Application of geological dara to ground source heat pump systems with special reference to thermal conductivity of geological materials

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Ground source heat pump systems are getting popular in Japan. Ground source means low temperature energy in geological units shallower than 200 meters below the surface. A geothermal heat pump system is much more efficient than a conventional air source heat pump system. A ground source heat pump system also contributes to mitigating a heat island phenomenon in large urban areas like Tokyo, because it does not emit exhaust heat outside in summer.

Effective thermal conductivity is one of the most important parameters to design ground source heat pump systems. Thermal response tests result in effective thermal conductivity of geological units under the building site. The reference values of thermal conductivity for several geological units are also available to building designers.

The regulation of Energy Conservation Standards came into effect in April 2016. Under the regulation annual primary energy consumption for every type of building is standardized. An owner of building has to submit building certification application with data of annual energy consumption calculated by Web Program of Building Research Institute. When ground source heat pump systems are installed in the building, the thermal conductivity of the building site must be input the Web Program for calculation of annual primary energy consumption.

Thermal response test is the best method to estimate the thermal conductivity of the geological units under the building site. However, it is not always applied to residential houses and small size buildings. The reference data of thermal conductivity are usually applied to them. Since geological units are so diverse in the Japanese Islands that much more measured data of thermal conductivity are required for reference database.

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