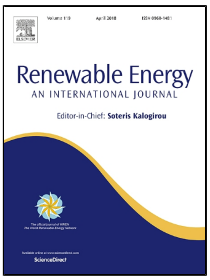
Accepted Manuscript



The thermal characteristics and performance of a ground heat exchanger for tropical climates

T.M. Yusof, H. Ibrahim, W.H. Azmi, M.R.M. Rejab

PII:	S0960-1481(18)30093-4
DOI:	10.1016/j.renene.2018.01.083
Reference:	RENE 9688
To appear in:	*Renewable Energy*
Received Date:	20 September 2017
Revised Date:	28 December 2017
Accepted Date:	21 January 2018

Please cite this article as: T.M. Yusof, H. Ibrahim, W.H. Azmi, M.R.M. Rejab, The thermal characteristics and performance of a ground heat exchanger for tropical climates, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.01.083

The thermal characteristics and performance of a ground heat exchanger for tropical climates

T.M. Yusof [a,b], H. Ibrahim [a], W.H. Azmi [a,b,*], M.R.M. Rejab [a]

[a] Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia. Tel./Fax +6-09-4246257 / +6-09-4242202 email: myusof@ump.edu.my, drhassan@ump.edu.my, ruzaimi@ump.edu.my

[b] Automotive Engineering Centre, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia. Tel./Fax +6-09-4246338 / +6-09-4242202 email: wanazmi2010@gmail.com

[*]Corresponding author email: wanazmi2010@gmail.com

Abstract

This paper presents the thermal characteristics and performance of ground heat exchanger (GHE) based on the mathematical model for tropical climate conditions. The case study is undertaken with the depth of ground, z of 2 m, air inlet temperature of 35 °C, air mass flow rate of 0.02 to 0.2 kg/s and different sizes of internal pipe diameters (ID). The effectiveness of the GHE is analyzed at 0.8, 0.9 and 0.99. The performance results of the GHE show that the flow rate of 0.02 kg/s gives great fluid temperature (T_f) reduction in the pipe compared with higher flow rates. However, the outlet temperature (T_{out}) of air at the end of the 25 m length of pipe with different flow rates tend to reach the same point with a maximum difference of only 0.36 °C for the range of the flow rates. Meanwhile, the rates of heat transfer relatively increase as the flow rates increase. Effectiveness of 0.9 has been identified that it is possible and achievable to be obtained with the 25 m length of the pipe. This finding has confirmed that the GHE has a great potential and good performance to be implemented in tropical climate countries.

Keywords: Ground heat exchanger; Passive cooling; Heat transfer; Annual outlet temperature; Thermal characteristic.