The TRANSGEO Project:

Well Reuse for Geothermal Energy

Interreg CENTRAL EUROPE

Co-funded by the European Union

TRANSGEO

12 February 2025

Hannes Hofmann, Ferenc Fedor, Matej Prkič, Monika Hölzel, Tomislav Kurevija, Ema Novak, Julie Friddell, Katarina Marojević, Catarina Castro, and the TRANSGEO Partners

Agenda for today's webinar (90 minutes)

- Welcome, introduction to TRANSGEO, well reuse in central Europe – Hannes Hofmann
- TRANSGEO products and outputs
  - Reuse technologies, Engineering Workflows – Hannes Hofmann
  - Criteria Catalogue, Database, Well Assessment tool – Ferenc Fedor
  - Socio-Economic Analyses – Matej Prkič
  - Policy/Legal Analysis – Monika Hölzel
  - Feasibility Studies, pilot site case study – Tomislav Kurevija
  - Transnational Strategy and Action Plan – Ema Novak

- Opportunities to engage – products and stakeholder meetings – Julie Friddell
- Questions and discussion
- Invitation to connect via social media/email list

Welcome, Introductions

Well reuse in central Europe

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GFZ Helmholtz Centre for Geosciences

Prof. Dr. Hannes Hofmann


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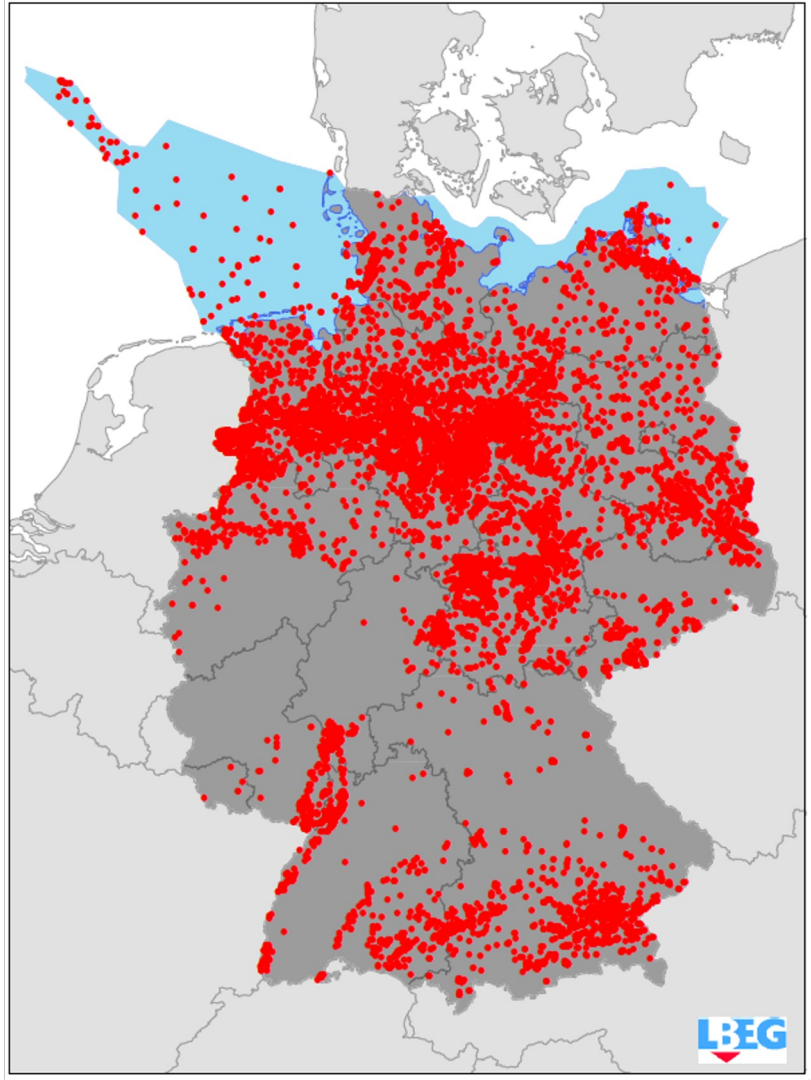
Why reuse old wells?

There are thousands of oil & gas wells in central Europe

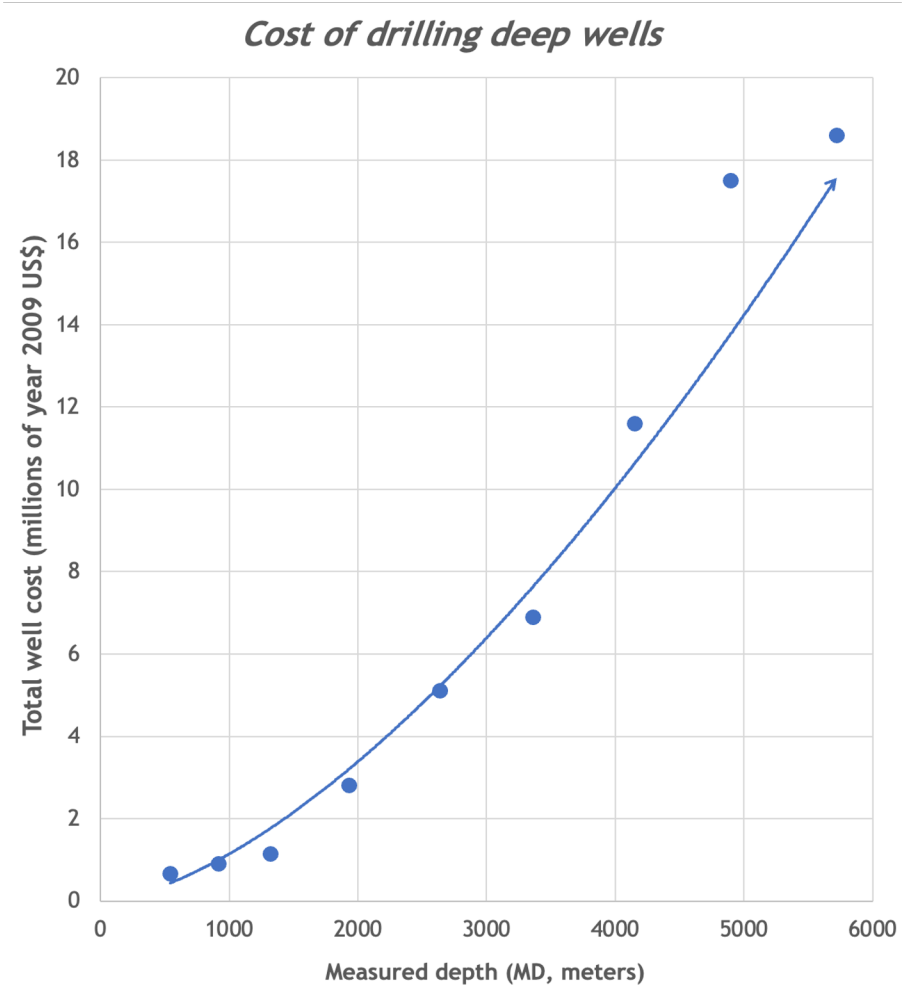
- Germany: >20.000 *(Jordan et al., 2022)*
- Hungary: >8.000 *(pers. comm.)*
- Austria: >4.000 *(pers. comm.)*
- Croatia: >3.000 *(Kurevija and Vulin, 2011)*
- Slovenia: >100 *(pers. comm.)*



Why reuse old wells?

Reduction of high up-front investment

- New deep wells cost € millions, often >50% of the total geothermal project cost
- Millions of € can be saved by reusing existing wells



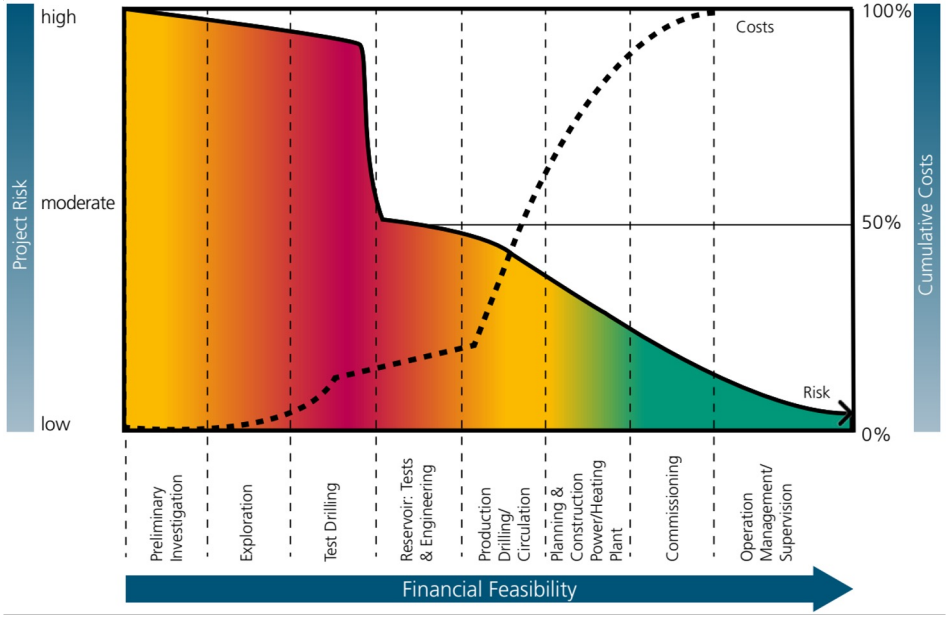
(after Tester et al., The Future of Geothermal Energy, 2006)
(Data from Joint Assoc. Survey on Drilling Costs, indexed to 2009 US$)

Why reuse old wells?

