GEOTHERMAL ENERGY

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ABSTRACT

This paper deals with the European status of geothermal energy use. This article describes geothermal power production status, geothermal direct uses status and last chapter is the future of geothermal energy.

1. INTRODUCTION

Geothermal energy is energy derived from the heat of the earth's core. It is clean, abundant, and reliable. If properly developed, it can offer a renewable and sustainable energy source. The situation varies from country to country according to the geothermal technology that best suits the available natural resource. Shallow geothermal is available everywhere and is mostly harnessed by ground source heat pump installations. Geothermal power generation in Europe currently stands at 1060 MW installed capacity, surpassing fast the target of 1000 MW set forth for 2010 by the White Paper from 1997 (Eurobserv'ER, 2005) [1-3].

Shallow geothermal energy, ground source heat pumps (GSHP), installation growth rate is even more spectacular, and a capacity of 8000 MWt could be reached if 10% growth per year is maintained (Rybach, 2006).

Geothermal energy has been used for many centuries in Roman and Ottoman baths, for district heating in France during the Middle Ages, and for extracting various borate compounds at Lardarello, Italy, starting in the 1700s. Geothermal energy can be reclaimed in two different ways: in the form of electricity and the form of heat. Each type of utilisation is distinguished by different technologies and applications [2-4].

Europe has significant geothermal resources both in volcanic and sedimentary basin evironment (fig. 1). According to a study carried out by SHELL that investigates the temperatures at 5000 m depth (fig. 2) it can be observed that on the whole territory of the continental Europe there are favourable temperature anomalies, especially throughout the large basins [1-4].

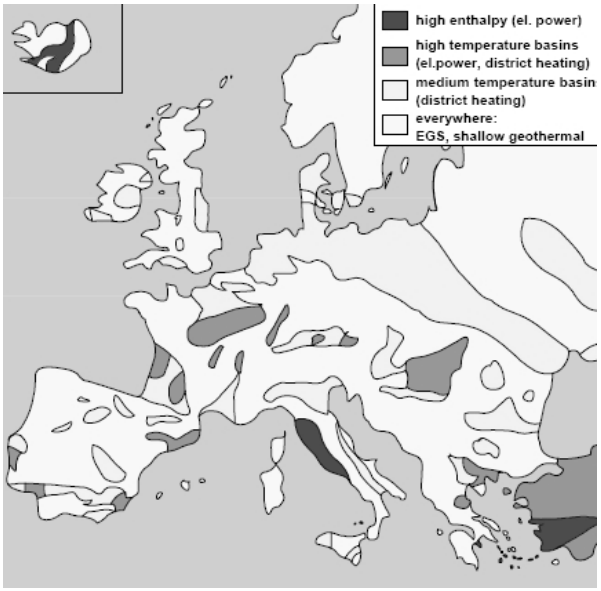

Fig.1. Main basins and geothermal resources of Europe

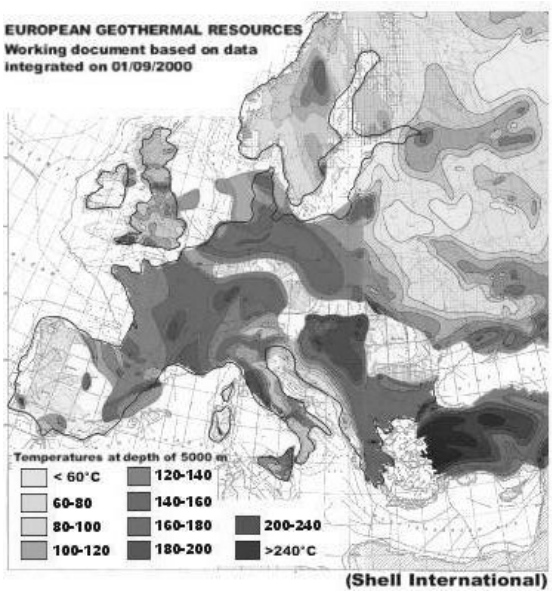

Fig.2. Temperature distribution at 5000 m depth (source SHELL)

We distinguish the geothermal heating and cooling production with heat pumps from the other direct heat use applications. In some statistics geothermal energy is limited to the deep applications only, excluding heat pumps.

