

Evaluation of Ground Source Cooling Potential for Batticaloa, Sri Lanka

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Ground source for cooling has been identified as a promising technology in dry tropical regions. However, it is not popular in Sri Lanka. Therefore, this study was conducted to design a ground source cooling system that can be adopted in Batticaloa, Sri Lanka (Dry zone). The experiment was conducted during July and August, the hottest period of the year for Batticaloa. Thermocouples fixed to a data logger were installed into the soil to obtain the temperature profiles up to 7 m. It was found that the temperature did not vary below 2 m from the surface. The temperature at the water table depth of 7 m was 27 °C. In utilizing this information, the cooling load for a system was designed for a 3 m×3 m×3 m room with the occupation of four people and some electrical equipment. The calculations were based on thermal conductivity determined from experimental and standard values from literature. The highest ambient room temperature was considered as 40 °C. Total cooling load approached a value of 5.2 kW to reduce and maintain the room temperature at 27 °C. Water was used in the calculation as the heat-transfer medium of the system. It requires a flow rate of $2.48 \times 10^{-4} \text{ m}^3/\text{s}$ with a pump rating of 24.33 W to maintain the required cooling load. It can be obtained from solar power. The copper tube selected for the design of heat exchanger has the dimensions of 0.9 cm inner and 1.14 cm outer diameters and best installed down to 7 m. Flat horizontal tubes are preferred to increase the contact surface area with soil and water filled pores. The application of Arduino-uno could increase the efficiency of the system by optimizing operating conditions. Coupling with pre-existing refrigeration system can boost the efficiency and demand where, we can have varying temperature according to the comfort preferences.

Key words: Cooling load, Ground source cooling, Thermal conductivity, Water as heat-transfer medium