

# *Reuse of Hydrocarbon Wells for Geothermal Energy Production: Economic and Policy Aspects*

**Interreg**  
CENTRAL EUROPE



Co-funded by  
the European Union

**TRANS GEO**

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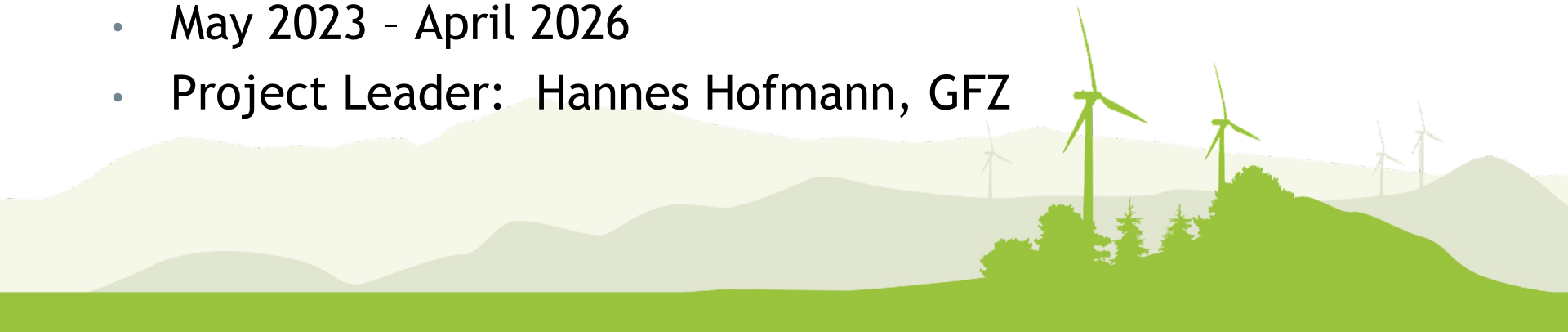
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# TRANSCEO - information and tools for reuse of existing wells for green geothermal energy

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- 11 Partners
- 5 Countries - Germany, Hungary, Austria, Croatia, Slovenia
- Budget - 2.61 Million € (funded by Interreg Central Europe)
- May 2023 - April 2026
- Project Leader: Hannes Hofmann, GFZ

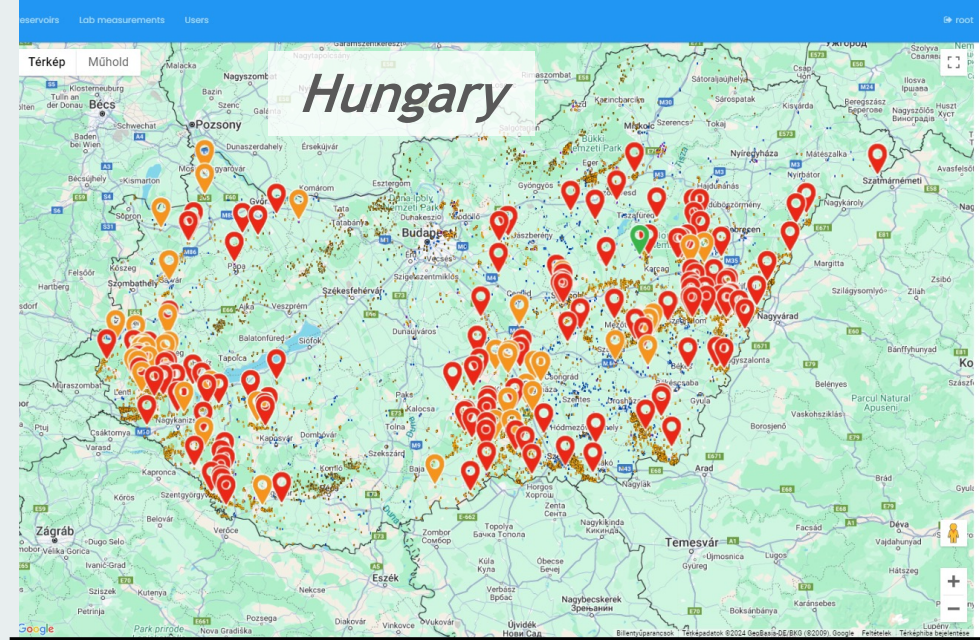


# Why reuse old wells?

*There are thousands of abandoned oil and gas wells in central Europe*

- Germany ~20.000 (Jordan et al., 2022)
- Hungary >8.000 (pers. comm.)
- Austria >4.000 (Hamilton et al, 1999)
- Croatia >3.000 (Kurevija and Vulin, 2011)
- Slovenia >100 (pers. comm.)

