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research highlights

GEOTHERMAL ENERGY

Underground urban scene

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The activity in cities results in an increase of the air temperature. This urban heat island effect is a major environmental issue for most cities. A lesser known effect goes on underground, as the subsurface is also warmer than in rural areas due to waste heat from basements, pavements and buried infrastructures. Heat from the ground can be exploited through geothermal energy conversion in which heat is exchanged between the ground and carrier fluids. Now, Jaime Rivera from ETH Zurich and colleagues in Germany have shown that the subsurface heat island effect could lead to an increase of 6% to 16% of the technical potential of geothermal energy conversion in city centres, for realistic infrastructures and ground parameters as measured in Zurich, Switzerland.

The researchers model how typical ground-surface temperature increases, between 0.5 K and 5 K, affect the heat extraction rate and power output of a network of ground source heat pumps equipped with vertical boreholes between 50 m and 200 m long. The case study uses a temperature–depth profile measured in a neighbourhood of Zurich and shows that energy extraction from the ground can be higher than in rural areas, or alternatively that the borehole length can be reduced by 4 m per additional degree of ground temperature without sacrificing heat extraction. In addition, the system can be used to recycle the heat losses from the city to the ground and to avoid the depletion of the underground heat reservoir. ❐

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