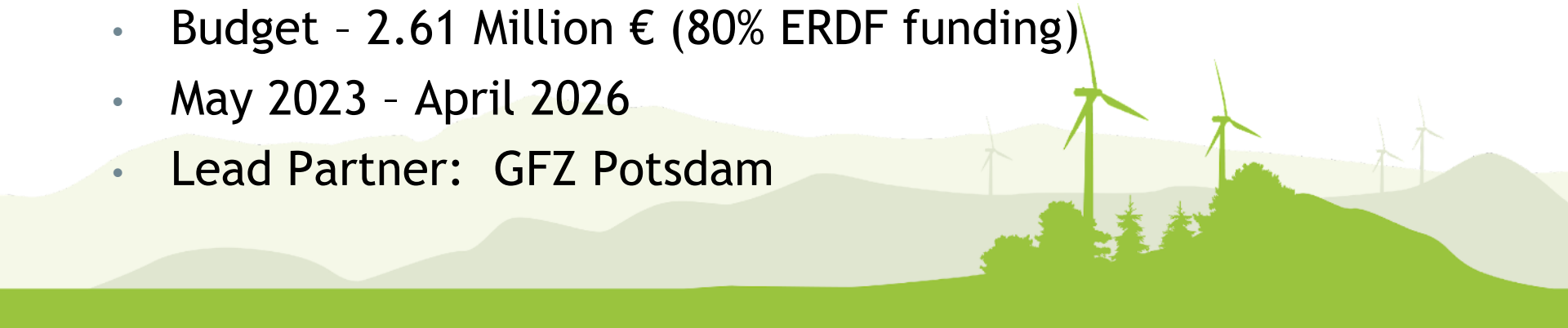
EU funding program for cohesive regional development, to find solutions for joint challenges such as climate change, in an area divided by the “Iron Curtain”, to contribute to a united and stronger central Europe

Programme priority:
Cooperate for a greener central Europe

Objective:
Support the energy transition to a climate-neutral central Europe

TRANSGEO – information and tools for municipalities, industry, and agriculture to reuse old wells for their needs with increased knowledge and decreased risk

- 11 Partners
- 5 Countries – Germany, Austria, Hungary, Croatia, Slovenia
- Budget – 2.61 Million € (80% ERDF funding)
- May 2023 – April 2026
- Lead Partner: GFZ Potsdam



Partners

GREENWELL ENERGY

GFZ Helmholtz Centre POTSDAM

oneo

LBGR Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg

BVH

GeoSphere Austria

CROST

University of Zagreb FACULTY OF MINING GEOLOGY AND PETROLEUM ENGINEERING

MEĐIMURSKA ENERGETSKA AGENCIJA d.o.o.

