Current and Future Geothermal Energy Utilization in the Transenergy Area between Austria, Hungary, Slovenia and Slovakia

Nina Rman[1], Andrej Lapanje[2], Annamária Nádor[3], Nóra Gál[4], Daniel Marcin[5], Gerhard Schubert[6], Julia Weilbold[7]

[1-2]: Geološki zavod Slovenije, Dimičeva 14, 1000 Ljubljana, Slovenia; e-mail: [1]nina.rman@geo-zs.si, [2]andrej.lapanje@geo-zs.si
[3-4]: Magyar Állami Földtani Intézet, Stefánia út 14, 1143 Budapest, Hungary
[5]: Štátny geologický ústav Dionýza Štúra, Mlynská dolina 1, 817 04 Bratislava 11, Slovakia
[6-7]: Geologische Bundesanstalt, Neulinggasse 38, A-1030 Wien, Austria

Abstract

Many thermal water users are known in the transboundary area between Austria, Hungary, Slovenia and Slovakia, but no detailed estimation on actual use of thermal water has been known till this research. With it harmonized transboundary utilization data were collected, incorporated into a SQL database and interpreted. There are 145 active users identified and 27 inactive. Thermal water is used for bathing and swimming, drinking and industrial water, individual space and sanitary water heating, agriculture, greenhouse and district heating and other purposes. Neglecting the unreported Austrian production, the total annual production reached 30.2 million m^3 in 2009, with the Mesozoic carbonate and the Upper Miocene clastic geothermal aquifers producing 93% of it. The rising development trend could cause an additional thermal water production as capacity of inactive wells is estimated to 6 million m^3 annually without major investments. Quantities asked for or granted in water permits reach almost double the current production. However, changes in aquifers due to exploitation are already evident, especially in the Upper Miocene clastic aquifers, therefore the negative impact could become more

Aims of our work

• provide an integrated assessment of geothermal energy utilization in the transboundary area between AT, HU, SI, SK

• identify (un)sustainable use of geothermal resources

• present hydrogeological characteristics of exploited geothermal aquifers

• point out negative effects of thermal water production and production difficulties

• provide a fast and simple overview of what-to-expect for potential investors in geothermal sector

Methodology

• thermal water has at least 20°C at the wellhead or spring

• unified transboundary methodological approach

• field inspection manual and questionnaire for thermal water users

• SQL database with three-level data approach

• unification and quality check of gained information by applying pull-down menu options

• numerical and graphical interpretation in Excel and Statistica

• ArcGIS maps showing spatial distribution of the most important utilization parameters

• reports are available at Transenergy project website (http://transenergy-eu.geologie.ac.at)

• database of users is available directly at http://akvamarin.geo-zs.si/users

Thermal water users

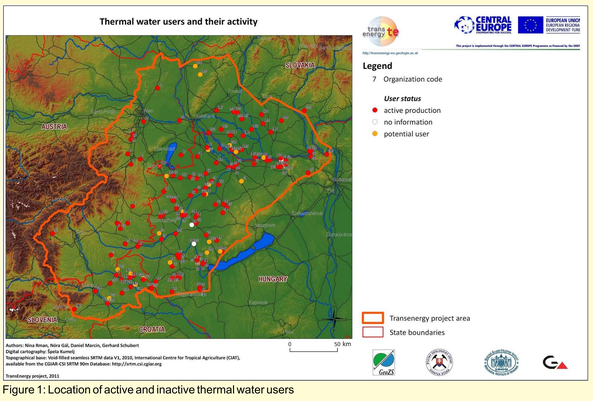

Figure 1: Location of active and inactive thermal water users

Table 1: Number of active and inactive geothermal wells and springs

User activity	active			no information	inactive	
Borehole activity	constantly	occasionally	inactive	no information	inactive	Sum of wells
E Austria	41		4	4		49
NW Hungary	139	5	17	1	19	184
NE Slovenia	16	12	2		5	35
SW Slovakia	18	12	4		5	39
Sum of wells	214	29	27	5	29	307

Hydrogeological characteristics of the area

• 11 different geothermal aquifers are identified, but only 4 are widely exploited (figure 2)

• 55% of wells capture the Upper Miocene clastic aquifers, which often show yield and water level decrease combined with chemistry and temperature changes

• 27% of wells capture the Mesozoic carbonate aquifers, which do not show major changes due to exploitation

• other geothermal aquifers are either local or contain predominately cold or high mineralized water or much gas

• 39 active and 8 inactive wells are screened in multiple aquifers allowing in-well flow

• total annual production (neglecting Austria) reached 30.2 million m^3 in 2009 (figure 3)