➤ *All 5 countries have geothermal well reuse projects, especially Croatia and Hungary*

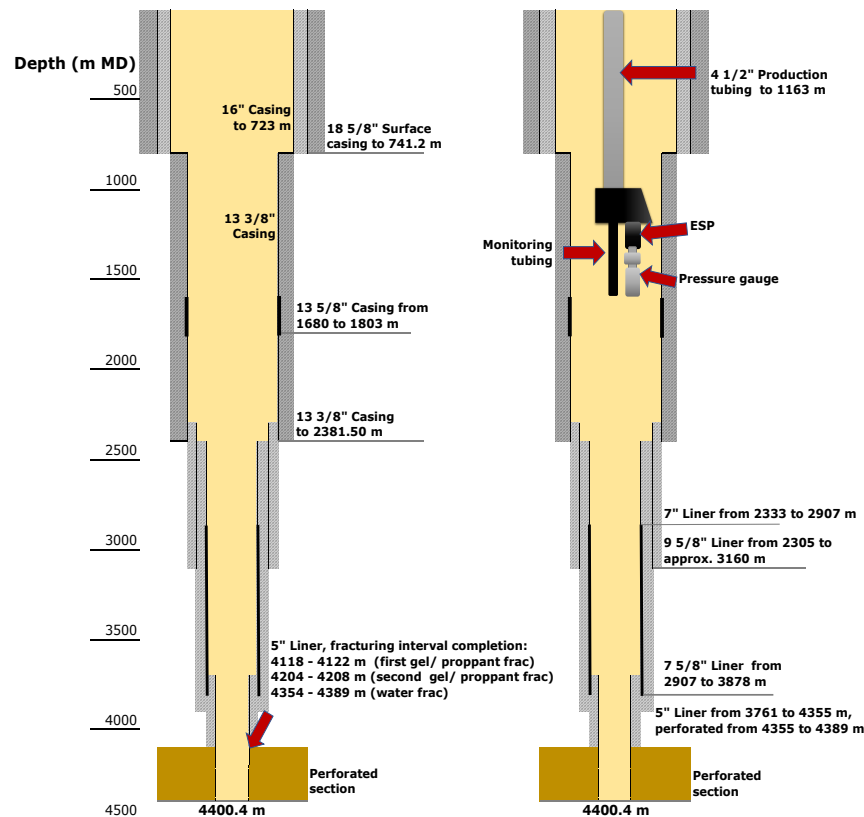


# Why reuse old wells?

*€ millions can be saved by re-purposing existing infrastructure*

- Well reuse can cost a fraction of a new deep well and is thus more financially viable for municipalities and small companies interested in green heat or energy solutions
- Reuse before abandonment is most efficient method → work with well owners