LEA Pomurje Lokalna energetska agencija za Pomurje

PÉCSI TUDOMÁNYEGYETEM UNIVERSITY OF PÉCS

Associated Partners

REPUBLIKA HRVATSKA Međimurje MEĐIMURSKA ŽUPANIJA

REPUBLIKA SLOVENIJA GOV.SI

AUSTRIA AG

Geologischer Dienst Nordrhein-Westfalen – Landesbetrieb –

Amt der NÖ Landesregierung

growth RASt

KORMÁNYHIVATALOK

GeoZS Geološki zavod Slovenije

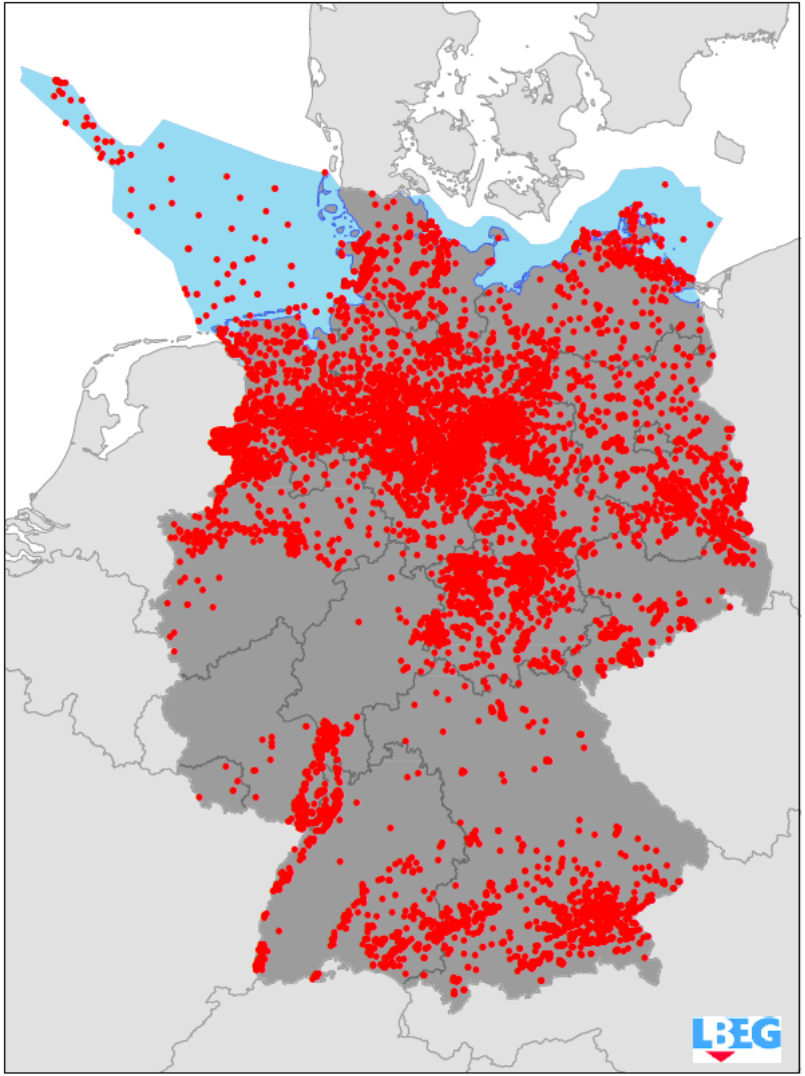
Bundesministerium Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie

AZU Agencija za ugljikovodike

Why reuse old wells?

There are thousands of abandoned and soon to be abandoned oil and gas wells in central Europe

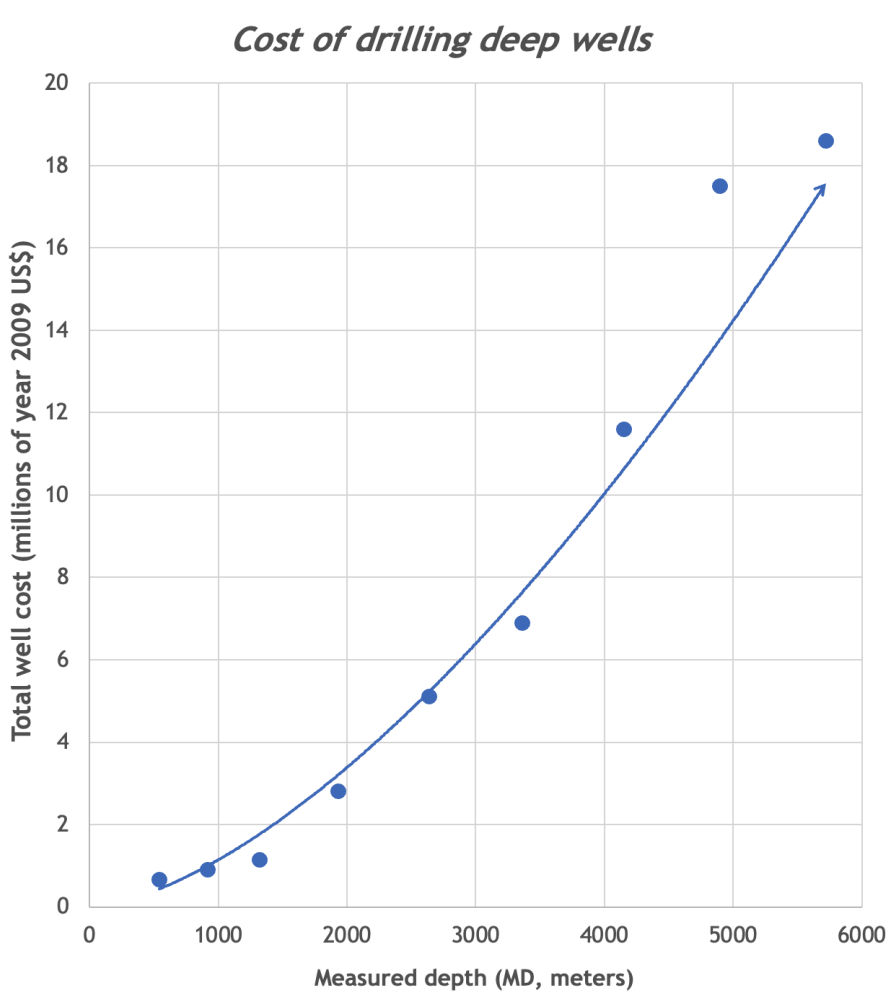
- Germany: >20.000 *(Jordan et al., 2022)*
- Hungary: >8.000 *(pers. comm.)*
- Austria: >4.000 *(pers. comm.)*
- Croatia: >3.000 *(Kurevija and Vulin, 2011)*
- Slovenia: >100 *(pers. comm.)*



