



Key Issues for Renewable Heat in Europe (K4RES-H)

Contract EIE/04/204/S07.38607

Deliverable 2 : The Best available statistical data on Geothermal energy, for each EU-25 country, including a description of the sources, their accuracy and recommendations to improve their quality

- Task 5.1: Verifiable Targets for RES-H -

The Objective is to set verifiable absolute targets for RES heating and cooling. It implies the solution of some statistical and methodological issues. Goal of this task is to tackle these issues and develop recommendations for a methodology to set RES-H targets and identify the improvements of the EU statistics.

1. Best available statistics for Geothermal Heat

This Key Issue is broken down into the following steps:

1. Collection, evaluation and compilation of available data for each country
2. Compilation of statistics for Europe as a whole
3. Recommendations to improve quality of data
4. Proposal for a methodology to set verifiable targets

Firstly, we define the concept of geothermal energy in order to present an harmonized view of the data presented :

Geothermal Energy is the energy in form of heat beneath the surface of the solid earth.

Within the EU member states, this definition is not yet used universally. It is accepted in most of Central and Northern Europe, however, in some countries differing national opinions want to limit geothermal energy to resources above a certain temperature level. This reflects in the national statistics, concerning the type of geothermal applications counted. There are many ways to bring geothermal heat to good use, either direct or through heat pumps, the latter allowing for adjusting the delivery temperature level to the needs of the user. For the statistics, we mainly can distinguish two areas:

- **Direct Use** – Geothermal heat is produced at higher temperature levels (above ca. 25 °C), suitable for direct heating. This typically means deeper drillings (>200 m, sometimes several km) and large installations. In some cases heat pumps are installed also in this kind of applications, in order to

bring the delivery temperature to desired values. This kind of geothermal resource is also known as “low to medium enthalpy”.

- **Geothermal Heat Pumps** (Ground Source Heat Pumps, GSHP) – Geothermal heat is produced at low temperature levels, so a heat pump is required to increase the temperature to useful levels. Depth is typically less than ca. 200 m, the size of plants can range from small residential houses to large offices, etc.; cooling often is combined into these type of applications. This kind of geothermal resource is also known as “very low enthalpy”.

In a large part of the statistical data, only one of the technologies mentioned above is covered (in particular Eurostat tends to count the direct use only, while EHPA is covering only GSHP, sometimes together with other heat pumps). So it is always necessary to look at different sources and to check what is the basis of the statistical sample. For K4RES-H we do the utmost to cover all geothermal technologies for heating and cooling.

To define the RES- HEAT production, in this project K4RES-H, we address the total amount of produced renewable and useful heat (net heat production). This definition comprises the following specifications:

- The heat is measured directly after the conversion what means that all storage and transfer issues are neglected.
- Auxiliary energy supply within the conversion process is only considered when being a considerable amount of more than 5 % (i.e. in the case of heat pumps).
- K4RES-H recognizes heat which is produced for sale as well as for the own consumption. Consequently, the IEA differentiation between “public producer” and “autoproducer” is neglected.
- In cogeneration only the total amount of useful heat demand is considered as it is defined in the EC Cogeneration Directive

1.1 Collection, evaluation and compilation of available statistics

For each of the statistics, their key characteristics are described (e.g. special focus on a certain region or sector, years covered, funded by), and how the data of the different sources were generated, e.g. by measurement, calculation, estimation.

The original sources of the data is identified (e.g. manufacturers, installers, scientists, public administration,...). Any specifics of the methodology used are mentioned.

When any of these information could not be identified (e.g. because the publisher didn't want to acknowledge the original source) this is mentioned, too.

The overview is broad: All statistics/studies deemed relevant are included in this overview.

1.1.1. Overview and description of available statistics and information sources

Existing statistics

- Eurostat :

In June 2006, Eurostat published the ‘Energy : Yearly Statistics’ with data from 1999-2004 for geothermal energy as total primary energy (heat), as (heat) input into heat and power production, and as final energy use in form of heat (non-electrical use). The differentiation between the two latter categories is not very clear and seems not to be consistent:

- Heat input into heat and power production should be equal to the total primary energy, as there are no other uses for the energy. However, it seems that in Eurostat the heat input means the heat lost in production, as in the cases where this heat input is listed, the final heat consumption and the heat input sum up to the total primary energy.
- For the final energy consumption in form of heat, there are several countries with consumption, but no input into heat production. Does that mean there are no losses?
- It is also not possible to understand the term “inputs to electricity and heat production” as valid only for electrical power, as some countries like Hungary and Slovak Republic are listed with inputs, but there is definitely no geothermal electric power production.

Probably these inconsistencies are a consequence of different national statistics forming the basis of Eurostat data. The same seems to apply for the inclusion of GSHP, which judging from the data are only included in Germany (since 2001). In the Germany data, the values seem to be based on the total heat delivery of the GSHP (i.e. including the auxiliary energy).

Remark : Power produced from geothermal energy is also listed, in a different chapter, as annual production and installed capacity. From EU 25, electric power data are only given for Italy and Portugal (Azores), in spite of existing plants in France (DOM-TOM), in Austria (since 2000), and in Germany (since 2003).

Eurostat collects the data from the 25 national statistical offices.