*Groß Schönebeck, North German Basin*  
New well, 4400 m depth → 13 M €

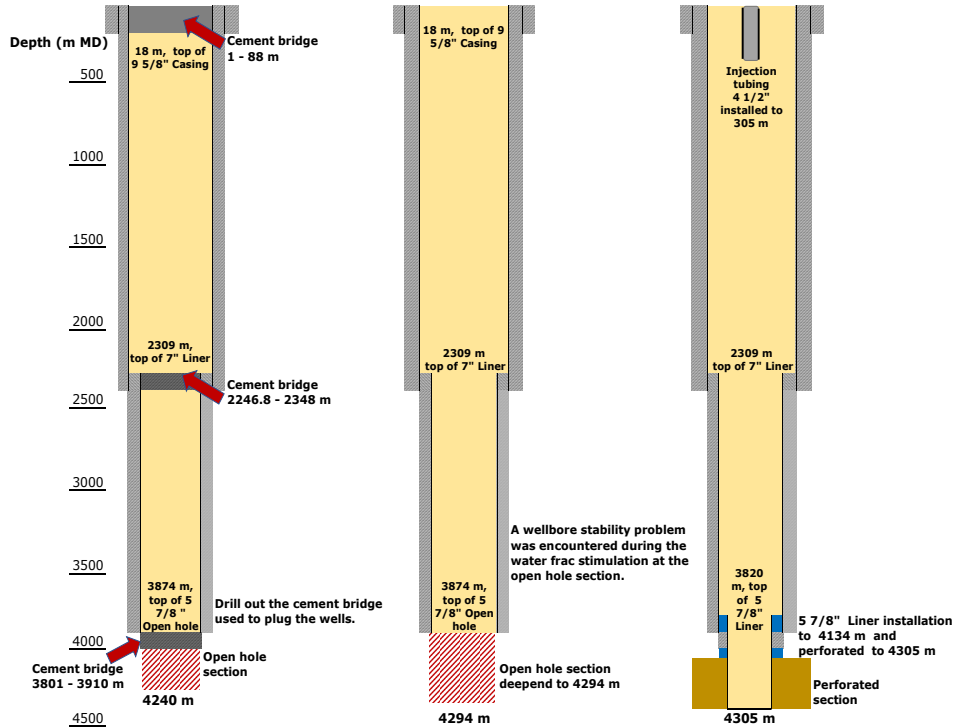


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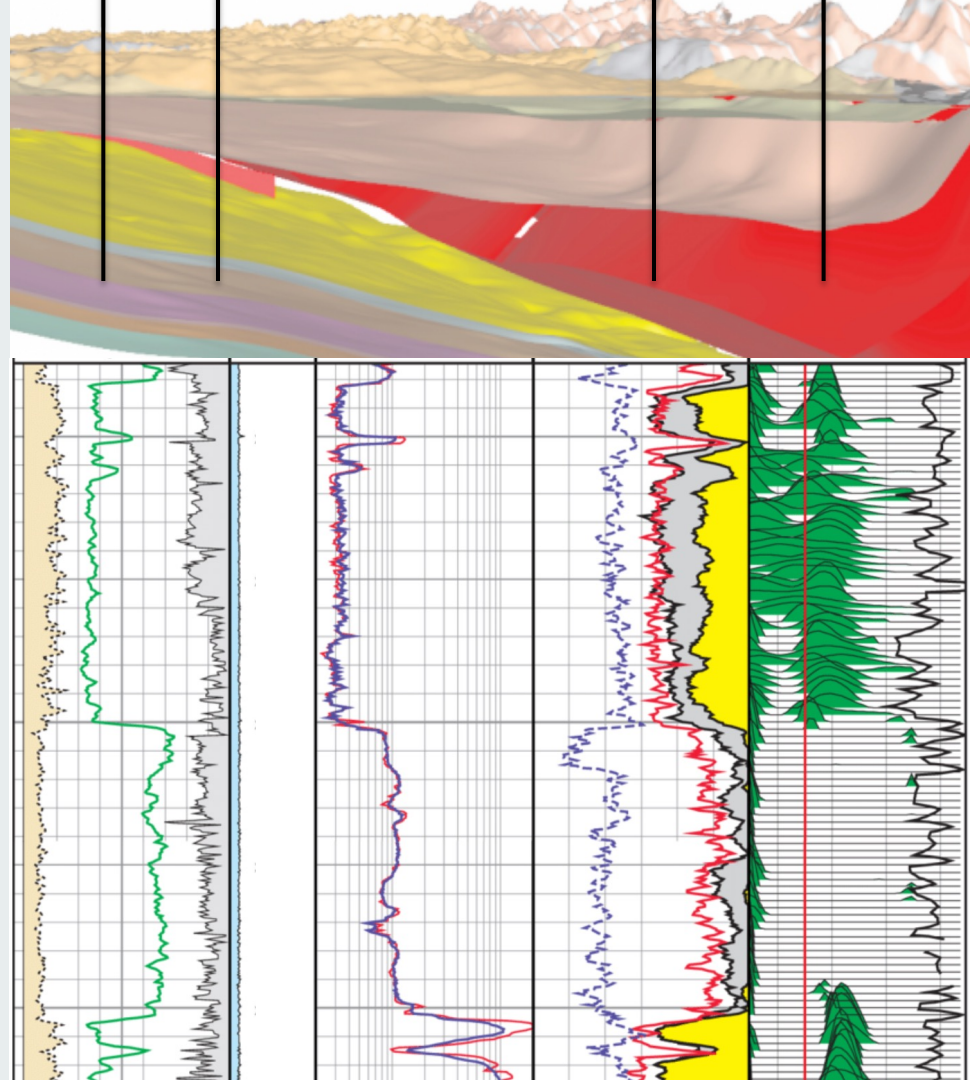
*Groß Schönebeck, North German Basin*  
Old well, with workover → 1.5 M € !



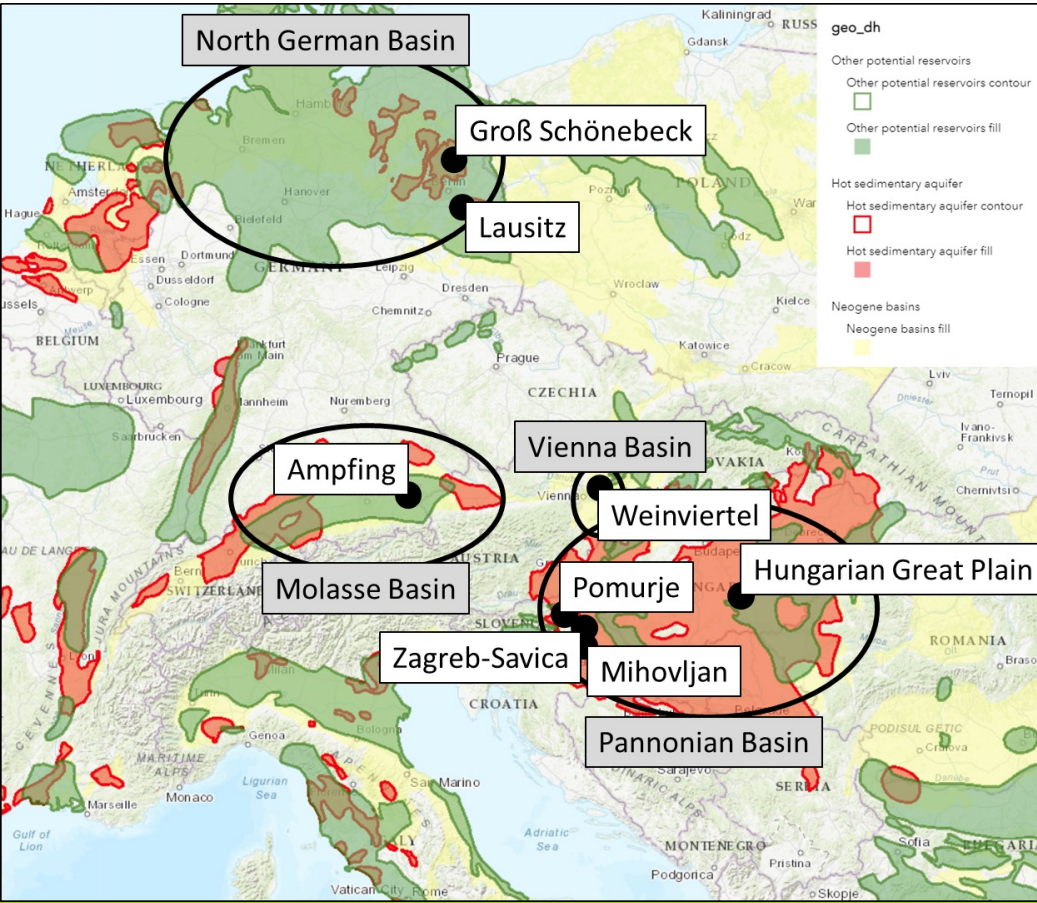
# Why reuse old wells?

