Low-Enthalpy Geothermal Applications in Perth, Western Australia

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This study discusses two low-enthalpy geothermal applications in Perth, Western Australia. The objective of this study is to present outcomes from two projects where this low-enthalpy geothermal energy has been used for supplementing heating inventories of Olympic-size swimming pools in winter and is being mulled for substantially reducing electricity bills of cooling and heating at in suburban areas. Although the case studies herein pertain to the Perth Metropolitan Area in Western Australia, the techniques are adoptable all over the globe where near-constant temperature aquifers are present. The first application pertains to using tepid groundwater [1] for the municipal heating of Olympic-size outdoor swimming pools. The second application examines the viability of ground source heat pumps (GSHP) against air source heat pumps (ASHP). In the first application, the objective is to develop an accurate sizing methodology to improve the capital effectiveness for geothermal swimming pools. The predicted pool-water temperature and heating demands are compared against on-site measurements at a Leisure Centre. This model can replicate 71 and 73% of the measured heating capacity data within ± 25 kW for the 30-m pool and ± 35 kW for the 50-m pool, respectively. In the second application, we assess the feasibility of implementing a GSHP vis-à-vis an ASHP for domestic applications. For the second application, the adoption of ground source heat pumps (GSHPs) is one feasible technique to reduce energy consumption. GSHPs use the constant subsurface temperature as a heat source for heating and a heat sink for cooling, thereby insulating heating and cooling device performance from diurnal and seasonal changes in ambient temperatures [2]. The GSHP has a constant coefficient of performance (COP) of 3.8 ± 6.7%, while that of ASHP ranges from 2.2 to 2.7 ± 6.5%. For cooling, the GSHP has a constant COP of 3.1 ± 13%, while that of ASHP varied between 1.4 and 2.4 ± 11.5%. When a GSHP is considered with a planned installation of a borehole for irrigation, the payback period ranges from near-immediate to four years.

Figure 1: Redeveloped 50 m and 30 m pools at the Beatty Park Leisure Centre, Perth [3]

Figure 2: Two almost identical houses. Left: ASHP, right: GSHP

References

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