LOW ENERGY GROUND COOLING SYSTEM FOR BUILDINGS IN HOT AND HUMID MALAYSIA

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ABSTRACT

This thesis presents an investigation into the viability of Low Energy Earth Pipe Cooling Technology in providing thermal comfort in Malaysia. The demand for air-conditioning in buildings in Malaysia affects the country escalating energy consumption. Therefore, this investigation was intended to seek for a passive cooling alternative to air-conditioning. By reducing the air-conditioning demand, there would be a higher chance of Malaysia government to achieve their aim in reducing CO_2 emissions to 40 per cent by the year 2020, compared to 2005 levels. The passive technology, where the ground was used as a heat sink to produce cooler air, has not been investigated systematically in hot and humid countries. In this work, air and soil temperatures were measured on a test site in Kuala Lumpur. At 1m underground, the result is most significant, where the soil temperature are 6^oC and 9^oC lower than the maximum ambient temperature during wet and dry season, respectively. Polyethylene pipes were buried around 0.5m, 1.0m and 1.5m underground and temperature drop between inlet and outlet were compared. A significant temperature drop was found in these pipes: up to 6.4^oC and 6.9^oC depending on the season of the year. The results have shown the potential of Earth Pipe in providing low energy cooling in Malaysia. A parametric study on the same experiment was carried out using Energy Plus programme. Energy Plus data agreed with the field work data and therefore, this confirms Energy Plus is reliable to investigate Earth Pipe Cooling in Malaysia. Furthermore, thermal comfort of air at the Earth Pipe outlet was analyzed and the result has shown that the outlet air is within the envelope of thermal comfort conditions for hot/humid countries.

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