*Development risk is reduced by using existing data*

- Knowledge about the subsurface reduces barriers for large-scale and fast geothermal development
- Well integrity may be a challenge (but you can assess in advance)

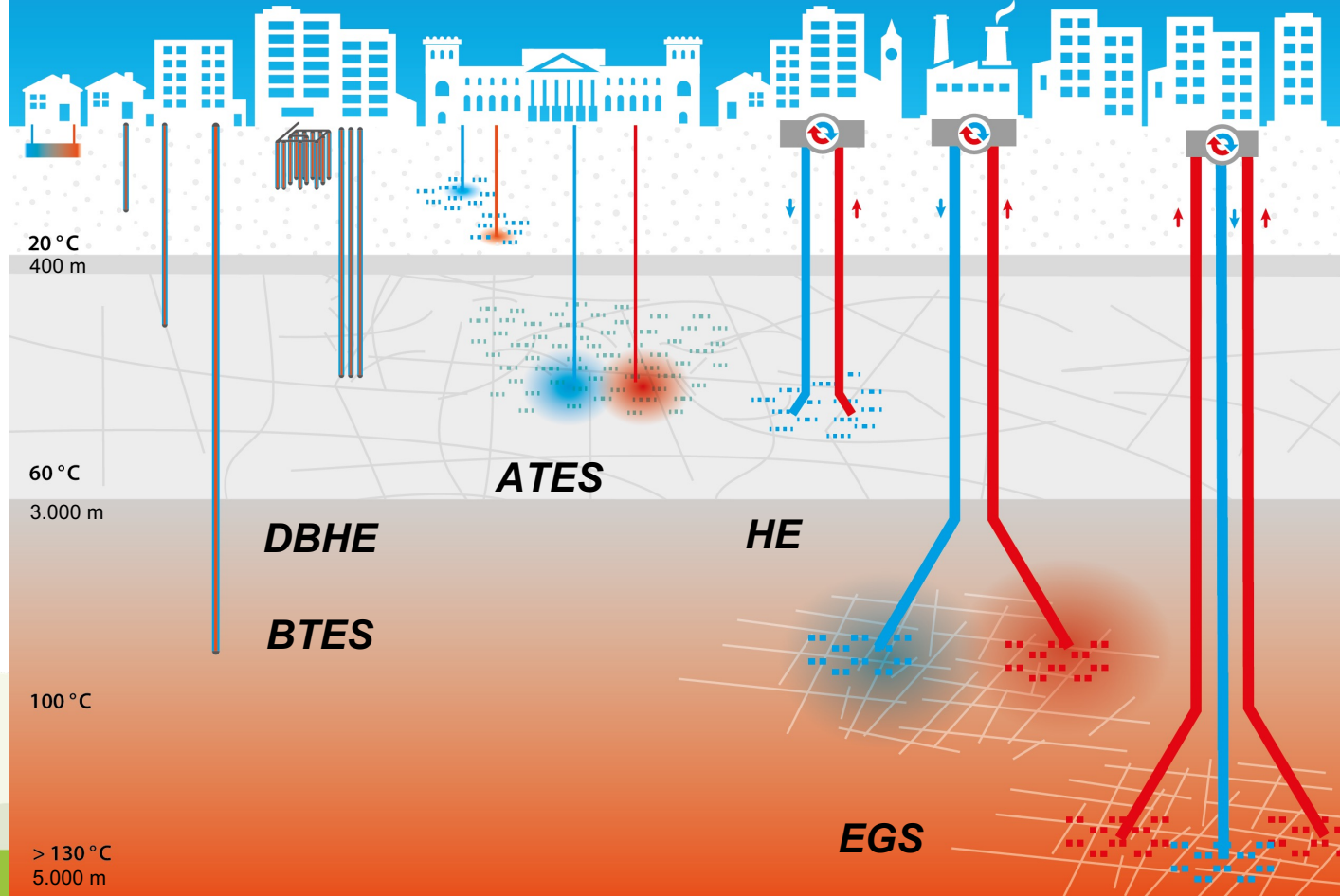


# TRANSGEO Technical Deliverables



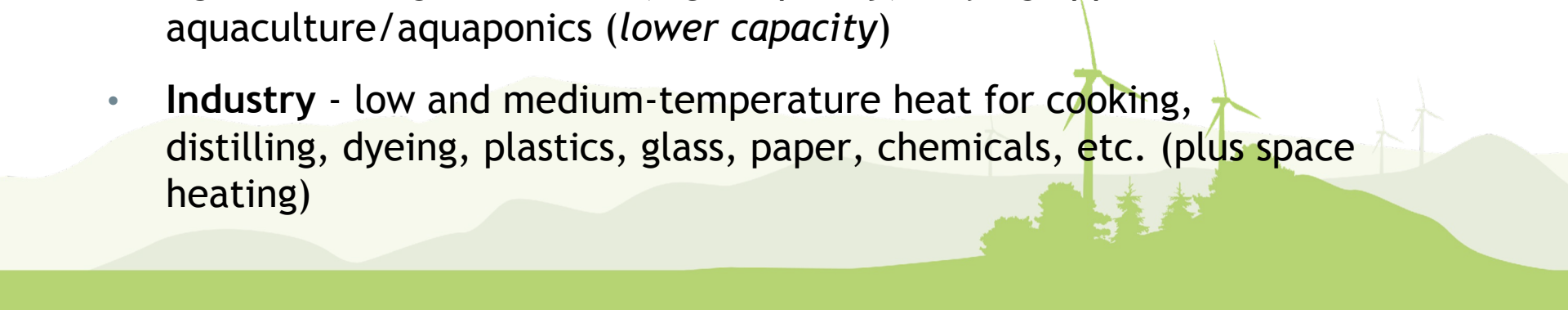
- **Database** of old wells in 4 basins + heat/energy demand
- **Online Well Selection Tool** to identify suitable wells for reuse
- **Engineering Workflows and Well Reuse Procedures** to inform well repurposing for 5 geothermal technologies
- **8 Pilot Sites** to test and demonstrate reuse potential and procedures