The national figures could be calculated in cooperation with different ministries (Environment, Energy, Industry...), with energy agencies, etc. These institutions again receive information from municipalities or utilities (for district heating), industry association, or they make their own survey (sometimes in collaboration with an independent consultant). For geothermal, the direct use mainly is considered only, because this technology is typically used in larger district heating networks, where measurement and reporting is mandatory. GSHP, in the contrary, are not considered in all countries but Germany (where the data seem to be derived from sales numbers and estimation); for Italy, Portugal and Spain the exclusion of GSHP is obvious, but could not be verified.

As a conclusion, Eurostat provides good data for heat production from geothermal direct use for 13 out of the EU 25 countries: Austria, Belgium, Denmark, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Slovak Rep., Spain and UK; and in addition data for the total geothermal heat use for Germany (however, apparently with a definition not consistent with the K4RES-H definition above).

- EU Observer :

EU Observer compiled different sources of information, and notably data from the World Geothermal Congress (see below). It does not add new or more reliable data to our survey.

- EHPA :

EHPA collects each year statistics from their members (the national association, where they exist) : total sales of HP, sales figures space heating, sales figures heating only (excluding heat recovery HP). The related questionnaire is shown below. All heat pumps in the fields water / water, brine / water, and direct expansion / water can be GSHP and thus use geothermal heat.

If there is no national association or no response, EHPA has to estimate the data.

FIZ Karlsruhe and the EHPA Strategy Committee are in charge of this survey. The yearly questionnaire is sent to international contacts, who are primarily EHPA members and national heat

pump associations as well. Only seven countries can provide reliable statistics. Generally they have to trust more or less in the data provided. And sometimes they have to make their own estimations.

The official heat pump statistics are for : Austria , Estonia, Finland, France, Germany, Netherlands, Sweden

The Estimation by FIZ or national EHPA members concern : Czech Republic, Denmark, Greece, Ireland, Italy, Poland, Portugal, Slovenia, Spain, UK.

EHPA Questionnaire :

European Heat Pump Statistics Sales Figures and HP Stock: 2005

1.	Space heating (residential and tertiary sector)	Sales Figures			HP Stock in 2005
		<15-20 kW _{th} ¹⁾	>15-20 kW _{th} ¹⁾	Total	Total
1.1	Heating only ²⁾				
	air / water			0	
	water / water			0	
	brine / water			0	
	direct expansion / water			0	
	exhaust air / air ³⁾			0	
	exhaust air / air + HX ⁴⁾			0	
	exhaust air / water ³⁾			0	
	exhaust air / water + HX ⁴⁾			0	
	others ⁵⁾			0	
	Subtotal heating only	0	0	0	0
1.2	Reversible (heating and/or cooling) ⁶⁾				
	air / air ⁷⁾			0	
	air / water			0	
	others ⁵⁾			0	
	Subtotal reversible	0	0	0	0
	Total space heating	0	0	0	0
2.	Tap water only heat pumps ⁸⁾				
3.	District Heating ⁹⁾				
4.	Industrial Heat Pumps				
	All Heat Pumps			0	0

1) Heating Capacity

2) Hot tap water can be provided by the same heat pump (or not).

3) Small heat pumps for heat recovery from domestic exhaust air.

4) Small heat pumps for heat recovery, integrated in central domestic ventilation units with heat exchanger.

5) Please specify on a separate sheet.

6) Must be able to provide heating in winter (can work below -7°C external temperature).

7) In Scandinavian countries primarily used for heating purposes.

8) Including small heat pumps for heat recovery from domestic exhaust air preparing only hot tap water.

9) Heating capacity >500 kW, smaller central heat pumps for heating several buildings have to be included under point 1.

The national HP associations collect data from the industry : HP manufacturers.

For example The Swedish statistics are collected on a monthly basis. On the 15th each month the member companies (manufacturers and importers) fill in an xls-spreadsheet. The sales statistics excludes exports. The xls-sheet is sent to a person working for another trade organisation, not related to HVAC at all. This person compiles the figures into a new xls spreadsheet and sends it to the Swedish HP Association. In this manner they can only see the total sales figures and not any market

shares, but they do see which companies have provided information. When they have got the compiled statistics for a month they send it out to the people who provided information.

In France, since 2003, the AFPAC (French Heat Pump Association) realised a yearly survey with the member companies (HP manufacturers) to evaluate the market.

A questionnaire is elaborated to correspond to the market : by technologies, by power, by application...

Answers are collected by a neutral AFPAC member, with high confidentiality.

Results are aggregated and after all answers are eliminated to keep the survey anonymous.

Then, the results are studied by the AFPAC Board and are generally corrected.

They adapt figures sub- or under-estimated, with their extensive knowledge and French experience.

They estimate that this survey covers 80% to 90% of the HP market.

In Germany, BWP (German Heat Pump Association) is collecting the data for the national market. The number of 25486 given by EHPA for 2005 is likely to include all heat pumps; the value for GSHP in BWP-statistics for 2005 is 18217 for all heat pumps, including 12292 ground-source (geothermal) heat pumps. Thus geothermal heat pumps in 2005 accounted for about 73 % of the total heat pump market in Germany. In 2006, a drastic increase was observed, with a total of 43886 new heat pump units of all types (141 % growth!), of which 28605 were destined for geothermal use.