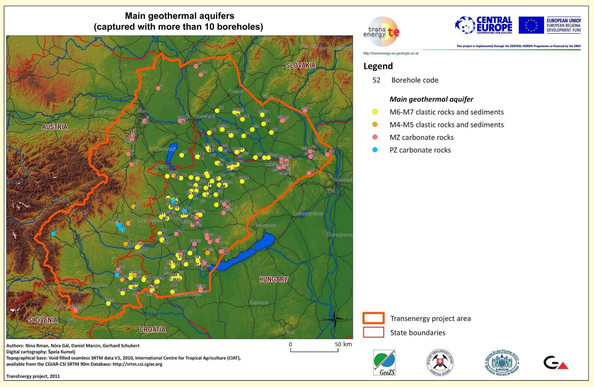

Figure 2: Main geothermal aquifers captured by geothermal wells

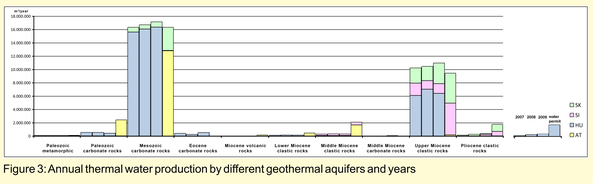

Figure 3: Annual thermal water production by different geothermal aquifers and years

Thermal water utilization and management

• application of monitoring (groundwater level, produced quantity, water temperature and quality) and its data storage is rather poor in all four countries

• the same was evident for waste water (emission) monitoring application

• majority of produced thermal water is emitted into surface waters without any treatment

• 10% of users clean waste water at purifying or dechlorination plants

• reinjection is constantly applied in a well in Austria and periodically in one in Slovakia and one in Slovenia

• more than 94% of users emit waste water with temperature above 20°C

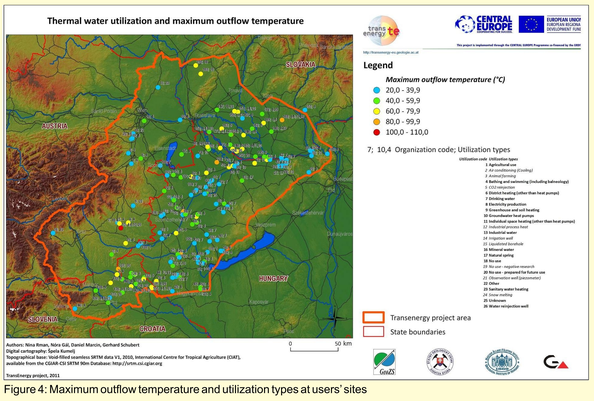

Figure 4: Maximum outflow temperature and utilization types at users' sites

Figure 5: Distribution of maximum outflow temperature by countries

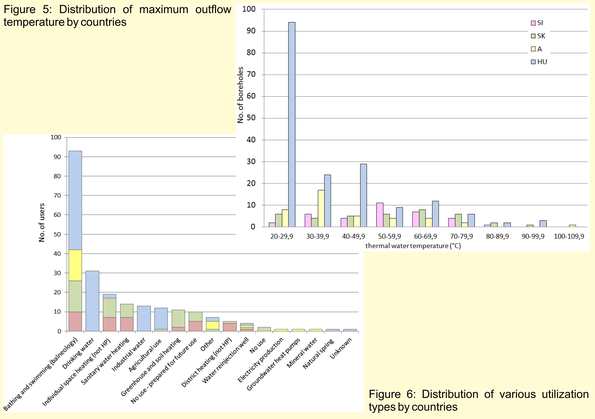

Figure 6: Distribution of various utilization types by countries

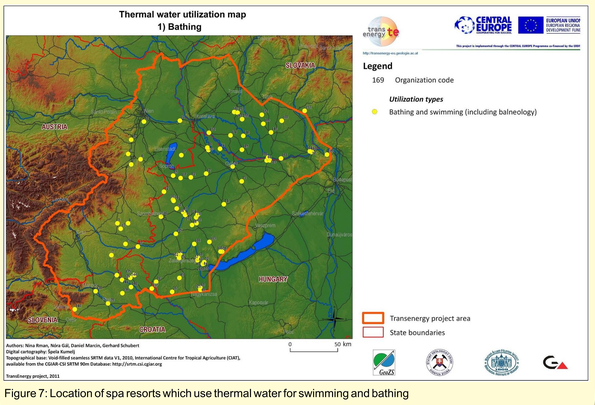

Figure 7: Location of spa resorts which use thermal water for swimming and bathing

Conclusions

• 145 active users of low-temperature geothermal resources are identified, producing over 30 million m^3 thermal water annually (no Austrian data)

• The most exploited are the Upper Miocene clastic and the Mesozoic carbonate aquifers

• 17 utilization types are reported: bathing and drinking waters prevail, followed by various space and water heating types

• Only one well produces geothermal electricity at a binary power station (0,2 MWe)

• Production and emission monitoring is mostly poorly applied, thermal and chemical pollution of surface waters is indicated

• Potential of inactive wells is estimated to 6 million m^3 per year, while the quantity in water permits is at least double the current abstraction. However, it is not known if this production is hydrogeologically feasible, as changes in operation have already been reported.

References

Rman, N., Lapanje, A. and Prestor, J. [2011] Water concession principles for geothermal aquifers in the Mura-Zala basin, NE Slovenia. Water Resources Management, 25/13, 3277-3299.

Rman, N. et al. [2011] Database of users and database of utilization parameters. Final report for Transenergy project available at http://transenergy-eu.geologie.ac.at/index-Dateien/Page959.html.

Rman, N., Kumelj, Š. et al. [2011] Utilization maps. Final report and 12 maps for Transenergy project available at http://transenergy-eu.geologie.ac.at/index-Dateien/Page959.html.

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF.