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Optimizing Energy Extraction and Water Conservation of Geothermal Heating Systems

Direct use geothermal heating systems utilize warm water in a common single-pass heating application because they are relatively cheap to build and easy to implement. This project looked for evidence of opportunities to improve energy utilization and water conservation by comparing an existing direct use district heating system to a theoretical semi-recirculation design. The heating performance and water use of a commercial 40,000 ft2 building containing 20 fan-coil heating units was evaluated. Entering and exiting water temperatures and flow rates were examined at various locations. The current single-pass system utilizes only 6oF or 119,333 Btu/h of the estimated 466,400 Btu/h of available heat from the constant 40 gpm of warm water necessary to supply all the fan-coil units. 74% of the geothermal water's original 112oF heating potential remains in the return water, available to be recycled back into the heating system. If only 50% of the current 40 gpm of water was recycled back into the heating loop through a theoretical semi-recirculation design, 28,800 gallons per day or 2.65 acre-feet per month would be saved. This single-pass district geothermal heating system lacks the ability to adjust water usage based on varying heating demands throughout the building and with a relatively small design change could substantially reduce water consumption without impacting the system's ability to heat the building. Water conservation in semi-arid climates must be a top priority when utilizing this valuable resource, even when considering the economic and environmental advantages of geothermal heat sources over burning fossil fuels.