Reduction of exploration risk

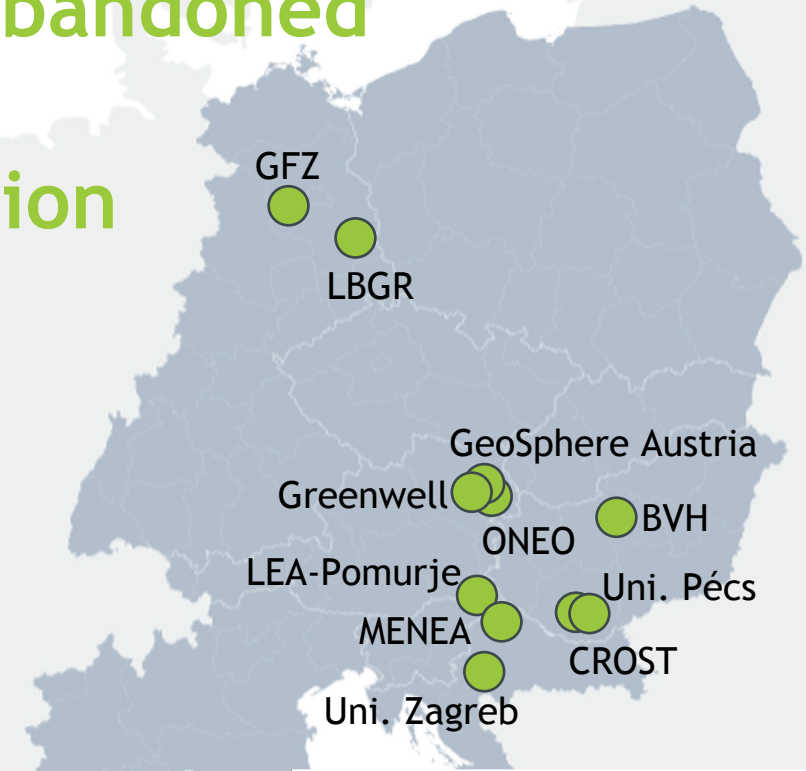
- The biggest hurdle for geothermal development is the geological uncertainty associated with the high upfront investment for drilling
- Knowledge about the subsurface reduces barriers for large-scale and fast geothermal development

Development phases of a geothermal heating plant, with cost progression



Bracke & Huenges, 2022

TRANSGEO – transforming abandoned hydrocarbon wells for geothermal energy production



- 11 Partners
- 5 Countries: Germany, Austria, Hungary, Croatia, Slovenia
- Budget: 2.61 Million € (80% ERDF funding)
- May 2023 - April 2026
- Lead Partner: GFZ Potsdam
- *https://www.interreg-central.eu/projects/transgeo/*

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Partners

GFZ Helmholtz Centre for Geosciences

BVH

GeoSphere Austria

oneo

green well
ENERGY. NATURALLY.

LBGR
Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg

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

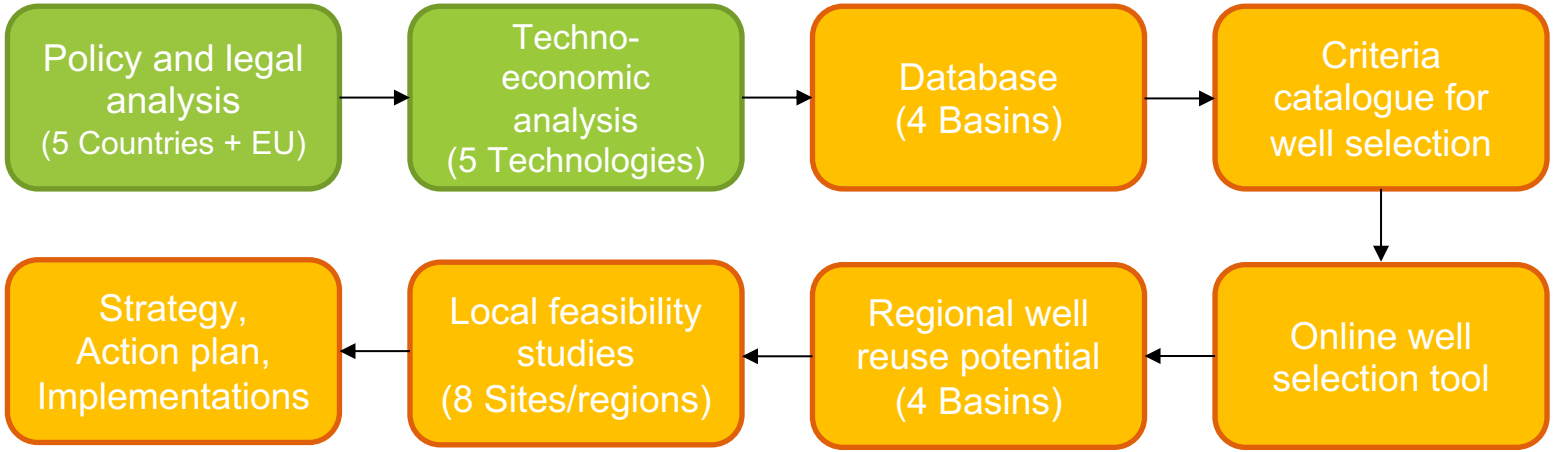
KORMÁNYHIVATALOK

GeoZS
Geološki zavod Slovenije

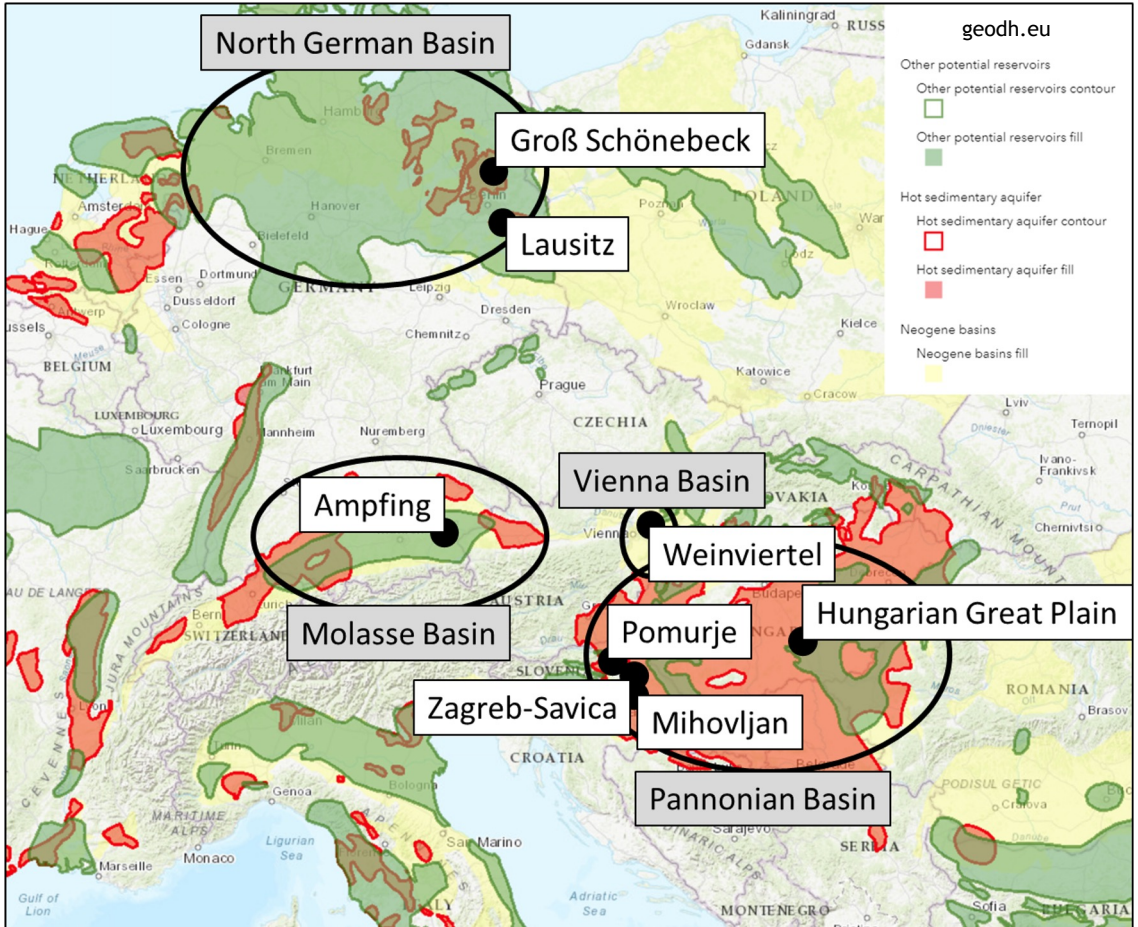
Bundesministerium
Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie

AZU
Agencija za ugljikovodike

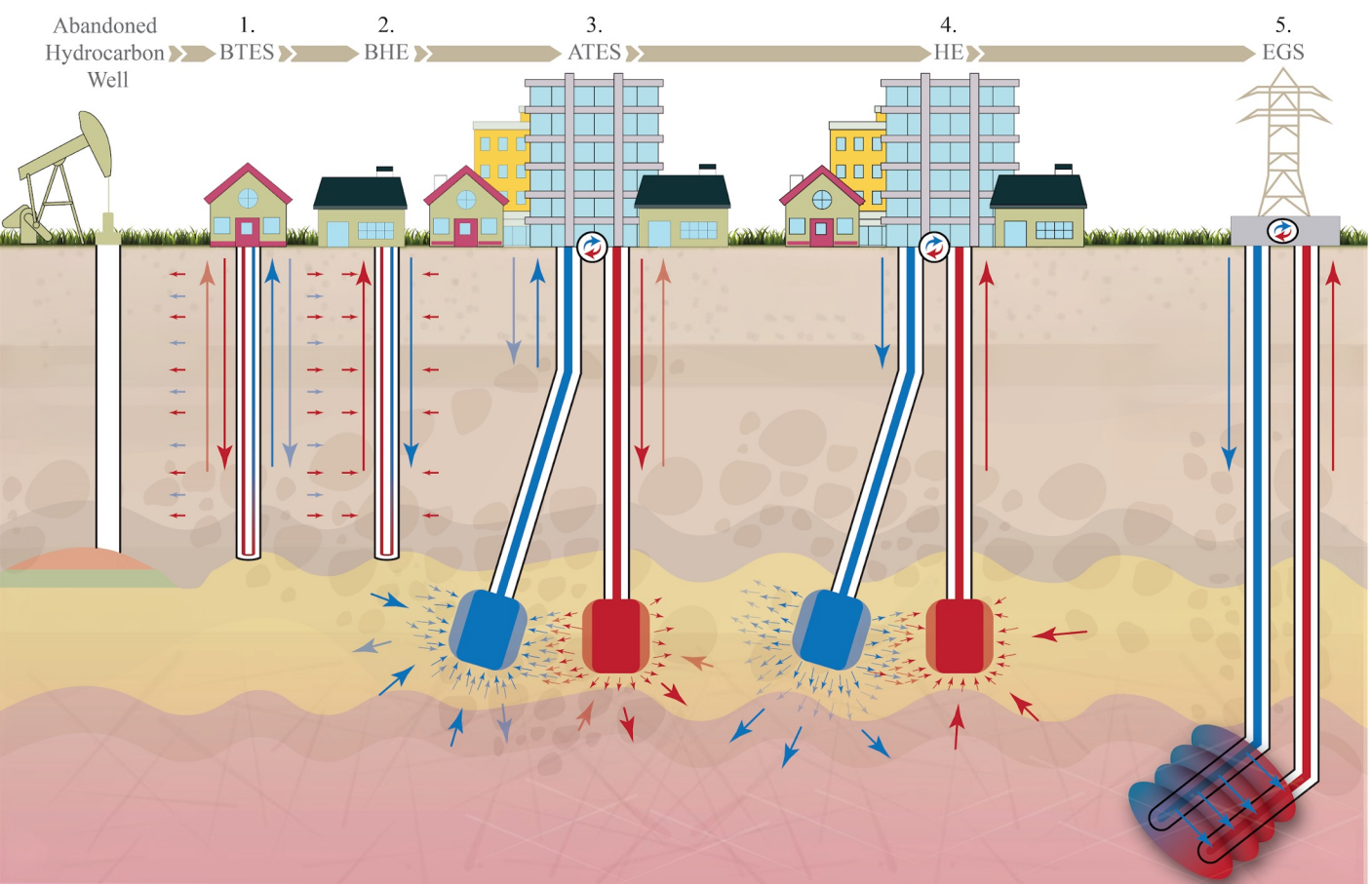
What is the potential for geothermal energy development from oil and gas wells in central Europe? How to exploit it?