Why reuse old wells?

€ millions may be saved by re-purposing existing infrastructure

- A new deep well would cost a few million €
- Well reuse may be more financially viable to small companies / municipalities interested in green energy solutions
- Reuse before abandonment!

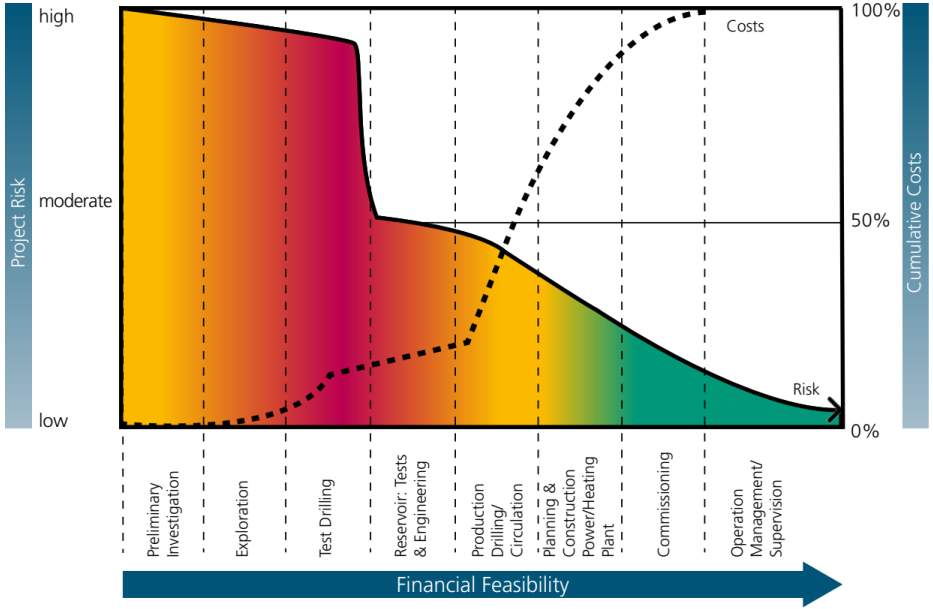


(after Tester et al., The Future of Geothermal Energy, 2006)
(Data from Joint Assoc. Survey on Drilling Costs, indexed to 2009 US$)

Why reuse old wells?