As a conclusion, the EHPA statistics is good for new installations in 15 out of the EU 25 countries, 7 of which provide very reliable data. A problem exist in the exact distinction between GSHP and other heat pumps using surface water, sewage water, waste heat, etc. Sometimes even air-source heat pumps cannot be separated from ground source units in the data. Also, with only the new sales considered, the EHPA statistics cannot directly serve as a basis for calculating the annual geothermal heat production from GSHP.

- WGC 2005 :

The International Geothermal Association (IGA) organises every 5 years a World Congress (1995 Italy, 2000 Japan, 2005 Turkey, 2010 planned in Indonesia...). It permits to evaluate the market, to present the new technology, to discuss the latest R&D-results, etc.

The latest event was held in Antalya, Turkey, in April 2005. The procedure was the following :

Approximately one year in advance, forms for updating the information on electric and direct-uses (in this context, comprising both direct use and GSHP) of geothermal energy were mailed to representatives in 90 countries in preparation for the World Geothermal Congress 2005 (WGC2005) in Turkey. The forms, consisting of eight tables, were revised versions of those utilized in the 1995 and 2000 surveys, especially in terms of how to make the necessary calculations for installed power and energy utilized. The tables were also made available on the Internet. These eight tables were to be completed, where applicable, and attached to the various country update papers submitted to the WGC2005.

Approximately 80 countries responded with abstracts (20 EU countries); 75 of them subsequently submitted draft papers and 68 a final paper, 60 of which had some direct utilization of geothermal energy.

Unfortunately, not all countries responded in a similar manner, as some had only limited development and use data to report, while others had difficulty obtaining temperature and flow data for the various uses or were unable to locate and catalogue all the direct-uses in the country.

In some cases, with the help of the extensive IGA knowledge and international experiences, reasonable estimates could be made of the various uses, especially that for geothermal heat pumps, and bathing and swimming pool heating.

Reference often had to be made to other publications for data to augment the country update paper, and reports from WGC2000 were also utilized and updated where necessary.

Key data and explanations were frequently missing from the country update reports used in this report and tables, despite the fact that such essential elements were requested. In some other cases, the data appeared to be in error or misreported. A coordinator (J. Lund of the GeoHeat Centre in Oregon, USA), together with IGA members, has attempted to correct for these errors by contacting the authors or making estimates for the various missing data, and has stated so in the country summary.

In the WGC 2005 collection, data are for the installed capacity (MWt), for the annual energy use (TJ/yr and GWh/yr) and for the capacity factor. The data mainly are valid for 2003/2004. Through this work, the European application of geothermal energy for direct utilization could be reviewed, updating the previous surveys carried out in 1995 and 2000. An effort was made to include and quantify GSHP data.

Methodology :

The authors of the country papers collected data with different methods. Generally, they were asked to use the method recommended and elaborated by IGA and submitted for WGC2005, e.g. they followed these same equations for installed capacity, heat production, etc.

In some cases, however, the difference between calculated and real figures given by operators of particular plants appeared (resulting, among others, from the facts that the plants are not operating all year round using maximum water flowrate / temperatures) as assumed in equations. This is explained to some extent, for instance, in the paper for Poland.

Some other adjustments were due to the accuracy of data from particular plants and sites and - in case of heat pumps – due to the problem of collecting all information (almost impossible since these devices are scattered, no universal data base system exists in many countries).

As a conclusion, the WGC 2005 data have the widest coverage of technologies and countries (20 out of the EU 25 countries). A drawback is the fact that this survey is made only every 5 years, and not for a given year exactly (ca. 2003-2004). Also the quality of the data and the basis of the sample are varying; however, in most cases, there is sufficient explanation in the related country papers that form part of the effort.

Raw Data collected

The geothermal statistical data for the EU-25 were collected from different sources, using various definitions for geothermal energy, and of varying quality. These variations are due to different methodologies to collect data.

The three pillars of the collection are the data from Eurostat, from the World Geothermal Congress (WGC 2005), and from the European Heat Pumps Association (EHPA; sales figures)

There is no standard international terminology in use throughout the geothermal community, which is unfortunate, as this would facilitate mutual comprehension.

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.

Direct heat use is one of the oldest, most versatile and also the most common form of utilization of geothermal energy. Bathing, space and district heating, agricultural applications, aquaculture and some industrial uses are the best known forms of utilization. There are many other types of application, on a much smaller scale, some of which are rare ; but heat pumps are the most widespread.

Traditionally, direct use of geothermal energy has been on small scale by individuals. More recent developments involve large-scale projects, such as district heating, greenhouse complexes or major industrial use.

The problem is to take into account all applications in a country. An important difficulty concerns the spas and bathing-swimming applications.

The raw data collected for heat pumps typically do not refer to the energy produced by geothermal application, but to the number of installations. One problem is to separate the geothermal heat pumps (GSHP) and the other ones. Information about operating data for GSHP cannot be gathered in forms covering whole countries, but is limited to exemplary monitoring, and to information to be found in papers describing operating experiences for projects with known operating data.

The differences between the raw data could mainly be explained by the use of different sources and methodologies associated : estimation from experts or data collection based on a survey. An estimation depends on the good knowledge of the situation. The survey is representative only if it covers a large part of the market.

For the district heating plants, a difference between the figures comes to different concept of installed capacity versus capacity in operation.

