



Current state and prospects of geothermal-energy implementation in Poland

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Abstract

Poland has rich geothermal water resources. Geothermal energy should be treated as one of the main renewable sources of energy. In particular, the space-heating sector has good prospects for its wide application. This will result in a considerable reduction in the use of traditional fuels and in the emissions generated in many regions. Among the main factors influencing the low official estimate of the potential for the use of geothermal energy are the low, competitive prices of fossil fuels, insufficient law regulations and lack of finance. This paper presents the main aspects of geothermal energy use in Poland. Basic information is given referring to the plants in operation, under construction and further plans. Particular prospects for the development of geothermal energy in Poland include the use of abandoned wells for the exploitation of geothermal water; cascaded, integrated and distributed systems; heat extraction not only from large depths but also from shallow water and rock formations. Such solutions will result in the lowering of investment costs, increasing their effectiveness, extending the market and making geothermal energy competitive both with traditional energy sources and other renewables.

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Keywords: Geothermal energy; Geothermal use; Renewable energy sources; Sustainability; Poland

1. Introduction

Poland has one of the richest low-enthalpy geothermal energy resources in Europe. First steps to use geothermal energy for heating were taken in the 1980s. In 1993, the Polish Academy of Sciences set up its first Experimental Geothermal Plant in the Podhale region [1]. Three geothermal heating plants are currently being operated in Poland and a few others are under construction. Also, numerous geothermal studies and projects are underway.

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According to official forecasts, geothermal energy will only slightly increase its share in the Polish energy market, even though it fulfils all the conditions needed to be seen as the main source of renewable energy. Considering that geothermal energy is used in many locations chiefly for heating, it could contribute to a substantial reduction in the level of emissions caused by the burning of traditional fuels. Geothermal energy should also be promoted in view of the conditions Poland has to meet as a prerequisite for its admission to the European Union, one such condition being the increase in the use of renewable energy sources.

2. Geothermal resources

Poland has three geothermal provinces, which consist of extensive sedimentary basins (originating in the period extending from the Palaeozoic to the Tertiary) and consist of numerous geothermal reservoirs (Fig. 1). They occupy a total area of some 250,000 km², i.e. 80% of Poland's territory [2–5]. Reservoir temperatures vary from 30 to 130 °C (at a depth from 1 to 3 km). Differences in the total mineralisation of waters are huge, ranging from 1 to 300 g/l. These geothermal provinces are the Polish Lowland, Fore-Carpathians and Carpathians. Interesting conditions also exist in the Sudety region, where geothermal water can be found in the cracks of crystalline and metamorphous rocks [6]. The best geothermal conditions are found in the Polish Lowland province. Also the Podhale region (the Carpathians) has exceptionally favourable geothermal conditions.

Considering the current prices of traditional energy carriers, profit-yielding geothermal facilities could be built on an area equal to some 40% of Poland's territory [7]. This area could be even larger if another approach is adopted [4,8].

3. Review of current geothermal implementation

3.1. General remarks

A key application for developing geothermal energy use in Poland is space-heating. Wide-ranging use that would be adequate for the deposit potential and demand would permit one to significantly limit reliance on traditional fuels and eliminate the negative effects of such fuels being burnt [4,7,8]. A huge potential lies in cascaded and integrated sets of uses that can be adapted to match a wide range of temperatures and purposes, making geothermal energy more effective, attractive and marketable. Currently, geothermal energy is used mainly for heating, therapeutic and recreational purposes [9] (Fig. 1, Table 1). In other fields, such as greenhousing, drying and fish-breeding, geothermal energy is used on a semi-industrial scale. The installed capacity and amount of geothermal energy produced have increased significantly after a regional heat distribution network was installed at the end of 2001 in the town of Zakopane and connected to a large number of buildings.

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