# 5 Geothermal Reuse Technologies



# Socio-Economic Analysis: Opportunities for Well Reuse

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- **Municipalities**
    - District heating → *high-capacity: Hydrothermal Energy, Enhanced Geothermal Systems, and Aquifer Thermal Energy Storage*
    - Small residential communities, baths or spas, or swimming pools → *lower capacity: Deep Borehole Heat Exchangers or Borehole Thermal Energy Storage*
  - **Agriculture** - greenhouses (*high-capacity*), drying applications, aquaculture/aquaponics (*lower capacity*)
  - **Industry** - low and medium-temperature heat for cooking, distilling, dyeing, plastics, glass, paper, chemicals, etc. (plus space heating)
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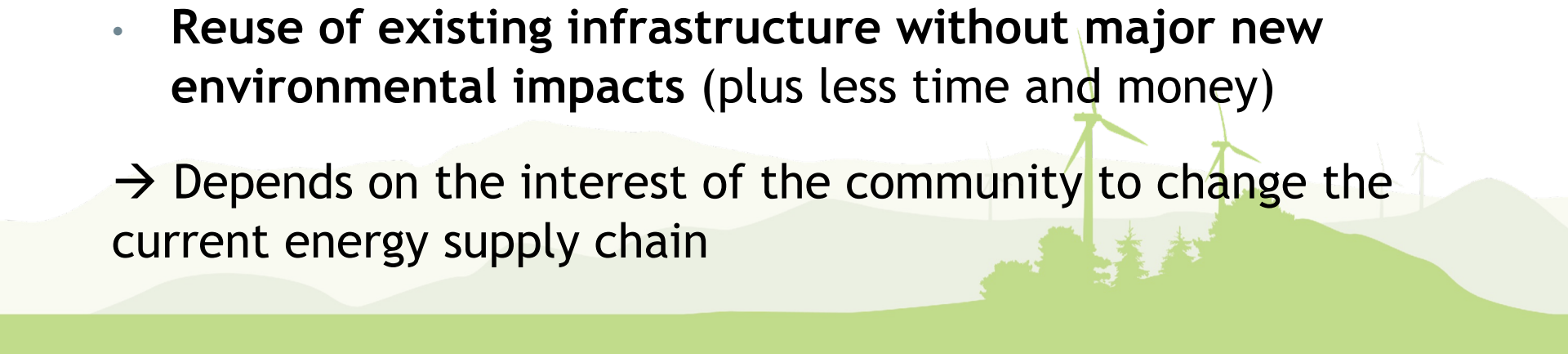
# Social Awareness and Acceptance

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Benefits of geothermal development in abandoned wells include:

- Replacing fossil fuels with renewable energy, and reducing greenhouse gas emissions
- Security and independence of the geothermal energy supply
- **Reuse of existing infrastructure without major new environmental impacts (plus less time and money)**

→ Depends on the interest of the community to change the current energy supply chain



# Estimated\* Costs for Well Reuse

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For workover, surface equipment, and 20-30 years of operation and maintenance:

- *Hydrothermal Energy, Aquifer Thermal Energy Storage, and Enhanced Geothermal Systems (0,5-50 MWth)*
  - 427.000-5.170.000 Euro
- *Borehole Heat Exchangers or Borehole Thermal Energy Storage systems (0,05-0,5 MWth)*
  - 375.000-930.000 Euro
- Payback period of the initial investments is estimated at 10-15 years

*\*Estimates are in 2023-24 Euros and include assumptions about initial well status (assume shut-in or active), configuration (1 or 2 wells, depth, pipeline, etc.), reuse technology, uptime, location/country, heat output, price of sold energy, etc.*

# Estimated\* Costs for Well Reuse

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## Workover, including services and material

- *ATES, BTES, and DBHE (0,05-20 MWth)*      *HE and EGS (5-50 MWth)*
  - 185.000 - 560.000 Euro      380.000 - 2.370.000 Euro