2. GEOTHERMAL POWER PRODUCTION STATUS

In some regions of Europe geothermal power plants already substantially contributes to an environmentally friendly and sustainable energy supply, using existing technologies of exploiting steam and hot water reservoirs. This is done mainly in Italy, and on the Azores and other islands of volcanic origin in Europe including, last but not least, Iceland. In South-East Europe, Turkey and the Caucasian region further huge, yet unexploited, reservoirs may contribute to a sustainable energy supply [2-5].

Geothermal power in Europe is provided mostly by Italy (5200 GWh/yr), followed by Iceland (1500 GWh/yr). Distribution of installed capacities is given in (fig. 3) [1-5].

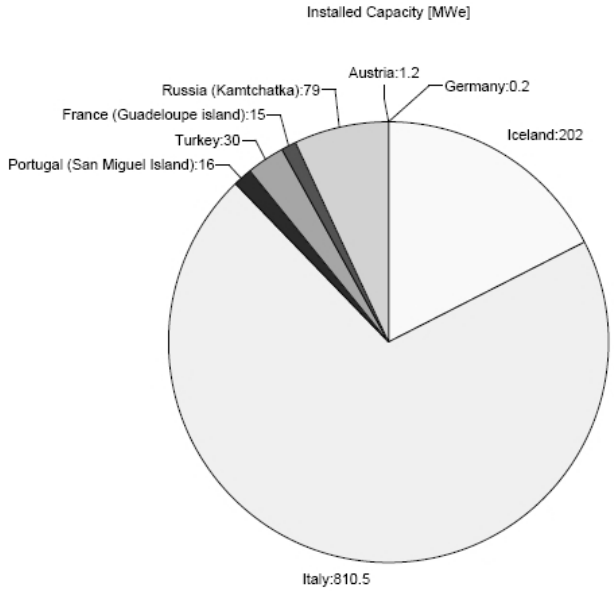

Fig.3. Distribution of installed geothermal power capacities

3. GEOTHERMAL DIRECT USES STATUS

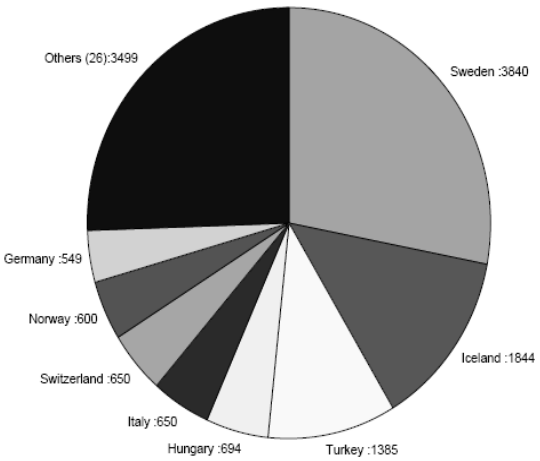

Fig.4. Geothermal direct use capacity distribution in Europe (MWt)