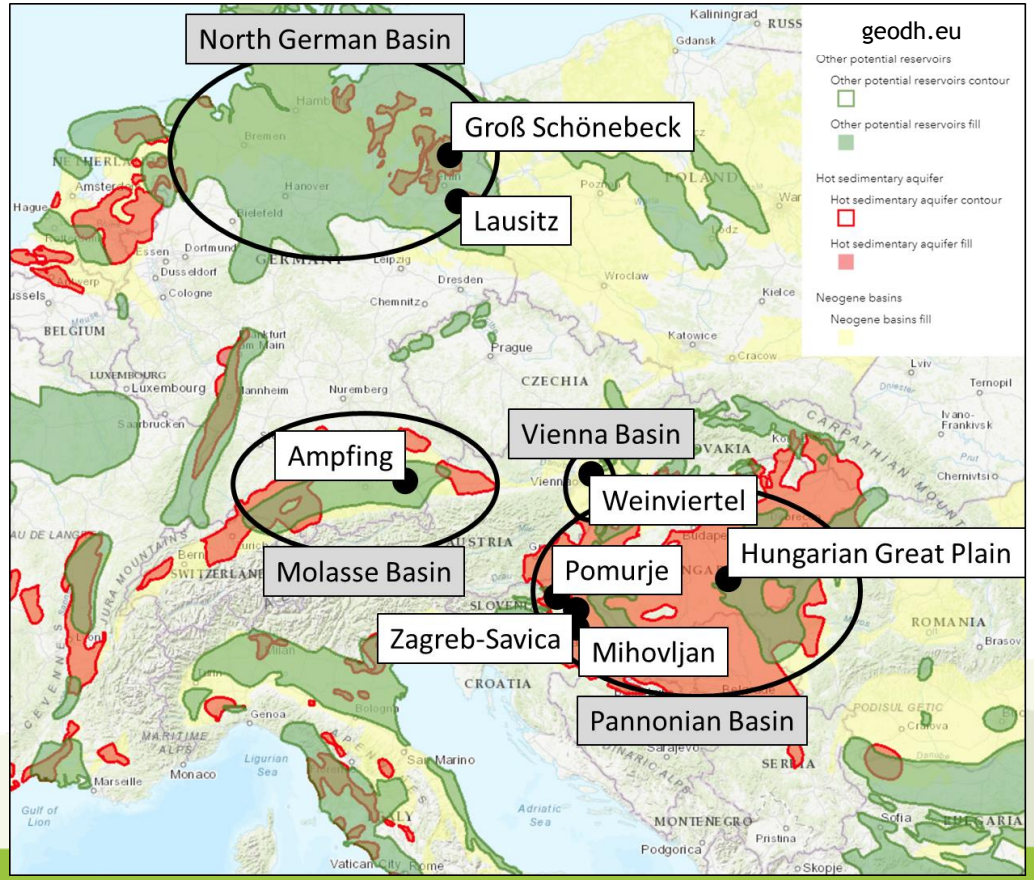
Exploration risk is reduced by using existing data

- The biggest hurdle for geothermal development is the exploration risk associated with the high upfront investment for drilling
- Knowledge about the subsurface reduces barriers for large-scale and fast geothermal development



Development phases of a geothermal heating plant with cost progression (Bracke & Huenges, 2022)