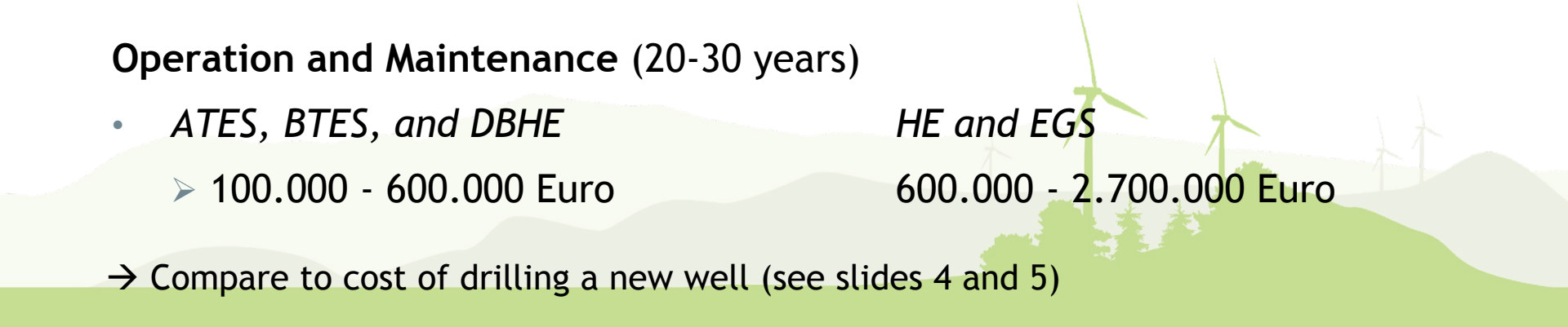
## Surface Equipment, including pumps, piping, heat exchanger

- *ATES, BTES, and DBHE*      *HE and EGS*
  - 30.000 - 90.000 Euro      270.000 - 1.300.000 Euro

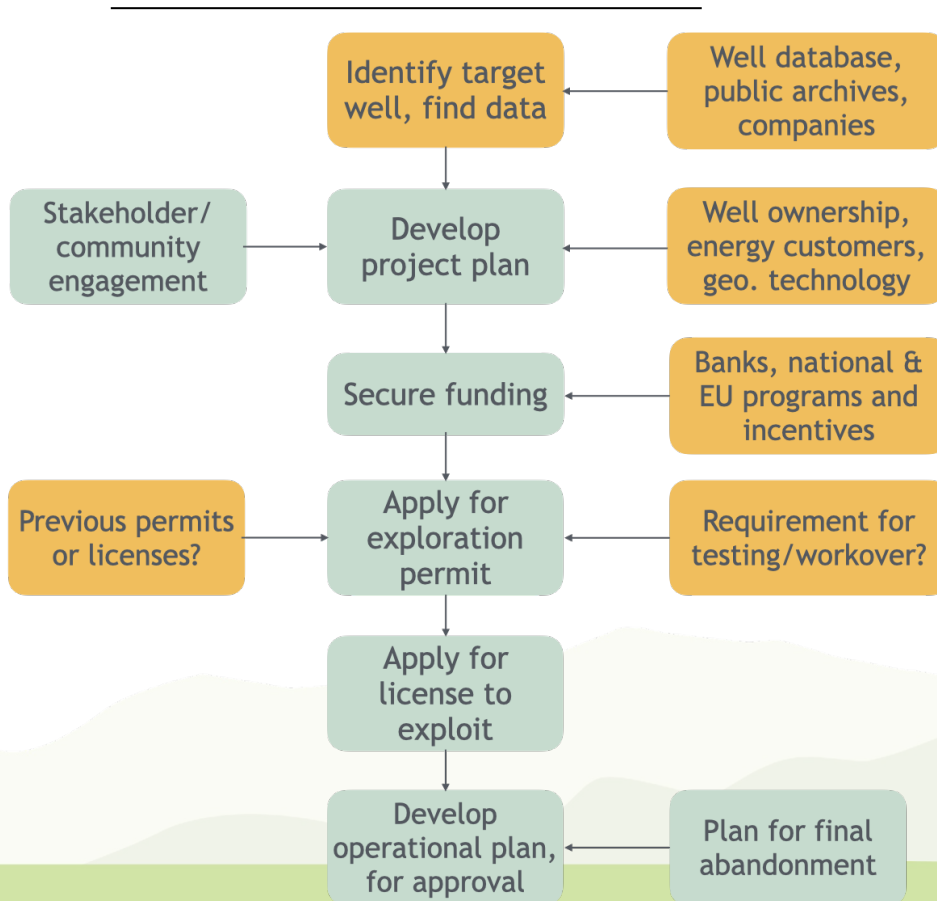
## Operation and Maintenance (20-30 years)

- *ATES, BTES, and DBHE*      *HE and EGS*
  - 100.000 - 600.000 Euro      600.000 - 2.700.000 Euro

→ Compare to cost of drilling a new well (see slides 4 and 5)



# Policy Analysis: Example of workflow in Germany



- Typical project development steps (**green**), with special considerations for well reuse (**orange**)
- In Germany, multiple applications for approval are usually required: Mining Authority, Water Authority, state environmental agency, nature conservation associations, various district authorities, nuclear waste repositories
- Financial incentives: None explicitly for well reuse but for general geothermal development (BEW\*, federal development bank KfW funding program, etc.)
- New draft law to speed up approval procedures, and revising the Mining Act

