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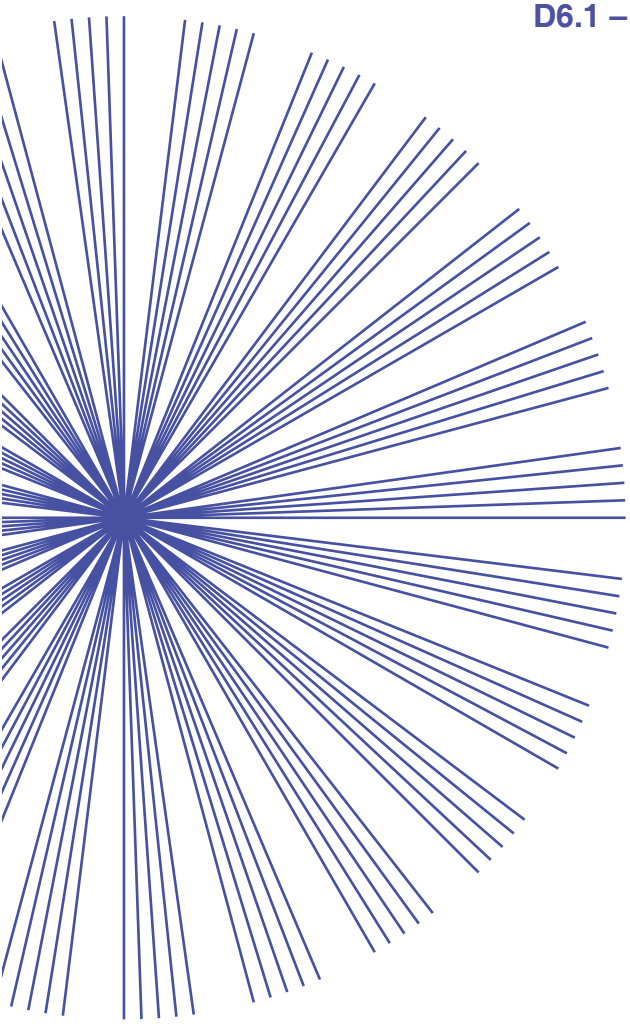
STUDY ON PUBLIC PERCEPTION OF GEOTHERMAL ENERGY

D6.1 – Final version



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CONCERTO

SEVENTH FRAMEWORK PROGRAMME

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Introduction

The presented report forms a Deliverable D6.1 resulting from the realization of Workpackage WP.6.1 titled "Public perception of geothermal energy" in frame of the EU-Project "Geothermal communities – demonstrating the cascaded use of geothermal energy for district heating with small scale RES integration and retrofitting measures" (GEOCOM).
The activities embraced by WP6.1 were conducted between 25 – 37th months of the project duration (year 2012). The following seven countries were covered by WP6.1 works and this Deliverable D6.1:

- FYROM (Former Yugoslav Republic of Macedonia),
- Hungary,
- Italy,
- Poland,
- Romania,
- Serbia,
- Slovakia.

The work was done with the contribution of all Project partners, coordinated and summarized by the team of Mineral and Energy Economy Research Institute (PAS MEERI), WP6 leader.

1. Objectives of Workpackage WP6 "Socio-economic research" and WP6.1 "Public perception of geothermal energy"

The objective of Workpackage WP6 was defined as "developing a better understanding on the public perception of geothermal energy, overview of socio-economic market drivers, fiscal measures and incentives". It has been composed of three parts:

- WP6.1 "Public perception of geothermal energy",
- WP6.2 "Public perception and understanding of RUE measures (pilot-site case studies)",
- WP6.3 "Overview of market drivers, fiscal measures and subsidies".

In particular, the Workpackage WP6.1 "Public perception of geothermal energy" – the results of which are presented in this Report as Deliverable 6.1 – aimed at cross-national, comparative analysis of public understanding and attitudes towards geothermal energy. The works embraced the assessment and evaluation of the society's understanding of the functioning and role of geothermal energy in energy systems and everyday use. The public understanding and acceptance are among the crucial factors – one may say *a sine qua non* conditions – for further successful development of RES and geothermal energy uses, specially in the GEOCOM Project partner countries. Therefore the insight into the current state of public perception in the GEOCOM states was necessary both for the needs of the Project itself, to define the current societies' circumstances accompanying the efforts to introduce more geothermal energy into the regional and local energy markets and to suggest some measures to build further public acceptance and awareness for geothermal energy uses in Project partner countries as well as in Europe. The work was conducted taking into account wider background of renewable energy sources as a whole (when necessary).

2. Renewable and geothermal energy in the GEOCOM countries – an overview

2.1. Geothermal energy potential of the GEOCOM countries

As a whole, Europe possesses mostly low-temperature geothermal resources (water and formation temperatures below 150ºC). Geothermal aquifers are predominantly hosted by sedimentary rock formations, sometimes volcanic and crystalline rocks. Their reservoir and exploitation parameters imply their exploitation for direct uses. This is also the case of the GEOCOM countries. Moreover – one shall point out that some of them: Hungary, parts of Slovakia, Serbia, Romania are located in the Pannonian basin which belongs to the best and most prospective ones since very good reservoir parameters, large extent of geothermal aquifers as well as current and future potential interest and demand for their practical uses. Also other Partner countries: Italy, Poland, Slovakia have prospective resource bases for harnessing geothermal energy in much wider scope as it has been so far.
On the other hand, in case of Italy (Tuscany region mostly), high-temperature resources are also found (water and formation temperatures above 150ºC) successfully implemented for power generation (main geothermal electricity production in Europe) and for direct uses. Italy belongs to group of six European states possessing geothermal steam resources, along with Iceland, Turkey, Greece, Portugal (Azores), Spain (the Canary Islands).

It is worth to notice that among the main European geothermal fields under exploitation are several ones located in the GEOCOM countries: in the Larderello region (Italy), in the Pannonian Basin (Hungary, Serbia, Slovakia, Romania /also Slovenia/); in several sectors of the European Lowlands (Poland /also Germany/); in the Palaeogene systems of the Inner Carpathians (Poland, Slovakia). The

other main fields under exploitation in Europe are the Paris Basin, other Alpine and older structures of Southern Europe (Romania, several other states), the Upper Rhein Graben, the Alpine Foredeep.

Depending on the exploitation parameters (temperatures, water flow rates), in the GEOCOM countries, (similar like in other states) the use of geothermal energy can be realized in the systems based only on this energy source but also in integration with other energy carriers, both fossils and other renewable sources (so-called hybrid systems). These options open many opportunities for wide and efficient geothermal uses.

2.2 Current state of geothermal energy uses in the GEOCOM countries on an European background

According to the data reported at the World Geothermal Congress 2010, direct geothermal uses take place in 37 European countries (for a world total of over 70 countries reporting this type of use; Lund et al. 2010). The total installed thermal capacity in geothermal uses was 23 469,308 MW_t, while heat production amounted to 233 736,7 TJ (61 839,9 GWh/a), i.e. about 47% and 51% of the world total (table 1). These figures had almost doubled as compared with the data presented five years earlier at the World Geothermal Congress 2005 (Lund et al., 2005), partly updated for Europe by Antics and Sanner (2007). This significant trend of increase has been continuing and current statistics on particular European countries will be presented during the European Geothermal Congress to be held in Italy in June 2013.

