

GEOTHERMAL COOLING FOR DATA CENTERS

Sai Ram Chanduri¹, Mojtaba Zabihi¹, Ri Li^{1,*}

¹School of Engineering, University of British Columbia, Kelowna, Canada

*sunny.li@ubc.ca

ABSTRACT

Though geothermal heating and cooling systems are widely used to cater the commercial and residential needs, their use in data center cooling is highly limited. Due to the absence of a heating loop, high thermal impedance of the soil, and the continuous need for cooling, geothermal systems have significant challenges to serve the data center cooling needs. Considering these limitations, this paper investigates the possibility of developing a geothermal cooling system for a 250 kW data center.

The proposed cooling model utilizes underground as a heat sink, and the heat is transferred from the server room to the underground relentlessly. Air-water heat exchangers installed at the rack-level, exchange the heat between the hot server room air and the cold water circulated from the underground geothermal well system. A numerical model is developed to analyze this heat rejection process, with the focus on the thermal performance of the geothermal-well system. This system is analyzed under steady-state and transient conditions. An analytical approach is used to study the thermal steady state of the system, and a numerical approach is used for the transient state. The results suggest that it is not feasible to operate the system under steady-state conditions, due to the high thermal resistance of the soil. Also, they imply that the heat transferred through a single well is insignificant, and hence, a multiple geothermal well system is developed. The thermal performance of this well system is used to infer the feasibility of developing a geothermal cooling solution for data centers.

Word count: 250