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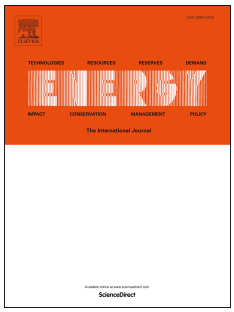

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Evaluation of a transient borehole heat exchanger model in dynamic simulation of a ground source heat pump system

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Abstract

The performance of a vertical ground source heat pump system (GSHPS) largely depends on the fluid temperature leaving the borehole heat exchanger (BHE) that may be affected by the short-term behavior of the BHE. Although considerable research has been carried out to analyze the short-term transient response of the BHEs, few studies have investigated its impact on dynamic simulation of GSHPS. Therefore, this paper presents a numerical approach based on a transient BHE model to evaluate the performance of a residential GSHPS over short and long timescales. The numerical results are compared with the results of EnergyPlus software. It is shown that the proposed model can appropriately predict the dynamic behavior of the system. Moreover, effect of borehole thermal capacity on the performance of the GSHPS is investigated in comparison with a quasi-steady state model. It is found that including the borehole thermal capacity substantially affects the design borehole length. Using the transient model instead of the quasi-steady state model leads to a 16% reduction in the required borehole length.

Keywords: Ground source heat pump; Borehole heat exchanger; Short-term response; Part-load fraction; Transient model; Thermal capacity.

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