Europe is one of the world leaders in geothermal direct uses. It occupies the first place ahead of Asia, the Americas, Oceania and Africa. In the countries of our continent geothermal energy is primarily used for heating and for bathing/swimming. Each of these two types consume around 36% of the produced geothermal heat. A significant share is also bound with horticulture (greenhouses and soil heating) – ca. 18% (Antics and Sanner, 2007). The GEOCOM partner countries contribute significantly to these uses: totally they presented about 1582 MWt of installed thermal capacity while heat production of ca. 27 553 TJ in 2009, i.e. about 7% and 12% of Europe total (table 2). It is worth noting that Italy and Hungary are among ten top European states in Europe in geothermal direct uses (8th and 9th places, respectively) – each of them produced over 9700 TJ/2009.

In a number of countries development is based on hydrothermal resources exploited from wells up to ca. 3 km deep. Some of them have been dynamically develop shallow geothermal energy use based on heat pumps – a very prospective geothermal line.
Climate, market demand, reservoir conditions, economic, social and ecological reasons favour applications of geothermal energy in Europe mainly for space heating (centralized and individual), heating greenhouses and tunnels, bathing and balneotherapy. Other uses comprise aquacultures, industrial uses and some others). In many cases the utilities operate as integrated (hybrid) systems. Three former types prevail in Europe as a whole, they also dominate clearly geothermal heat markets in the GEOCOM states (table 3), what also indicates the prospects, market demand for development in these directions particularly.

Table 1. Direct geothermal uses worldwide, 2009 (acc. to Lund et al. 2010)

Type of use	Installed capacity [MW_t]	[%]	Heat uses [TJ/a]	[%]	Use factor [%]
Heat pumps *	35 236	69.6	214 782	49.0	0.9

Space heating**	5 394	10.7	62 984	14.4	0.37
Heating greenhouses, tunnels, soil	1 544	3.0	23 264	5.3	0.48
Aquacultures	653	1.0	11 521	2.6	0.56
Drying of agricultural products	127	0.5	1 662	0.4	0.42
Industrial uses	533	1.0	11 746	2.7	0.70
Bathing and balneotherapy	6 689	13.2	109 032	24.9	0.52
De-icing	368	0.7	2 126	0.5	0.18
Other	41	0.1	956	0.2	0.13
TOTAL	50 583	100	438 071	100	ave. 0.27

* space heating using heat pumps, ** space heating by water and steam produced by deep geothermal wells

Table 2. Geothermal energy uses in the GEOCOM countries on general European background, 2009 (based on Lund et al. 2010, Bertani 2010)

Country	Direct uses		Power generation	
	Installed capacity [MW_t]	Heat production [TJ/a]	Installed capacity [MW_{el}]	Production [GWh/a]
FYROM	46.18	586.11	-	-
Poland	281.05	1 501.1	-	-
Romania	153.24	1 265.43	-	-
Serbia	100.8	1 410.0	-	-
Slovakia	132.2	3 067.2	-	-
Hungary	654.6	9767.0	-	-
Italy	867	9 941.0	843	5 520
Total 7 GEOCOM countries (% of total Europe)	1581.47 (6.7%)	27553.14 (11.79%)	843 (54,28%)	5520 (44.62%)
Europe – total	23 603.708	233 736.7	1 553	12 371.8

Table 3. Specification of direct geothermal energy uses in the GEOCOM countries, 2009 (based on Lund et al. 2010, Bertani 2010)*

Country	Heat pumps	Space heating	Heating greenhoses, foil tunnels,	Aquaculture	Agricultural drying	Industrial uses	Other	Bathing, swimming	Subtotal	TOTAL (with heat pumps)
FYROM	?	43.39 MW	2.79	-	-	-	-	-	46.18	46.18 +?
	?	524.97 TJ	61.14	-	-	-	-	-	586.11	586.11 +?
Hungary	40	118.6	196	4	10	12	2	272	614.6	654.4
	518	1162	2388	44	123	159	17	5356	9249	9767
Italy	231	210	111	100	-	28	-	187	-	867
	961	2732	1329	1632	-	130	-	3157	-	9941
Poland	203.1	68	0.2	0.3	0.5	-	0.28	8.67	77.95	>281
	1045.5	393	1.0	1.0	2.0	-	4.4	55.2	456.6	>1501
Romania	5.5	72.23	4.18	4.5	1.4	0.75	-	64.68	147.74	153.24
	?	656.55	20.78	9.7	12.7	6.84	-	489.16	1235.73	1235.73 +?
Serbia	9.9	20.9	18.5	6.4	-	4.6	-	39.8	90.9	100.8
	83.0	356	128	128	-	58	-	647	1327	1410
Slovakia	1.6	27.5	17.6	11.9	-	-	-	73.6	130.6	132.2
	13.5	613.1	461.1	271.0	-	-	-	1708.5	3053.7	3067.2

* For each country the numbers for all types of uses given as:
installed capacity [MWt] – upper cell, heat sales [TJ/2009] – lower cell

In case of power generation using geothermal steam it takes place in a few states in Europe, i.e. Iceland, Italy, Turkey, Portugal (Azores). In 2010, total installed capacity was 1 553 MW_e, and power generation 12 371,8 GWh (Bertani, 2010), i.e. 14,5 % i 18,4% of world generation, respectively.
Italy (GEOCOM partner) is the leader in Europe (before Iceland) with significant contribution of 843 MWe and 5520 GWh/2010 and also one of the world top countries (Bertani, 2010). Geothermal power plants operate in the Larderello – Monte Amiata area meeting ca. 40% energy needs of Toscany region. In this area a wide variety of geothermal direct uses has been also developed (space heating, agriculture, bathing) based both on high-temperature and low-temperature resources. It is also an area where Montieri – GEOCOM pilot-site is located.
Since several years in Austria and Germany some 0,2-0,5 MWe binary installations for power generation based on 97 – 155˚C waters have been on-line (Organic Rankine Cycle, Kalina systems). So far, no such installations have been operating in the GEOCOM countries. However, intensive studies and works are being conducted aimed to select optimal localities for power generation using L-T geothermal waters in an efficient economic way (mostly as combined heat and power systems, CHP) since this is a prospective line of electricity generation on a local scale.

2.3. Renewable and geothermal energy share in current energy structures in the GEOCOM countries

In 2010 the share of all RES in gross final energy consumption in 27 EU-countries amounted 12,5% on average. In this same year, the contribution of geothermal energy to this share was only 1%; the RES sector is dominated by hydropower (60%), wind (21%) and biomass (17%), while solar (thermal, PV) was also 1% (www.eurostat.ec.europa.eu).

In 2010 in the GEOCOM countries the RES share in gross final energy consumption amounted to 14.3% on average. In individual cases it ranged from 5.19% (Hungary) to 23.4% (Romania) (table 4). In that year geothermal energy contributed to total RES mix in the share of 0.02 – 0.6% (FYROM, Poland, Romania, Slovakia), more significant figures reaching in Italy: 5.6% and Hungary: 8.1%. An average, it was 2.56% only.

