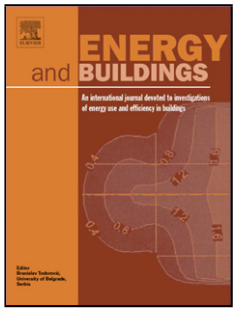


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# Potential cooling savings from a ground-coupled return-air duct system for residential buildings in a hot and humid climate

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**Abstract**

This study presents an estimation of the potential cooling energy reduction that a closed-loop Earth-Air Heat Exchanger (EAHE) could bring to residences in the hot and humid climates of Texas (Climate Zones 2A and 3A). This analytical study was based on a system simulation model that utilizes ground temperature patterns to improve cooling energy use in residential buildings by coupling return-air duct systems with the ground. The simulation model was validated by comparing the calculated air temperatures against two sets of experimental air temperatures published in previous literature. The potential cooling energy savings from the closed-loop EAHE system were obtained by comparing simulations of a residential Air-Source Heat Pump (ASHP) system model with and without an EAHE. The simulation performance results comparing a typical ASHP system with and without an EAHE showed annual cooling energy savings of 9.6% for Houston and 13.8% for Dallas. In addition, parametric analyses were developed to determine the effect of the EAHE's thermal performance by varying the pipe length, buried pipe depth, and airflow velocity.

Keywords: Building energy simulation; Earth-air heat exchanger; Residential energy efficient measures

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