

GEOTHERMAL ENERGY IN SLOVAKIA

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ABSTRACT

The Slovak Republic is a landlocked state in Central Europe. It has a population of over five million and an area of about 49,000 square kilometers. Slovakia is a landlocked country bordered by the Czech Republic and Austria to the west, Poland to the north, Ukraine to the east and Hungary to the south. Slovakia is one of the countries in central Europe with high geothermal resources occurrence which are not used sufficiently. The disadvantage of these sources is a low temperature. These low temperature sources can be used directly for district heating or to produce electrical power. The largest source in Eastern Slovakia is located in a place near Košice city – Ďurkov.

1. INTRODUCTION

Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, from volcanic activity, and from solar energy absorbed at the surface. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface.

Ďurkov geothermal field is one of the places in Eastern Slovakia which offers large thermal potential in a low-to-medium temperature field. This potential can be changed to electric power using small geothermal binary power plants or it can be used directly for district heating or recreation purposes. [1][2][3]

2. GEOTHERMAL UTILIZATION

2.1. Geothermal utilization in Europe

Geothermal heating has been used since Roman times for bathing, cooking and as a way of heating buildings and spas by utilizing sources of hot water and hot steam that exist near the earth's surface. Water from hot springs is now used world-wide in spas, space heating, and for agricultural and industrial uses.

In 1892 the first geothermal district heating system began operations in Boise, Idaho (USA). In 1928 Iceland, another pioneer in the utilization of geothermal energy also began exploiting its geothermal fluids (mainly hot waters) for domestic heating purposes. Using of geothermal energy to produce electricity is a relatively new industry. The Larderello field in Tuscany, Italy, produced the world's first geothermal electricity in 1904. In the experiment, five light bulbs were lit by electricity produced through steam emerging from vents. The success of this experiment was a clear indication of the industrial value of geothermal energy and marked the beginning of a form of exploitation that was to develop significantly from then on. Electricity generation at Larderello was a commercial success. The major production at Larderello began in the 1930s, and in 1970, the power capacity reached 350 MWe. In 1911, the world's first geothermal power plant was built in the Valle del Diavolo, named for the boiling water that rises there. [1][2][3]

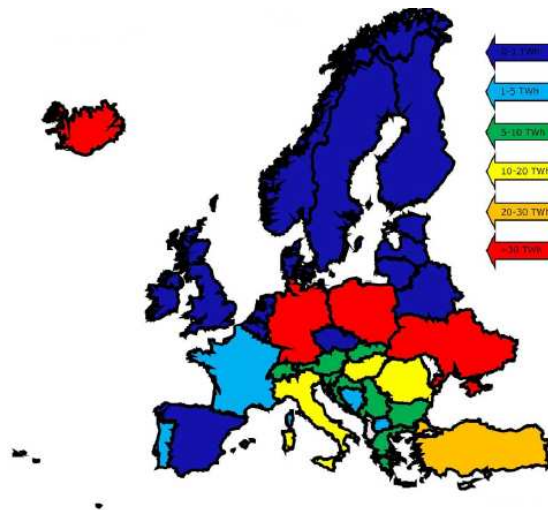


Figure 1 – Geothermal potential in Europe [1]

2.2. Geothermal utilization in Slovakia

Systematic research of geothermal energy sources with the realization of geothermal drillings started in Slovakia in 1971.

Within the basic exploitation financed by the state budget in years 1971 – 1994 the characteristics of surface and depth structure of the Western Carpathians together with the spatial distribution of geothermal waters and spatial characteristics of earth heat distribution were mapped through the realization of 61 geothermal boreholes. An informative projection about the amounts of geothermal energy and water was obtained. One of the most significant results was the determination of 26 perspective geothermal areas with beneficial conditions for energy utilization of geothermal waters. [1]

The total utilization potential of these boreholes with 210 – 2800 m depth presented 904 l/s of geothermal water with temperatures at the wellhead from 20 to 92 °C and mineralization of 0,4 – 90 g/l. In heat power they presented 176 MWt of geothermal energy, from which 31 MWt (131 l/s) presented reinjection exploitation of 145 MWt (773 l/s) in single boreholes. The results obtained during more than two decades of geothermal source investigations in Slovakia are summed up in “Atlas of geothermal energy in Slovakia”, which was published by the State geological institute of Dionýz Štúr in 1995. The basic information in this atlas is the results obtained by basic investigations which gathered information about the tertiary filling of basins and folds, the pretertiary underlay of the whole inner Western Carpathian and about temperature field and hydrogeothermal conditions. [1]

