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SPA AND INDUSTRIAL USES OF GEOTHERMAL ENERGY IN ITALY

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ABSTRACT

Thermal spas with a production of around 27 million m^3/y of mineral water cover a significant portion of direct geothermal energy uses in Italy, for about 125,000 TOE/y. In comparison, industrial uses of geothermal energy are very limited. A description is given of the main applications (for location, see Fig. 1).

1. INTRODUCTION

Spa and industrial uses are respectively the largest and smallest non-electric applications of geothermal energy in Italy. The other direct uses of this resource are described in our paper presented at WGC 2000, "Geothermal space and agribusiness heating in Italy" (Carella and Sommaruga, 2000).

This paper stated that Italian direct uses of geothermal energy amount to about 240,000 TOE/y, of which 125,000 for spa treatments, 60,000 in agribusiness, 40,000 for civil space heating and 15,000 industrial and miscellaneous.

2. THE SPA SITUATION

Italy has some 2,300 mineral water sources located in 930 localities, about a thousand of which are utilised. Two thirds are cold, while the remainder exceed 20°C, reaching up to 100°C (Sommaruga and Verdiani, 1995).

Ownership of ground water is in the hands of Regional Governments and its use is subject to concession. In 1970 558 mineral water concessions were granted, of which 257 were for thermal water (over 20°C).

Well-equipped mineral water resorts number about 180, with 460 spa-hotels and thermal establishments. Some of the main spas are public, while other big and all the minor ones are privately owned. Water output is estimated around 40 million m^3 / year, a very small amount compared to the total ground water extracted in Italy (over 12 billion m^3/y) (C.C.E., 1982). Several million m^3 of mineral water are bottled yearly, mostly for table use.

Presently around 3 million tourists spend over 16 million days in Italian spa localities (TCI, 1999, modified according to national and local official statistics). While not all of them used the spa facilities, other groups not included in the statistics (local residents, commuters) spent time in the thermal establishments (ASSOTERME et al., 1996; Provincia di Pistoia, 1998).

Two spa centres dominate the Italian thermal business: Abano area (NE Italy) and Ischia island, near Naples, both with high temperature springs and with over 3 million visitor days per year, for an estimated cumulative use of around 27 million m^3/y of water. Five spa towns have between 1 and 2 million visitor days per year: Montecatini and Chianciano (Tuscany - TU) with warm water (23°-36°C); Sirmione (Lombardy - LO) with 65°C fluids; Salsomaggiore (Emilia - ER) and Fiuggi (Latium - LA) with cold (11°-16°C) water. Seven of the remaining spas have between 100,000 and 300,000 visitor days per year, the rest being smaller.

The majority of the large spas are dedicated exclusively to balneological applications; two (Montecatini and Chianciano) have combined drinking and balneological uses; one (Fiuggi) is predominantly for drinking therapy.

The heat of thermal water used in spas for therapeutical treatments (baths, muds, swimming pools, etc.) is included in our calculation of energy substitution because the geothermal water temperature provides all or part of the energy otherwise supplied by conventional fuels.

It is not easy to estimate the amount of geothermal heat, contributed by hot springs in spas. Taking into consideration the amount of water involved, the interval between outlet and inlet temperature of the resource and the operating time, one can arrive at the following values: Abano area 90,000 TOE/y, Ischia 25,000 TOE/y, other spas 10,000 TOE/y, for a total of 125,000 TOE/year.

A brief description follows of the main thermal spas (C.N.R., 1992; TCI, 1999).

2.1 Abano area (Veneto region – VE in Fig.1)

Located in NE Italy, it is one of the most important spa complexes in the world. Besides the main town of Abano, it also includes Montegrotto, Galzignano and Battaglia Terme. 65° to 87°C water from Upper Mesozoic limestones is tapped by shallow wells. 120 hotels have their own thermal facilities, each with an average of two wells, for a total of 230 producers. In addition three spa establishments are operating. Average yearly water output is 22 million m^3. Spent geothermal water is disposed of at the surface.

Some 200 swimming pools use the geothermal water and all the spa hotels are heated (through heat exchangers) by part of the fluid produced. Most hotels operate from March to November and some are open all year. In 1998, 3.4 million days were spent in this resort area by almost half a million tourists. Heat contained in the geothermal fluids used for direct balneological applications corresponds to about 90,000 TOE/y, while the part used for space heating is 25,000 TOE/y.

2.2 Ischia island (Campania - CP)

Another important spa complex covers several villages (Ischia, Barano, Casamicciola, Forio, Lacco Ameno, S. Angelo) on this beautiful island located near Naples. In 1998 there were over 4 million days spent here by about 400,000 tourists, the majority of which utilised the existing thermal facilities (especially the swimming pools).

Several tens of very shallow wells and a number of springs provide waters mostly at temperatures of 58° to 73°C and partly in the 25° to 40°C range.

Similarly to Abano, 77 of the more than 140 hotels in Ischia have their own wells and/or springs and spa facilities. Many of them also have thermal swimming pools. The spent water is channelled into the island drainage system.

The geothermal heat contained in the produced fluids (estimating the outflow in the order of 900 m^3/h) is about 25,000 TOE/year.

The tourist season is eight months (March to October) but a few hotels are open all year.

2.3 Montecatini (Tuscany - TU)

Warm waters, 23° to 32°C, are used in nine thermal establishments both for drinking therapy and for balneological uses. A total of 1,780,000 days were spent by over half a million tourists in 1998 in this popular resort town.

2.4 Chianciano (Tuscany - TU)

Warm (32° to 36°C) water is used in this well-known spa centre, with 1,378.000 days spent by about 280,000 tourists in 1998. Both drinking therapy and balneological applications are in use in four thermal establishments.

2.5 Sirmione (Lombardy - LO)

A total of 1,038,000 days were spent by over 220,000 tourists in 1998 in this charming resort on Lake Garda. The 65°C water is utilised in two thermal establishments and three hotels for balneological applications.

2.6 Other thermal spas

Of the seven spa towns which have visitor days between 100,000 and 300,000 per year, hot springs (23°-70°C) are utilised in Sciacca (Sicily - SI), Porretta Terme (Emilia - ER), Acqui Terme (Piedmont - PI) and Bagno di Romagna (Emilia - ER). In these last two resorts a geothermal DH system was built. While the Acqui Terme system uses temporarily conventional fuels, the Bagno DH is successfully operating without interference between the therapeutical uses and space heating.

3. INDUSTRIAL USES

The main industrial application of geothermal energy in Italy is the use, since 1967, by a private operator of 15 t/h of low-pressure steam from the Italian utility ENEL Larderello field (in Tuscany - TU) for pre-heating and dehydration of colemanite (imported from Turkey) for the production of 50,000 tons/year of boric acid and 12,000 tons/year of borax (Allegrini et al., 1992; Burgassi et al., 1995).

Inlet temperature is 200°C and outlet 80°C. The estimated energy use amounts to 7,500 TOE/year.

Another industrial plant went on stream in 1993 at the Torre Alfina (Latium - LA), which is a 140°C water-dominated field. A total of 32,000 tons/year of carbon dioxide from the incondensable gas-cap, tapped by one well , are sold by ENEL to a private firm which built on site a treatment plant where the gas is purified before being marketed (ENEL, 1995).

Among the industrial uses abandoned for economic reasons is the production of boric acid, borax and other chemicals directly

from the Larderello steam, and the drying of hay and cereals in Rodigo (Lombardy-LO) where a combined geothermal greenhouse and fish farm is operating.

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Fig.1 Italy – Main thermal spas and geothermal industrial uses.

