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Influence of coating soil types on the energy of earth-air heat exchanger

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Abstract

In this paper, a study is conducted to quantify the impact of coating soil types on the energetic performance of an earth-air heat exchanger (EAHE). A new numerical modelling based on the finite element method and taking thermal properties of soils as inputs is first proposed. Afterwards, the model is validated with experimental measurements of temperature in soil and in the EAHE, at the University of Strasbourg in France, which contains three different types of coating soils at different parts of the buried pipe. To evaluate the energy impact of the different types of coating soils, numerical modellings are carried out for a typical EAHE configuration with these three coating soils along the entire length of the pipe. The obtained results show that both the moisture content and the soil type have non-negligible influence on the EAHE's thermal performance. In extreme cases, the difference of energy performance between a sand with a minimum humidity and a mix for a maximum humidity, measured in the experimental EAHE, reached 17.4 % for the same period.

Keywords: Renewable energy, earth-air heat exchanger, transient simulation, finite elements

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