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GEO THERMAL RESOURCES IN ROMANIA AND THE RONDINE PREDEFINED PROJECT

M. Rosca, C. Bendea, G. Bendea
University of Oradea

INTRODUCTION



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Signs of use in pre-historical times.

Spas attested during the Roman Empire times.

First well drilled in 1885 in Felix Spa (depth 51 m, flow rate 195 l/s, temperature 49°C), still used.

Exploration started in early 60's (geological research).

More than 200 geothermal wells drilled by now:

- Depth: 800 – 3,500 m;
- Well head temperatures: 40 - 120°C.

INTRODUCTION



Proven geothermal reserves 200,000 TJ for 20 years.

Annual production about 3,000 TJ.

Total thermal capacity of existing wells 480 MW_{th} (for a reference temperature of 25°C).

Only about 200 MW_{th} currently used, from 96 wells (of which 40 wells used for balneology and bathing).

Capacity factors between 1% and 68% (Oradea).

Only 2 new wells drilled during 2001 – 2015, two more have been drilled last year (RONDINE projects).

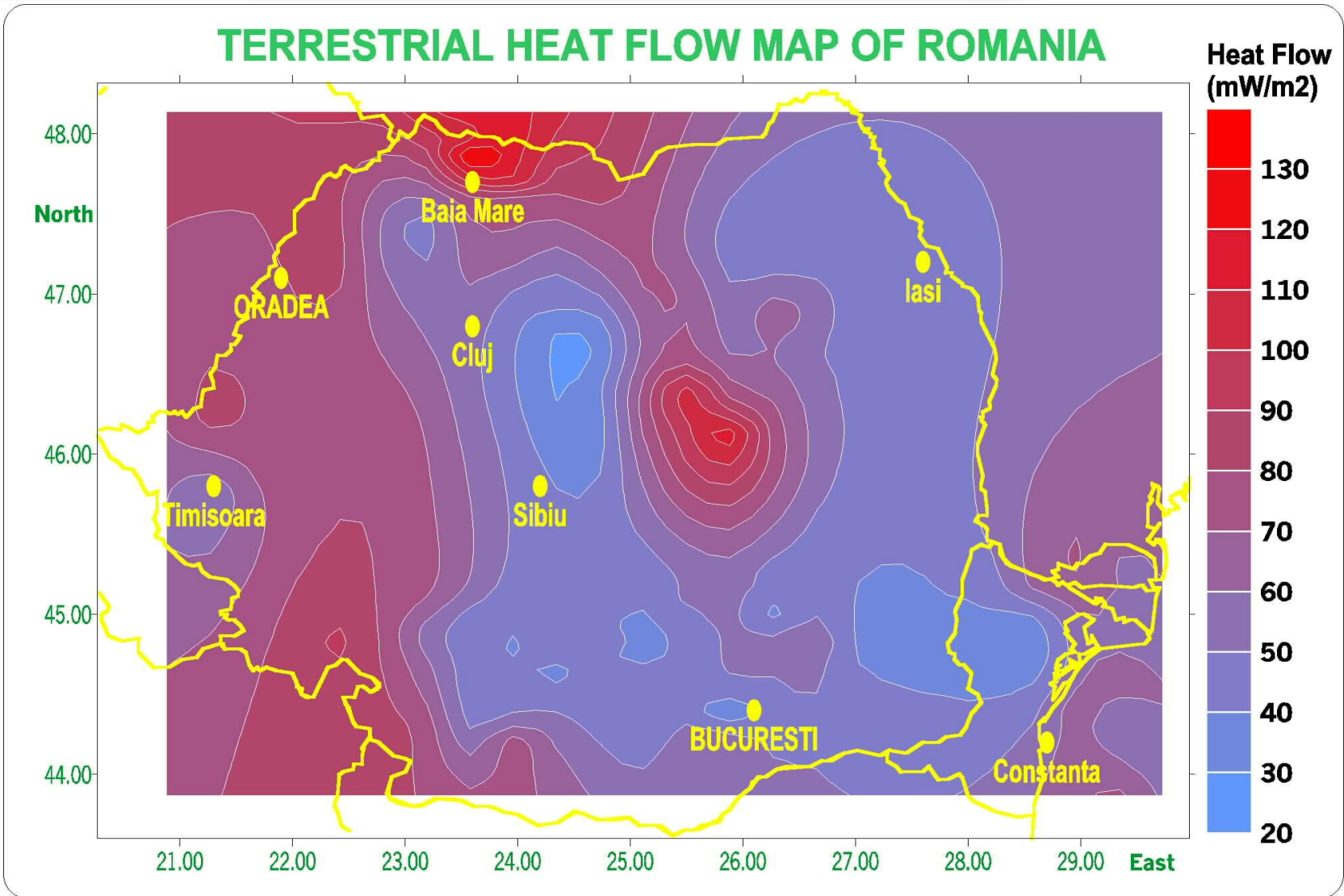
GEOHERMAL RESERVOIRS



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POTENTIAL EGS AREAS



The Pannonian geothermal aquifer

- Located in the sandstones at the basement of the Upper Pannonian (late Neocene age).
- About 2,500 km² along the Western border of Romania.
- Thermal gradient about 45 - 55°C/km.
- Usual depths 800 to 2,100 m.
- Wellhead temperatures between 50 and 85°C.
- Mineralization 4 - 5 g/l (sodium-bicarbonate-chloride type), calcite scaling prevented by downhole chemical inhibition.
- Out of 80 geothermal wells drilled, only 37 are currently used (for greenhouse heating, space and tap water heating, health and recreational bathing).

The Oradea geothermal reservoir

- Located in the Triassic limestone and dolomite.
- Depths 2,200 to 3,200 m.
- About 75 km² mostly within the Oradea City limits.
- Thermal gradient about 40°C/km.
- Wellhead temperatures between 70 and 105°C.
- Mineralization 0.9 – 1.2 g/l (calcium – sulphate - bicarbonate type), no significant scaling.
- 15 geothermal wells drilled.
- Hydro-dynamically connected to the Felix Spa reservoir (depth 50-450 m, wellhead temperature 35-50°C).
- Total annual average flow rate 300 l/s (approved by the NAMR, \approx natural recharge rate).

The Bors geothermal reservoir

- Located in the Triassic limestone and dolomite.
- Depths 2,000 to 3,000 m.
- Approximate area of 12 km², 6 km NW Oradea.
- Closed reservoir, no natural recharge.
- Wellhead temperatures about 120°C.
- GWR 5 Nm³/m³ NCG (70% CO₂, 30% CH₄).
- Mineralization 13 g/l, scaling prevented by downhole chemical inhibition and keeping CO₂ in solution.