TRANSGEO - 4 Basins, 8 Pilot Sites/Regions



5 Geothermal Technologies



BTES
Borehole Thermal Energy Storage

(D)BHE
(Deep) Borehole Heat Exchanger

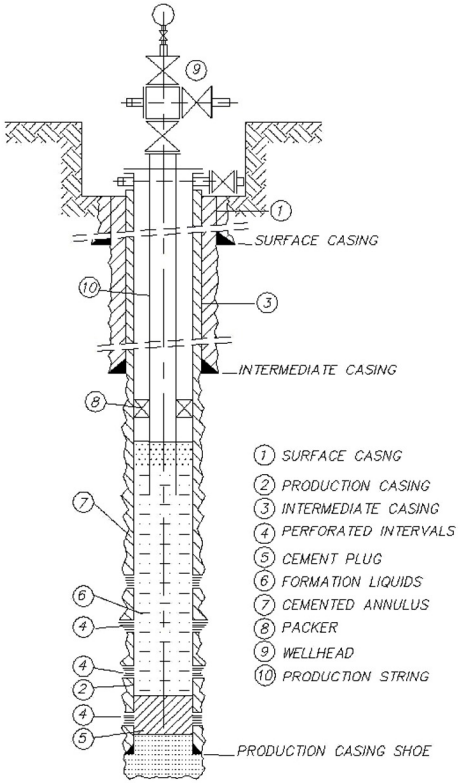
ATES
Aquifer Thermal Energy Storage

HE
Hydrothermal Energy

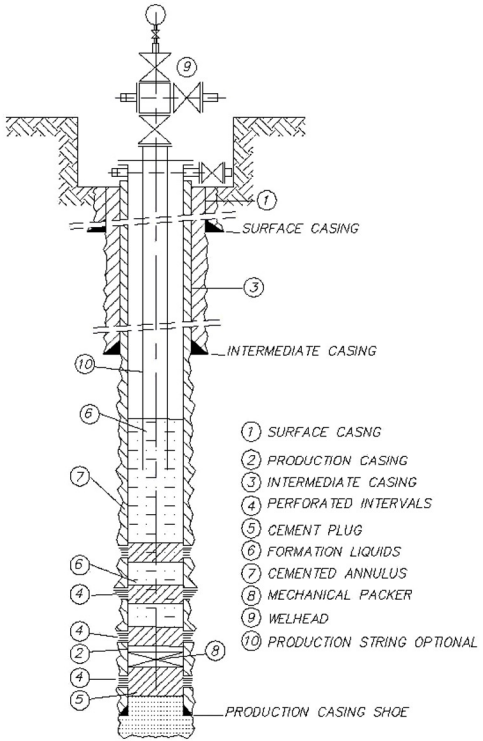
EGS
Enhanced Geothermal Systems

Active or shut-in wells = most suitable for reuse

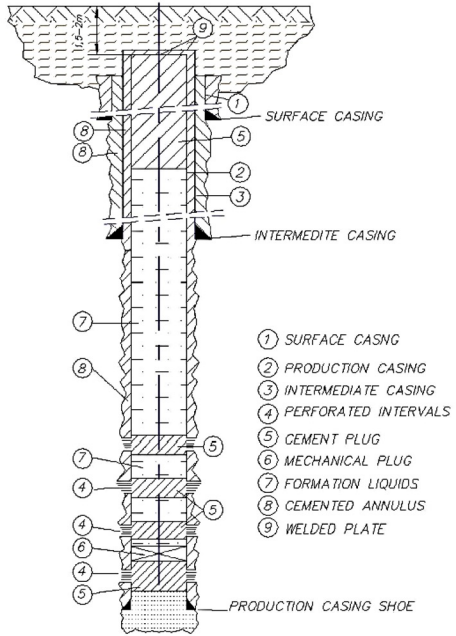
Active well



Shut-in well



Abandoned well



Geothermal Reuse Technologies Engineering Workflows

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Prof. Dr. Hannes Hofmann

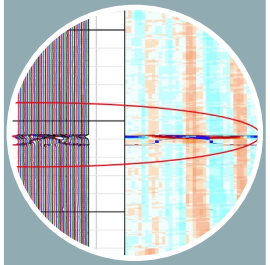
Well reuse workflow

1) Feasibility assessment & business model

- Data access
- Identification of potentially suitable well(s) & customers
- Initial feasibility assessment
- Feasibility study
- Investment decision

2) Ownership transfer & permitting

- Private contracts (liabilities)
- Licenses for heat (oil/gas) exploration and production
- Permits for activities (workover, testing, operation)



3) Reconditioning & revaluation

- Detailed planning
- Drill site const. and access
- Workover (open/ clean/repair well)
- Logging and integrity tests
- Hydraulic tests (open systems)

4) Well completion

- Cementation
- Deepening/side-track
- Perforation
- Tubing
- Downhole pump
- Monitoring devices

5) Surface infrastructure

- Heat exchanger
- District heating network
- Pipes, pumps, etc.
- Depending on resource and application

6) Operation

- Long-term heat and/or electricity production
- Maintenance work
- Monitoring program

7) Plug & abandon

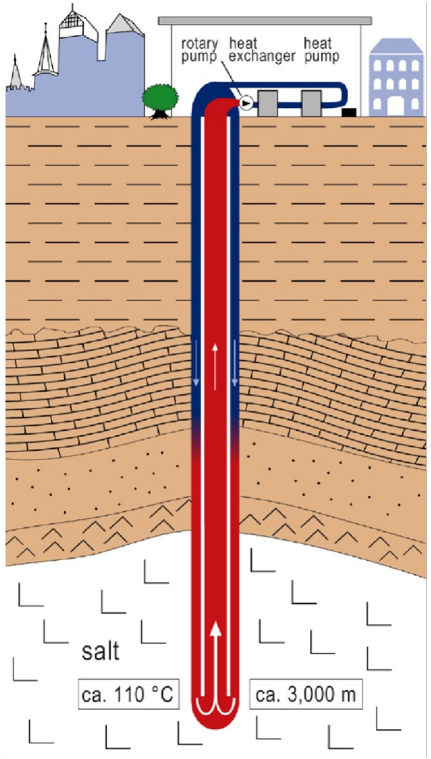
- Cementation of the well
- Remediation
- Proof of financing and expertise for P&A required at the start of the project

Link to Workflow reports:

https://www.interreg-central.eu/wp-content/uploads/2025/02/TRANSGEO-D1.1.6-Engineering-Workflows-FINAL-December-2024.pdf

Deep Borehole Heat Exchangers: Key aspects

- *Classic reuse, but low energy yield*
  - ✓ ~50 to ~500 kW (depending on well length and temperature)
- *Economically challenging, but better than new well*
  - ✓ Cost for reuse >100.000 € (100k to >500k €)
  - ✓ Cost for P&A >100.000 € (200k to 1.000k €)
  - ✓ + Operating costs >10.000 €/a
  - ✓ Revenue >10.000 €/a (10 ct/kWh & 50kW ➡ 50k €/a)
- *For economic reuse*
  - ✓ The well must not yet have been abandoned
  - ✓ The final abandonment must already be financed
  - ✓ The heat consumer must be in the immediate vicinity
  - ✓ The wellbore integrity and diameter should be recently confirmed by logging and testing
  - ✓ PE should be used instead of steel pipes, where T allows
  - ✓ A high geothermal gradient and thermal conductivity helps



Stadtwerke Prenzlau

Hydrothermal Energy: Key aspects

Option 1: Co-Production

- GWR/OWR can be <<10% in old reservoirs
- >10 L/s water production rate possible (>2.5 MWth)
- Only installation of a heat exchanger and consumer required

