

Accepted Manuscript

Research Paper

Numerical Modeling of Energy Transfer in Underground Borehole Heat Exchanger within Unsaturated Soil

Mohammad Hossein Jahangir, Hamid Sarrafha, Alibakhsh Kasaeian

PII: S1359-4311(17)35165-7

DOI: <https://doi.org/10.1016/j.applthermaleng.2018.01.020>

Reference: ATE 11674

To appear in: *Applied Thermal Engineering*

Received Date: 5 September 2017

Revised Date: 24 December 2017

Accepted Date: 5 January 2018

Please cite this article as: M. Hossein Jahangir, H. Sarrafha, A. Kasaeian, Numerical Modeling of Energy Transfer in Underground Borehole Heat Exchanger within Unsaturated Soil, *Applied Thermal Engineering* (2018), doi: <https://doi.org/10.1016/j.applthermaleng.2018.01.020>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Numerical Modeling of Energy Transfer in Underground Borehole Heat Exchanger within Unsaturated Soil

Mohammad Hossein Jahangir^{*}, Hamid Sarrafha, Alibakhsh Kasaeian^{*}

Department of Renewable Energies, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran.

Corresponding Authors: Alibakhsh Kasaeian, akasa@ut.ac.ir, Tel: +98 9121947510, Fax: +98 21 88497324

Mohammad Hossein Jahangir, mh.jahangir@ut.ac.ir, Tel: +98 9124221035, Fax: +98 21 88497324

Abstract

In the current study, the heat emission and heat extraction process is numerically studied for six u-shaped upright underground pipes during a 10 day period. The soil medium is considered to be unsaturated, which is the common case in most of the practical scenarios. For this purpose, the convective flows of dry air, water vapour, and surface water are simultaneously accounted for and the energy transfer amounts are estimated. Also, the radial distributions of temperature and moisture content are acquired for the 2nd, 4th, and 10th days by minimizing the residual norm's value. The study mostly aims to obtain the results which yield a good insight into the efficiency of the system, which in case of further analysis could be used for the design purposes of heat pipe arrangement. It is shown that, for a constant 70 W/m² of heat emission and for the distances more than 1.5 m from the heat source, the amount of wasted energy remains approximately the same, independent of the measurement time period. Also, it is calculated that about 83.3% of the storable energy is stored in the medium by the end of the 6th day; and 10% of the aggregated stored energy is wasted through convective heat flows, by the end of the 10th day.

Keywords: Underground heat storage; emission phase; unsaturated soil; heat extraction; energy transfer.

Download English Version:

<https://daneshyari.com/en/article/7046111>

Download Persian Version:

<https://daneshyari.com/article/7046111>

[Daneshyari.com](https://daneshyari.com)