- 5 geothermal wells drilled, 3 can produce up to 50 l/s (artesian), 2 used for reinjection.
- Cold water from shallow wells injected in all 5 wells during summer to build up reservoir pressure.

The Beius geothermal reservoir

- Beius town (about 10,000 inhabitants) situated 60 km SE from Oradea.
- Located in the Triassic limestone and dolomite.
- Depths 1,800 to 2,400 m.
- First production well drilled in 1996, second in 2004, and one injection well.
- Line shaft pumps in both production wells, flow rates 45 l/s.
- Wellhead temperatures about 84°C.
- NCG 22.13 mg/l, mainly CO₂, and 0.01 mg/l H₂S.
- Mineralization 0.5 g/l TDS, no scaling.

The Cozia – Calimanesti geothermal reservoir

- Located on the Olt Valley (South Carpathian).
- Located in fissured Senonian siltstone.
- Depths 1,900 to 2,200 m.
- Wellhead temperatures about 90-95°C.
- GWR 2 Nm³/m³ NCG (90% CH₄).
- Mineralization 1.4 g/l TDS, no scaling.
- 5 wells drilled, 3 in use.
- Thermal capacity of the 3 used wells 18 MW_{th} (of which 3.5 MW_{th} from gases), but only 8 MW_{th} is used at present.
- Energy from geothermal water and from separated combustible gasses (CH₄).

The Otopeni geothermal reservoir

- North of Bucharest, partially delimited (300 km²).
- Located in fissured calcite and dolomite.
- Depths 1,900 to 2,600 m.
- Wellhead temperatures about 60-80°C.
- 25 ppm H₂S (reinjection compulsory).
- Mineralization 1.5 – 2.2 g/l TDS, minor scaling problems.
- 14 wells drilled, 3 in use (downhole pumps).
- New project (RONDINE program) finalized in Balotesti, Ilfov County, near Bucharest, for heating a hospital and drilling a new injection well.
- Shallower and colder reservoir identified, possible to use with heat pump assisted systems.

RONDINE PREDEFINED PROJECT

Project no. 456/UDPI/15.07.2015



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“Geothermal Training for Romanian Professionals by the Geothermal Training Programme of the United Nations University in Iceland (UNU-GTP)”

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ACTIVITIES

Full fellowships for 4 Romanian specialist for the Six Month Programme of the United Nations University Geothermal Training Programme in Iceland, in:

1. Reservoir Engineering and Borehole Geophysics;
2. Geothermal Geology;
3. Drilling Technology;
4. Project Management and Finances.

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ACTIVITIES

Three short courses (one week each) on:

- Geothermal Utilization;
- Surface Exploration;
- Resource Assessment and Management.

A 2 days Workshop on geothermal for decision makers in Romania from areas with geothermal potential.

THANK YOU FOR YOUR ATTENTION!