A lot of times, no data are available from National statistics offices and International Institutions. They have data only for geothermal electricity. Until now, they mostly did not consider it relevant to calculate geothermal production for heating and cooling.

In Germany, the working group of energy statistics for BMU started compiling data for all geothermal uses in 2004. The procedure is apparently still under development and fine-tuning.

The geothermal sector is not yet fully structured. National geothermal organisations don't have all data available. French and German national association (in Germany, both BWP for heat pumps and GtV for all deeper geothermal) publish data each year.

Aggregation and conversion of raw data to energy output

The conversion concerns mainly the heat pumps : from number of installations to energy output.

The estimation of the number of heat pumps installations (capacity installed) permits to calculate the energy production :

- with an average capacity (e.g. 5-20 kW_{th}),
- with assuming a seasonal COP (e.g. 3-4)
- and with a number of equivalent full-load hours per year (e.g. 1,800-2,200 h/a)

Sometimes, International Institution considers Geothermal energy in reporting only geothermal energy that is for direct use. Production (TJ) is then the difference between the enthalpy of the fluid produced in the production borehole and that of the fluid eventually disposed of (re-injection borehole).

The use of heat pumps to extract heat from the air or lakes etc. should not be included at all as they are not geothermal projects.

Comments

Data could be collected for 21 countries of the EU 25 (Malta seems not to have any geothermal application, in Cyprus and Latvia the existence of some GSHP cannot be excluded, and in Luxembourg a few GSHP are expected). The quality of statistical data provided from the 21 countries differs considerably. There is no single source providing all data in good quality for all countries. WGC 2005 comes closest to this goal. In general, not all direct use applications are reported, and the number of GSHP in HP sales figures are not always easy to separate (in some cases only by estimation).

- Eurostat has data only for 13 countries, and mainly for direct use excluding GSHP.
- EHPA gives data on GSHP for 15 countries. Only seven countries can provide reliable statistics : Austria, Estonia, Finland, France, Germany, Netherlands, and Sweden. A major problem for Southern European countries is to draw a distinction between reversible HPs primarily used for heating purposes and air-conditioners with heat pump function. Some million air-conditioners with heat pump function predominantly used for cooling purposes in Southern Europe are disregarded in this statistics.
- The main source, WGC 2005, covers 20 countries and does not provide data only for 5 countries : Cyprus, Estonia, Latvia, Luxembourg and Malta.

To summarize, joint efforts to improve reliability and completeness of data are required. Main emphasis is to be placed on Southern European countries and information concerning stock of installed systems.

1.1.2. Evaluation and Identification of information gaps

It was decided that the overview table (see end of document) will not be public.

The statistics are now evaluated according to the following parameters : 1 shall be deemed highest reliability, 3 shall be deemed least reliable.

1 data stem directly from a public incentive programme or other public register, which is widely considered as covering nearly all of the market (or a certain segment thereof) or data are based on closed/anonymous survey of market participants (manufacturers, service providers)

2 data based on open/public survey of market participants (manufacturers, service providers) or data are based on estimations of at least 3 experts

3 no data available or data based on estimations of just one person or labelled “vague” or “just a guess” by those who published them.

The data from Eurostat generally are ranked “1”. They are from national statistical offices. We can consider they publish data only when they are relevant, and it’s why they don’t have data for all countries.

The difference in the figures given by Eurostat and the others is that GSHP is not always included.

For some countries Eurostat has no data for geothermal, while WGC has: Czech Rep., Finland, Ireland, Lithuania, Netherlands, Slovenia, Sweden.

There are 5 countries without any data: Cyprus, Estonia, Latvia, Luxembourg, Malta. They all do not have deep geothermal uses (well, Cyprus might have some potential), but could have GSHP (Luxembourg for sure has some). For Denmark, values are given as input to electricity + heat production, but in fact all is heat.

For the figures from the World Geothermal Congress in 2005 (WGC 2005), we mainly ranked them with score = 2. Indeed a large number of country reports are written by the best national experts and they compared their data. We ranked as 3, only when just one expert was in charge of the estimation. For 5 countries we don't have figures so they are not evaluated.

For EU Observer 2005, the geothermal report considers for some countries the same data than for WGC 2005. In this case, we ranked the country as for the WGC2005.

The last source of data is the European Heat Pump Association (EHPA).

They have official heat pump statistics for 7 countries: Austria , Estonia, Finland, France, Germany, Netherlands, Sweden. They can be considered relevant with a rank = 2.

The Estimation by FIZ or national EHPA members concern : Czech Republic, Denmark, Greece, Ireland, Italy, Poland, Portugal, Slovenia, Spain, UK. In this case, the rank is 3.

