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Study on development of potential map for geothermal heat pump system

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Geothermal heat pump (GeoHP) system, which utilizes the shallow geothermal energy for cooling and heating, hot water supply and snow melting, is one of the energy saving systems. The system is widely used in Europe and the United States for years, and recently, in China and Korea, the installations spread rapidly. In Japan, however, its use is limited because of the lack of information on the advantage and the high initial cost during installation. The promotion of the GeoHP system requires evaluating the effective utilization of the geothermal energy, verifying the stability of the system in long-term running and designing the environmentally friendly system. For these purposes, the potential of the geothermal heat pump system should be evaluated quantitatively and the suitable utilization of the energy also should be proposed. The aim of this study is to develop the potential map for the geothermal heat pump system. In this presentation, we review the previous studies about the geothermal heat pump potential (and potential map) and propose the approaches for the development of the potential map.

There are 2 main types of GeoHP systems, one is the system using groundwater directly and the other is the system using the heat exchanger. Both systems can be used as the ground heat storage system. The efficiencies of those systems are influenced by the geological and hydrogeological setting, but the contributions of each condition for it have not been demonstrated enough. There are some studies about the geothermal potential in Japan. In those studies, the geological settings, the groundwater level, the thickness of aquifer, the groundwater yield, the quality of groundwater, the groundwater velocity and the regulation of the pumping were applied for the system using groundwater directly as the indexes for the potential evaluation. On the other hand, for the system using heat exchanger, the geological settings, the groundwater level, the thickness of aquifer, the temperature of subsurface and the groundwater velocity were also applied. Few studies, however, about the quantitative evaluations of each index for the efficiency were performed. As future works, the organizing the previous studies and the quantitative evaluating the indexes empirically and analytically are required for the practical potential map for GeoHP systems.

Keywords: Geothermal heat pump system, Groundwater, Potential map, Geological information