Groundwater as an energy resource in Finland

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Groundwater can been seen as an option for renewable energy utilisation. Finland has multiple groundwater reservoirs that are easily exploitable, but groundwater energy is not commonly used for renewable energy production.

Three different scale research were made to provide a reliable assessment of the groundwater energy potential in Finland. Firstly, the national groundwater energy potential of Finnish classified aquifers was mapped. Secondly, the urbanisation effect on the peak heating and peak cooling power of groundwater was investigated, and finally, the long-term groundwater energy potential was modelled for three different building complexes. Hydrological and thermogeological data were used together with accurate data on the energy demands of buildings. The heating and cooling power of groundwater was calculted based on the groundwater flux, temperature and heat capacity and the efficiency of the heat transfer system. The power producible from groundwater was compared with the heating and cooling demands of buildings to calculate the concrete groundwater energy potential.

Approximately 20% to 40% of annually constructed residential buildings could be heated utilising groundwater from classified aquifers that already are under urban land use in Finland. Urbanisation increases the heating energy potential of groundwater. The average groundwater temperature was 3 to 4 °C higher in city centres than in rural areas. Approximately 50% to 60% more peak heating power could be utilised from urbanised compared with rural areas. Groundwater maintained its long term heating and cooling potential during 50 years of modelled operation in an area where the natural groundwater temperature is 4.9 °C. Our results demonstrate that groundwater can be effectively utilised down to a temperature of 4 °C.

Groundwater can form a significant local renewable energy resource in Finland. Groundwater energy utilisation should be noted as one easily exploitable option to increase the use of renewable energy resources. Accurate information on hydro- and thermogeology together with the energy demands of buildings is essential for successful system operation.