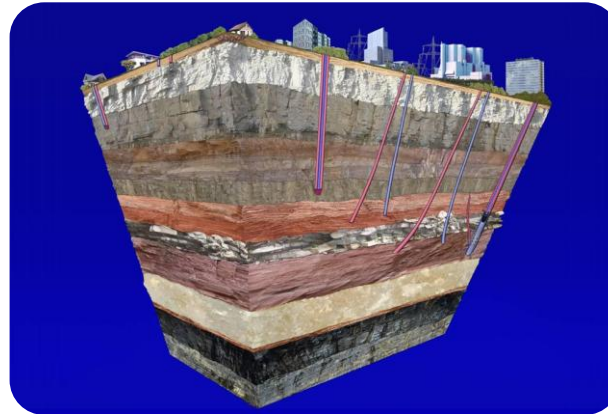


Challenges of geothermal development – Contribution to the workshop on geothermal research/knowledge exchange



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What current issues are worked at?

Exploration

- **Reduction of exploration risk by characterisation of potential aquifers**
facies, diagenesis, hydraulic properties, seismic methods, geochemical/isotopic methods, outcrop analogue studies, risk analysis, ...
- **Fault-bounded reservoirs**
estimation of geothermal potential, thermohydraulic processes
- **Characterisation of in crystalline rocks by 3D seismic data**
lithology, faults

Realisation

- **Developments in drilling engineering**
e.g. seismic prediction and acoustic positioning while drilling, automation
- **Enhanced Geothermal Systems, hydraulic stimulation concepts**
fracture propagation in various low-permeable rocks, multfrac-concept, numerical simulation, reservoir modeling
- **Monitoring of induced seismicity**
mainly Upper Rhine Graben

What current issues are worked at?

Operating stage

→ **Monitoring of aquifer & installations**

development of methods, improvement of strategies for long-term operation

→ **Corrosion, scaling, fluid-solid-reactions, impact of microbial processes**

e.g. use of inhibitors to avoid baryte precipitations in the North German Basin

e.g. prevention of scaling in surface systems not using inhibitors (for licensing reasons) in the Molasse Basin

→ **Operation of a geothermal triplette**

Molasse Basin

→ **Optimisation of pumps**

e.g. extension of the service life of submersible motor pumps, Molasse Basin

→ **Radionuclides in the thermal waters and disposal of the filtrate**

→ **Improvement of plants for power production (Kalina/ORC)**

Other

→ **Public acceptance & communication**

Recent developments in Lower Saxony

Shallow geothermal systems

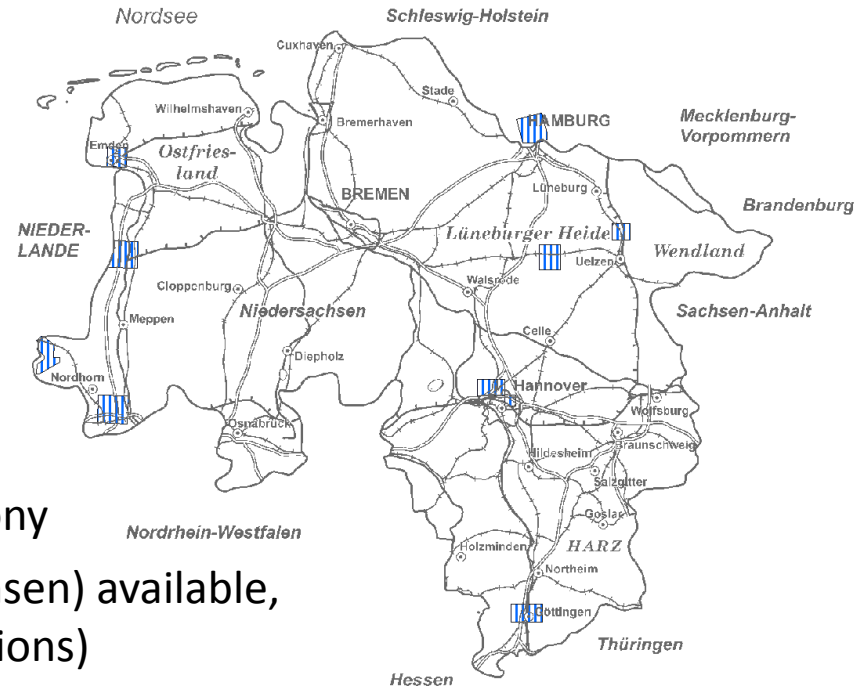
- > 10.000 shallow geothermal installations (> 300.000 installations in Germany)
- Increase p.a. in Lower Saxony fairly constant (slightly declining in Germany)
- Trend to large (industrial-scale) heat exchanger fields for heating & cooling

400-1000 m heat exchanger systems/open geothermal systems

- Cost effectiveness is often problematic for deep heat exchanger systems, interest mainly from public baths with low temperature heat demand
- One successful project (Osnabrück), geothermal doublet at <400 m (productive horizon) instead of initially planned ~800 m deep vertical heat exchanger

Recent developments in Lower Saxony

Geothermal exploration licenses
(Erlaubnisfelder zur Aufsuchung von
Erdwärme , Stand 12/2014)



Hydrothermal systems

- ➔ No project realised until now in Lower Saxony
- ➔ Feasibility study for one project (Bad Bevensen) available, target are Triassic sandstone units (two options)

Enhanced Geothermal Systems (EGS)

- ➔ No site in production until now in Lower Saxony
- ➔ Some experience with massive water fracs in low-permeable sandstone units from two wells (GeneSys project, Hannover and Horstberg)
- ➔ Feasibility studies for several projects are currently in progress, ambitious concepts (e.g. multfrac-concept), practical experience lacking, need for R&D

General framework in Lower Saxony

Projects are mainly operated by local authorities and public services, frequently with little or no experience in the field of geothermal energy production.

- Need for general guidelines
- Need for reliable regulatory conditions
- Data access is problematic in many cases (confidential industry data)
- Need for competent partners (planning, exploration, realisation, operating stage) that provide the required experience

Financial scope and risk capital is frequently (very) limited.

- Reduction of risk is a key issue (mainly exploration risk, e.g. by insurance)
- Reduction of costs is a key issue (mainly drilling costs)
- Need for financially strong investors and/or funding