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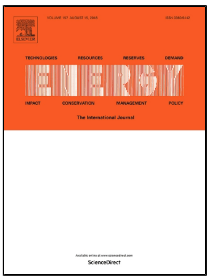

Investigation on the thermal behavior of energy piles and borehole heat exchangers: A case study

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Investigation on the thermal behavior of energy piles and borehole heat exchangers: A case study

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Highlights:

- Spiral-tube energy piles were compared with double U-tube borehole heat exchangers.
- Constant-flux and operation thermal behavior of two type of GHEs was investigated.
- Short-term thermal response of energy piles is more rapid than that of boreholes.
- Heat transfer performance of energy piles is more efficient than that of boreholes.
- Regular fluctuation in fluid temperatures and heat transfer rates were observed.

Abstract: Constant-flux and operation thermal behavior of ground heat exchangers are meaningful for system design and control strategy of ground-coupled heat pump systems. Based on a ground-coupled heat pump project, four thermal performance tests and an operation test were conducted to compare the constant-flux and operation thermal behavior of spiral-tube energy piles with that of double U-tube borehole heat exchangers. The thermal performance of energy piles is more efficient than that of borehole heat exchangers. A large radial scale of heat source, a long heat exchange tube per unit depth of holes and a backfilled material with large thermal conductivity is helpful to improve the heat transfer efficiency of ground heat exchangers. The short-term thermal response of energy piles is more rapid than that of borehole heat exchangers. The short-term thermal resistance of energy piles is much less than that of borehole heat exchangers. In operation test heat transfer rate per unit length of pile and per unit length of pipe for energy piles is greater than those for borehole heat exchangers. The regular fluctuations in fluid temperature and heat transfer rate in operation should be determined by heating capacity of heat pumps and thermal loads of buildings.

Keywords: Energy piles; Borehole heat exchangers; Constant-flux thermal behavior; Operation thermal behavior.

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