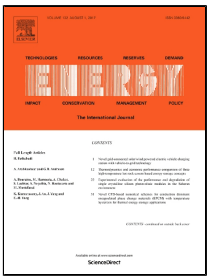
Accepted Manuscript



Investigation of the effect of geometric and operating parameters on thermal behavior of vertical shell-and-tube latent heat energy storage systems

Saeid Seddegh, Xiaolin Wang, Mahmood Mastani Joybari, Fariborz Haghighat

PII:	S0360-5442(17)31188-X
DOI:	10.1016/j.energy.2017.07.014
Reference:	EGY 11202
To appear in:	*Energy*
Received Date:	19 January 2017
Revised Date:	29 June 2017
Accepted Date:	04 July 2017

Please cite this article as: Saeid Seddegh, Xiaolin Wang, Mahmood Mastani Joybari, Fariborz Haghighat, Investigation of the effect of geometric and operating parameters on thermal behavior of vertical shell-and-tube latent heat energy storage systems, *Energy* (2017), doi: 10.1016/j.energy.2017.07.014

Investigation of the effect of geometric and operating parameters on thermal behavior of vertical shell-and-tube latent heat energy storage systems

Saeid Seddegh[a], Xiaolin Wang[a*], Mahmood Mastani Joybari[b], Fariborz Haghighat[b]

[a] School of Engineering & ICT, University of Tasmania, Hobart, TAS 7001, Australia.

[b] Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Quebec H3G 1M8, Canada.

Corresponding author, Email: xiaolin.wang@utas.edu.au; Tel: 61-3-62262133; Fax: 61-3-62267247

Abstract

In this study, the effect of the geometrical and operational parameters on vertical cylindrical shell-and-tube LHTES systems is investigated. Four different ratios of the shell-to-tube radius are considered with the phase change material (PCM) on the shell side and the heat transfer fluid (HTF) flowing through the tube. The PCM temperature distributions are measured and compared experimentally among the studied storage units. A weighting method is utilized to calculate the average PCM temperature, liquid fraction, and stored energy fraction to evaluate the performance of the storage units. The results show that a shell to tube radius ratio of 5.4 offers better system performance in terms of the charging time and stored energy in the studied LHTES systems. Furthermore, the effects of HTF flow rate and temperature on the storage performance are studied. The HTF flow rate does not show a significant effect on the storage performance; however, the HTF temperature shows large impacts on the charging time. As the HTF temperature increases from 70 to 80 °C, the charging time reduces by up to 68% depending on the radius ratio.

Keywords: latent heat thermal energy storage, phase change material, geometrical parameter, shell-and-tube, heat exchanger