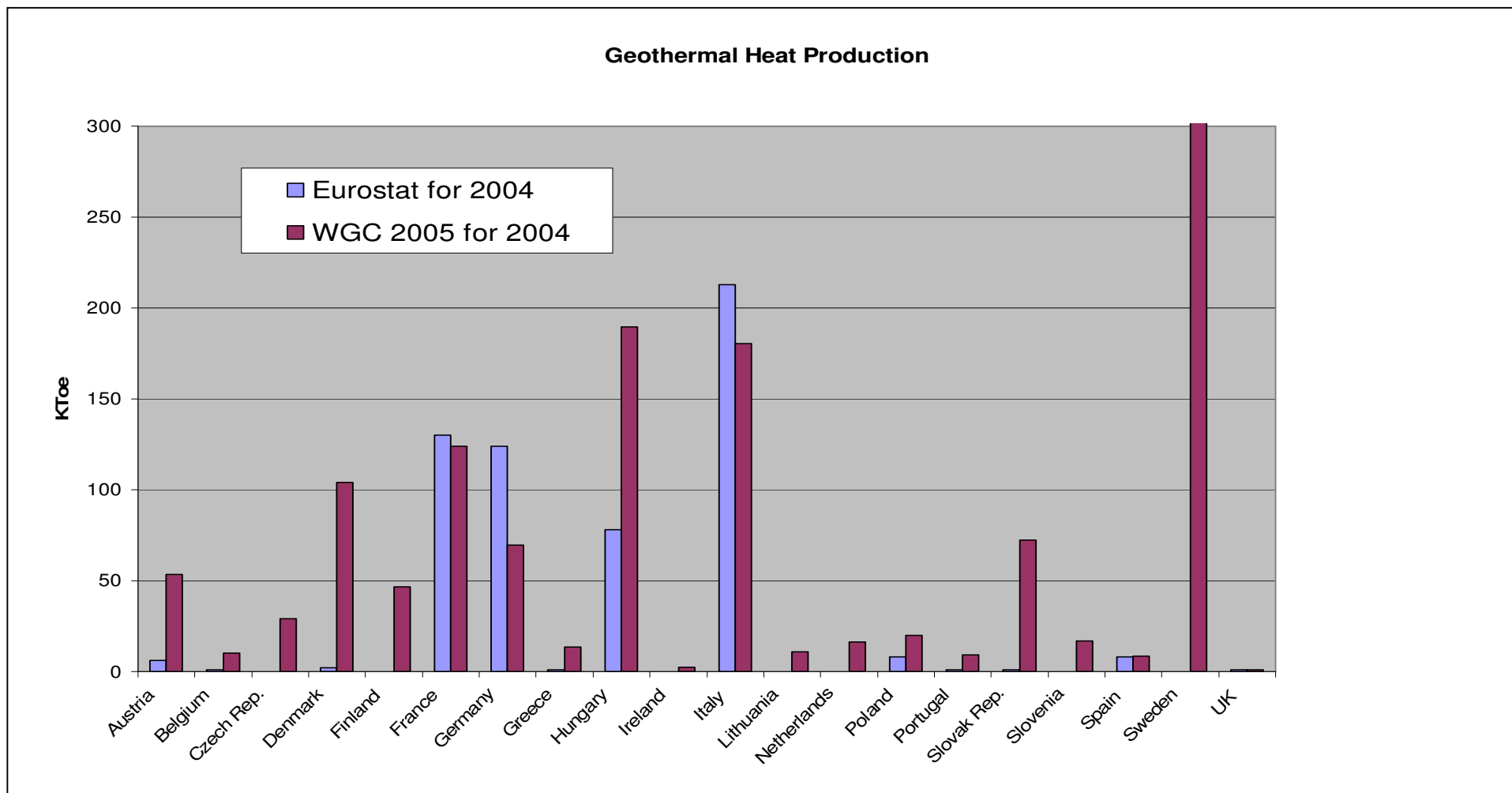
The large difference between national HP association (BWP) and EHPA could be explained by different definition of Heat Pumps, notably figures given for total production / export / import...

As a result, we can state as information basis and remaining gaps :

- For the following countries, there is sufficient statistical information to start with, both in terms of coverage of all technologies and in terms of quality (minimum ranked 2): Austria, France, Germany, Netherlands (4 countries)
- For the following countries, information in good quality exists only for direct use (excluding GSHP), so reliable GSHP data are missing : Belgium, Czech Rep., Denmark, Greece, Hungary, Italy, Poland, Portugal, Slovak Rep., UK (10 countries)
- For the following countries, information in good quality exists only for GSHP, so reliable direct use data are missing (or no direct use exists) : Estonia, Finland, Sweden (3 countries)
- For the following countries, some data exist, but the reliability is considered low or inconsistencies are obvious : Ireland, Lithuania, Slovenia, Spain (4 countries)
- For the following countries, no data exist, but the existence of geothermal plants for direct use and/or GSHP is known, so the data are missing : Luxembourg (1 country)
- For the following countries, no data exist at all, and geothermal heat use is assumed either absent or negligible : Cyprus, Latvia, Malta (3 countries)

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Comparison of the Eurostat-values to the WGC 2005 values (representing 2003/2004).