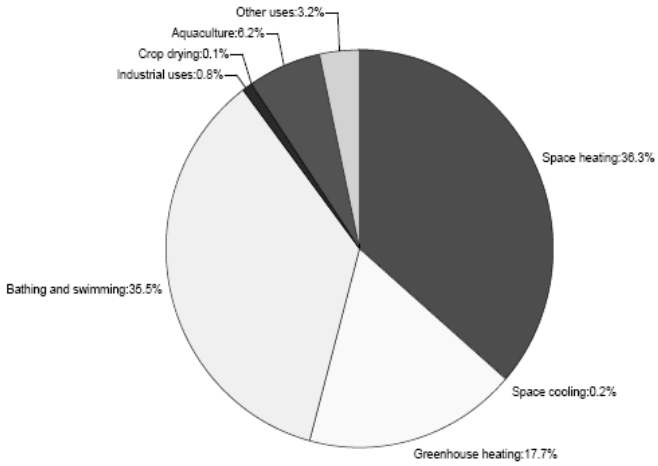

Fig.5. Distribution of geothermal energy direct use

Heat supply from geothermal energy in Europe is primarily achieved by using hot water from deep aquifers for district heating, etc., or in a large number of small to medium shallow geothermal plants. Shallow geothermal also supports the use of solar energy for heating, through underground storage of solar heat from summertime until its use in winter, and offers many other opportunities addressing long-term thermal energy storage [4-6].

There are other direct uses of geothermal energy such as fish farming (aquaculture), greenhouse heating, crop drying and, last but not least, balneology. Balneology in many countries may have a significant, comparable to space heating, thus upgrading the geothermal input (fig. 4). Figure 5 shows the distribution of the installed capacities according to their respective use [1, 3-5].

4. THE FUTURE OF GEOTHERMAL ENERGY

On January 10, 2007, the European Commission released an "energy package" including a renewable energy roadmap. Currently, the European Commission prepares a plan on how to divide this renewable energy share over individual member states. In this respect, a new directive is under preparation to foster renewable energies in all sectors, and by that eventually replacing the existing directives on RES for electricity and on biofuels by years 2009-2010 [3-7].

The European Renewable Energy Council, with the help of EGEC, published the Renewable Energy Technology Roadmap (fig. 6) [3-4].

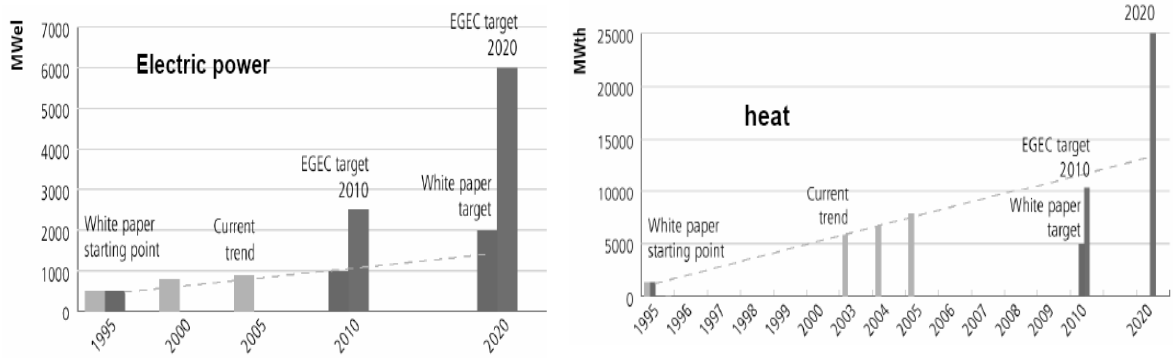

Fig.6. Comparison of current trend with targets

Technology evolution can be expected in both sectors, power and heat, and towards increasing the usable geothermal potential, improving plant efficiency, and decreasing installation and operational cost.

The future development of the geothermal heating and cooling sector is bound to achieve [2-7]:

- Further increase of efficiency of ground source heat pumps, optimized system concepts, application of advanced control systems, improved components and materials (compressors, refrigerants, pipes, etc.),
- Increased application and innovative concepts for geothermal energy in agriculture, aquaculture, industrial drying processes, etc.,
- Demonstration of new applications like de-icing and snow melting on roads, airport runways, etc., sea-water desalination, and geothermal absorption cooling.

5. CONCLUSIONS

Geothermal energy has many advantages over most other forms of energy. Geothermal energy does not produce any pollution, and does not contribute to the greenhouse effect and the power stations do not take up much room, so there is not much impact on the environment. The advantages of geothermal energy use vastly outweigh the disadvantages which conclude that it would be an effective way of preserving our earth and environment.

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4. REFERENCES

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