Option 2: Water production from oil/gas reservoir

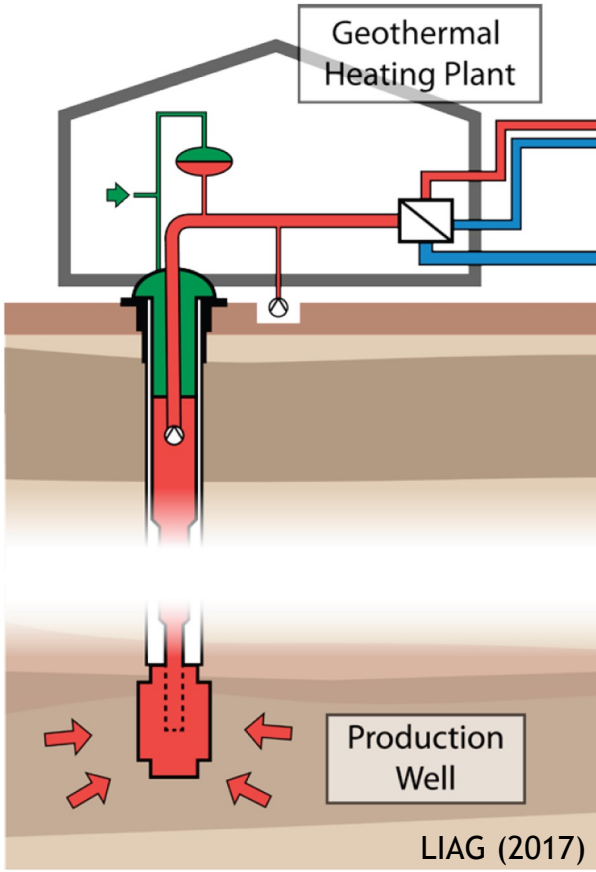
- Low reservoir pressure after decades of production
  - ➡ use for injection
- Low relative permeability of water due to residual oil/gas
  - ➡ use “dry” exploration wells

Option 3: Deepening into a geothermal reservoir

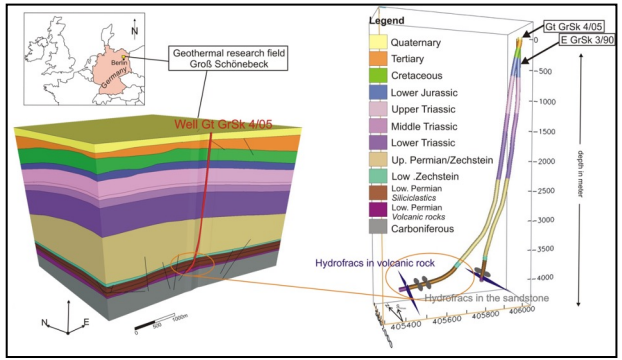
- Frictional pressure losses due to small well diameters

Option 4: Perforation of a shallower reservoir

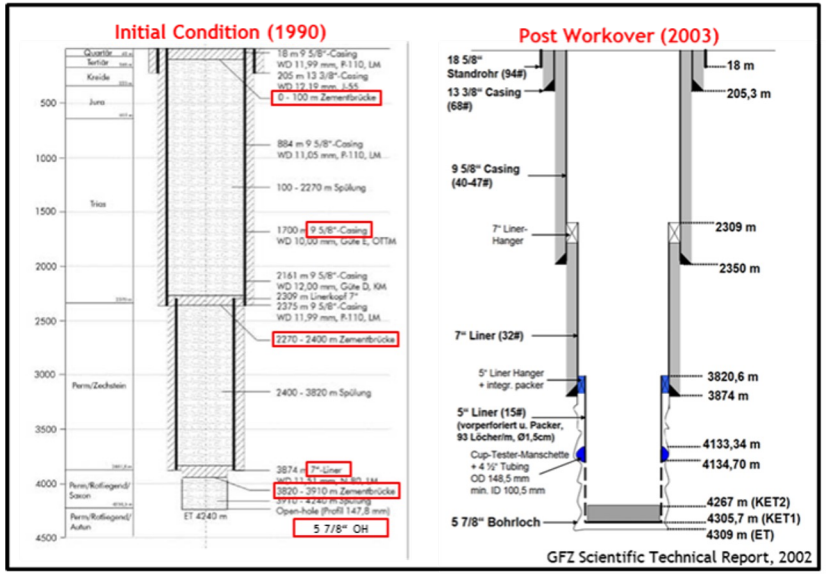
- Reservoir access and integrity can be challenging



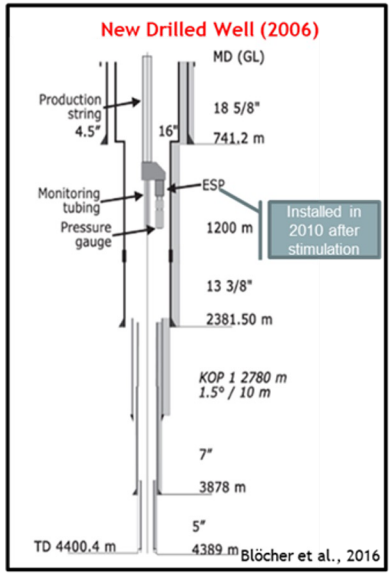
Example Groß Schönebeck: Reuse of an abandoned gas exploration well as geothermal injection well



E GrSk 3/90 Well Completion - Injection -



Gt GrSk 4/05 Well Completion - Production -



Cost for reuse:
~1.5 Mio €

Cost for new well:
~13 Mio €

https://doi.org/10.1016/j.geothermics.2025.103268

Criteria Catalogue, Database, Well Assessment Tool

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Dr. Ferenc Fedor

Criteria Catalogue, Database, and Well Assessment Tool

Criteria Catalogue: summarises, evaluates and weights all relevant factors affecting the repurposing potential of wells and surface infrastructure, including technological, geological, thermal, political and socio-economic factors.

Relational Database: collects all available data of deep wells, surface infrastructure, heat transfer and heat demand of customers required to evaluate the repurposing potential of the existing and abandoned hydrocarbon well infrastructure of the targeted rural areas.

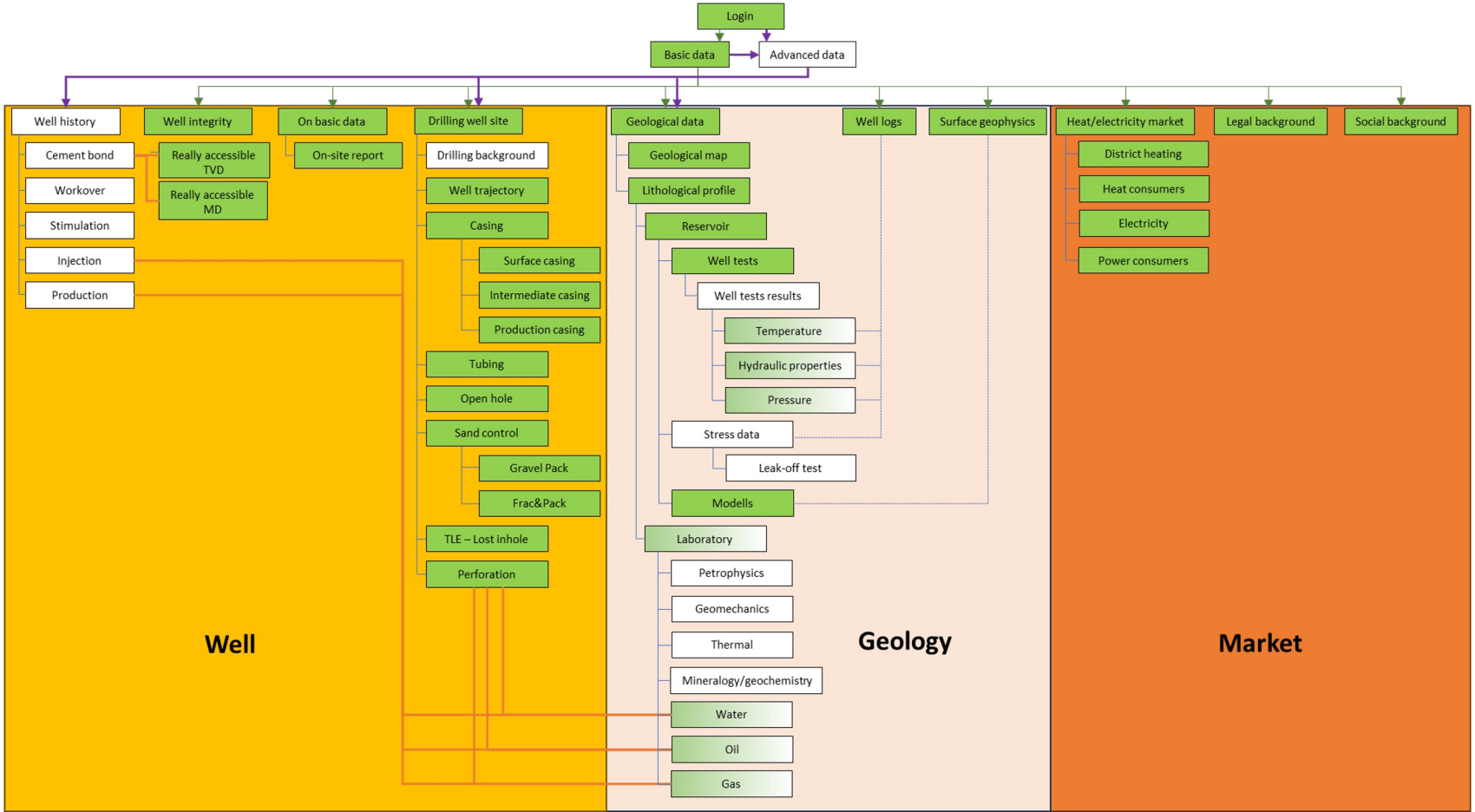
Well Assessment Tool: IT-based selection tool for identifying the most promising wells for repurposing and the most suitable reuse technologies, on the basis of the Criteria Catalogue/decision tree.

