# A feasibility study for supercritical geothermal energy in enhanced geothermal system

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Japan has many volcanoes and large potential of geothermal energies. However, since 1996, the construction of large-scale geothermal plants in Japan has been stopped, and the amount of electricity generated by the geothermal plants decreased by about 30 percent compared to the peak time in 1997. Existing geothermal energy development has mainly targeted shallow geothermal resources. However, shallow geothermal resources are eccentrically located so we can generate power at narrow area and obtain the limited amount of energy. On the other hand, geothermal power generation using supercritical water is expected to increase power output with one power plant than the conventional geothermal power plants. Moreover, by constructing artificial reservoir, it becomes possible to introduce it in wide area and it is expected to contribute to reduction of development and attenuation risk. However, the feasibility of the geothermal power plants using supercritical water has not been fully investigated yet. In this research, we focus on artificial geothermal reservoir under supercritical environment, and quantitatively investigate its feasibility using numerical simulations. Specifically, artificial supercritical geothermal power generation with a downhole coaxial heat exchanger and a single U-shaped pipe method are considered as the heat exchanger method. We solve the unsteady thermal conduction problem using the finite-difference method with various flow rate and injection pressure conditions. As the result of numerical simulation, it was confirmed that in the case of both the double pipe system and the single U-shaped pipe, it is possible to extract supercritical water. Moreover, it was also found that high-performance heat insulating tubes are required for the inner pipe or the production well in either the double pipe type or the single U-shaped pipe type.

Keywords: supercritical geothermal power generation, numerical simulation, finite-difference method

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