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# Assessing the feasibility of high-density subsurface heat extraction in urban areas

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The subsurface is increasingly utilized as a heat source (sink) for use in heating (and cooling) applications. This is driven by the need to increase the amount of heat generated from renewable sources to meet the EU renewable energy target of 12% by 2020. This study explores the feasibility, performance and long-term sustainability of high density, closed-loop GSHP installations in urban areas. Specifically, it employs a 2D, finite element, heat transport model to assess the impact of high density heat extraction in a residential area in Reading. A block of semi-detached houses is modelled, assuming that separate GSHP systems are installed in every property. The model considers conductive and advective heat transport. Uncertainties are explored through varying thermal properties and groundwater gradients across the site. Different heat demand scenarios are evaluated and the impact on the subsurface temperature distribution and on heat pump efficiency is assessed. The scenarios are selected to represent variations in inter-annual weather pattern, heating pattern and building insulation standards. Results indicate that high density heat extraction for domestic heating can be sustainable over the lifespan expected for GSHP systems (of around 20 years), in particular where heat demand is reduced by home improvement measures. Based on the results, recommendations are being presented for the sustainable deployment of high density GSHP installation in urban areas.