



Research and Innovation in Geothermal of Hungary

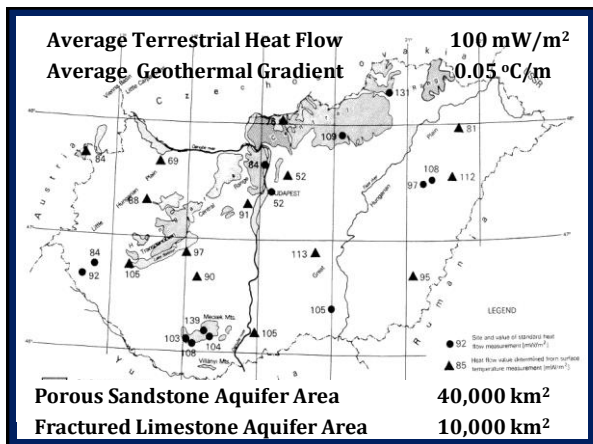
Prof. Elemer Bobok
University of Miskolc
Petroleum and Gas Engineering Department

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Hévíz Spa 62 MW_t



Natural Conditions

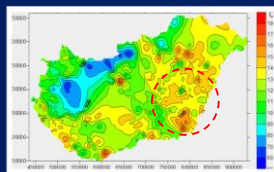
- Pannonian sedimentary reservoir
 - multilayered, sandy, shaly
 - area 40,000 km²
 - thickness 200-300 m
 - porosity 20-30%
 - permeability 500-1,500 mD
 - depth 1200-2200 m
- Triassic fractured limestone reservoir
 - area 10,000 km²
 - thickness 80-100 m
 - porosity < 5 %
 - permeability 500-1,500 mD
 - depth 2000-3000 m

Production and Utilization

Most Hungarian geothermal wells produce hot water from the Pannonian basin.

The best area is the Southeast of Hungary.

Operating Wells: 672
Abandoned Wells: 179
Temporarily Closed: 220
Produced: 79.46 million m³
Thermal Power: 863.6 MW_t



Temperature distribution at the depth of 2500m

Utilization	Wellhead Temperature in C°							
	40-50	50-60	60-70	70-80	80-90	90-100	>100	
Number of Wells	Balneology	119	53	35	9	3	0	
	Agriculture	69	15	14	17	19	1	
	Communal	2	2	2	7	3	1	
	Industrial	44	11	6	6	3	0	
	Multi Purpose	17	13	29	16	5	1	
Thermal Capacities								
Total Flow Rate [kg/s]	7116.10							
Capacity [MW _t]	863.58							
Avg. Flow Rate per Well [kg/s]	2373.02							
Energy [TJ/yr]	9573.06							
Capacity Factor	0.47							



Tiszaújváros Spa



Balneology

Thermal wells : 295
 Natural springs : 132
 Production: 41 million m³
 Thermal power: 352 MW_t
 Averaged value: 3,912 TJ/year



Agriculture

Thermal wells : 181
 Production: 11 million m³
 Greenhouses: 70 ha
 Plastic tents: 250 ha
 Thermal Power: 3,414 TJ/year



District and space heating

District heating: 80 %
 Individual heating: 20 %
 Thermal power: 186.58MW_t; 2,026 TJ/year.

Miskolc Geothermal Project 2013-14
 Production wells: 2,305 -1,514 m
 Flow rate: 6,600- 9,000 l/min
 Temperature: 90-105 °C
 Capacity: 50-60 MW_t



Geothermal heat pumps

The installed capacity is about 40 MW_t.
 The number of installed units is more than 4,200.
 The average COP obtained is 4.0.
 The size of individual units is 10 kW to 1,000kW
 Sales of heat pumps in Hungary decreased in 2010 -2014.

Main causes:

- very well-developed existing natural gas infrastructure
- the ongoing macroeconomic crisis
- insufficient supports and incentives
- electricity tariff applies to heat pumps used for heating in cold periods, but not for cooling in the summer.



Environmental Impact

Reservoir pressure decrease

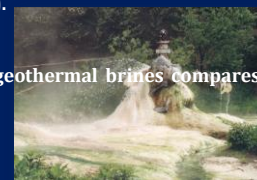
Some fields have been exploited for more than eighty years, like the *Hajdúszoboszló* field, where production can only be sustained by artificial lifting methods.

Although injection is a routine technology in the petroleum industry, little of the total produced thermal water is injected (34 of 672).

Salinity

The salinity of Hungarian geothermal brines compares to that of seawater..

Bükkszék Spa: 24.000 mg/l dissolved solids



Energy Policy: Legal and Regulatory Aspect

- There is no national geothermal authority for geothermal energy production and utilization.
- The geothermal sector has no access to an integrated and comprehensive national database containing precise, reliable, independently updated information.
- National taxation law does not promote increased capital investment in geothermal energy.
- A geothermal insurance and risk fund, particularly for deep exploratory drilling, requires that financial tools be made available, to help replace fossil-fuel use and reduce the country's CO₂ emissions.

Education and Training

Geothermal education has a long tradition in Hungary, dating back to the early 60s. The University of Miskolc offers geothermal degrees at BSc, MSc, and PhD levels.



Course Title	Lesson I. Sem.	Crdt II. Sem.	Lesson III. Sem.	Crdt IV. Sem.		
Renewable Energy						
Advanced Geology						
Advanced Geophysics						
Fluid Dynamics						
Hydrogeology						
Drilling/Well Design						
Geothermal Reservoir						
Geothermal Water Production						
Geoinformatics						
Geothermal Chemistry						
Geothermal Heat-Transfer						
Geothermal Systems						
Geothermal Power Production						
Geothermal Direct Uses						
Geothermal Heat Pump						
Geothermal Environmental Impact						
Energy Management						
Economic Studies					16	2
EU Tenders					16	2
Legal Knowledge					12	2
Total Number of Lessons	80	80	96	44	300	

Conclusions

- Hungary has favorable natural conditions for geothermal energy production, but actual use lags far behind potential.
 - For the Hungarian geothermal industry to progress, it needs a well-considered energy policy together with supportive legal and financial conditions.
- Nevertheless, there are promising elements:**
- With support from the EU, some new geothermal district heating systems were implemented with successful injection practice.
 - Implementation for the EGS pilot power plant has been given the go-ahead .

Thank you for your attention!