TRANSGEO - 4 Basins and 8 Pilot Sites/Regions

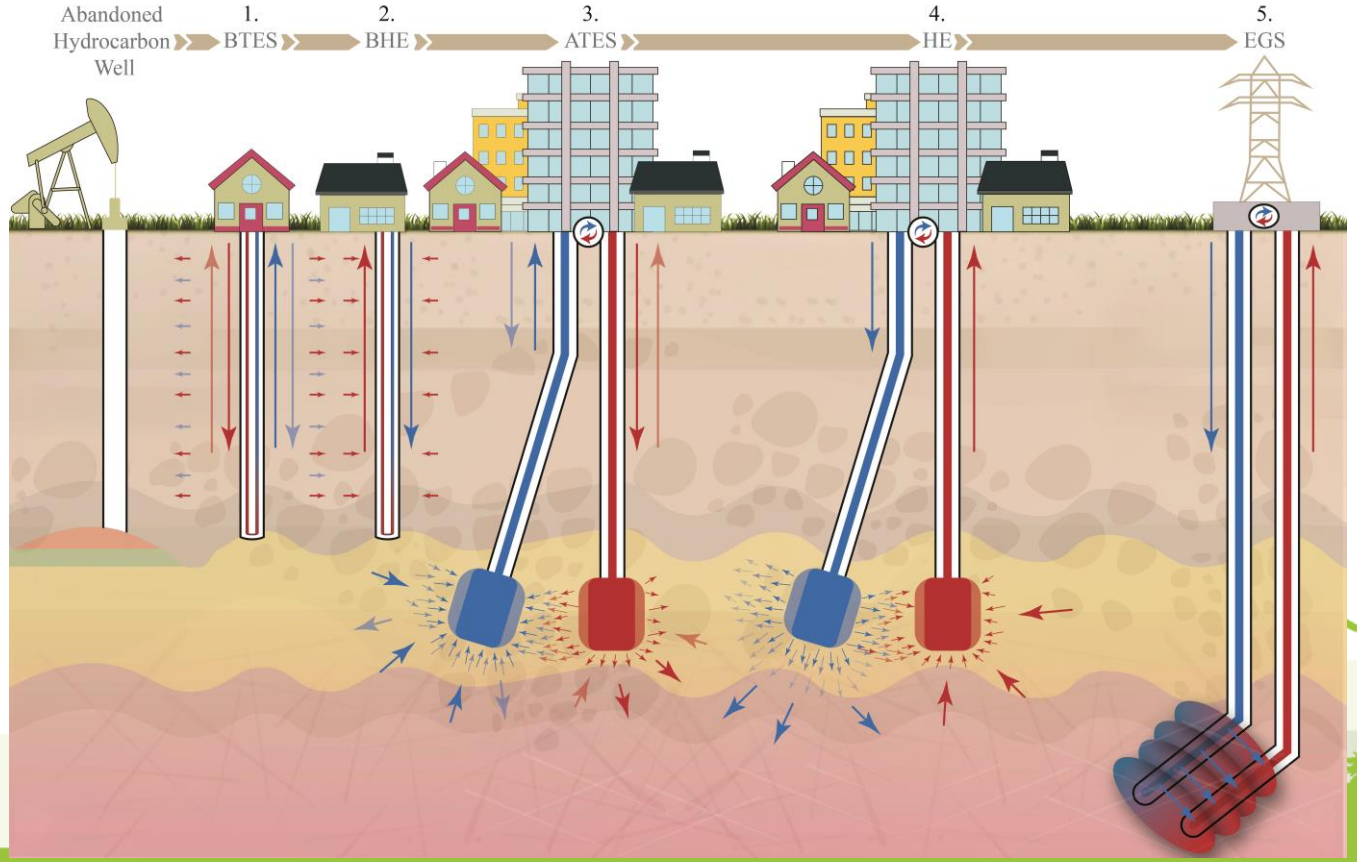


- **Proof-of-concept studies** of 5 well reuse technologies
- Develop **criteria catalogue** and **Online Well Selection Tool** to identify suitable wells for reuse
- **Collect data** on wells and energy demand in 4 basins and **assess regional potential**
- **8 Pilot Sites/Regions** to demonstrate reuse potential and procedures

Transnational Cooperation

Social, Economic, and Legal Analyses	To consolidate understanding of barriers and risks of well reuse and advocate for policy alignment across jurisdictions
Transnational Strategy	***Public Workshop*** for stakeholder input
Transnational Action Plan	***5 National Meetings*** to share results and ***3 Letters of Intent*** to facilitate new development projects

5 Geothermal Technologies



BTES:

Borehole Thermal Energy Storage

BHE:

Borehole Heat Exchanger

ATES:

Aquifer Thermal Energy Storage

HE:

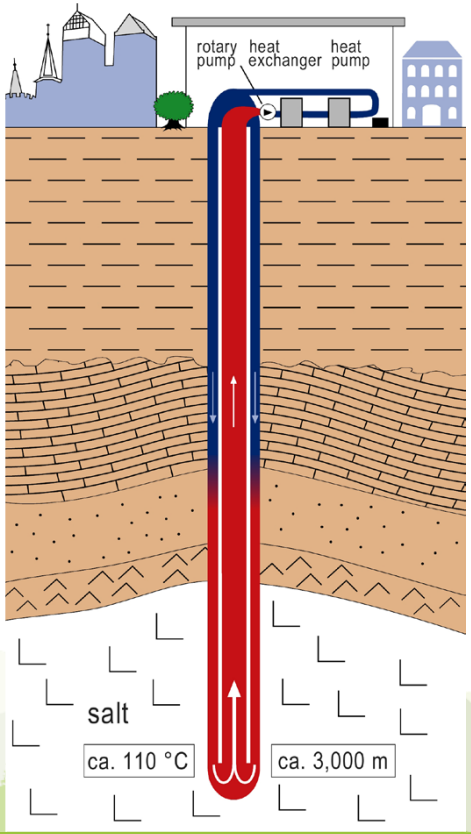
Hydrothermal Energy

EGS:

