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Technically exploitable geothermal energy by using Borehole Heat Exchangers: A revisit of the Cologne case

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In previous studies, the amount of shallow geothermal energy was estimated by assuming a uniform temperature drop of at least 2 °C in the aquifer. In this work, a more comprehensive numerical model has been employed to evaluate the technically exploitable geothermal energy by using Borehole Heat Exchanger coupled Ground Source Heat Pump systems. A case study on the city of Cologne was revisited, adopting the same hydrogeological conditions and simulating the long-term evolution of the subsurface temperature field subject to the operation of borehole heat exchangers. It is found that the cities' heating demand could potentially be fully covered by BHE-coupled GSHP systems. The resulting equivalent uniform temperature drop is then around 1.6 °C . It was also found that utilising geothermal energy will lead to at least 50% reduction of CO_2 equivalent emission in comparison to conventional district heating, depending on the source of electricity used for heat pump operation.