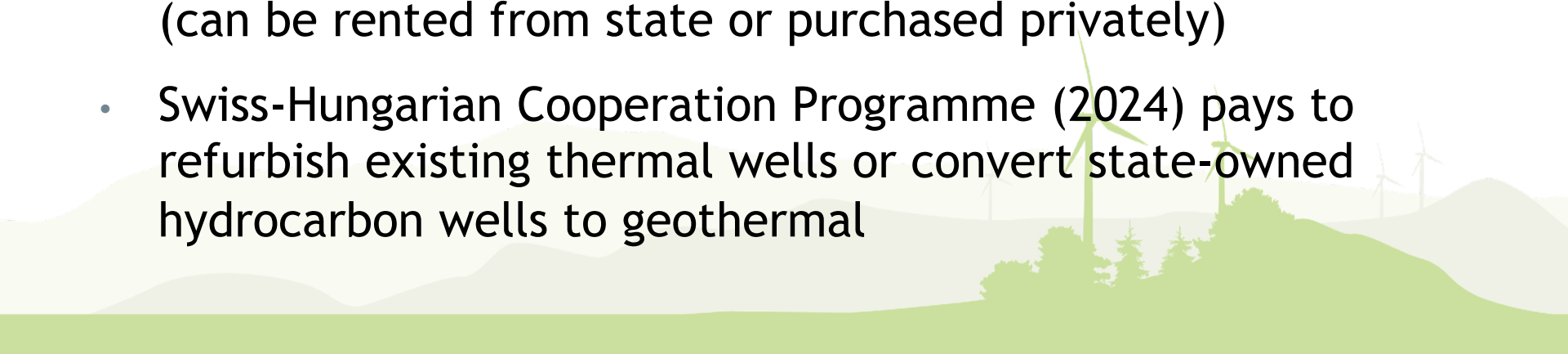
# Project Workflow: Other TRANSGEO countries

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- Except for Hungary, permit and license application procedures in each country vary and usually depend on the purpose of the projects and locations
- → Need to check regulations for reusing existing wells in each country/jurisdiction
- **Slovenia** - licence procedure includes 3 different agencies located in 2 Ministries
- **Austria** - does not have a licensing system for geothermal, but provides funding for well reuse (KPC\*)

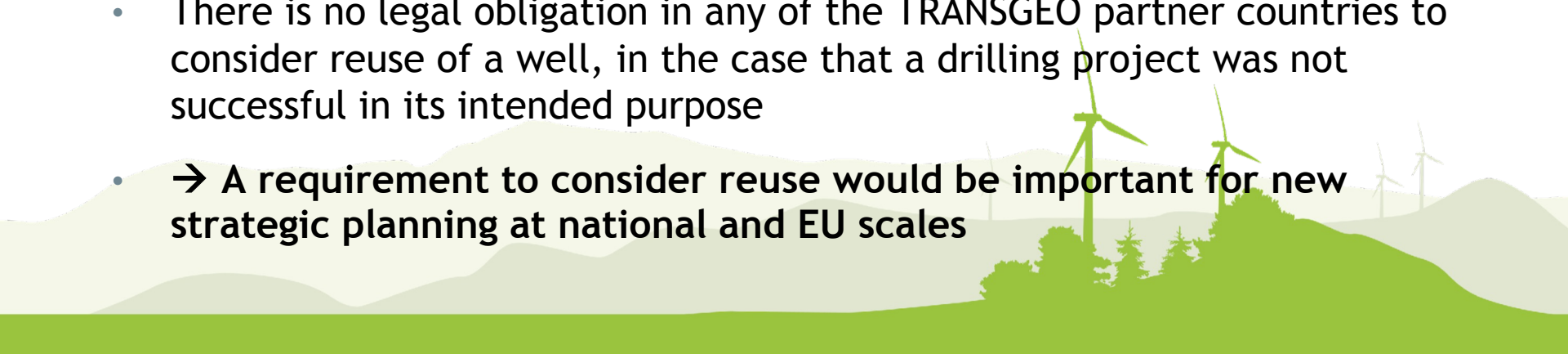
# Project Workflow: Hungary

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- **One-stop shop since 2023, online, fast and efficient**
  - Geothermal license application process **explicitly considers well reuse**, unlike other TRANSGEO countries
  - Well tests must be done to prove well is appropriate for geothermal, then developer must gain ownership of the well (can be rented from state or purchased privately)
  - Swiss-Hungarian Cooperation Programme (2024) pays to refurbish existing thermal wells or convert state-owned hydrocarbon wells to geothermal
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# Legal comparison: Well ownership & reuse

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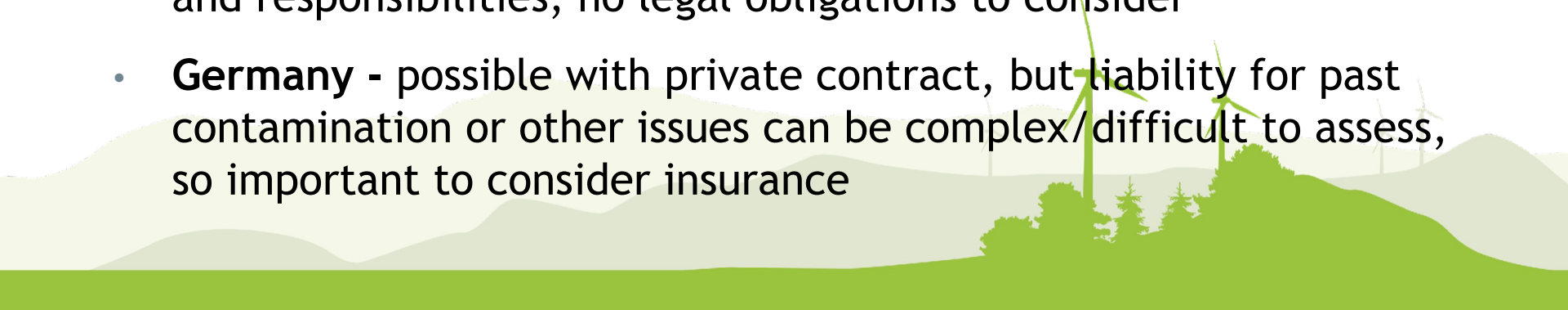
- Ownership often moves from the original company that developed the project to the operator or licensee
  - In the 5 TRANS GEO countries, after the license expires, the state may take over well ownership, as in Hungary (but there are wells in Slovenia with no owner, and in Austria, well ownership remains with the first operator until abandonment)
  - There is no legal obligation in any of the TRANS GEO partner countries to consider reuse of a well, in the case that a drilling project was not successful in its intended purpose
  - **→ A requirement to consider reuse would be important for new strategic planning at national and EU scales**
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# Transfer of Ownership, Data Access

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Big differences between 5 countries!