It results from presented statistics that exceptional geothermal resources in GEOCOM-countries, specially in their CEE segment, have been exploited so far at the scale far beyond real, even conservative, possibilities. They are rather “unexploited”. Among the reasons one may indicate the lack of knowledge about the resources available in particular regions and localities, lack of technological know-how, low or lack of public acceptance. In some cases geothermal uses are carried out in an unsustainable way or district heating projects lack the energy efficiency component and the spent geothermal water is not injected back into aquifer but disposed to the surface waters. Such facts contribute significantly to the low activity for new projects, and even discourage their implementation (even if they are isolated cases, and good examples are more numerous).

2.4. Renewable and geothermal in energy structures of the GEOCOM countries by 2020 in national and EU-documents

For European countries (and the GEOCOM states as well) an increased use of renewable energy sources is expected in the coming years. It will follow the guidelines of the Directive of the European Parliament and of the Council 2009/28/EU on the promotion of energy from renewable sources and

transposed into the National RES Action Plans (NREAPs) and national energy strategies (in which generally hydro, biomass and wind are treated as priorities with smaller contributions envisaged for other RES, including geothermal).
In general officially forecasted geothermal share will not exceed a few percent in most countries (including the GEOCOM states), while locally and regionally this will translate into significant share in absolute terms and a variety of positive effects. One shall add that geothermal experts and communities called for higher share of geothermal energy in national energy strategies and NREAPs for 2020 than eventually included into official documents. This fact proofs how geothermal energy is neglected by decision makers and politicians.

In the GEOCOM countries the share of renewable in final gross energy consumption in 2020 is projected for 14 - 27% (Slovakia – Serbia; table 4).

Taking into account the share of geothermal in final gross renewable energy consumption in 2020, it is projected for 0.04 – 19.16%. The lowest share shall be in FYROM, the highest in Hungary (table 4).

However, in case of Romania (table 4), no official projections on geothermal energy share in RES mix in 2020 are available similar to all other renewable energy types for heating and cooling – this sector is the most neglected of the energy sub-sectors and received the least attention at legislative level. As a result, the NREAP does not give any detailed projections as to the renewable/geothermal share in 2020 (*http://www.repap2020.eu/fileadmin/user_upload/Roadmaps/EREC-roadmap-V4_final.pdf*).

Main types of uses: space heating (centralized, individual), agriculture, bathing, other types, heat pumps and new ones – CHP systems (power generation part based on binary ORC or Kalina cycles using L-T geothermal water), development of EGS technologies is also expected with more concrete results.

The above projections and expectations as to geothermal uses' progress will be achieved in far more easy and effective way if accompanied by wide public acceptance and awareness. It becomes more and more urgent to make a kind of diagnosis of its current state and to undertake proper effective measures and steps to increase its level as an indispensable part of expected and beneficial growth, adequate in relation to the resources' base and benefits for European and GEOCOM states. Such work was done in frame of GEOCOM WP6.1 "Public perception of geothermal energy" and its results are presented in the following sections of this Report.

Table 4. Renewable and geothermal energy shares in gross final energy consumption in the GEOCOM countries in 2010 and planned for 2020
(based on *www.eurostat.ec.europa.eu*, EU-Directive 2009/28/EC, National Renewable Energy Action Plans, Italian Management Energy, Italian Oil Union, and other sources)

Country	2010			2020	
	Gross final energy consumption [1000 toe]	RES share in gross final energy consumption [%]	Geothermal share in RES gross final energy consumption [% of total RES]	RES share in gross final energy consumption [%]	Geothermal share in RES gross final energy consumption [% of total RES]
FYROM	1 782	20.84	0.02	21.0	0.04

Hungary	18 255	5.19	8.1	14.65	19.16
Italy	124 769	10,1	5.6	17.0	6.9
Poland	66 319	9.4	0.2	15.0	0.5
Romania	22 475	23.4	0.4	24.0*	?**
Serbia	9 792	21.2	3.0	27.0	5.0
Slovakia	11 593	9.8	0.6	14.0	1.7

* Electricity only
** NREAP for Romania does not give any detailed projections as to RES / geothermal share in heating and cooling sector in 2020 (this sector is prospective for geothermal energy development) (*http://www.repap2020.eu/fileadmin/user_upload/Roadmaps/EREC-roadmap-V4_final.pdf*)

3. Basic factors influencing public perception and acceptance of renewable and geothermal energy

While considering public perception and acceptance of renewable energy sources and geothermal energy one shall take into account several decisive factors of various nature including social, economic, environmental, technological, scientific ones. They can be included in several groups of subjects (Czaplicka-Kolarz, Pyka [eds], 2010):

- position of energy in the hierarchy of social values,
- priorities in the implementation of energy policy,
- the level of knowledge on energy sources,
- the level of support for the use of various sources of energy,
- priority areas of research related to energy,
- adopted the RES share in energy mix and energy costs,
- energy savings.

Building up the public perception and acceptance of RES and geothermal energy in particular is more and more important to speed up their development. This is essential also because energy is one of the most important factors for the economic development and the competitiveness of the European economy. The security of energy supply is of major importance; the environment and the sustainable development should be regarded. The European energy market should also retain its competitiveness. The environmental dimension and sustainable development in EU-energy policy are

also indispensable. Geothermal energy usage perfectly fits a large number of the requirements from the European Commission as well as other international and country documents, energy and development strategies. It is :

- one of the safest and most sustainable renewable energy sources available,
- available all day, all year, its availability not affected by external factors (i.e. weather, climate, day or night time),
- produces insignificant or no greenhouse gases and harmful substances,
- domestic source - not dependent on external markets or political fluctuations or decisions.

It must be specially pointed out that geothermal energy has particular potential in the Central-Eastern European region where almost all GEOCOM states are located.
The above statements have been already proved by positive experiences and results of many geothermal installations working throughout Europe and CEE.

4. Research on public perception of geothermal energy in the GEOCOM countries

4.1. Basic elements of public perception of geothermal energy diagnosed for the GEOCOM countries

In frame of WP6.1 „Public perception of geothermal energy" the research embraced an insight into basic socio-economic components that make up this perception (with reference to the issues listed in the previous section) in the GEOCOM Partners countries, i.e.:

- state of knowledge on RES / geothermal energy,
- orientation on basic national and EU-documents, strategies and obligations related to RES (geothermal energy),
- level of knowledge of RES / geothermal potential in particular country and main domains of their uses taking into account economic and social aspects,
- acceptance for RES / geothermal energy uses,
- opinion on costs of RES / geothermal energy,
- opinion on the needs and measures to be introduced to support RES/geothermal energy development in particular countries,
- the state of education and promotion addressing various groups of society,

- proposals of concrete methods and tools of education on RES/geothermal energy dedicated to various groups of society,
- other issues.

These factors were covered in details by the Questionnaire survey (described below) recognized on the background of national, regional and local circumstances regarding geothermal, other RES and fossil energy resources' base, its availability, energy policies, costs, prices, regulations, and other conditions.

4.2. Research methods

The work to diagnose the current level of public perception of geothermal energy employed a comparative research design, investigating differences between respondents residing in seven GEOCOM countries.

