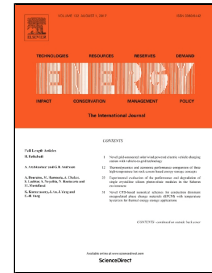


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Investigation of the effect of geometric and operating parameters on thermal behavior of vertical shell-and-tube latent heat energy storage systems

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1 **Investigation of the effect of geometric and operating parameters on thermal behavior**  
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3

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10 **Abstract**

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

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

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