

Geothermal Application for Building

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1. Background

The carbon-dioxide emissions from residences and buildings show the upward tendency every year, recording of 31.9% increase in the business sector, and 34.9% increase in the residential sector in the fiscal year of 2010 (compared with 1990).

For saving energy of residences and buildings, the low carbon building authorization standard was promulgated in December 2012, and the energy conservation standards are revised based on the estimation of primary energy consumption. Although this method is introduced to estimate the energy saving technology of building envelope and equipment comprehensively, some renewable energy technology (geothermal use and so on) is not evaluated. It is necessary to evaluate the technology on the same framework of the estimation method of primary energy consumption

In there search on "introduction of new technologies for buildings with a focus on the renewable energy (2011-2013)", the estimation method is developed from the experimental evaluation about renewable energy technology (solar energy, geothermal energy, etc.).

2. Experiment of Geothermal Application

Various technologies have been developed for the use of geothermal energy as a function of the period (daily or yearly cycle), usage (directly or as heat source of heat pump) and groundwater level.

The information of developmental status about the technologies have been organized, and the experiment is conducted to evaluate energy saving effect of heat pump system with geothermal use. Two U-tubes (inside diameter: 25mm) were installed in the ground to a depth of 50 meter (Photo 1), and thermal response experiment has been conducted to check the heat exchange performance between soil and water in tubes (Fig. 1). And heat pump with the water supply from U-tubes as heat source is installed for air-conditioning in the experimental room, and the energy saving effect of heat pump system with geothermal use is examined compared with general air-conditioning system which will be installed in another room which is kept in same condition.



Photo 1 Installation of the U-tubes

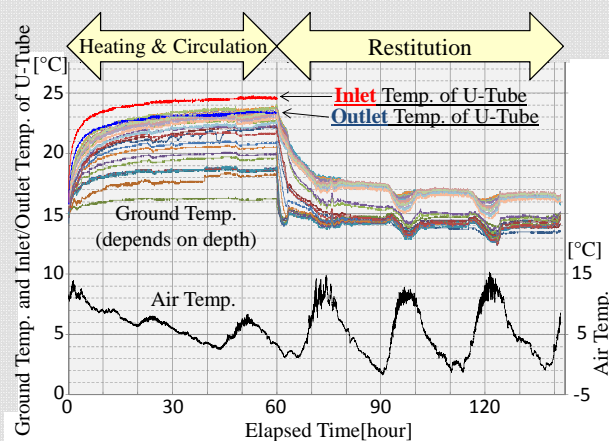


Fig.1 One trend of thermal response experiment

3. Conclusion

The experiment which uses geothermal for air-conditioning of a building is conducted, and the efficiency of the heat pump system with geothermal use will be examined. Hereafter, the estimation method of energy saving effect is built based on these observations.

【Reference】

- 1) Technical information about the energy-saving standard of residences and buildings, and the authorization standard of a low carbon building (In Japanese)

<http://www.kenken.go.jp/becc/index.html>