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TJ	EUROSTAT June 2006						WGC2005
	1999	2000	2001	2002	2003	2004	2004
EU 25	17877,6	18756,9	23153,0	23153,0	24199,7	23948,5	76967,6
EU 15	14570,1	15281,8	19719,8	19719,8	20347,8	20306,0	62765,0
Austria	167,5	209,3	209,3	293,1	251,2	251,2	2229,9
Belgium	41,9	167,5	167,5	41,9	41,9	41,9	431,2
Czech Rep.	0,0	0,0	0,0	0,0	0,0	0,0	1220,0
Denmark	41,9	41,9	83,7	83,7	83,7	83,7	4360,0
Finland	0,0	0,0	0,0	0,0	0,0	0,0	1950,0
France	4689,2	5191,6	4563,6	4479,9	5401,0	5442,8	5195,7
Germany	418,7	418,7	5191,6	5359,1	5107,9	5191,6	2909,8
Greece	83,7	83,7	83,7	41,9	41,9	41,9	567,2
Hungary	3307,6	3349,4	3307,6	3307,6	3265,7	3265,7	7939,8
Ireland	0,0	0,0	0,0	0,0	0,0	0,0	104,1
Italy	8917,9	8917,9	9085,4	9085,4	9085,4	8917,9	7554,0
Lithuania	0,0	0,0	0,0	0,0	0,0	0,0	458,0
Netherlands	0,0	0,0	0,0	0,0	0,0	0,0	685,0
Poland	0,0	125,6	125,6	251,2	293,1	334,9	838,3
Portugal	0,0	0,0	0,0	41,9	41,9	41,9	385,3
Slovak Rep.	0,0	0,0	0,0	41,9	83,7	41,9	3034,0
Slovenia	0,0	0,0	0,0	0,0	0,0	0,0	712,5
Spain	209,3	334,9	334,9	334,9	334,9	334,9	347,2
Sweden	0,0	0,0	0,0	0,0	0,0	0,0	36000,0
UK	41,9	41,9	41,9	41,9	41,9	41,9	45,6
Bulgaria	0,0	0,0	0,0	0,0	0,0	0,0	1671,5
Romania	209,3	251,2	209,3	628,0	711,8	3307,6	2841,0

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KTOE	EUROSTAT June 2006						WGC	GSHP apparently incl. in	
	1999	2000	2001	2002	2003	2004		2005	Eurostat
EU 25	427	448	553	553	578	572	1838		
EU 15	348	365	471	471	486	485	1499		
Austria	4	5	5	7	6	6	53	no	yes
Belgium	1	4	4	1	1	1	10	no	yes
Czech Rep.	0	0	0	0	0	0	29	no	yes
Denmark	1	1	2	2	2	2	104	no	yes
Finland	0	0	0	0	0	0	47	no	yes
France	112	124	109	107	129	130	124	no	no
Germany	10	10	124	128	122	124	69	since 2001	yes
Greece	2	2	2	1	1	1	14	no	yes
Hungary	79	80	79	79	78	78	190	no	yes
Ireland	0	0	0	0	0	0	2	no	yes
Italy	213	213	217	217	217	213	180	no (?)	no (?)
Lithuania	0	0	0	0	0	0	11	no	yes
Netherlands	0	0	0	0	0	0	16	no	yes
Poland	0	3	3	6	7	8	20	no	yes
Portugal	0	0	0	1	1	1	9	no (?)	yes
Slovak Rep.	0	0	0	1	2	1	72	no	yes
Slovenia	0	0	0	0	0	0	17	no	yes
Spain	5	8	8	8	8	8	8	no (?)	no (?)
Sweden	0	0	0	0	0	0	860	no	yes
UK	1	1	1	1	1	1	1	no	yes (?)
total	428	451	554	559	575	574	1838		
Bulgaria	0	0	0	0	0	0	40	?	no (?)
Romania	5	6	5	15	17	79	68	yes (?)	yes (?)

1.1.3. Methodology for inaccurate data

In order to close the information gap, different methodologies could be adopted.

The gaps reported above are because of two main facts :

- there are a lot of old direct-use applications in EU-25 not taken into account (district heating, swimming pool, spas...). These individual applications are difficult to estimate.
- The market for Ground Source Heat Pumps is new and not yet considered important enough to report in some countries.

Indeed, the increase of HP sales 2005 vs 2004 of the most important markets (excluding Greece, Italy, Spain) is 16% in average. For the heating, the GSHPs are still the dominating geothermal systems in many countries.

For heat pumps (unreliable or missing GSHP data are the most frequent gaps), a methodology can concern interviews with different experts that could be conducted. We can suggest to consider the following potential experts:

- expert from national industry association
- expert from national research institute/university
- experts from larger manufacturers
- expert from Energy Ministry or Ministry of Environment
- journalist having good knowledge and expertise in the market or market or subsector

For the missing direct use applications, data might be available through water authorities, mining authorities, etc.; however, the effort to cover all will be high compared to the amount of energy concerned.

1.2 Compilation of best available statistics for EU 25

The different statistics divide the market into separate segments; the following ones are considered appropriate for geothermal energy :

- by technology : medium to low energy applications (direct use) / very low energy applications (GSHP)
- by application : domestic hot water, space heating, space cooling, industrial processes, agricultural heating and processes
- by sector : residential, commercial, industrial, agricultural sector.

Furthermore, the unit of measurement vary, e.g. number of new installations, number of HP newly installed, MW_{th} of installed capacity, TJ, GWh or toe of annual geothermal energy produced.

We have some doubt concerning the data for medium and low enthalpy for : Belgium, Ireland, Portugal, Spain, Sweden and Lithuania.

For Austria, we think the produced heat is too high in EU observer, it is the total heat produced and not the geothermal part (with 2000 h/a, the average HP would be ca. 20 kW that way, and >25 kW if it would be only geothermal.