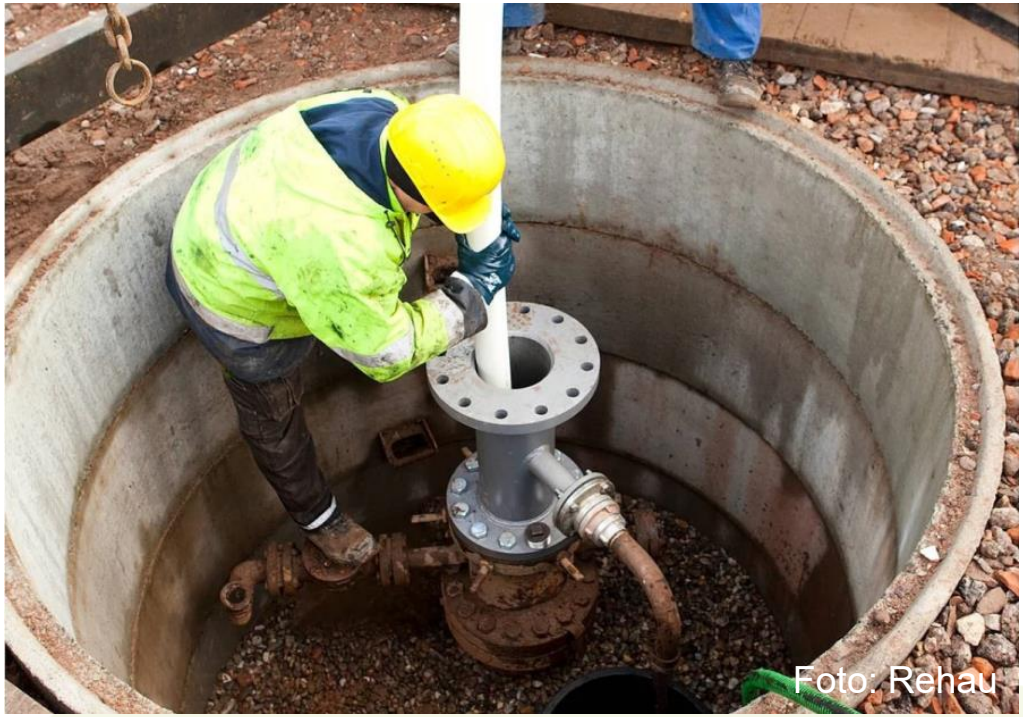
Enhanced Geothermal Systems

BHE Reuse – Key Aspects

- Only a **few 10-100 kW** of heat can be produced from a multi kilometre deep BHE making an economic use challenging:
  - Cost of abandonment a **few 100.000 € (200k-800k €)**
  - Cost of BHE installation a **few 100.000 € (100k-500k €)**
  - Yearly gross income of a **few 10.000 € (8 ct/kWh and 50 kW → 35k €/year)**
- To make BHE reuse projects economically feasible:
  - The well must not have been plugged and abandoned
  - The well and site condition should be known and good (no: logging/testing, well intervention, site preparation)
  - PE pipes instead of steel pipes where temperature allows
  - A high geothermal gradient helps
  - Heat consumer must be nearby



BHE Reuse Example - Landau



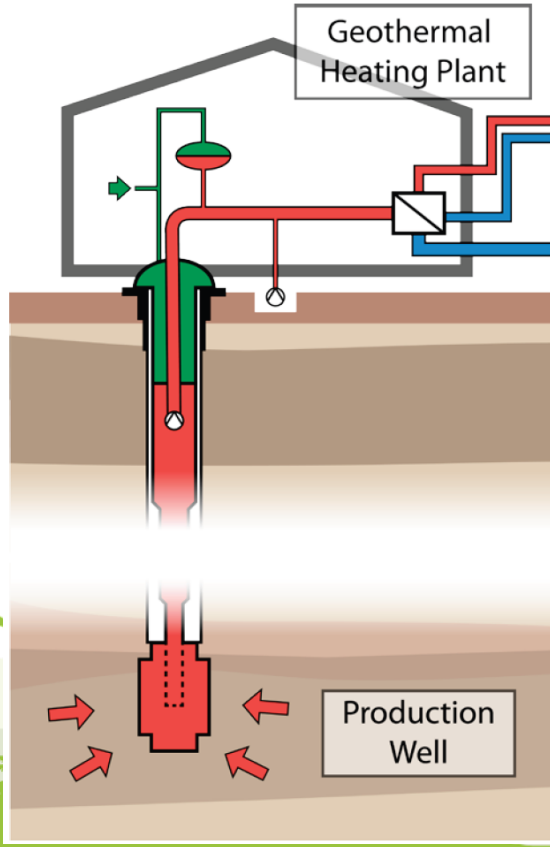
Installation of PE tubing in old oil well La049, drilled by Wintershall, 2014

- A car dealership in Landau in der Pfalz is heated by BHE in an old gas exploration well, since 2014
- Length of co-axial PE tubing ~800 m
- Surface water temperature 42 °C
- ~80 kWth capacity
- Cost ~150.000 €

Hydrothermal Reuse – Key Aspects

- Producing high flow rates of hot water from hydrocarbon reservoirs can be **challenging due to:**
  - Low reservoir pressure after decades of HC production
  - Low relative permeability of water due to residual oil/gas
  - High frictional pressure losses due to small well diameters and high water rates required for economic production

