Study of Effect of Thermal Diffusivity on Ground Temperature for Malaysian Climate

Taib Mohd Yusof, Shahrani Anuar, Hassan Ibrahim

Abstract: Ground has been proven that it is able to supply cooling and heating resulting in significant reduction of electricity consumption. This paper discusses potential of ground towards implementation of ground thermal storage by using ground heat exchanger (GHE) to supply passive cooling for any application. Analysis has been conducted based on empirical equation from conduction heat transfer for depth up to 6 m and thermal diffusivity from 0.04 to 0.1 m^2/day. The main input parameters were obtained from local weather station for three consecutive years. The results showed that significant reduction of temperature occur at depth below than 2.0 m in which cooling can be supplied constantly throughout the year. Temperature amplitude also gets attenuated relatively with depth in which amplitude less than 1°C occur at depth more than 4 m for thermal diffusivity 0.04 m^2/day. In addition, thermal diffusivity plays important role in determining ground temperature variation. It has been obtained that the temperature amplitude significantly increase when the thermal diffusivity increase. Therefore, this paper had suggested that the application of GHE should be placed in condition of thermal diffusivity 0.06 m^2/day and below.

Keywords: Ground Heat Exchanger, Mathematical Models,Underground Temperature Variation

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