A truly revolutionary novel drilling technology boosting access to geothermal as alternative energy source

Renewable geothermal energy is low on emissions and has the potential to become an important cornerstone of base-load energy generation in Europe, either for electricity or via direct utilisation for heating of households or greenhouses. One important advantage of geothermal over other currently available renewable energy sources is its capability of providing continuous and more or less constant base-load electricity, irrespective of daytime, weather conditions or the time of the year. In principle, geothermal energy could be utilised in most parts of the globe. However, suitable geological rock formations are commonly found at great depths in the order of 4,000 to 5,000 meters below surface. Accessing such deep energy reservoirs are inherently linked to significant drilling costs that, in many instances, amount to almost half of the total capital investment costs of the entire geothermal energy plant. During borehole establishment, different geological rock formations with variable hardness and strength are penetrated. Hard rock types (e.g. granite) encountered during drilling are causing much reduced penetration rates and lead to excessive wear of the drill bit. To overcome the aforementioned issues, the ThermoDrill consortium, managed to develop a novel revolutionary drilling technology which has already been successfully deployed in field tests.

Innovative drilling technology

The novel hybrid drilling technique combines standard rotary drilling with a technology called water jet cutting. The high-pressure water jet (approx. 2,000 bar) is used to pre-damage the rock on impact with the effect of significantly increasing the rate of penetration and thus the overall efficiency of the drilling process. Technical, economic and safety reasons demand that the high-pressure generation unit is directly placed below the drill bit. Despite several great challenges including confined space and harsh conditions at the borehole bottom, a prototype of the high-pressure generation unit was developed and successfully integrated as essential component of the ThermoDrill drilling system.

Novel technology successfully tested

The feasibility and efficiency of the innovative drilling technology was initially tested in experiments at various laboratory scales. Final field tests under real environment within an existing 1,3 km deep borehole confirmed the enormous potential of the technology, which is capable of achieving around twice the rate of penetration when compared to standard rotary drilling. Moreover, the tests highlighted that the novel “ThermoDrill-System” can be integrated with existing drilling infrastructure and technology without any difficulties, thereby boosting the acceptance for its deployment as a market-ready system in future.

Significant cost-reductions for geothermal drilling

As previously mentioned, a considerable reduction of the drilling costs leads to substantially reduced overall capital expenditure, hence to much improved economics of entire geothermal projects. Via the deployment of the "ThermoDrill-System", cost savings of approx. 20% or around 3 Million Euro are expected to be achieved, just for a single deep borehole (5,000 m). Further future advancements will bring this drilling technology to market-readiness, thereby paving the way for intensified utilisation of geothermal as environmentally friendly alternative energy source throughout Europe and even globally.

Projektkonsortium

- Montanuniversität Leoben, Austria (Project Coordinator)
- ES-Geothermie, France
- BESTEC GmbH, Germany
- RAG Energy Drilling GmbH, Austria
- INERCO, Spain
- Technische Universität München, Germany
- sirius-es Handels GmbH, Austria
- Smith International Italia SPA, Italy
- Geo Energie Suisse AG, Switzerland

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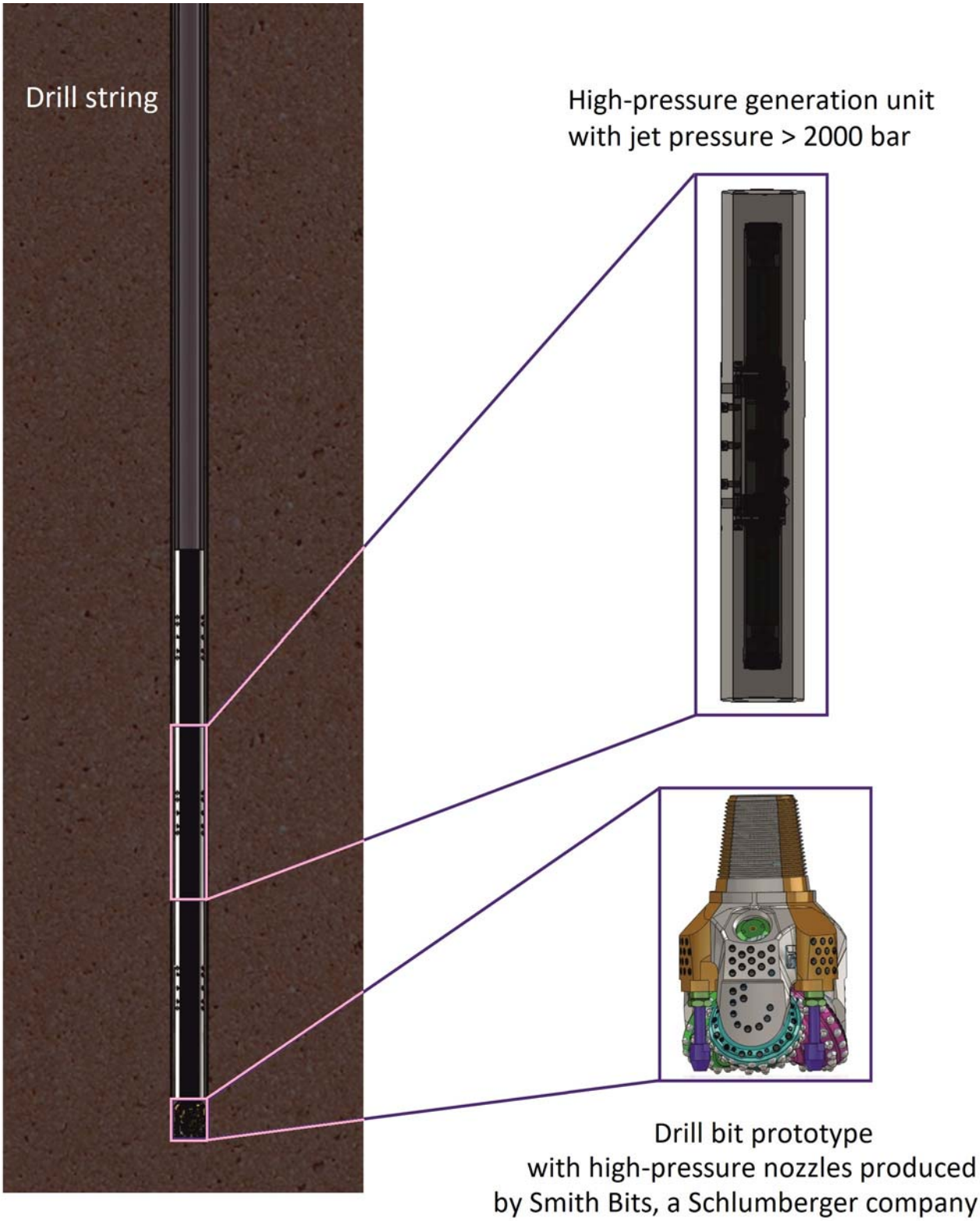
Additional information:

- Webpage: www.thermodrill-h2020.org
- Project Folder: http://www.thermodrill-h2020.org/_pdf/5a952d99bb584.pdf
- Video: www.thermodrill-h2020.org


Drill string
High-pressure generation unit
with jet pressure > 2000 bar
Drill bit prototype
with high-pressure nozzles produced
by Smith Bits, a Schlumberger company