- **Alternative hydrothermal use options:**
  - Use of “dry” exploration wells
  - Deepening/side-tracking a well below the Hydrocarbon-Water contact or into another (geothermal) formation



LIAG (2017)

Hydrothermal Reuse Example – Ampfing

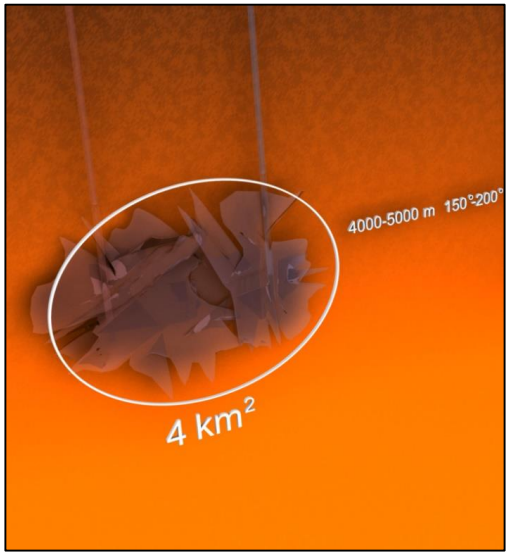
Infrastructure for testing the Ampfinger oil deposit (Bavaria)

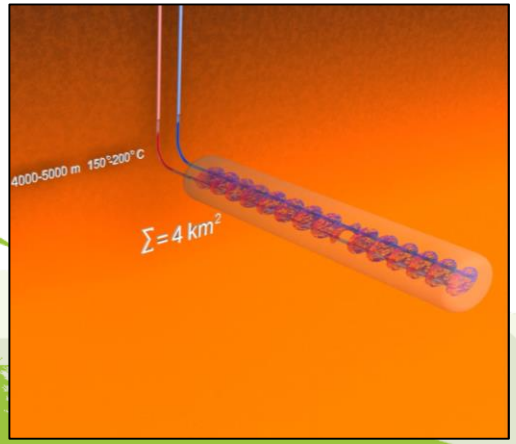
- In Ampfing, ONEO is working with the town to reuse an unsuccessful 2019 oil well for geothermal heating
- Concept: Existing borehole deepened into Malm aquifer + new well
- Production rate 80-100 l/s → ~19-24 MW

EGS Reuse – Key Aspects

- Multi-stage (>10) stimulation of long (>1 km) horizontal well sections required to allow sufficient flow through the reservoir
- Large well diameter required (min. 7”) to allow sufficient flow through the well
- → Usually well deepening or side-track from shallow section required due to small well diameters

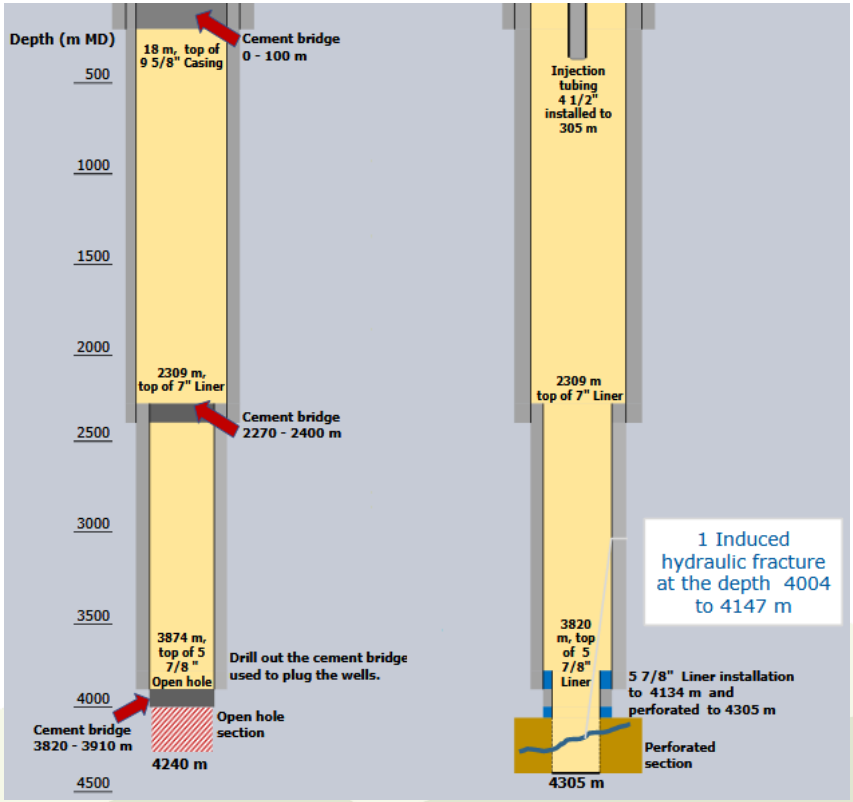
- Alternative EGS reuse options:
  - One/few open hole stimulation(s) of vertical well
  - Use hydrocarbon well as (seismic) monitoring well