The research included two main research methods to obtain necessary source data and information:

- quantitative (questionnaire surveys),
- qualitative (open opinions, comments) and screening of basic information on RES and geothermal energy development, prospects and place in energy mix of the particular Partner countries.

The questionnaire surveys enabled to gain required information from a large number of appointed experts from seven GEOCOM states in an efficient and standardized manner.

Qualitative methods were used to emphasize experts' personal experiences and interpretation over quantification in an efforts to understand the meaning of the quantified social responses; to place and interpret the investigations and understand their results.

Quantitative methods – the questionnaire:

The detailed scope and topics of the questionnaires and qualitative methods were proposed by the WP6 leader, consulted, and eventually accepted for realization by all Project partners. They took into account the necessity to consider the basic elements that compose the public perception of geothermal energy.

The items included into the Questionnaires were formulated as the questions which required that the respondents (experts) had to quantitatively assess the level of given items in the proposed numerical scale (ranking) or by selecting one or more options from the proposed answers. Furthermore, the respondents were asked to supplement their answers by some open opinions and feedbacks related to the issues and aim of the Questionnaire.

The issues investigated by the Questionnaires corresponded to the ones listed in section "Basic elements of public perception of geothermal energy diagnosed in the GEOCOM Project partners countries".

Qualitative methods:

In combination with the questionnaire surveys, the research comprised also qualitative methods. They included open opinions of individual experts (and than their common summaries for each country) related to public perception of RES and geothermal energy with the references to various

country-specific circumstances affecting this perception (e.g. availability and parameters of various local RES, environmental, social, economic, legal, administrative, etc. factors, level and availability of information and education oriented to various social groups).
In addition, the results of survey on public perception of geothermal energy in Project partners' countries were put on a wider background of geothermal resources base, main prospective areas, current state and development prospects.

4.3 Experts involved in research

The WP6.1 research works (similar as WP6.2 and WP6.3 tasks) were realized in cooperation with the teams of appointed experts from all of the GEOCOM countries. They delivered the basic information and data necessary to gain an insight and create a picture of the state of public perception of geothermal energy in particular countries covered by the Project.
The experts' role was to objectively assess the state of geothermal energy perception by the public in their country. The experts made important part of works, including the questionnaires survey and sharing open opinions on geothermal energy's public perception in respective states. They contributed to the assessment and evaluation of the society's understanding of the functioning and role of geothermal energy in energy systems and everyday use and to comparative analysis of public understanding and attitudes towards geothermal energy.
The numbers of experts from particular GEOCOM countries were as follows: FYROM – 5 experts, Hungary – 6 experts, Italy – 5 experts, Poland – 9 experts, Romania – 1 expert, Serbia – 4 experts, Slovakia – 7 experts.

The experts represented both scientific and practical sectors of activities related to research, R&D, investments, operation of traditional energy sources as well as RES and geothermal utilities, energy planning, management. There were, among others, researchers, practitioners, regional and local municipal administration employees. Therefore they were properly selected and their opinions were

objective thus enabling to conduct the planned works and obtain expected information. The experts had have an expertise in the above fields, were well or sufficiently familiar with essential technical, economic and social aspects of considered issues, i.e.: renewable energy sources, geothermal energy, rational use of energy, energy distribution, integrated energy systems, heating engineering, power engineering, economy, social aspects of energy uses, energy management, legislation. They had also at least a basic orientation as to the assumptions and objectives of the GEOCOM Project.

Information and opinions shared by the experts reflected in an objective way the situation among the general public in reference to the investigated issues. Were formulated on the basis of the knowledge and familiarity of the public approaches with regard to the studied matters.

Particular experts' contributions were collected by each expert group contact person, preliminary summarized, accompanied by general commentary or information arising from country specific circumstances. Then the questionnaires and other qualitative information material were submitted to WP6 leader for further elaboration.

5. Public perception of geothermal energy in the GEOCOM countries – picture obtained on the basis of research

This section presents an insight into public perception of geothermal energy in the GEOCOM countries, which consists of several basic factors mentioned in more general way in the previous sections, namely:

- energy in the hierarchy of issues important to Europeans,
- state of knowledge on RES and geothermal energy,
- knowledge on national and EU-strategies and documents related to RES and geothermal,
- state of knowledge on possibilities of geothermal energy uses,
- opinion on costs of renewable and geothermal energy,
- suggested tools that should be introduced to support RES and RUE measures,
- level of acceptance of geothermal energy uses on a background of RES uses,
- state of education and promotion of RES and geothermal energy addressing various groups of society,
- recommended methods and tools for RES and geothermal energy education and promotion in the GEOCOM countries.

These elements were diagnosed by quantitative and qualitative research; their results, some interpretation and conclusions follow.

5.1 Energy in the hierarchy of issues important to Europeans

Place of energy matters (such as prices, energy supply) in the hierarchy of issues important to the public of European countries were given according to results of separate comprehensive research covering 25 European states (*Attitudes on issues related to EU Energy Policy ...,* 2007). They showed that the energy matters occupied 12th place in such a ranking (for 17 issues of ranking (Fig. 1); in the countries covered by quoted research, the percentage was different, which certainly also applies to GEOCOM countries).

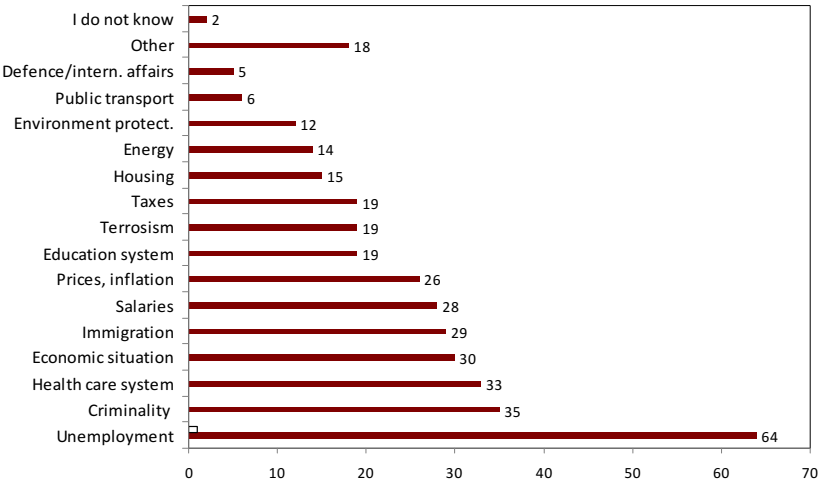

Fig. 1. Position of energy matters in the hierarchy of priorities important for Europeans (%) ([in]: Czaplicka-Kolarz, Pyka [eds], 2011)

5.2. State of knowledge on renewable and geothermal energy

According to experts, the level of public knowledge on RES and possibilities of their uses is generally poor (in 4-rank scale), with more optimistic picture for FYROM and Slovakia (55 – 60% of "sufficient" ranks) and Hungary - the respective knowledge was evaluated as sufficient by 85% of experts (fig. 2). In no case the experts evaluated the public knowledge on RES as good (highest rank 4).
Regarding the situation in all seven GEOCOM states, 40% of all evaluations indicated the respective knowledge as sufficient (while 60% as poor).

