A Pilot Study on a Ground Source Heat Pump with Horizontal Heat Exchangers for Space Cooling under Tropical Climate of Thailand

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Demand of space cooling has been increase due to rapid population and economic growth and consumes high amount of electricity in tropical regions such as Southeast Asia. In order to reduce electricity consumption, Ground Source Heat Pump (GSHP) has been proven a reliable, cost-effective, safe, and environmentally-friendly alternative for cooling and heating spaces in various countries. In this study, the horizontal GSHP coupled with a normal air conditioner was installed in an experimental room in Saraburi campus of Chulalongkorn University, Thailand. In tropical countries, the GSHP may not provide better thermal performance than a conventional air conditioner (AC) arises because the difference between ground and atmospheric temperatures is essentially low. This paper reports the potential use of the GSHP with horizontal heat exchangers in a tropical country. Daily operational data of the GSHP and the AC during a four-year operation were analyzed and compared. The results indicated that the GSHP with shallow heat exchangers perform better than the conventional air conditioner throughout the years in Thailand. It was found that the ground-source heat pump consumed 23% less electricity than the conventional air conditioner during this period. Moreover, on the basis of the data derived from our measurements, intermittent use of the GSHP and the conventional air conditioner provided enough time for the ground to transfer heat to the place nearby. This can be interpreted that significant subsurface temperature rising, as a result of heat rejection during GSHP operation, was not observed in this study area. These findings suggest that GSHP has the potential to reduce emissions and electricity consumption within areas under tropical climates, such as Southeast Asia, for sustainability and future generation despite the dominance of cooling demand, leading to a thermal imbalance within the subsurface.