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Simulation of the Ground Heat Exchanger under Malaysian Environment Based on Different Thermal Conductivity of Soil and Pipe Materials

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Abstract
Energy is a major global issue that is essential to the advancement of technology and humanity. Renewable energy is becoming increasingly important as primary energy consumption rises year after year. Renewable energy from geothermal sources, namely ground heat exchangers (GHE), has a lot of potential for use in building applications. Over the past few decades, extensive research has been conducted and GHE technology is well known. The main idea behind GHE is to use the ground as an endless thermal reservoir for fluid medium cooling and heating. Air is used as a fluid medium of work in the GHE system. The air cools in the summer and heats in the winter due to the temperature differential between the air and the ground. In this study, a simulation was conducted to examine the effects of pipe materials and soil thermal conductivity on the performance of the GHE. According to the findings of the study, the materials of the pipe does not have a significant impact on the overall performance of the GHE. As a result, low-cost pipe materials with low thermal conductivity can be used in GHE configurations. The study also showed that the thermal conductivity of soil should be between 1.5 and 10W/m.K for optimal ground heat exchanger performance. In addition, the length of the pipe was reduced from 25 to 14m, thereby decreasing the land area.

Keywords: Ground heat exchanger; GHE performance; Pipe materials; Thermal conductivity.