On such a background, the public knowledge on geothermal energy as one of the RES mix component, is even worse: the ranks "poor" dominate (for Italy the "lack of" knowledge is counted as 80%). The two only states with the significant share of higher evaluations defined as "sufficient" level of knowledge are Hungary (50%) and Slovakia (75%) (fig. 3).
This more positive image is made up of several factors (e.g. access to information, relatively frequent uses, opportunities to see the installations, positive experience of using geothermal water (numerous geothermal bathing and spa centers, etc.).
Taking into account responses from all countries, the level of public knowledge on geothermal was evaluated as sufficient by ca. 18% of experts only, prevailing is the rank "poor" (70%) or even lack of knowledge (12%).

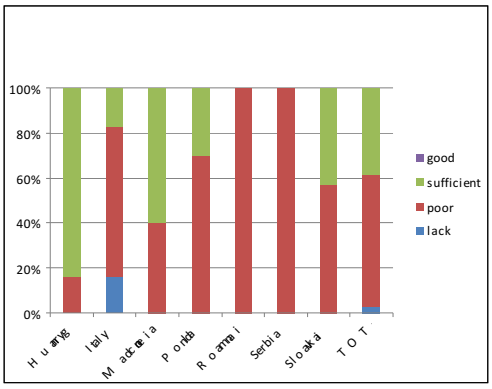

Fig. 2. Level of public knowledge on RES and possibilities of their uses, the GEOCOM countries

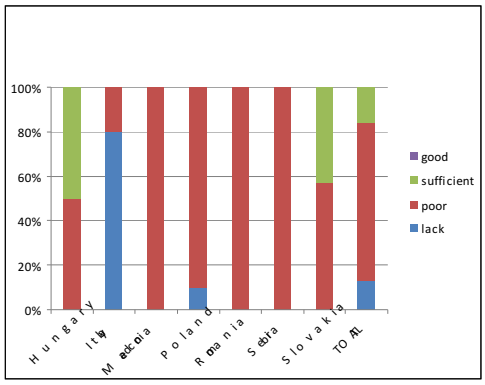

Fig. 3. Level of public knowledge on geothermal energy and possibilities of its uses, the GEOCOM countries

In the context of the received image of the level of public knowledge on RES and geothermal energy, which is generally low, the experts point to the need for education and promotion directed at very important social group – decision makers and administration of various levels – as an indispensable element of building public acceptance for these energy sources. Observations and experience of experts demonstrate that the relevant substantive knowledge is sometimes weak or superficial, which results, among others, in unsatisfactory level of some documents and regulations, quality of social dialogue, efficiency of cooperation with professionals and NGOs (such entities are sometimes neglected by the governmental agencies in the process of preparing legal and regulatory documents, and their expertise and knowledge are not used sufficiently). Fortunately, there are also positive examples of such cooperation – as Hungary, where geothermal NGO was appointed to elaborate a part of NREAP related to geothermal energy uses' development by 2020 – this path should be followed by others.

In all cases, conspicuous is the lack of or poor knowledge of national and EU- documents related to RES and geothermal (partly sufficient level of this knowledge is supposed in Hungary and Macedonia only) (fig. 4). On the other hand – as indicated by experts from Slovakia, where public awareness on renewables is generally at sufficient (or even good) level, such documents and strategies are generally poorly or not at all known to the public, as they are not sufficiently disseminated. This is an important information, the diagnosis of situation which must be consistently changed by appropriate actions, as it is an essential factor – "a reference point" for national activities at various levels in the

RES and geothermal energy sectors, as well as part of a building of public perception of these energy carriers. Better knowledge of national strategies and commitments could stimulate the activity of citizens as well as increase knowledge and acceptance of RES/geothermal.

In respect to all the GEOCOM states, experts evaluated that respective public knowledge is missing (35%) or its level is poor (ca. 45%); the percentage of "sufficient" ranks was low (10% of responses).

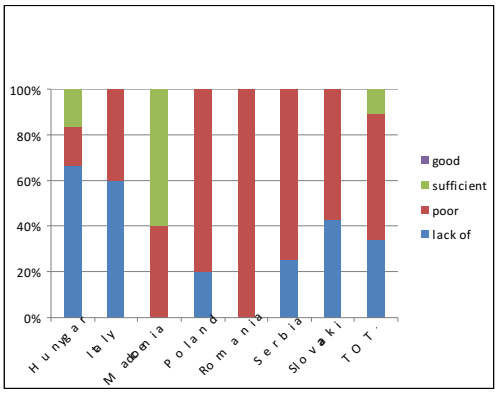

Fig. 4. Level of public knowledge on national and EU-strategies and documents related to RES and geothermal energy, the GEOCOM countries

5.3. State of knowledge on possibilities of geothermal energy uses

Referring to the orientation as to the main types of geothermal energy uses (taking into account economic and social aspects) which shall be developed in particular countries, the public in all seven states is generally aware that from the economic point of view the best are the uses for (fig. 5):

- space heating (centralized and individual systems),
- agriculture,
- balneotherapy and recreation.

It is interesting that in all seven states not only space heating but also agricultural sector is strongly indicated among the best uses from economic point of view – this is supported by the fact that the potential for such kind of development exists in all states therefore more attention shall be paid on this line.

In case of Italy the public indicates also power generation (since this is Italy having high-temperature resources (steam) harnessed by large power plants in economic profitable way in Larderello area, Tuscany). It is worth to mention that in Hungary and Slovakia the co-generation is also indicated (these states have proper conditions for such systems /with low-temperature binary power installations/; this is a hot topic among the professionals now therefore also in other GEOCOM countries, e.g. Poland – some interest is growing.
Along with the above types of uses, the public in all surveyed states indicated also balneotherapy and recreation as one of the main sectors for the use of geothermal water and energy. They are attractive from the economic, social points of view, relatively better known and experienced by the general public that the uses in heating or power generation industries.

The listed types of uses enhance local or regional business, market development of various specialized services (e.g. in bathing and spa & wellness centers), which in turn translates into increased revenues involved in the activities of entrepreneurs.

In respect to types of geothermal uses the best from social point of view (fig. 6) the public in all countries prefers the uses similar like in case of economical aspects – three main types of uses (acc. to the percentage share of answers) are these same, i.e.:

- space heating,
- agriculture, balneotherapy and recreation.

Relatively high is also percentage of indications at power generation and co-generation (Italy), and co-generation (Slovakia).

For the public it is important that these options in some cases create and maintain new places of employment (as has been observed in several countries where new installations of various uses were launched or some old ones were retrofitted and put into operations) – this factor is important both from economic and social point of view. Geothermal spas and recreation utilities contribute to maintain and upgrade quality of life and leisure, positively influence the curing and prevention of many diseases – both cases form important added values for the society as well as for economics (on local, regional scales).
Some geothermal uses (like heating) increase the comfort of live and result in energy saving and increase energy efficiency, some (horticulture) bring not only economic income but high quality and ecologically-grown local food products as well.
These benefits will be even more evident if more intense geothermal energy uses development takes place (the conditions for which exist in each of the Partner countries).

It is noted a regularity that the same options of geothermal applications are shown by the public (country by country and as total) in both cases - economic and social ones, which indicates that their development on a larger scale can produce both economic profits as well as social benefits – this coincidence confirms similar situation for geothermal energy development in GEOCOM countries.

