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A Feasibility Study Regarding Micro-Drilling Technology

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2 Executive Summary

In this study we investigated the technical feasibility of small caliper exploration-only boreholes, so-called micro boreholes, with the intention of lowering drilling cost. In the literature, micro-boreholes are defined generally as boreholes with diameters of less than 3-1/2 inch. We found that micro-boreholes are technically feasible but a reduction in borehole diameter is not the only factor required for a decrease in cost. Diameters of 2 inch to 3 inch seem to define the lower limit for the diameter of boreholes deeper than 1000 m. This is due to limitations of the hydraulic system. Also, drilling speed is limited because the Weight-on-Bit (WOB) is rather limited and the friction forces between drill string (or coiled tubing) and borehole wall quickly approach the material strength of the string (or tubing). But a reduction in borehole diameter does contribute to a reduction in drilling cost.

For slim holes of less than 5-3/4 inch diameter there is a wide range of drilling equipment available. The challenge lies in optimizing the cost increase due to high development and production costs for small components on the one hand, and, large equipment required for larger diameter boreholes on the other hand.

A cost reduction is expected from modifications of the drilling system. We expect that a combination of Coiled Tubing (CT) with an electrically driven downhole motor has a large potential. The electric motor may be combined with percussion drilling to reduce the required WOB and to increase the Rate of Penetration (ROP). This allows reducing the size of the surface unit compared to conventional drilling rigs. Thus, a smaller unit can be used for reaching the same depth. This, together with a correspondingly shorter rig time can help to reduce the cost of a borehole significantly.

This study was performed in cooperation between the institutes of Applied Geophysics and Geothermal Energy (GGE) and Power Generation and Storage Systems (PGS), both E.ON ERC. This report summarizes the results of this study.

The main result of this study is the finding that the anticipated reduction in drilling cost cannot be achieved by a reduction of the borehole diameter only. Additionally required is a combination of a CT drilling rig with an electrically driven downhole motor with commercially available and reasonably priced slim hole drilling equipment. This will result in a higher rate of penetration and a reduction of the drilling unit's size. All factors combined may provide the desired cost reduction.



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