If we take that number, we suggest an annual COP of 3.5, bringing the value of 105 KTOE down to 75 KTOE. This fits also better with WGC 2005. For France, we reduced the 124 KTOE from WGC 2005 by 2 KTOE (from 16 MW GSHP), and added 85 from GSHP. And in Italy, on our own calculations from the capacity result in 166 KTOE; according to figures from Eurostat. Estonia and UK are straightforward calculation.

For Denmark, apparently a conversion error happened for the heat delivered (see explanation of WGC2005 data for Denmark below). We take the more likely number of 10.4 Ktoe annually.

Recommendations to improve quality of statistics

The definition of geothermal energy is lacking in the acquis communautaire and the national practice is diverse - some authorities consider it as a type of energy carried by thermal waters exclusively -, which hampers the distribution of most up-to-date technologies using shallow depth reserves via heat-pumps or deeper closed-circuit heat-exchanger fluids.

⇒ A broad sense legal definition of geothermal energy is needed in a relevant piece of Community legislation, e.g. the heating-cooling legislation in preparation.

Inventories

As in the case of other state-owned territorial commodities, low-resolution, static inventories of geothermal resources and installations are available or being prepared by institutes or geological services, that are not capable of meeting the requirements of neither the investing enterprises nor the licensing environment protection and water management authorities. In some countries not even the data access for the competent agency hosting the geo information and/or the inventory is enforced by the law.

⇒ The development of national dynamic inventories of geothermal energy as to being capable of registering annual changes and allowing country-scale modelling is highly recommended. To make such inventories comparable on pan-European level a common basic methodology shall be elaborated, preferably via the assistance of Community level professional associations, e.g. EGEC, EuroGeoSurveys.

Industry based / supply chain

For the heat pump sector, it could be good that each country realises a survey on sales figures. It will permit to know the new installations. Moreover for old installations, we have to compare data from all entities implied :

- national authority in charge of licensing – of financing
- the drillers
- the heat pumps companies
- the energy agencies

The licensing process for drilling as measurement of new installations is actually the methodology done in Switzerland with good success.

For the district heating, industrial applications... we have to collect and compare data from :

- public communication
- public authorities
- geothermal associations
- energy agency...

To conclude, we need an EU-wide harmonised methodology to convert data into energy units, and to increase resources for RES-H statistics at national level and Eurostat/IEA.

2. Conclusion

We can consider to have sufficiently good data only for 4 countries. So a big work has to be done for the others in data collection.

So firstly, the Institutions like Eurostat and the IEA or the national statistical offices have to pay more attention to geothermal heating and cooling in considering all applications.

For the heat pump, we can agree it will be difficult to collect information about all old installations.

But from now, we have to realise yearly survey on sales figures in each country.

For district heating, the municipalities have to be contacted to know their data.

For agricultural and industrial applications, the drillers could be the good contact to collect statistics.

An important topic concerns the adoption of a unified conversion methodology for geothermal installations and notably heat pumps (GSHP). For GSHP, also a unified approach to count only the heat from the ground and to exclude the auxiliary power from the supply values should be found.

To finish, EGEC recommends that geothermal energy should be defined as the energy in form of heat beneath the surface of the solid earth, in all data collection.

Annex

Tables with data

Sources of data WGC 2005 - IGA:

State, Possible Future Developments in and Barriers to the Exploration and Exploitation of Geothermal Energy in Austria – Country Update

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The Austrian report was done by a geothermal expert, from the company Geoteam, involved in a lot of projects in Austria. The number of HP is an estimation.

Belgium :

Only an abstract was submitted, thus information on geothermal uses is only estimated

Geothermal Energy Potential of Czech Republic

Vlastimil Myslík, Michal Stibitz, Václav Frydrych, GEOMEDIA Ltd., Společna 35, 182 00 Prague
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The Czech report was realised by three experts from the Company Geomedia. Geothermal energy in this country was studied in detail over the last ten years. Geothermal energy is included in the country's energy policy as a renewable source of energy for the future period up to 2020, according to the Ministry of Industry and Business. The direct-use of thermal water in spas and swimming pools dates back several hundred years. A total of 11 major spas and thermal springs are listed. They gave an estimation of the HP installations (over 1,000 geothermal heat pumps installed) to calculate the production : each with an average capacity of 20-kWt, and assuming a COP of 3.5 and 2,200 equivalent full-load hours per year.

Geothermal Development in Denmark, Country Update 2005

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The authors are from DONG. This company is part owner and has played a major role in the establishment of the only two geothermal plants in Denmark producing heat from the inner of the earth. On those plants he has been project manager for major construction phases and not needed questioners to gather the information.

For the other type of geothermal plants using the soil close to the surface to store or produce stored heat, e.g. producing heat from the sun stored from Summer to Winter in the top soil, he contacted the Danish Energy Agency and talked to heat pump experts from Technical Institutes plus an installer of ground water based cooling systems to cover this area.

The use of questionnaires to cover this area was really useful, but he underlines that such systems are used by private people where the suppliers loose the contact after the delivery of the systems, and it is hardly realistic to issue a questionnaire to all houses in Denmark.

The numbers are thus primary based on expert extrapolation of data from a period where funding of such projects provided detailed information about the projects.

For the heat output, a conversion error might have occurred, as the total amount of 104 Ktoe would mean more than 10'000 full-load hours per year (with a year having only 8760 hours!). Thus the value is more likely to be 10.4 Ktoe. That would also explain the astonishingly high value given in the WGC2005 overview data, that had been doubted frequently.