- *Available in summer/fall 2025 for review and feedback*

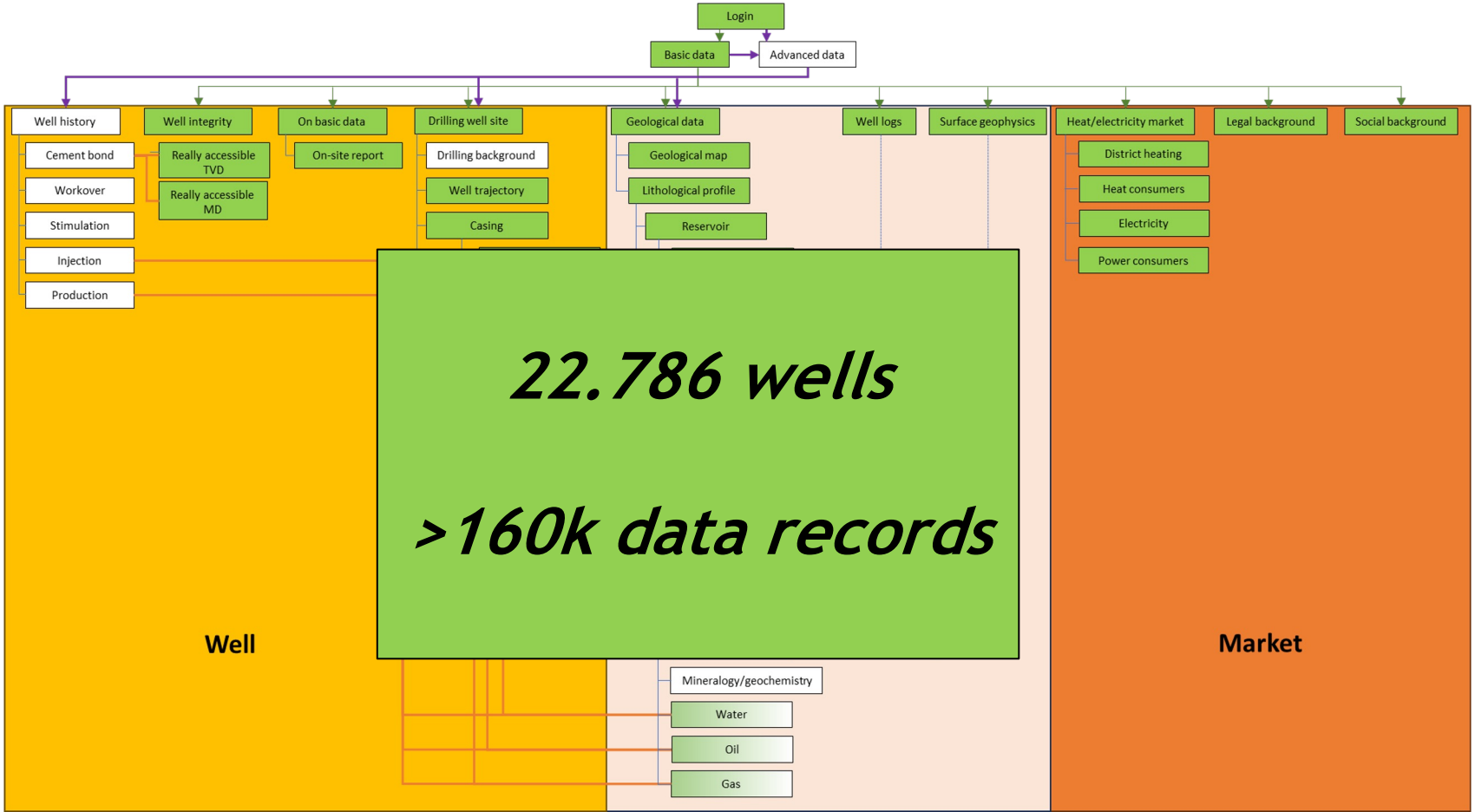
Criteria Catalogue (Decision Tree)

	Technology	EGS	HS	DBHE	BTES	ATES
1	Goal	Electricity (and heat)	Heat			
	Well/Market	W/M				
	Heat storage	Production			Storage/production	
	Well status Well integrity Protected areas	Pr?/Shut-in/TA/PA?/U? No, possible?, proven? Yes, No?	Pr?/Shut-in/TA/PA?/U? No, possible?, proven? Yes, No?	Pr?/Shut-in/TA/U? No, possible? Yes, No?	Pr?/Shut-in/TA/U? No, possible? Yes, No?	Pr?/Shut-in/TA/PA?/U? No, possible?, proven? Yes, No?
2	Market	M/I	M/A/I			
3	Geology BHT Depth Well distance	Cl, Ca, M/P >90 oC >1000 <2 km	Cl, Ca >35 oC >400 <2 km	Cl, Ca, M/P >20 oC >400 irrelevant	Cl, Ca, M/P < 100 oC 3000>D>400 <2 km	Cl, Ca, M/P any >400 <2 km
4	Mineralogy Water chemistry Gas content Porosity Permeability Water flow rate Productivity Index Minimum casing Impermeable layers Reservoir thickness	qualification qualification qualification < 10% (< 30?) < 10 exp(-14) (-12?) < 50 (< 100?) < 10 >=7 (<7?) No importance irrelevant	qualification qualification qualification > 30% (any?) >10 exp(-12) (-14?) < 100 > 10 >=7 (<7?) No importance >10 (>5?)	irrelevant irrelevant irrelevant any any irrelevant irrelevant >=7 (<7?) No importance irrelevant	irrelevant irrelevant irrelevant any <10 exp(-12) (any?) irrelevant irrelevant >=7 (<7?) No importance irrelevant	qualification qualification qualification > 30% (>10?) any > 100 (>50?) > 10 >=7 (<7?) need >10 (>5?)

Database structure - flow chart



Database structure - flow chart



Well Assessment Tool

Dataflow

GIS
ArcGIS, QGIS

Raw Data
XLS, JSON import, manual input

Reservoir Data
Well test results

Lab Measurements

Well Database

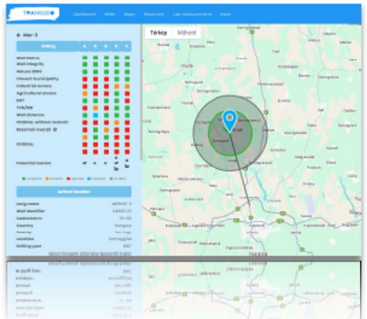
Surface Location
Geological data
Well test results
Well integrity
Well history
On-site basic data
Well logs
Surface geophysics
Calculated values (GIS)

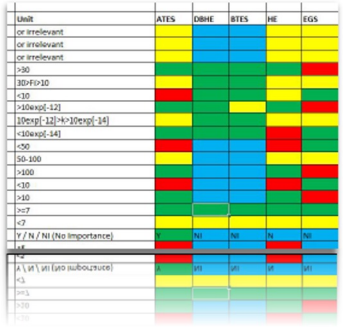
Data Flow

1. Raw Data → Well Database
2. Lab measurements → well DB
3. Reservoir data → well DB
4. Well Database → GIS
5. Calculated data → well DB
6. Maps → Dashboard
7. Well Rating
8. Visualisation

Well Rating Algorithm

19 aspects evaluated, per layer, per technology

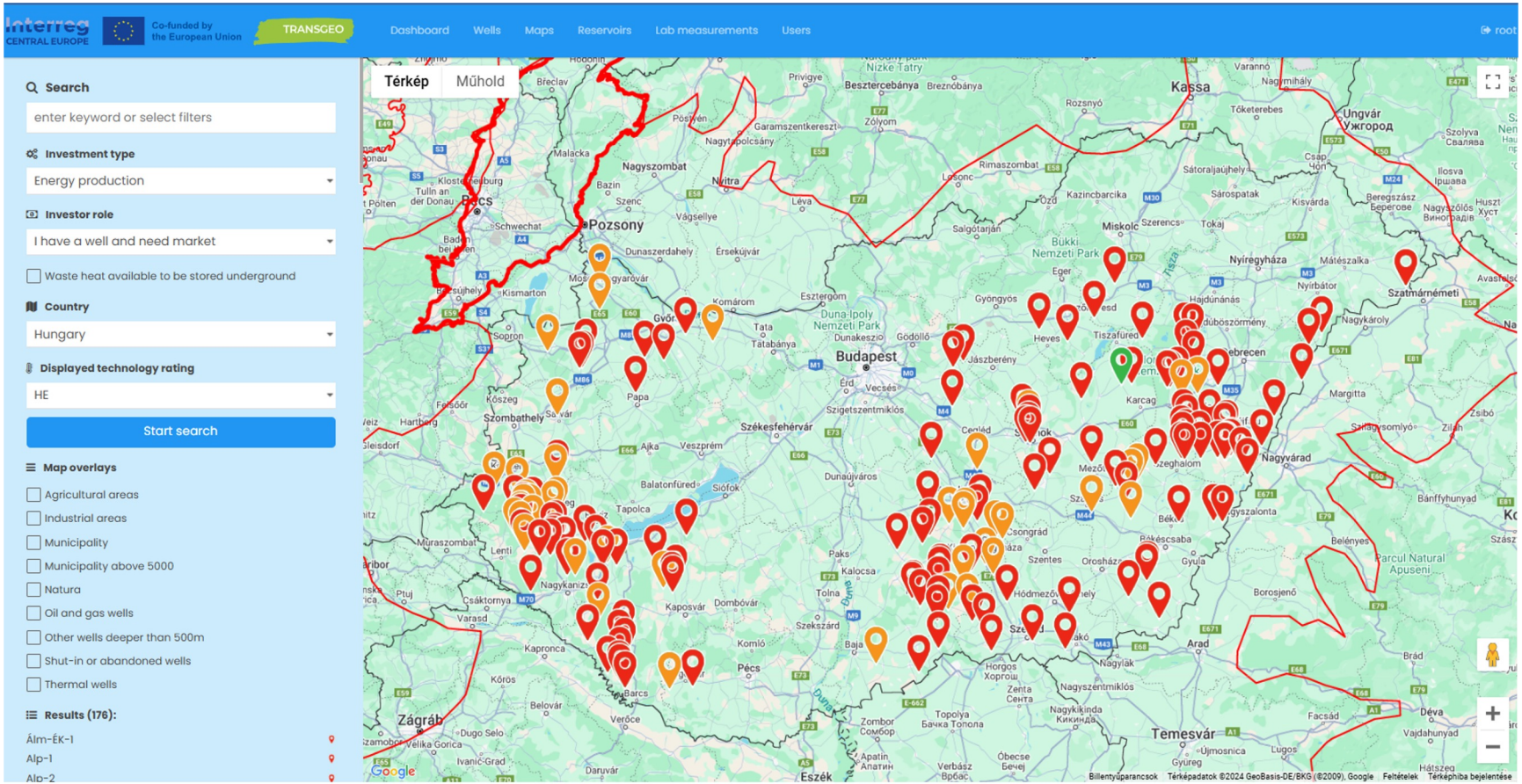




Results Dashboard

Overview of wells
Selectable map overlays
Keyword search
Detailed well data
Well ratings visualized
Potential markets
Geografical data visualized

