

Title of doctoral thesis: ***Conditions for the occurrence and possible applications of water and geothermal energy from the Mesozoic formations of the Mogilno-Łódź trough***

## Summary

Geothermal water and energy occupy a special place both in terms of energy and due to the possibility of their comprehensive use. However, before exploiting this source, it is important to know its parameters and then use it in a sustainable manner. One of the latest trends in research in the world is the interest in the possibility of using increasingly shallower geothermal resources, also characterized by lower temperatures. Currently, geothermal reservoirs are also considered as "georeservoirs" for storing energy from renewable sources and from waste. The above is related to the development of heat pump technology and heat storage, which allows to combine heat supply with its demand and their better adjustment during the season.

The main motivation for the research carried out as part of this doctoral dissertation was to address the problems of parametric recognition allowing for sustainable and innovative use of water and geothermal energy. Among them, thermal energy storage is the biggest challenge.

The series of four thematically coherent publications focuses on the analysis of selected hydrogeochemical and thermal parameters of water and energy from Mesozoic formations (Lower Cretaceous and Lower Jurassic) of the Mogilno-Łódź trough in terms of the possibility of using them in a sustainable and comprehensive manner. As a result of the work carried out, the parameters of geothermal waters used in operating geothermal recreation and heating centers were characterized. The area was divided into three zones and the spatial and depth variability of water and energy parameters was analyzed. It was indicated that in the area of the trough there are possibilities for other than the present use of water and geothermal energy. A method for assessing the suitability and sustainable use of the considered waters and geothermal energy at low temperatures (max. 65°C) based on the linkage with the relevant parametric thresholds was developed. Its results allowed to indicate the possibilities of using in heating, balneotherapy and balneorecreation, recovery of elements from water and thermal energy storage systems.

A numerical simulation of the innovative aquifer thermal energy storage (ATES) system in the southern part of the Mogilno-Łódź trough was developed and interpreted. Thanks to it, it was shown that increasing the geothermal potential for the Lower Cretaceous reservoir, where low temperatures occur naturally, will allow for local improvement of the exploitation conditions.