GeoTHERM
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Ortenauhalle Kongress 2
Oberflächennahe Geothermie

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Ortenauhalle Congress 2
Near-surface geothermal energy

Directional Steel Shot Drilling for curved bore hole heat exchangers

Stahlgranulat-Richtbohrtechnik für bogenförmige Erdwärmesonden

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In May 2025 Canopus constructed two bore hole heat exchangers at The Green Village at Delft Technical University, (NL). The heat exchangers had a depth of 405 and 444 m, were successfully completed with two grouted probes and connected to a heat pump installation in the Green Village office.

These two bore hole heat exchangers were the first two installations constructed with Directional Steel Shot Drilling, retrofitted on a Remborg 15 tons Conrad drilling machine. The drilling was steered and each BHE constructed within 4 days.

The above is considered the proof of concept of the technology for constructing curved BHE's which can each yield heating and cooling for 5 to 10 household-equivalents. The curved heat exchangers are drilled away from each other thereby minimizing interference. By following a curved trajectory, the BHE's access relatively high temperatures while keeping the vertical depth with the near-surface installation limit (500 m in NL) thus improving the heat per meter bore hole.

DSSD is a combination of PDC drilling and directed steel shot erosion. The steel shot erosion increases rate of penetration in hard rock and provides the basis for a low cost rotary steerable solution. During the Delft trial chert was drilled with less than 1.5 ton weight on bit and retrieving the bit completely undamaged. All steel shot was retrieved and circulated out of the well. The real time rig monitoring system enabled great well control, early identification of formation changes and drill string torque and drag measurements key for smooth probe installation and grouting.

The real time monitoring of the mechanical and hydraulic power enables the emidiate identification of formation changes

and its strength as well as an assessment of the well bore stability as a function of bore hole inclination. This enables the real time selection of the drilling trajectory for a reliable probe installation.

This paper presents details of the construction of the BHE's at The Green Village in Delft, the results of the succeeding temperature response test and an assessment of the impact that the curved BHE's drilled with DSSD are expected to have on the near-surface geothermal heating and cooling market.

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