Well Assessment Tool: Candidate well identification



Socio-Economic Analyses for Municipalities, Agriculture, and Industry

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TRANSGEO

LEA Pomurje
Lokalna energetska agencija za Pomurje

Matej Prkič

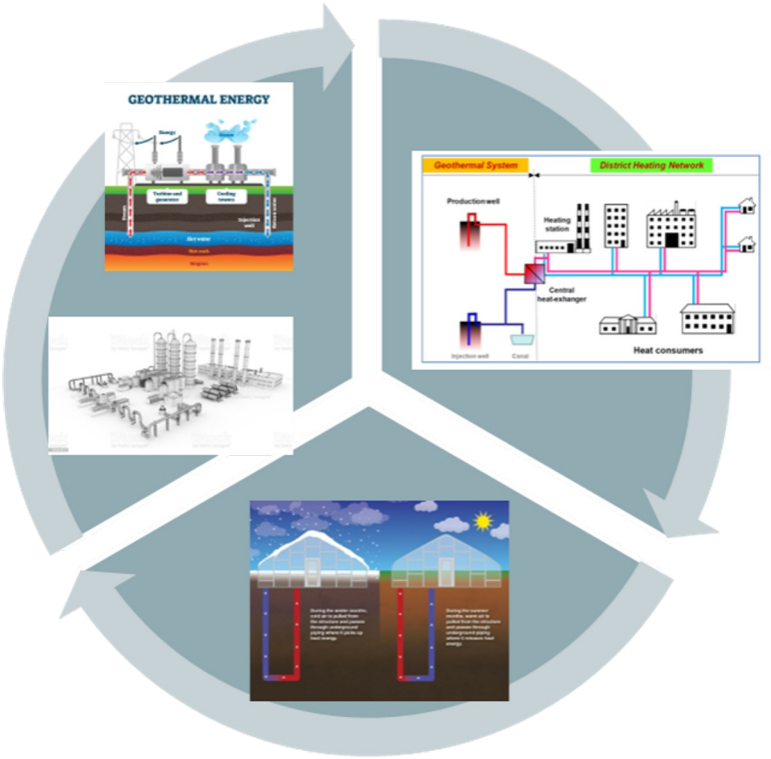
Goals of Socio-Economic Analysis

Investigate different sectors for potential application of reuse technologies:

- Industry
- Agriculture
- Municipalities

Recognize and understand the potential and challenges:

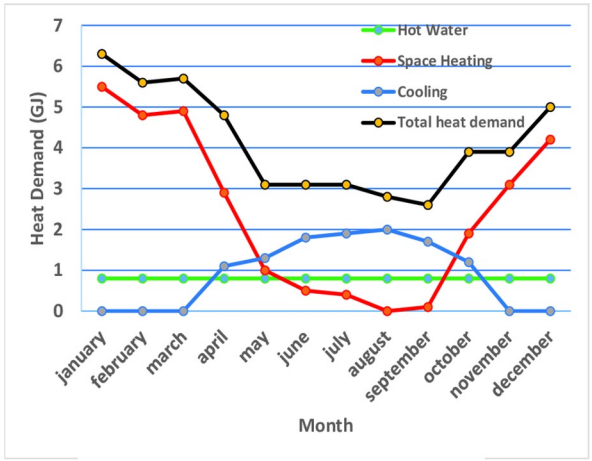
- Geothermal source
- Social view of acceptability and challenges
- Economic feasibility assessment
- Good practices

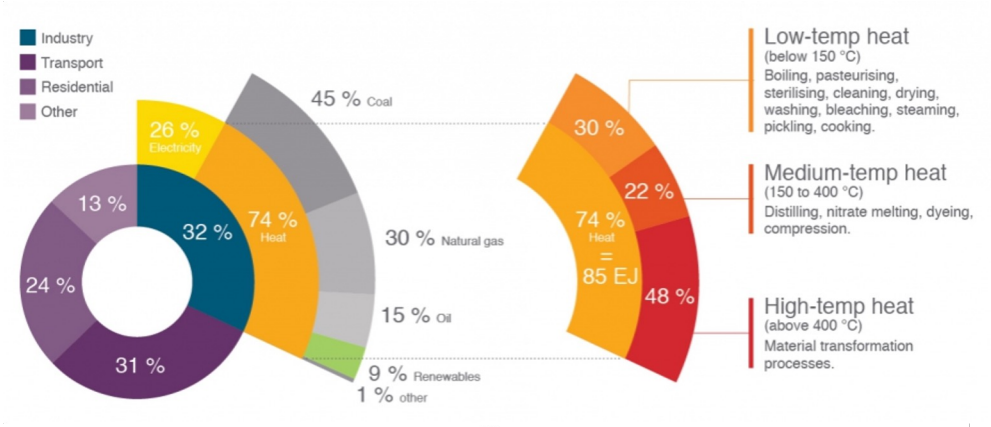


Link to 3 reports:

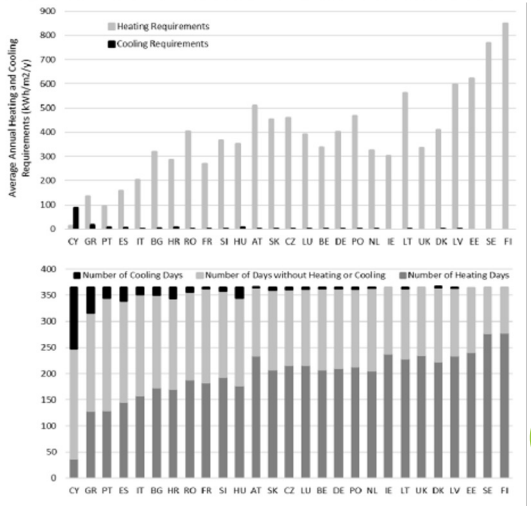
- https://www.interreg-central.eu/projects/transgeo/?tab=outputs

Demand Patterns, Applicability, and Target Groups

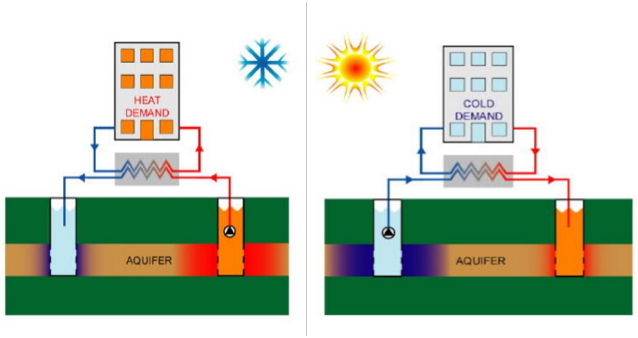


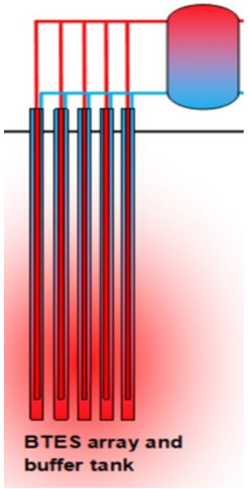


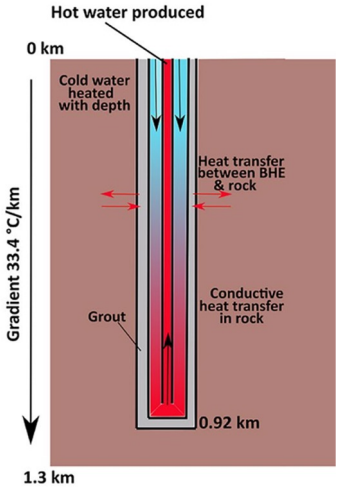
	AUSTRIA		GERMANY		HUNGARY		CROATIA		SLOVENIA	
	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%
Industry	84,7	28,8	699,0	29,0	55,0	25,2	13,1	16,9	15,0	26,6
Transport	95,3	32,4	653,0	27,0	56,9	26,0	25,9	33,2	21,8	38,6
Private sector (households)	79,9	27,1	670,0	27,0	74,7	34,2	26,4	33,9	13,8	24,3
% of overall consumption		88,3		83,0		85,4		84,0		89,5
Service sector	28,3	9,6	385,0	16,0	24,2	11,1	9,4	12,1	4,4	7,8
Agricultural sector	6,1	2,1	24,0	1,0	7,8	3,6	3,1	3,9	1,6	2,7
% of overall consumption		11,7		17,0		14,6		16,0		10,5

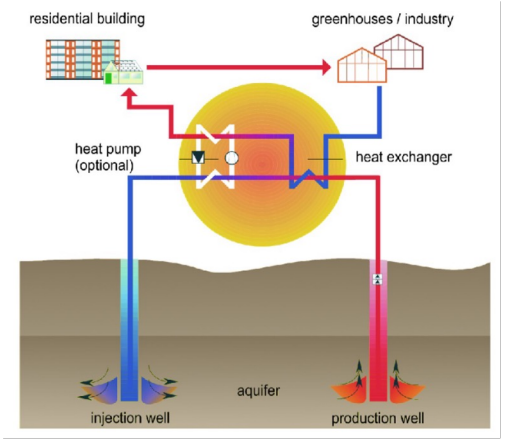


Energy Potential









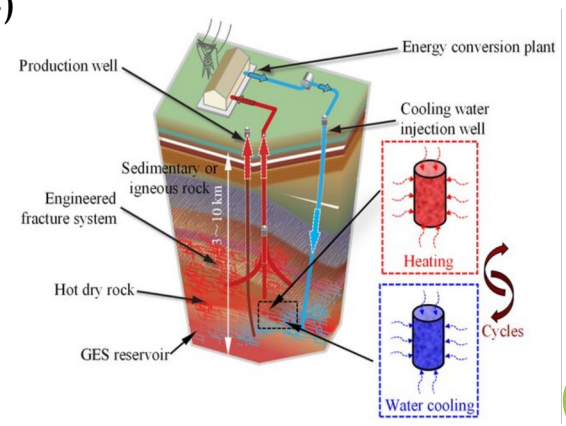
DBHE -» 0,05-0,5 MWth (e.g., Bundesverband Geothermie, 2024)

BTES -» 0,05-0,5 MWth

ATES -» 0,5-20 MWth (Fleuchaus et al., 2018)

HE -» 10-50 MWth (e.g., Bundesverband Geothermie, 2024)

