

Atlases of Geothermal Resources in the Polish Lowlands – the Compendium of Knowledge for Specialists and Future Investors

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ABSTRACT

The article presents the scientific achievements of the Department of Fossil Fuel of AGH - University of Science and Technology in the field of promotion of knowledge regarding questions of geothermal resources and possibilities of utilization of geothermal waters in Poland.

In late 2006 the AGH-University of Science and Technology in Krakow, Poland published “Atlases of geothermal resources in the Polish Lowlands”.

The Atlases were commissioned by the Ministry of the Environment and paid through the National Fund for Environmental Protection and Water Management.

The Atlases represent a comprehensive and many-sided source of information on the occurrence, possibility of exploitation and utilization of geothermal waters and energy.

The information included at the Atlases constitutes a source of knowledge for the academic staff and students specializing in energy problems and environment protection. It is also helpful for local authorities and specialists dealing with utilization of geothermal waters for various purposes.

1. HISTORICAL REMARKS

Over decades, the Department of Fossil Fuels of the Faculty of Geology, Geophysics and Environment Protection at the AGH-University of Science and Technology (formerly the University of Mining and Metallurgy) in Kraków has carried on the research and development projects focused on the selection of optimum areas for construction of geothermal heat plants. These projects included analyses of geothermal energy resources and development technologies of geothermal waters in the Polish Lowlands.

Results of studies of geothermal waters and energy carried on the 1980-ties at the University of Mining and Metallurgy were reflected in many publications, unpublished reports and conference materials. The summary of these studies is the “Atlas of geothermal waters in the Polish Lowlands” (Górecki [Eds.], 1990) (see Figure 1).

Publications and conference materials issued in the 1980s aimed to spread the knowledge on possibilities of geothermal waters and energy utilization among the local communities and authorities, and among the potential investors.

In 1987 the Department of Geothermics was organized within the Institute of Fossil Fuels at the University of Mining and Metallurgy. The staff included specialists in geology, hydrogeology, geochemistry, seismics, well-log geophysics, drilling engineering, heat engineering, computer science and economics.

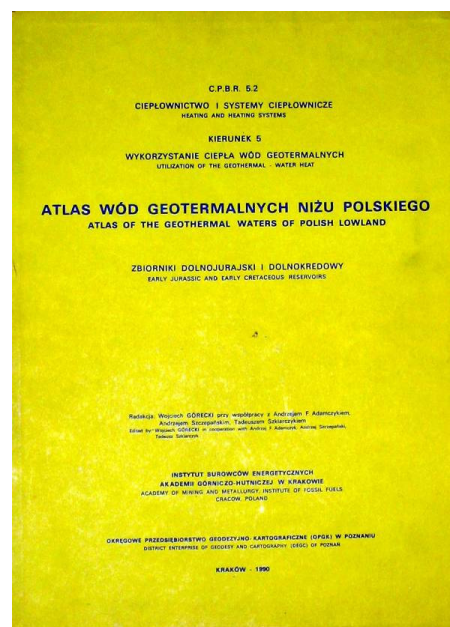


Figure 1: Cover page of the “Atlas of geothermal waters in the Polish Lowlands” (Górecki [Eds.], 1990).

The department has run both the basic and the applied research aimed to exploitation of optimum geothermal zones in sedimentary basins in Poland, methodology of resources calculation, production and injection of waters, economic effectiveness evaluation and designing of geothermal installations. Simultaneously, the new specialization: Renewable Energy Source was included in the Faculty curriculum. The specialization is focused on the education of specialists in geothermics.

In the years 1990-1995 the systematic studies were carried on at the Department of Fossil Fuels on the evaluation of geothermal waters and energy resources. The results of these studies were summarized in the “Atlas of geothermal resources of the Polish Lowlands” published in 1995 (Figure 2).

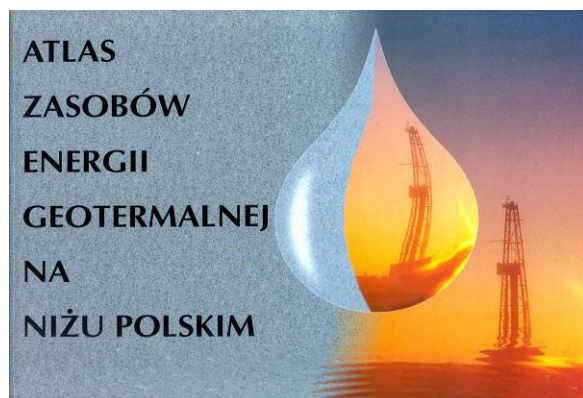


Figure 2: Cover page of the “Atlas of geothermal resources of the Polish Lowlands” (Górecki [Eds.], 1995).

