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Development of potential assessment on ground-source heat pumps

Tomoyuki Ohtani^{1*}, Kohei Kawachi¹

¹Gifu University

In several kinds of renewable energy, solar and wind energies have tools for potential assessment such as METPV and wind map, respectively, while ground-source heat pumps do not have such tools. Recently, several local governments try to estimate potential resources on renewable energy. Development of an assessment method is desirable to compare several results on potential assessment. In this study, a potential assessment method on ground-source heat pumps is developed and is applied to Tokai region (Aichi, Gifu, Mie) and Kanto region (Tokyo, Chiba, Saitama, Kanagawa). Although there are several kinds of ground-source heat pumps, the subject of this study is only ground-coupled heat pumps with vertical heat exchangers. Because those with horizontal heat exchangers need the large premises and are difficult to install in Japan. Groundwater heat pumps is restricted by the regulation of groundwater pumping up. As this means that those cannot be installed in several areas, this study does not treat this type of ground-source heat pumps.

Potential of ground-source heat pumps is divided into the following two types. Resources are maximum heat extracted from ground and do not depend on land use conditions. Potential installation is a realizable value of heat extracted from ground based on land use condition, population distribution and so on. In this study, each value is decided as follow. The length of heat exchanger is 100m. The interval of them is 5m. Working period of air-conditioner is 2400 hours per year.

For a resource assessment, geology influences a maximum heat extracted from ground. Estimated resources are higher in the area of acidic igneous rocks and lower in the area of the Quaternary sediments. For a potential installation, land use and distribution of heat demand is important. Heat demand is higher in urban area. Comparing the resource with heat demand in each area, the resource of ground-source heat pumps is higher than heat demand in most areas.

Keywords: potential assessment, ground-source heat pumps