With regard to the picture of all countries it is noted relatively large consensus as to the indicated main types of direct uses both from economic and social points of view: space heating, agriculture, balneotherapy and recreation (ca. 25% of each use) with some higher percentage of space heating (30%) where social criterion is concerned.

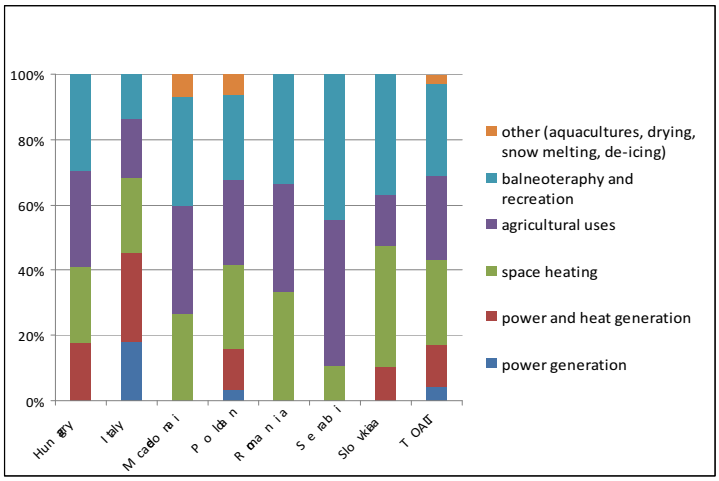

Fig. 5. The best types of geothermal energy uses from economic point of view, the GEOCOM countries

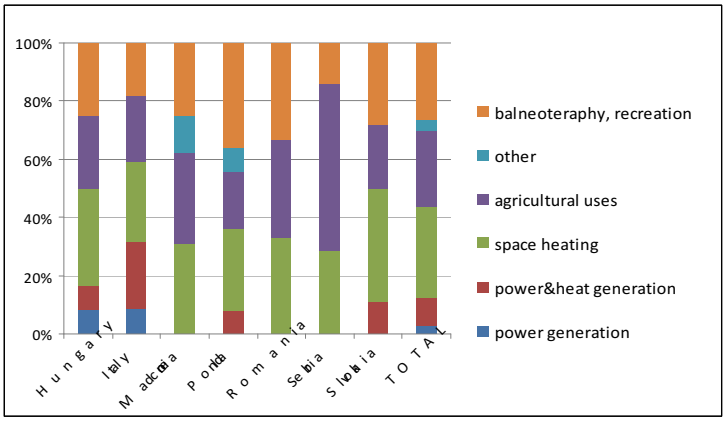

Fig. 6. The best types of geothermal energy uses from social point of view, the GEOCOM countries

5.4. Public opinion on costs of renewable and geothermal energy

Opinions on the costs of RES and geothermal energy, and their acceptability to a large extent affect the way of public perception of these types of energy. In a survey the evaluation of the level of costs (low, acceptable, high) was relative; the experts were asked for information about their social assessment in relation to the level of incomes and expenditures in particular GEOCOM countries (which are different).
Against the background of the costs and prices of traditional energy, in case of RES these parameters are rated as acceptable, and even low (Hungary, Italy, Serbia). The percentage rating "high" is low in five countries, only in two as high (80% of responses - FYROM, Poland; fig. 7), which is primarily affected by high investments in the RES sector (specially if sufficient support is not available).
For all countries the percentage of particular costs evaluations was as follows: low – 15%, acceptable – 45%, high – 40% (this rank affected by FYROM and Poland). This means that some 60% of evaluations indicate that the positive attitude as to these costs prevails (ca. 60% of “low” and “acceptable” ranks).

In the case of geothermal energy one observes a slightly larger share of the opinion that the costs in question are low or acceptable (fig. 8). This refers especially to Hungary and Slovakia, where several larger geothermally-heated utilities are operating, further investments are underway or planned, accompanied by relevant information. Convincing are also low or acceptable bills paid by real customers for geothermal heat. All these factors give a true picture of the situation, tend to take an interest and provide arguments for development. This is reinforced by the prospect of even reducing local dependence on imported energy resources (gas) – this advantage was also pointed out in the Deliverable 5.1 "RES Integration in CEE" prepared in frame of this Project (2011).
For all countries the share of geothermal uses’ costs evaluations was similar as in case of RES in general, but with higher evaluations of them as low (25%), acceptable – 45%, high – 40% (in total ca. 60% of “low” and “acceptable” ranks).

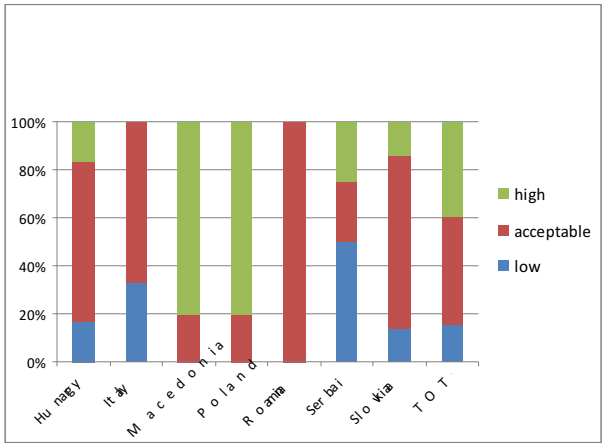

Fig. 7. Public opinion on costs of RES, the GEOCOM countries

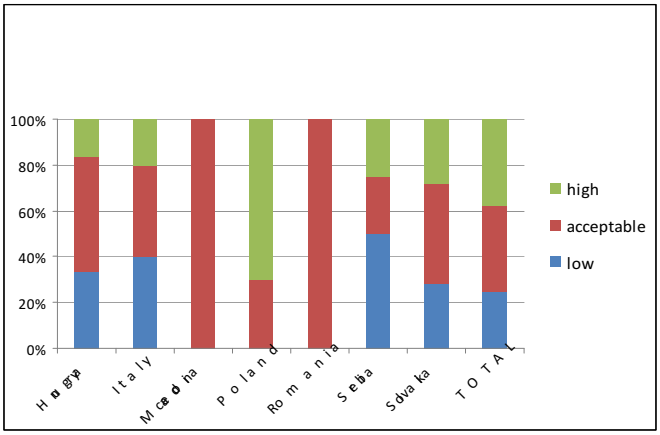

Fig. 8. Public opinion on costs of geothermal energy, the GEOCOM countries

In the Polish case, however, costs and prices are still seen as "high". Such an assessment may be affected e.g. by high investment costs of geothermal installations (especially drilling!) at low costs of coal (which is still commonly used in many heating systems) and lack of awareness of the real costs and current energy prices. As an example one may indicate the heat tariffs approved by the Energy Regulatory Office – the prices of heat from geothermal plants are in the middle ranges for heat from various sources.

It should be noted that in the CEE countries economic aspects are still the leading public perception and acceptance criteria for considered sources of energy – because they are lower-income population than the so-called Western European countries. In the latter case economic factors do not determine so clearly these ratings, due to the generally higher standard of living, higher places taken by environmental aspects, the use of local sources, comfort, etc. in the public hierarchy of needs and values. Therefore the more visible is the dominance of positive opinions as to the costs of RES and geothermal in the GEOCOM countries (60% of responses evaluating the level of costs as "low" and "acceptable).