## Ownership Transfer

- **Austria** - not possible to transfer single well ownership for geothermal development (only possible for hydrocarbon assets)
  - **Slovenia** - possible with simple contract which defines the well and responsibilities, no legal obligations to consider
  - **Germany** - possible with private contract, but liability for past contamination or other issues can be complex/difficult to assess, so important to consider insurance
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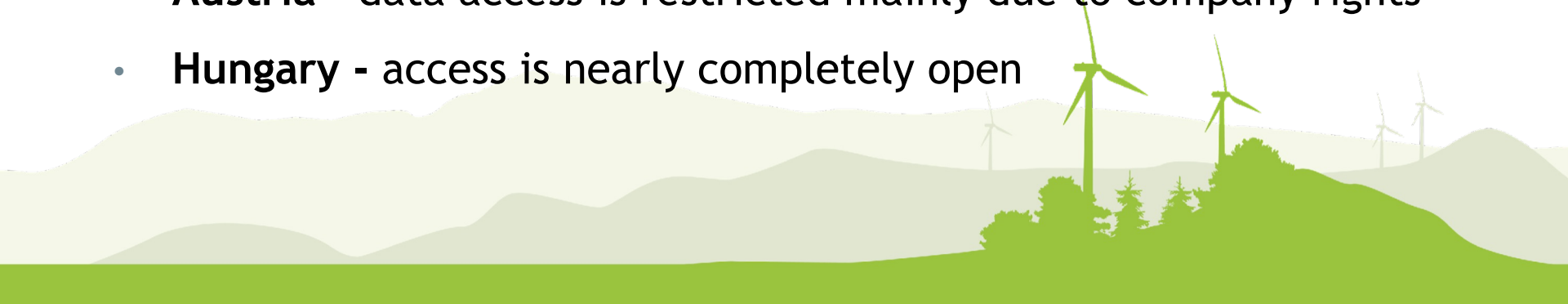
# Transfer of Ownership, Data Access

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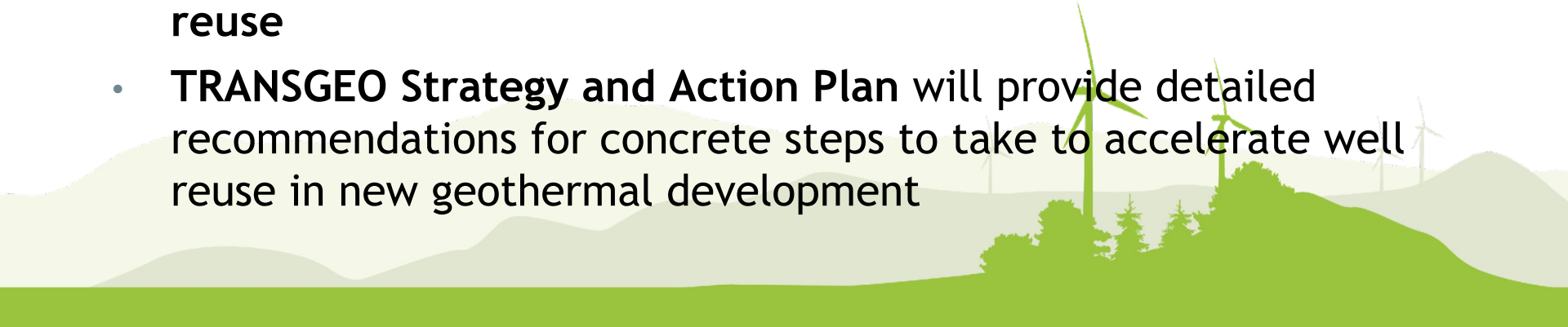
## Data Access

- **Germany** - Geological Data Act (2020), comprehensive obligation to secure geological data, but results in much data not being available due to private ownership rights
- **Austria** - data access is restricted mainly due to company rights
- **Hungary** - access is nearly completely open



# Barriers to Well Reuse and Next Steps

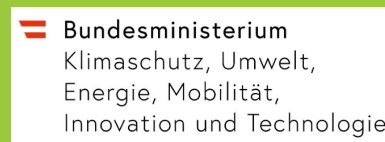
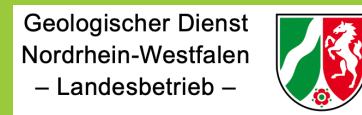
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- Our analyses show **there are no legal barriers to well reuse**
  - The largest barriers are **financial and social**
  - Must **raise awareness and improve access to data and information** about availability of wells and how they can be used
  - EU and national governments should provide **funding for well reuse**
  - **TRANSGEO Strategy and Action Plan** will provide detailed recommendations for concrete steps to take to accelerate well reuse in new geothermal development
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# Partners



# Associated Partners





# Thank you! Danke!



TRANS GEO

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[interreg-central.eu/projects/transgeo/](https://interreg-central.eu/projects/transgeo/)



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