Finland :

No country report was completed, thus, these estimated are based on expanded numbers from the report WGC 2000.

Geothermal Resources in France - Current Situation and Prospects

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For example in France, for the district heating, ADEME contacted a consultant to realise the work. He elaborated a questionnaire and contacted directly the Utilities, the DRIRE (Regional Authority for industry and energy: Indeed, the installations are regularly controlled by the DRIRE, so they have all information), and the regional offices of ADEME. The data collection was after detailed in deep.

For the Heat Pumps, the AFPAC is in charge of the survey (see EHPA). ADEME is one of the founding member of AFPAC.

Geothermal Energy Use in Germany

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Most figures are estimated, but due to the fact that these 4 experts have a perfect knowledge of the German situation, we can be confident in the approximation.

Greek Geothermal Update 2000-2004

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This report was written by 4 experts from different organisations.

They are implied in a lot of geothermal projects in Greece so they have a good view of the market : geothermal is used for the following direct-use applications: individual space heating (1.2 MWt and 14.3 TJ/yr); greenhouse heating (22.2 MWt and 231.2 TJ/yr); fish farming (8.9 MWt and 72.0 TJ/yr); agricultural drying (0.2 MWt and 1.5 TJ/yr); bathing and swimming (36.0 MWt and 181.6 TJ/yr) and others (spirulina cultivation and water desalination of 2.3 MWt and 27.5 TJ/yr) for a grand total (including heat pumps) of 74.8 MWt and 567.2 TJ/yr.

Geothermal Update of Hungary 2000–2004

Miklós Árpási, Founder Chairman of the Hungarian Geothermal Association

The author is an independent Expert specialised in geothermal energy. He calculated and estimated data for heating in cooling in Hungary for his knowledge and the other studied yet realised.

Utilisation of Geothermal Resources in the Irish Republic

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This country is new to the geothermal direct-use report, as nothing was reported for WGC2000, even though geothermal use, in the form of heat pumps, had been ongoing.

So these figures from 3 experts of the CIT are the first one made for Ireland.

Geothermal Power Generation in Italy, 2000–2004 Update Report

Guido Cappetti and Lio Ceppatelli, Enel GEM Geothermal Production, Via A. Pisano 120, 56122 Pisa, Italy
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We have a good estimation of geothermal heat production for industrial applications, space heating, greenhouse, bathing. For Heat Pumps, the estimation is done from different sources of information.

Geothermal Potential and First Achievements of its Utilization in Lithuania

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The authors present a good evaluation of geothermal production from the Klaipeda plant. The estimation for HP is more vague.

The Netherlands Country Update on Geothermal Energy

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The report was written by 3 dutch expert in geothermal heating & cooling, from the Dutch association for geothermal energy. HP are well estimated.

Geothermal Energy Country Update Report from Poland, 2000 - 2004

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The author works for the Polish Academy of Sciences and is specialised in geothermal energy. She compiled information available for heat production from heat plants in Poland, and she estimated the data for heat pumps.

Portugal Geothermal Country Update 2005

José Martins Carvalho, José Manuel Monteiro da Silva, Carlos Alberto Bicudo da Ponte and Rui Martins Cabeças, Dep. Eng. Geotécnica, Instituto Superior de Engenharia do Porto, R. Dr. Bernardino de Almeida, nº 431, 4200-072 Porto / SOGEO, Sociedade Geotérmica dos Açores S.A. – Rua Eng.º José Cordeiro, n.º6, 9504-535 Ponta Delgada

The country report presents figures for different direct-uses applications from geothermal energy. But it mentions that only one geothermal heat pump operation is known, and it is presently out of service.

Country Update of the Slovak Republic

Marian Fendek and Miriam Fendekova, Geological Survey of Slovak Republic, Mlynska dolina 1, 817 04 Bratislava 11, Slovak Republic / Department of Hydrogeology, PRIF UK, Pavilion G, Mlynska dolina, 842 15 Bratislava, Slovak Republic
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This country report was presented by two experts from the Geological Survey and the University of Bratislava. They indicate geothermal water in the country is used in agricultural farms, for space heating, fish farming and recreational purposes ; and eight geothermal heat pump installations are reported.

The Current Status of Geothermal Energy Use and Development in Slovenia

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The report was realised by two geothermal experts in Slovenia, working for the Geological Survey.

Geothermal Energy Development in Spain - Country Update Report

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In this report, only data for space heating and industrial applications were presented, not for heat pumps. They are considered marginal at this stage.

Country Update, Sweden

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The country update report for this country is incomplete and only reports one large geothermal heat pumps project in Lund. The author also reports two other projects under exploration and completion at Scania and Malmö. However, there are many other smaller geothermal heat pump installations in Sweden.

Heat pumps and large-scale installations for district heating networks are estimated.

The total installed capacity and annual energy use is estimated with a seasonal performance factor of 3.0.

Country Update for the United Kingdom

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According to the fact the exploitation of geothermal resources in this country continues to be minimal, and there are no high temperature resources and very limited development of low- and medium-enthalpy resources; the 3 authors gave an estimation of the geothermal production.

Evaluation of statistics- Overview

Confidential information