5.5 Suggested tools to support renewable and geothermal energy

It seems from the evaluation of public opinion on costs of renewable and geothermal energy that the level of their acceptance could increase (specially in the countries where the opinion prevails that they are high) if the costs and prices would be lowered thanks to more support dedicated to the development of these energies. However, according to information given by the experts, in some GEOCOM countries there are no governmental financial support tools for heat produced from RES, including geothermal energy (!) – they are aimed primarily at supporting the RES electricity, sometimes the-so-called "micro-installations" (less than ca. 50 kWe or 100 kWt) or a high-efficiency cogeneration (not applicable especially in case of low-temperature geothermal resources prevailing in GEOCOM states). What's more – national documents do not envisage to introduce them. Such an unfavorable situation has been pointed out by the experts from FYROM, Poland, Serbia, Slovakia. As a necessary support for RES in all GEOCOM countries the main three measures were indicated (fig. 9):

- grants, subsidies, low-rate loans/credits (40% of responses from all states),
- feed-in-tariffs (35%),
- green certificates (and other types of certificates) (20%).

In case of geothermal energy the attention is drawn to the fact that in addition to the conformity of the type of indicated tools of financial support for RES, identical specific support tool was indicated for geothermal development in four countries (Hungary, Italy, Poland, Slovakia), i.e. Geological Risk Insurance Fund (fig. 10) – a specific measure tailored for this type of energy. It has been successfully working in other countries (e.g. France, Germany; see IEE Project "Geothermal Regulations – Heat, GRT-H"; 2006-2010 reports), and it would encourage more entrepreneurs to invest in geothermal energy, reduce financial risk and ultimately affect the positive perception of geothermal energy and increasing acceptance of its use. The need to introduce this tool was indicate by the experts from countries where they are carried out more actively drillings of geothermal wells or the investors' interest exists (Poland) and where it would be very clearly recommended (Hungary, Italy, Slovakia). The GEOCOM public and experts pointed out that still operate legal and rules that do not favor the RES, especially geothermal.

No adequate governmental support now and in the documents covering the 2020 horizon makes geothermal energy *a priori* at a disadvantage compared to other renewable energy sources (particularly prospective in terms of electricity generation), and as a consequence – geothermal may be attracted to the inferior level of perception and social acceptance, as this is treated as if "the poor relation" and less hierarchical in the sense of development by decision-makers (although a good resource base exists!). Negative signals are sent to the public by government and decision-makers, both of economic importance (e.g. discouraging investors) and social one (e.g. social acceptance).
The above considerations are clearly confirmed by the case of Slovakia – lack of sufficient state support of RES (including geothermal) and rational uses of energy results in the fact that despite the country has a potential for development, it is not exploited as the public needs and accepts due to lack of funds or legislation constrains.
Similar opinions are shared by the Serbian experts who pay attention on the fact that a modest approach to the investigation and preparatory work for the use of geothermal resources and the lack of incentives for organized use of renewable energy sources are the main reason for the symbolic RES share in country energy mix and low geothermal energy uses in country energy mix extracted from geothermal water available in hundreds of geothermal wells.

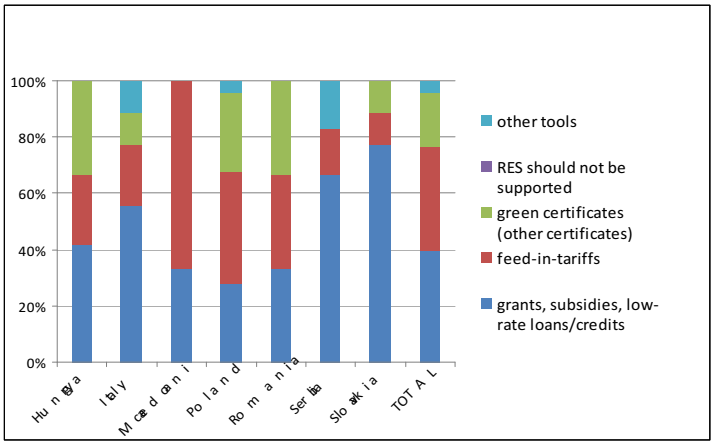

Fig. 9. Suggested tools to support RES uses, the GEOCOM countries

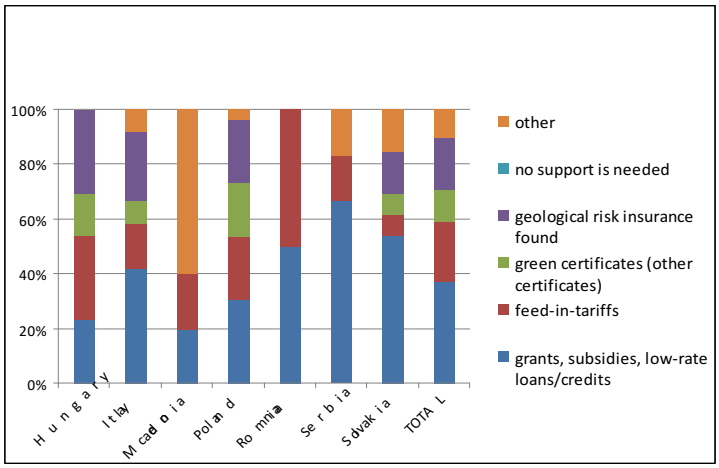

Fig. 10. Suggested tools to support geothermal energy uses, the GEOCOM countries

5.6. Level of public acceptance of renewable energy uses

In general – with the exception of Serbia – the acceptance of RES at sufficient level (50 - 100%) prevails in the GEOCOM states. In the case of Hungary, Slovakia and Poland the experts evaluate its level partly even as "good" (fig. 11).
There are also countries where the poor level of RES acceptance dominates: in Serbia, as well as – which may be surprising – in Italy where it is even a significant share (40%) of opinions indicating the lack of acceptance. Such a low assessment might be influenced by recently observed in some countries and regions lack of acceptance for the development of wind mills, which are largely regarded a synonym of RES.

A tendency is also observed that higher level of knowledge about RES and geothermal energy results in a higher level of acceptance of their application – as one can see it on the example of Hungary and Slovakia.

As a whole, in the GEOCOM states RES uses are generally accepted – 60% of responses were “sufficient” and 10% – good (30% - poor or lack of acceptance).

5.7. Level of public acceptance of geothermal energy uses

On the above general background for the RES, the percentage rated as "sufficient" level for the acceptance of geothermal energy is similar to the RES in general, with the exception of FYROM and Serbia - where it is poor, or even defined as a lack of acceptance (FYROM, and Italy /!/). As to the RES in the case of Hungary and Slovakia 50% of evaluations indicate good level of acceptance (!). Such evaluation appeared to be even in Poland (10%) (fig. 12).

Generally the public acceptance for geothermal energy is slightly lower than for the RES (which may be due to, among others, lower knowledge, less working installations accessible for public, specifics of geothermal energy – it is not so "visible" at the surface like other types of RES, etc.).
Comparing with the level of acceptance for RES uses in GEOCOM states as a whole, the acceptance for geothermal uses is slightly lower – ca. 50% of “sufficient” responses but more “good” ranks – ca. 20% – good (ca. 30% - poor or lack of acceptance).

