XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **525**

topic: **4**
Mineral and thermal water

4.1
Geothermal resources

title: **Geothermal water as renewable energy source — the state and prospects of use in the world and Europe**

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keywords: geothermal water, geothermal energy uses, world, Europe, current state, prospects

Among several important functions of groundwater is its role as a carrier of Earth's heat — geothermal energy. This renewable energy source (RES) has a variety of applications including power generation and a wide sector of direct uses such as heating, bathing and others. Geothermal (thermal) waters and energy are subject of increasing interest in many countries, being considered in global, regional and state documents on climate protection and sustainable energy development (e.g. the UE-Directive on promotion the use of RES). Local geothermal resources limit the dependence on the imported energy sources thus increasing the energy safety. Constant deployment of geothermal energy has been observed in the world, facilitated by progress in reliable technologies as well as ecological and economic factors. The variety of reservoir conditions and production methods proves the variety of possibilities in which geothermal energy can be used, adjusted to local conditions and needs.

As presented at the World Geothermal Congress 2010 electricity generation using geothermal steam takes place in 24 countries. In 2009 the total installed capacity amounted to 10 715 MWe while electricity generation was 67 246 GWh. An increase of about 20% has been achieved during five years' term since 2005. The top five countries for capacity and produced electricity are USA, Philippines, Indonesia, Mexico and Italy (Bertani, 2010).

Geothermal water uses for direct applications are reported from 78 countries. In 2009 installed capacity amounted to 50 583 MWt, while heat production was 438 071 TJ (121 696 GWh). Since 2005 these figures increased by 79% and 60% (!), respectively (Lund et al., 2010) with significant share of heat pumps deployment in several countries. In terms of the amount of produced heat, the leading top five countries are China, USA, Sweden, Turkey and Japan. The main sectors for geothermal direct uses are space heating as well as bathing and swimming. Other applications include horticulture and soil heating, aquacultures, drying, industrial uses, de-icing, and some other (Lund et al., 2010).

In case of Europe electricity generation using geothermal steam takes place in Iceland, Italy, Turkey and Portugal. In recent years the interest has grown in power generation via binary schemes based on 100–120°C water: first six 0.2–3 MWe pilot installations were launched in Austria and Germany (Bertani, 2010). This is an interesting line of electricity generation but needs further works. From the other hand, Europe is leading geothermal direct uses worldwide. They are being reported from 37 countries of this continent. In 2009 installed capacity amounted to 23 469.3 MWt and heat use was 233 736.7 TJ (46.7% and 53.4% of a global share of geothermal, respectively). Geothermal uses concentrate mainly on space heating, bathing and balneotherapy, than on heating greenhouses, aquacultures, industrial uses. In a number of countries the development is based on waters exploited from wells up to ca. 3 km deep (e.g. Iceland, Turkey, Hungary, Italy, Germany, France). Some countries have been dynamically developing shallow geothermal use based on heat pumps.

In Poland geothermal waters have been used for healing in some spas for centuries. Since the early 1990s they have been also used for heating — so far five space heating plants have been on-line. It is worth to note seven new recreation centers applying geothermal water opened in recent years. At the end of 2008 the total installed geothermal capacity (heat pumps including) was ca. 281 MWt while heat sales were ca. 1501 TJ (Kępińska, 2010). The country has prospective reservoir conditions for geothermal energy development for direct uses in several regions. Further research and investment projects are underway.

Although geothermal energy is not treated as main RES in many official prognoses, its further deployment is envisaged in many countries and regions in the forthcoming years and decades. This refers to various technologies and types of uses including space heating, bathing, power generation (with different technologies). These and several other important aspects were pointed out e.g. in Bali Declaration signed during the World Geothermal Congress 2010 (www.geothermal-energy.org).

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www.geothermal-energy.org

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0