Transboundary thermal groundwater
Transenergy project

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TRANSENERGY: Transboundary Geothermal Energy Resources of Slovenia, Austria, Hungary and Slovakia
April 2010 – April 2013
Hungary shares (transboundary) aquifers with:

- Austria
- Croatia
- Slovakia
- Romania
- Slovenia
- Serbia
- Ukraine

Danube river basin
800,000 km²
81 million inhabitants
2. **Negative water balance**

**Draw down** (drinking water extraction, irrigation + gr. water usage in Serbia)

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**Bilateral agreements**

**Good chemical status**
Negative water balance
GWDTE (previous mining, the actual gr.water extractions delay the recovery)

DWPA (NO3)
Main goals of Transenergy

A user friendly web-based decision supporting tool (interactive web portal), which transfers expert know-how about hydrogeothermal utilization (single-well - balneology and doublets - geothermal energy) and sustainable reservoir management to stakeholders (decision makers, water- and mining authorities, present and potential investors, scientific associations and wider public interested), such as:

- complex assessment of thermal groundwater bodies
- scenario models for different water extractions: predictable quality and quantity changes
- experiences of present (cross-border!) interactions, best practice recommendations
- sustainable utilization

Shallow geothermal potential (Ground-Source Heat Pumps) are not part of assessment
SLO-AT-HU cross border region
Bad-Radkersburg-Hodos pilot area

Styrian Basin
Maximum basin depths \( \sim 3.500 \text{m} \)
Maximum reservoir temp. \( \sim 130 \text{ C} \)
Heat flow 70-130 mW/m\(^2\)

Mura-Zala Basin
Maximum basin depths \( \sim 5.500 \text{m} \)
Maximum reservoir temperatures \( \sim 200 \text{ C} \)
Heat flow 60 -150 mW/m\(^2\)
AT-HU cross-border region: Lutzmannsburg - Zsira

Maximum basin depths ~2,000m
Maximum reservoir temp. ~70 °C
Heat flow 70-110 mW/m²

Karst water level at MÁFI’s monitoring well at Zsira
AT-SK cross-border region: Vienna basin

Maximum basin depths ~7,000m
Maximum reservoir temp. ~200°C
Heat flow 40-90 mW/m²

Hydraulic barrier

Recharge area

Low mineralization
Active recharge
Temperature anomalies

High mineralization
Connate
Over pressured
AT-HU-SK cross-border region: Central depression of Danube basin
SK-HU cross-border region: thermal karst of Komárom-Sturovo depression in karst water level 1990’s

http://transenergy-eu.geologie.ac.at
Current status of investigation — Common database

Additional water sampling
Additional well logging

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Current status of investigation — Utilization

Overview of legislations

Database of thermal water users and authorities who provide the licences for use

308 operating thermal wells in total

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Amount of thermal water usage by countries; 2009

24.5 mio m³/y
2.7 mio m³/y
4.1 mio m³/y

Type of usage

outflow 11%
opflow 1%
reinjection 3%
pumping 85%
no data 1%
Aquifer proportions

- PI clastic rocks and sediments
- M6-PI clastic rocks and sediments
- M6-M7 clastic rocks and sediments
- M4-M5 carbonate rocks
- M4-M5 clastic rocks and sediments
- M1-M3 clastic rocks and sediments
- M volcanic rocks
- E carbonate rocks
- Mz carbonate rocks
- Mz clastic rocks
- Pz carbonate rocks
- Pz metamorphic rocks

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Temperature distribution of extracted thermal water
Current status of investigation — Geological model
Determination of hydrostatic units

1. Pleistocene sediments
2. Upper Pannonian sediments
3. Lower Pannonian sediments / Post Sarmatian Miocene sediments
4. Sarmatian sediments
5. Badenian sediments
6. Palaeogene formations
7. Post Triassic Mesozoic formations (delineation of Upper Cretaceous limestones)
8. Triassic karstic limestone and dolomite complex
9. Fractured crystalline basement
Hydrogeological models

Supra regional model

- Identification of main flow systems and their connections
- Characterization of regional hydrogeological processes
- Boundary condition determination for the scenario models

1:500 000

Scenario models

- Survey of cross border hydrogeological issues
- Predictive modelling of the applications of different technologies
- Predictive modelling of different levels of thermal water use

1:100 000; 1:200 000

Model calibration

Chemical and isotope data
Monitoring data (spatial, temporal changes)
Production data

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Concluding remarks

- Present utilization of geothermal energy is still far below its potential, synergies with water management should be in focus.
- Only harmonized, multi-national management strategies can lead to sustainable utilization of transboundary (groundwater, geothermal) resources; good status maintenance, achievement.

Transenergy project

assessment of 5 transboundary pilot areas in the W-ern Pannonian basin (SLO, AT, HU, SK)
Thank you for your attention!