ABSTRACT

Geothermal energy is a renewable resource with strong potential to support sustainable clean energy supply. However, some geothermal wells become *idle* due to declining performance, even though they still retain thermal energy in the wellbore and surrounding rock formation. This study aims to evaluate the utilization potential of the *idle* well PTH-9B in the Patuha Geothermal Working Area using a coaxial Closed-Loop Geothermal System (CLGS). Numerical modeling was carried out using a turbulent flow approach and coupled heat transfer in fluid and solid domains. The model was developed based on secondary well data and calibrated through *history matching* against field data. After validation, a parametric study was conducted for mass flow rates of 1–5 kg/s using two working fluids, namely water and n-pentane. The results show that the model is able to represent field conditions satisfactorily. Increasing the mass flow rate tends to enhance heat extraction, but it also reduces the *outlet* fluid temperature at the surface. The highest gross electric power for water was 196.24 kW at a mass flow rate of 3 kg/s, while for n-pentane it was 207.93 kW at 5 kg/s. In general, n-pentane demonstrates better performance, indicating that mass flow rate optimization and working fluid selection are key factors in CLGS utilization for *idle* wells.

Kata kunci: closed-loop geotermal system (CLGS); *idle well*; coaxial heat exchanger; organic Rankine cycle (ORC); exergy analysis; mass flow rate; gross power potential.