EGS -» 1-5 MWe or 10-50 MWth



Cost estimates for WELLS

TECHNOLOGY	AUSTRIA / GERMANY			TOTAL COST BY TECHNOLOGY
	Workover	Services	Material	
DBHE (1 x 2000 m)	330.000 - 350.000 €	45.000 - 50.000 €	150.000 - 160.000 €	525.000 - 560.000 €
BTES (1 x 2000 m)	330.000 - 350.000 €	45.000 - 50.000 €	150.000 - 160.000 €	525.000 - 560.000 €
ATES (2 x 1000 m)	240.000 - 260.000 €	45.000 - 50.000 €	50.000 - 60.000 €	335.000 - 370.000 €
HE (2 x 2000 m)	510.000 - 550.000 €	55.000 - 65.000 €	50.000 - 60.000 €	615.000 - 675.000 €
EGS (2 x 3000 m)	2.000.000 - 2.100.000 €	120.000 - 150.000 €	100.000 - 120.000 €	2.220.000 - 2.370.000 €

TECHNOLOGY	HUNGARY / CROATIA / SLOVENIA			TOTAL COST BY TECHNOLOGY
	Workover	Services	Material	
DBHE (1 x 2000 m)	180.000 - 200.000 €	20.000 - 30.000 €	70.000 - 80.000 €	270.000 - 310.000 €
BTES (1 x 2000 m)	180.000 - 200.000 €	20.000 - 30.000 €	70.000 - 80.000 €	270.000 - 310.000 €
ATES (2 x 1000 m)	135.000 - 145.000 €	20.000 - 30.000 €	30.000 - 40.000 €	185.000 - 215.000 €
HE (2 x 2000 m)	320.000 - 350.000 €	30.000 - 40.000 €	30.000 - 40.000 €	380.000 - 430.000 €
EGS (2 x 3000 m)	860.000 - 900.000 €	90.000 - 100.000 €	90.000 - 110.000 €	1.040.000 - 1.110.000 €

- **Well workover**

Cost estimates for SURFACE EQUIPMENT

TECHNOLOGY	AUSTRIA / GERMANY				TOTAL COST BY TECHNOLOGY
	Surface/ Downhole pumps	Piping installation	Heat exchanger	Metering system	
DBHE (distance 50 m)	10.000 - 15.000 €	15.000 - 20.000 €	15.000 - 20.000 €	10.000 - 15.000 €	50.000 - 70.000 €
BTES (distance 50 m)	10.000 - 15.000 €	15.000 - 20.000 €	15.000 - 20.000 €	10.000 - 15.000 €	50.000 - 70.000 €
ATES (distance 50 m)	25.000 - 30.000 €	15.000 - 20.000 €	15.000 - 20.000 €	10.000 - 15.000 €	65.000 - 85.000 €
HE (distance 1000 m)	50.000 - 60.000 €	200.000 - 250.000 €	60.000 - 150.000 €	50.000 - 60.000 €	360.000 - 520.000 €
EGS (distance 2000 m)	180.000 - 220.000 €	400.000 - 500.000 €	150.000 - 500.000 €	60.000 - 80.000 €	790.000 - 1.300.000 €

TECHNOLOGY	HUNGARY / CROATIA / SLOVENIA				TOTAL COST BY TECHNOLOGY
	Surface/ Downhole pumps	Piping installation	Heat exchanger	Metering system	
DBHE (distance 50 m)	3.000 - 5.000 €	10.000 - 15.000 €	10.000 - 15.000 €	7.000 - 10.000 €	30.000 - 45.000 €
BTES (distance 50 m)	3.000 - 5.000 €	10.000 - 15.000 €	10.000 - 15.000 €	7.000 - 10.000 €	30.000 - 45.000 €
ATES (distance 50 m)	15.000 - 20.000 €	10.000 - 15.000 €	10.000 - 15.000 €	7.000 - 10.000 €	42.000 - 60.000 €
HE (distance 1000 m)	20.000 - 30.000 €	160.000 - 190.000 €	60.000 - 150.000 €	30.000 - 40.000 €	270.000 - 410.000 €
EGS (distance 2000 m)	120.000 - 160.000 €	320.000 - 380.000 €	150.000 - 500.000 €	50.000 - 70.000 €	640.000 - 1.110.000 €

- **Downhole pumps and production string**
- **Surface installation for distribution**
- **Heat exchanger**
- **Metering**

Policy/Legal Analysis

Interreg CENTRAL EUROPE

Co-funded by the European Union

TRANSGEO

GeoSphere Austria

Monika Hölzel

Analysis and comparison of the legal, administrative and financial framework for well reuse

- Documentation and presentation of differences and similarities in the political framework conditions at country level
- Providing a list of best practices for policy regulations and incentives to identify bottlenecks and suggestions for improvement (focus on subsurface)
- Results applicable at transnational level

Analysis and comparison of the legal, administrative and financial framework for well reuse - Examples

Licence systems for geothermal energy production exist in all TRANSGEO countries except Austria.

Well ownership:

HUNGARY	CROATIA	SLOVENIA	GERMANY	AUSTRIA
▪ permit holder ▪ state owned (600)	▪ investor/company/ permit holder/ operator ▪ after that State of Croatia	▪ operator/investor ▪ state	▪ permit holder/ operator/investor ▪ state	▪ permit holder/ operator/investor

Well ownership/ Liabilities Transfer:

HUNGARY	CROATIA	SLOVENIA	GERMANY	AUSTRIA
▪ In case of the state-owned wells the change of the ownership of a well is regulated by the State Property Act.	▪ Possible ▪ Transfer of rights and obligations can be partial or wholesome.	▪ Possible ▪ With a simple contract	▪ Possible ▪ Transfer of ownership with a contract	▪ Not applicable for single well (so far) ▪ Owner changes possible with employees and licence overtake

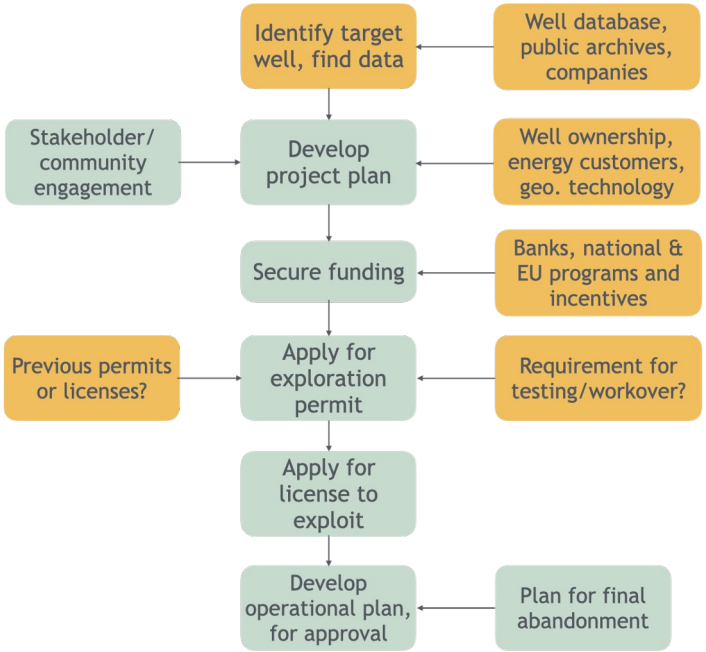
(Subsurface) Data ownership and data access:

HUNGARY	CROATIA	SLOVENIA	GERMANY	AUSTRIA
▪ Basic well data are free ▪ Detailed data can be purchased through a one-stop system.	▪ Well data are partly free ▪ For academic aFnd research use all data are free	▪ Basic well data are free: name, location, depth	▪ Basic well data are free ▪ Other data dependent on type of data and age	▪ No data are free - restricted ▪ Webmap services of Mining Authority show hydrocarbon licence boundaries

Analysis and comparison of the legal, administrative and financial framework for well reuse

Entities involved in permitting of general geothermal projects:

- **Hungary** has a one-stop shop since 2023, online, efficient and fast administration (Geothermal license application process explicitly considers well reuse, unlike other TRANSGEO countries).
- *In the other countries permit and license application procedures vary and usually depend on the purpose of the projects and locations*
- **Croatia** has a licensing process for acreages and separate applications for project execution within 3 Ministries: Mining Authority within Ministry of Economics, Ministry of Environmental Protection, Ministry of Construction and Physical Planning.
- The **Slovenian** licensing procedure includes 3 different agencies located in 2 Ministries. The process is under the supervision of the Inspectorate of Natural Resources and Mining, which is responsible for new and abandoned wells.
- **Austria** does not have a licensing system for geothermal areas. The process is mainly covered by regulations of the Mining Authority (e.g. drilling) and the Water Act (That is valid for applications using thermal waters. Closed systems, like deep borehole heat exchangers, are excluded)
- In **Germany**, multiple applications for approval are usually required: Mining Authority, Water Authority, state environmental agency, nature conservation associations, district authorities, nuclear waste repositories. There is a new draft law to speed up approval procedures, and revising the Mining Act.



Typical project development process (green), with special considerations for well reuse (orange)

Analysis and comparison of the legal, administrative and financial framework for well reuse

Question	HUNGARY	CROATIA	SLOVENIA	GERMANY	AUSTRIA	EUROPEAN UNION
National funding	no	no	no	no (for HE only)	yes	no (apart from usual EU funding)
Other/alternative funding	yes	yes	yes	yes	no	no (apart from usual EU funding)
Incentives	yes	no	no	no	no	no

- While funding for reuse projects is limited, the majority of funding is for geothermal energy projects that include drilling new wells.

Outcomes, Barriers and Next Steps

- Our analysis shows **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.**
- A requirement to consider reuse would be important for new strategic planning at national and EU scales.
- **TRANSGEO Strategy and Action Plan** will provide detailed recommendations for concrete steps to take to accelerate well reuse in new geothermal development.

Link to policy analysis report:

- https://www.interreg-central.eu/wp-content/uploads/2024/09/D-3.1.1-Policy-Analysis-FINAL.pdf

Feasibility Studies for Pilot Sites, and case example of Mihovljan

Interreg CENTRAL EUROPE

Co-funded by the European Union

TRANSGEO

University of Zagreb
FACULTY OF MINING GEOLOGY AND PETROLEUM ENGINEERING

Tomislav Kurevija

Site-specific Feasibility Studies for Well Repurposing

Eight pilot sites with abandoned hydrocarbon wells:

1) Ampfing, Germany - Hydrothermal energy
2) Weinviertel, Austria - Borehole Heat Exchanger
3) Hungarian Great Plain - Hydrothermal energy
4) Mihovljan, Croatia - Hydrothermal energy
5) Zagreb-Savica, Croatia - Borehole Thermal Energy Storage
6) Pomurje, Slovenia - Borehole Heat Exchanger
7) Lausitz, Germany - Aquifer Thermal Energy Storage
8) Groß Schönebeck, Germany - Enhanced Geothermal Systems

These studies

- Serve as validation and finalisation of the Criteria Catalogue, Well Assessment Tool, and Engineering Workflows for the 5 geothermal reuse technologies
- Are the basis for investment decisions at the pilot sites beyond the project implementation.

