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Innovative Hydraulic DTH Drilling Technology based on Coiled Tubing for deep, hard rock Geothermal Drilling

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The exploration and exploitation of low to medium enthalpy geothermal reservoirs for residential district heating and power generation is closely linked to the development of petro thermal systems. These reservoirs represent 85% of the total geothermal potential in Central Europe. Another 15% is characterized by hydrothermal systems (e.g. in the North Alpine Molasse Basin) and those which are related to tectonically affected parts of the upper crust (e.g. in the Upper Rhine Graben). Geothermal productions from these regimes are technically and geo scientifically established and may generally be defined as state of the art. In contrast, the majority of the petro thermal reservoirs need to be explored and exploited by methods from the mining sector and the hydrocarbon industry.

Without the massive development of these petro thermal reservoirs Europe′s political goals for renewable energies may not be realized. That′s why Enhanced Geothermal System (EGS) techniques need to be characterized, developed and designed such that a) small scale, better controllable crack systems develop (micro fraccing) and b) the seismicity will be further reduced and its impact communicated. Europe's deep geothermal future will highly depend on an adequate public acceptance of these systems.

However, in order to gain access to and harvest these important petro thermal reservoirs new drilling methods have to be developed. The highest investment in geothermal exploration and production is still for the drilling process. Moreover, there is a large gap between feasibility studies and the actual production drilling. This is where the International Geothermal Center Bochum (GZB) will develop highly innovative, Coiled Tubing based, high pressure hydraulic drilling systems. Existing technologies out of the oil and gas drilling industries are unfit for the mostly deeper, harder rock drilling applications seen in geothermal reservoir mining. Additionally, higher temperatures provide another challenge.
The focus at GZB rests on hydraulic DTH fluid hammer drilling, which may be used independent of depth and drills up to 10 x faster in hard rock than the current standard of tricone or PDC bits. Furthermore, these fluid hammers are compatible with the use of coiled tubing, where the drill string is reeled up (like a garden hose) in one piece on a large drum. Having been a standard in the oil and gas service drilling industry for the past 20 + years, the GZB in Bochum will adapt this technology now for the use of exploration and later production drilling in the geothermal environment.
This requires the development of new drilling tools (BHA), e.g. the above mentioned DTH fluid hammer systems. This will enable very fast drilling in hard rock formations, resulting in stable holes where coiled tubing may be deployed easily. The overall objectives are a.) to make deep exploration drilling und thus, reservoir characterization feasible, viable, fast and cheap, and b.) to use CT drilling for improved stimulation and fraccing technologies in order to develop the above mentioned petro thermal systems. Thus, the reservoir rock will be stimulated through one or multiple vertical and horizontal boreholes with multiple, stacked fracs. For years this has been standard practice for the exploitation of tight gas reservoirs in North America.