In the period 1995-2000 the staff of the Department of Fossil Fuels has undertaken the feasibility analyses of geothermal heat plants construction in nearly 200 towns in the Polish Lowlands. The studies aimed to dynamize the utilization of geothermal energy in those sites where both the hydrogeothermal conditions and the local heat market ensure the commercial utilization of geothermal waters and energy. Studies on investment opportunities of particular towns provided important materials for local authorities and for potential investors. From nearly 200 towns some tens were selected of most favourable conditions, for which the concepts of development of geothermal heat were prepared.

The staff of the Department of Fossil Fuels cooperated in the edition of the „Atlas of Geothermal Resources in Europe” issued in 2002 by the European Commission.

2. SCIENTIFIC KNOWLEDGE AND ITS PRACTICAL APPLICATION

In December of 2006 the AGH-University of Science and Technology published two geothermal atlases for the Mesozoic and Paleozoic aquifers (Figure 3 and Figure 4), edited jointly as the „Atlas of geothermal resources of the Polish Lowlands”.

The atlases summarize the results of long-term studies on particular geothermal aquifers in Poland. Data included into the “Atlas...” for the Mesozoic aquifers (Figure 3) contain relatively comprehensive, interdisciplinary information on broadly understood geothermics, which can be valuable for all specialists interested in this branch of science. The results of studies and the evaluation of resources contained in the “Atlas...” enabled the selection of the areas of optimum conditions for utilization of geothermal waters and energy, i.e. the areas where the construction of geothermal heat plants is possible. The principal targets of geothermal heat plants are:

- to improve the quality of environment in urban areas by closure of dispersed, inefficient heat plants or by modernization of existing heat supply systems in order to reduce dust and gas emissions into the atmosphere,
- to stabilize or even to reduce of running costs of energy generation and improvement of the quality of heat supply, stimulation of the growth of urban areas by development of one of crucial components of the infrastructure,
- to provide conditions for the growth of underdeveloped or entirely new economic activities: gardening, balneology, recreation; consumption of the excessive, low-temperature

geothermal energy in order to improve the effectiveness of geothermal installations,

- to centralize the heat supply in urban areas, mostly to apartment buildings, services and industrial plants, optimization of heat management, extension of the access to heat supply for local communities.

In the evaluation of exploitable geothermal resources and possibilities of the construction of new geothermal installations the following factors were considered:

- energy produced from geothermal waters can be utilized at the site of waters production, hence, the exploitable resources will be limited to urban, rural and recreational areas, and to industrial zones,
- due to high capital intensity of geothermal investments, the local heat market must be very attractive to the investors,
- construction of geothermal installations is limited to the areas where geothermal waters of optimum properties are reservoired.



Figure 3: Cover page of the “Atlas of geothermal resources in the Polish Lowlands – Mesozoic formations” (Górecki [Eds.], 2006a).



Figure 4: Cover page of the “Atlas of geothermal resources in the Polish Lowlands – Paleozoic formations” (Górecki [Eds.], 2006b).

The chapters are illustrated with figures and the described aquifers are supplied with appendices containing maps and cross-sections.

The atlases composed of two parts, with the 726 pages altogether and represent detailed study concerning problems

of exploration, production and utilization of geothermal waters in the Polish Lowlands. The study area covers more than 87 percent of the territory of Poland. The publication presents, among others, characteristics of geothermal systems, ways of using the geothermal waters and energy (e.g. heat engineering, electricity production, heat pumps, recreation, therapy) in Poland and in the world, degree of the waters and energy utilization, description of the geothermal installations and plants operating in Poland, and the classification and estimation methodology of different types of geothermal energy resources. Taking up more detailed issues of this discipline, the authors described technical and technological conditions of exploitation, transmission and injection of geothermal waters and heat perception (e.g. technique and technology of drilling geothermal wells, their design, surface infrastructure of heating systems, etc.).

Also problems arising from corrosion of construction materials and precipitation of solids in geothermal water transmission systems were demonstrated. Methods for reduction of unfavourable phenomena related to production and utilization of geothermal waters, e.g. using proper steel in the installations, monitoring of changes in chemical composition of geothermal water etc., were indicated.

The Atlases present also legal and legislative problems, as well as investment risk assessment and possibilities of financing the geothermal projects from Polish and European Union sources. The information from the Atlases constitutes a source of knowledge for the academic staff and students specializing in energy problems and environment protection. It is also helpful for local authorities and specialists dealing with utilization of geothermal waters for various purposes. The distinguished 9 geothermal aquifers were characterized, among others, from the point of view of their geological setting (lithology, stratigraphy and tectonics), extent and depth of the aquifers, their thickness, temperature, water mineralization, discharge of water intakes and calculated reserves.

Results of analyses were illustrated with a number of appendices: more than 150 maps and approximately 30 geological and hydrogeological cross-sections.

The knowledge derived from the Atlases can make decisions on planning the geothermal ventures, their localization and adjustment of technical parameters of a project to needs of a local heat market much easier for local authorities and/or private investors. Necessary knowledge can be acquired also by university staff and students of various specializations: renewable energy sources, unconventional power engineering, environment protection and others.

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