EGS Reuse Example – Groß Schönebeck

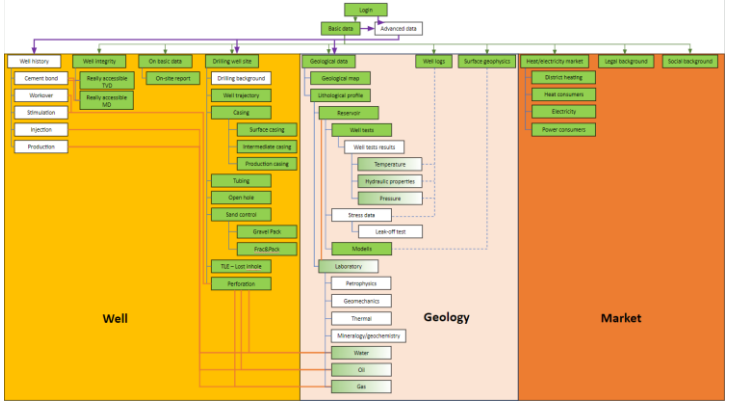
Initial Condition (1990) **Post Workover (2003)**



- Geothermal research site of GFZ
- Old gas exploration well reused as geothermal injection well

Some well selection criteria - HE use

- Well status
- Planned date of abandonment
- Well diameter
- Reported (well integrity) problems

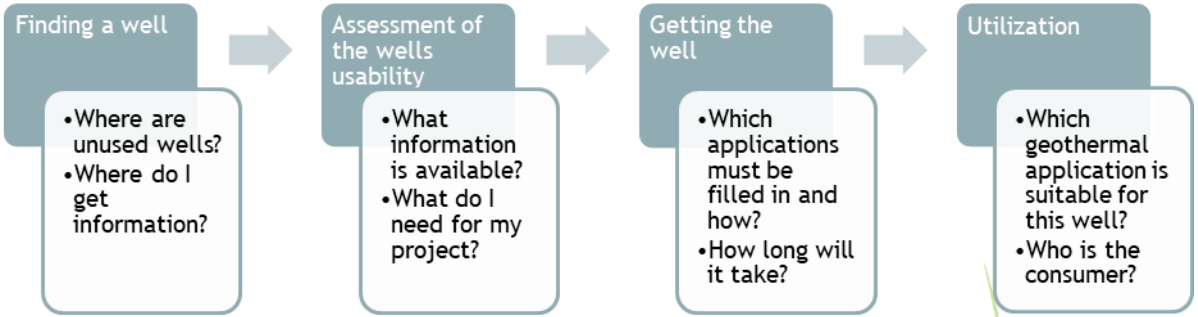


- Reservoir transmissivity (permeability * pay zone thickness)
- Reservoir temperature

- Heating demand, infrastructure and distance to well

Comparison of general framework

- 3 (Austria) – 15 (Croatia) reuse projects in each partner country incl. BHE, HE, EGS; heat storage projects are planned
- Awareness of the topic different, but limited in all countries



- Different legal frameworks for abandonment and reuse
- Different financial frameworks with no incentives (only Austria)
- Different data availability with often only basic data

Summary

- Geothermal reuse in principle attractive to reduce high investment costs and exploration risk
- Requirements: well not yet abandoned (at least for closed systems) and heat consumer nearby (often not the case)
- Data availability, financial and legal framework different in the different partner countries, but in principle well reuse is possible
- Some geothermal reuse projects already exist in central Europe, but no heat storage projects yet
- Technical and financial feasibility different from site to site
- *Workflows, database and well selection tool available in Q4/2024*
- *Regional and site specific reuse potential assessment in 2025*

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Thank you!

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