Example - Feasibility Study for the field Mihovljan (Pannonian Basin)

Addresses hydrothermal heat production (HE) from the mature oil field Mihovljan, which will be abandoned after oil production ceases. Mihovljan contains thin sandstone geothermal brine layers above oil saturated layers.

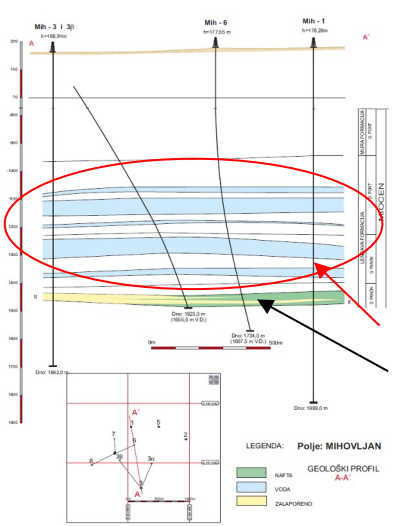
This field could be retrofitted to supply heat to the nearby town of Čakovec through a small district heating network, or provide geothermal heat to the agricultural sector/greenhouses.

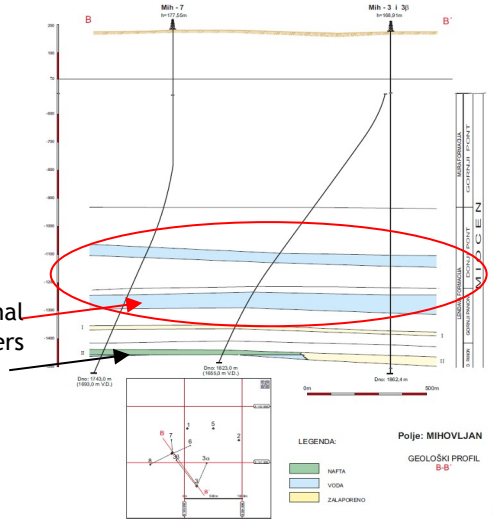
Feasibility Study content:

- Geographic location and analysis of spatial planning documentation
- Mihovljan exploitation field – well database analysis: well construction, geological-geophysical works and special operations, production tests
- Geological structure of the geothermal reservoir
- Production features of the potential location with quantification of possible brine production from the current well infrastructure and new drilling
- Environmental features of the project from the perspective of environmental impact
- Techno-economic analysis

→ *Studies will be available fall/winter 2025/26*

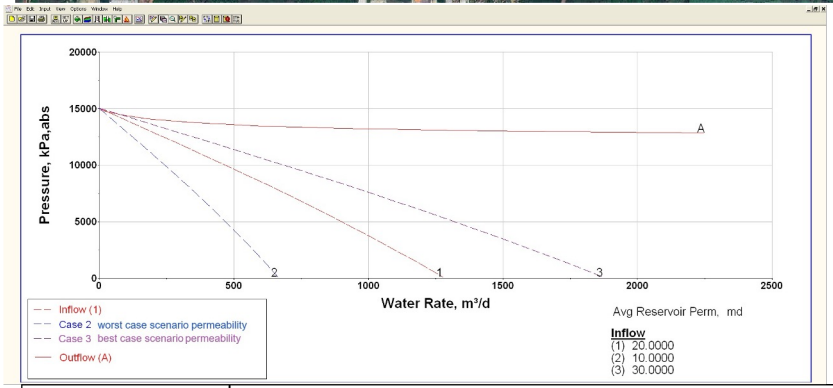
D.2.3.4 Feasibility study for the pilot field Mihovljan (Pannonian Basin) (expected to be available Fall 2025)





Geothermal brine layers

Oil bearing layers



Well status	Well name
Active	Mih-1, Mih-3beta, Mih-6, Mih-7
Liquidated	Mih-3, Mih-3alfa, Mih-4, Mih-4alfa, Mih-4beta, Mih-5, Mih-8

- 11 well channels drilled; 4 active wells proposed for revitalization and repurposed for geothermal brine utilization
- Two pairs of Production + Injection wells:
  - Mih-1 (P) + Mih-7 (I)
  - Mih-3beta (P) + Mih-6 (I)
- cca 5-8 l/s @ 82°C per well, mid-permeable (10 – 20 mD) thin sandstone layers ~ 35 m at 1545 m depth
- Analysis of production & injection pumps power capacities and determination of best possible SPF

Transnational Strategy and Action Plan

Interreg CENTRAL EUROPE

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TRANSGEO

MEĐIMURSKA ENERGETSKA AGENCIJA d.o.o.

Ema Novak

Why strategic planning?

- Importance of repurposing abandoned wells for energy use
- Lack of necessary resources
- Summarized findings, ideas and recommendations
- Beginning of changes on transnational level

Source: Freepik.com

Transnational Strategy for sustainable development of Central European regions

- Transition from fossil to geothermal energy use -

Current features of geothermal energy utilisation in the Central European regions

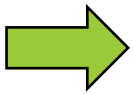
- Strategic, legislative and legal framework for geothermal energy exploration, exploitation and use
- Geothermal potential of the Central European regions
- Well repurpose potential of the Central European regions

Environmental impact of the geothermal energy use and well repurposing

Financing opportunities

Challenges and strategic objectives

Implementation recommendations



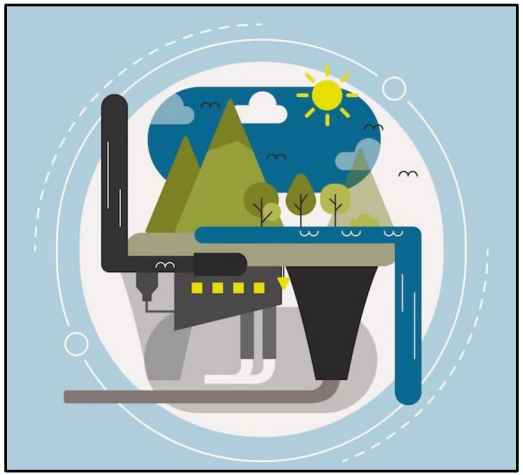
Transnational Action Plan

(Strategy available winter 2025/26)

Transnational Action Plan for the sustainable transition from fossil to geothermal energy use

- Empirical background based on the Transnational Strategy
- Elaboration of the priorities, objectives and measures
- Definition of the legal, human, time and financial resources

Guidance document



Source: Freepik.com

(Action Plan available spring 2026)

Outputs/Deliverables

- *Complete - available for download from the TRANSGEO website*:*
  - Engineering Workflows (with numerical modelling and literature reviews)
  - Socio-Economic Analyses (3) for Industry, Municipalities, and Agriculture
  - Policy/Legal Analysis (including funding support/incentive programs)

- *In preparation:*
  - Database and Criteria Catalogue (summer/fall 2025)
  - Well Assessment Tool, and assessment of wells in database (fall 2025)
  - Feasibility Studies of 8 pilot sites (fall 2025)
  - Transnational Strategy (fall 2025) and Action Plan (spring 2026)

* *https://www.interreg-central.eu/projects/transgeo/?tab=outputs*

Engagement Opportunities

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TRANSGEO

GFZ Helmholtz Centre for Geosciences

Julie Friddell

Input to our Products

- *Well Assessment Tool - summer/fall 2025*
- *Transnational Strategy - fall 2025*
- *Transnational Action Plan - winter 2025/26*

Upcoming Meetings

Join us for

- *Transnational Strategy webinar - September 2025*
- *Well Assessment Tool webinar - October 2025*
- *TRANSGEO Final conference - April 2026*

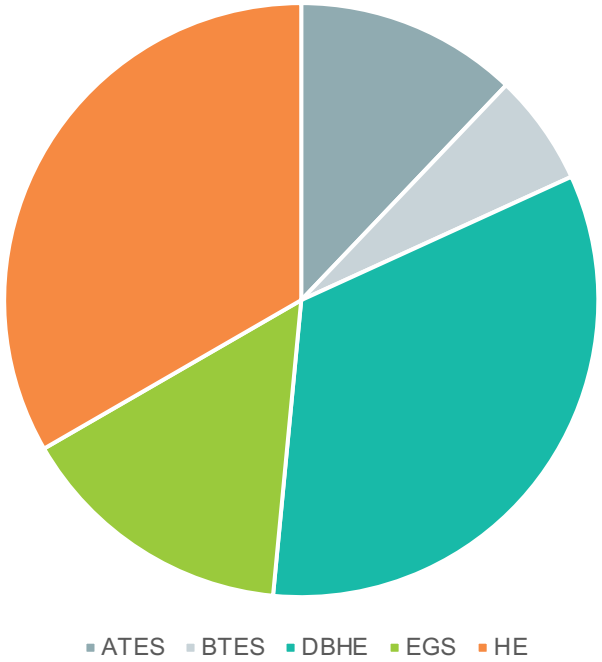
Upcoming Meetings

Join us for

- *Well Assessment workshops - summer/fall 2025*
- *Pilot site workshops - summer/fall 2025*
- *Transnational Action Plan workshops - winter 2025/26*

Discussion, Questions?

➢ Poll: *Which reuse technology fits best into the overall strategy for geothermal development?*



1. DBHE & HE
2. EGS & ATES
3. BTES

Opportunities for Collaboration

- Do you have information to share on new reuse projects, or do you have interest in reusing a well?
- Do you have case studies, best practices, or lessons learned to share?
- Can you suggest or recommend strategies or policy changes to improve the legal and permitting situation for well reuse?
- *Would you like to join our mailing list, to receive information on opportunities to provide input to our upcoming deliverables or to join our meetings and webinars in 2025 and 2026?*
- ***Would you like to collaborate on planning a well reuse project with our consortium?***

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Thank you!

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julie@gfz.de

+49 331 6264 3058