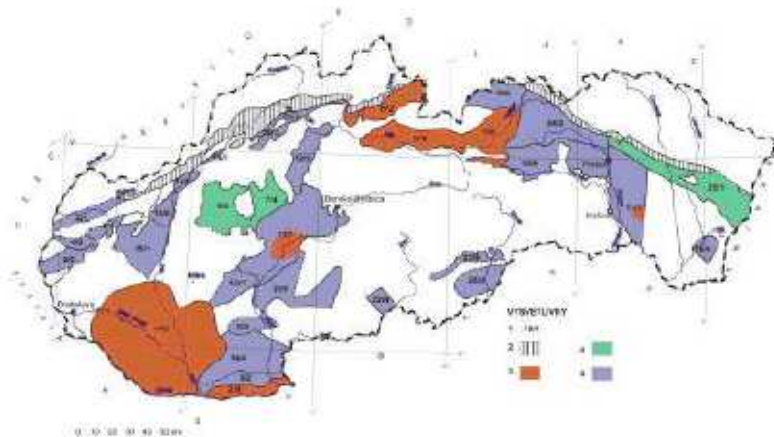


Figure 2 – Prospective areas of geothermal water in Slovakia [1]

In Slovakia there are 116 registered geothermal boreholes with which 1 787 l/s of water with temperature at the wellhead 18- 129°C were verified. Geothermal water was obtained by 92 – 3 616 m deep drillings. Flow from the wells at the wellhead was at intervals from tenths to 100 l/s.

Predominantly Na-HCO₃, Ca-Mg-HCO₃ and Na-Cl types of water with mineralization 0,4 -90,0 g/l can be found. The heat capacity of water in utilization until reference temperature 15 °C is 306,8 MWt, which presents 5,5 % of the total potential of geothermal energy in Slovakia, which was estimated by geological survey to be 5 538 MWt. Currently 36 localities are utilizing geothermal energy from geothermal waters for agricultural use, for heating buildings and for recreation purposes with overall used heating power at 131 MWt, which represents 2,3% from the geothermal energy potential in Slovakia and 42,7% from the heating power of registered geothermal boreholes. In the agricultural sector, 12 localities are utilizing geothermal water for greenhouse heating for the fast production of vegetables (cucumbers, tomatoes, paprika, etc.) and also for flowers. [1]

In 32 localities the geothermal water is used for recreation purpose, mostly for filling swimming pools (Poprad, Bešeňová, Galanta, Štúrovo, Rajec etc.).

From the above mentioned utilization examples it is quite visible that the use of Slovakian geothermal energy potential is unsatisfactory. The main reasons for the existing state of renewables utilization are the high financial costs for realization of geothermal drillings, the cost for necessary techniques and technologies and very small awareness about the need for support for the realization of projects from domestic but also from foreign subsidies.

However in recent years there has been a significant increase in interest about geothermal energy utilization.

2.3. Geothermal area in Eastern Slovakia Košice basin – Ďurkov

Slovakia is committed to exploiting its domestic geothermal sources. The results of geological investigations put Slovakia in the regions of the world with a high geothermal potential. From 26 geothermal areas in Slovakia the most prospective one is the Košice basin in Eastern Slovakia neogene.

The presence of geothermal water in Eastern Slovakian neogene was verified approximately 10 years ago by survey drills for crude oil and natural gas occurrence.

Most known and most prospective areas of geothermal water fields in the Eastern Slovakian neogene are in Košická kotlina Ďurkov, Rozhanovce, Kecerovské Pekl'any and in Prešovská kotlina Prešov and Renčíšov.

One of the most prospective localities in Slovakia is a mesozoic structure in Košická kotlina witch is situated between Slanské vrchy (Slanské vrchy Mountains) and Slovenské rudohorie (Ore Mountains) with an area around 868 km².

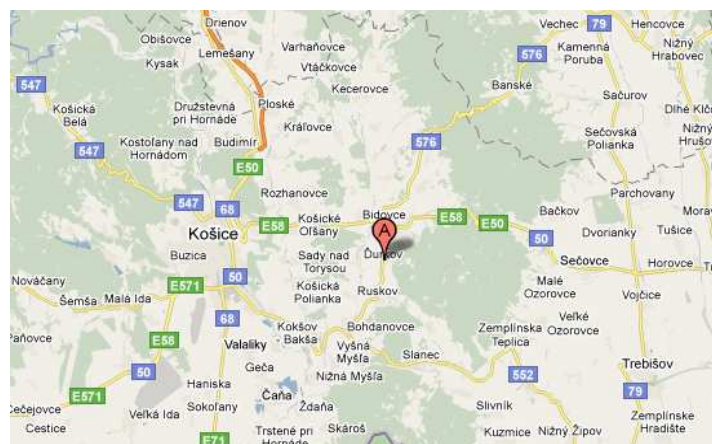


Figure 3 – Eastern Slovakia Košice basin – Ďurkov

3. CONCLUSIONS

In compliance EU directive world trends of use of renewable sources of energy, government of Slovak Republic approved in April 2003 Conception of use of renewable sources of energy. It defines basic framework for development of use of renewable sources of energy in Slovakia.

These large resources of geothermal energy in the East Slovak Basin would not be unnoticed.

Use of geothermal energy has many advantages. It represents home source, its cheaper than fossil fuels. It reduces danger of environmental damage by means of reduction of transport, processing and use of fossil fuels (accidents of production pipes/routes, construction and operation of gas and oil storages, waste dump management, emissions). It also enables control of energy prices. Operation of geothermal energy is safe, with minimal impact on environment and land settlement.

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