For Italy, somehow surprising is relatively low acceptance of geothermal energy – specially in a country with a tradition dating back to ancient use of geothermal waters (Roman "*therms*"!), significant share of electricity generated by geothermal power plants, as well as an important direct uses in some areas. In such a situation could also weigh expressed by some local communities fear that the geothermal investment and systems may affect in a negative way the areas with high historic, scenic, etc. values. In this regard, should allay fears and cause such a change in approach the project in Montieri – the GEOCOM pilot-site – which will be implemented with the care of non-interference in the historic and landscape qualities of this locality and its surroundings.

In addition, it is pointed out the different levels of perception of RES and geothermal energy by different social groups in particular countries. For example – in case of Slovakia a positive perception

of geothermal energy uses is observed among the general public mainly, which is caused by the presence of many popular spas and aqua parks based on geothermal waters. Implementation of new geothermal district heating projects in recent years also encouraged further interest of municipalities in prospective areas. In contrary – certain mistrust or even negative attitude towards geothermal energy use is noticeable among employees of ministries. This is probably caused by lack of objective information. And it is up to them, to a large extent, to create public awareness of RES and geothermal. In such a situation, significant interest of municipalities in geothermal district heating developments is at least slowed down.

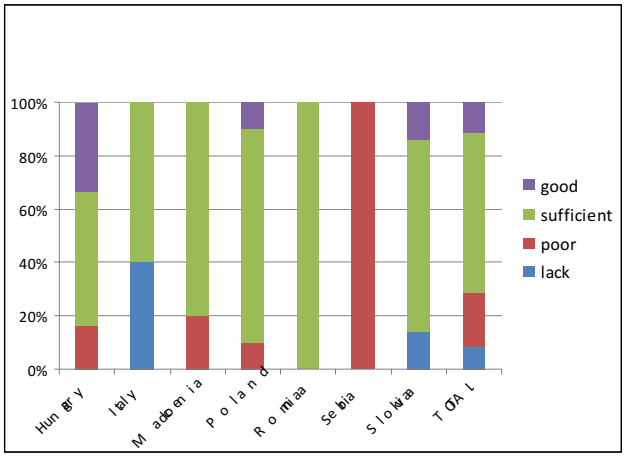

Fig. 11. Level of public acceptance of RES uses, the GEOCOM countries

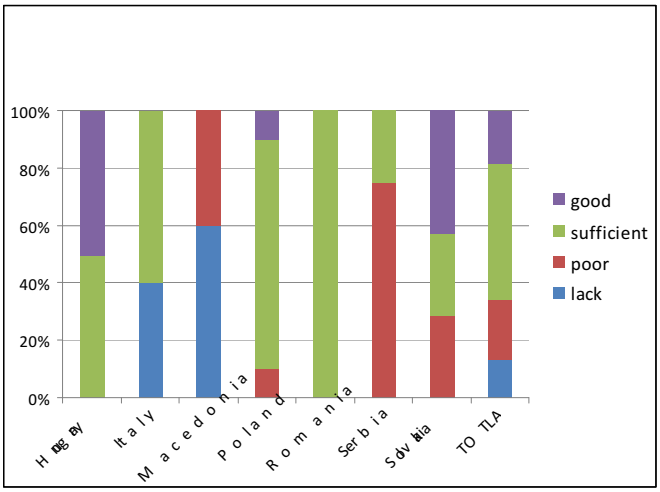

Fig. 12. Level of public acceptance of geothermal energy uses, the GEOCOM countries

According to some experts, for many years among some groups of politicians it was shaped an opinion that investments in the geothermal development were unprofitable. This contributed to the building of a small geothermal acceptance among some social groups and decision-makers. One important task is to change this false approach which in some experts' opinion is a major obstacle in development of geothermal energy, among others, in Poland.

The experts also noted that the determination of strategies and priorities for the development and support of individual RES is based not only on substantive grounds, economic and technological, but also often on political decisions or depends on the lobbying of different groups (which doesn't favor geothermal).

5.8. State of education on renewable and geothermal energy

The reported research gave an orientation on the state of knowledge on RES / geothermal knowledge and acceptance by the public and a number of factors that make up the picture. The question is whether proper education and promotion addressing different public groups is conducted and how it affects and can affect the state of respective knowledge. Part of the research was related to these matters.

In general, various information activities on RES / geothermal / RUE addressed to the general public have been conducted in the GEOCOM countries as confirmed by ca. 75% of all respondents (fig. 13). This is done in frames of many different national and international programs and projects (including EU). This applies above all to the most "popular" and promoted RES in the country, but it is worse in the case of geothermal energy. However, one may argue that information and education activities are not generally available (common), as directed rather to specific target groups, including the relatively small number of attendees, different is their efficiency and effectiveness (measured e.g. by increased knowledge and acceptance of RES in groups of people who participated in these events). Sometimes educational activities are *ad hoc* – directly precede the use of RES projects in certain localities, which does not always produce the desired results. Existing information and education is not always clearly publicized and advertised. It seems that there is not yet a consistent national and regional concept in the field of education programs on RES.

In case of geothermal energy, the information is generally even less available, carried out occasionally in localities and regions where its uses take place, while it often does not include broader information about resources and opportunities for development in other areas of the respective country. It also depends on the activity and involvement of operators of these systems, regional and local administration, cooperation with experts (to provide essential knowledge and not just superficial). Such activity is often carried out in relation to information about other values of a region or a location (e.g. Italy – Tuscany, FYROM – Kocani area, Poland – Podhale area, Hungary, Slovakia – several areas, where geothermal water and bathing centers are treated as main components of tourist offers) which places geothermal energy in the broader context of local natural resources, tourist attractions and it favors its positive image (and thus public acceptance).
As in the whole RES sector, also in geothermal energy no regular education and information have been conducted so far, which would be associated with general strategy of the country or region.

It is also shown by the experts that some social groups specially important for RES / geothermal uses promotion and development – i.e. politicians, decision makers, ministerial employees, local administration employees, leaders of local communities, etc. – sometimes have no or not sufficient objective knowledge on geothermal energy. Sometimes there is also observed that personal changes on administrative and decisive positions related to RES are not conducive to learning, contacts with professional circles, NGOs. It makes more difficult taking optimal decisions and their consistent implementation, with a view of not only months, but years (which is specific for the RES sector, geothermal in particular).

According to the experts, it is specially important that the information on geothermal energy (which is relatively little-known compared to other RES) disseminated among general public was objective and reliable. It was pointed out in some cases that the conflicting, not objective information about the resources, abilities and range of use, role and share in meeting the countries' energy needs (too optimistic, too negative) given to the public by various influential groups, and even individuals, can create too high expectations of society, undermine the credibility of this energy source, put into question economic and technical credibility discouraging the provision of sufficient public support and deter potential investors. In this light, it is therefore very important ethical responsibility of

individuals, communities and the media for the information, the public perception and the multiple consequences not only for individual choices and attitudes, but also for key strategic decisions taken at regional and national level with regard to RES and geothermal sectors.

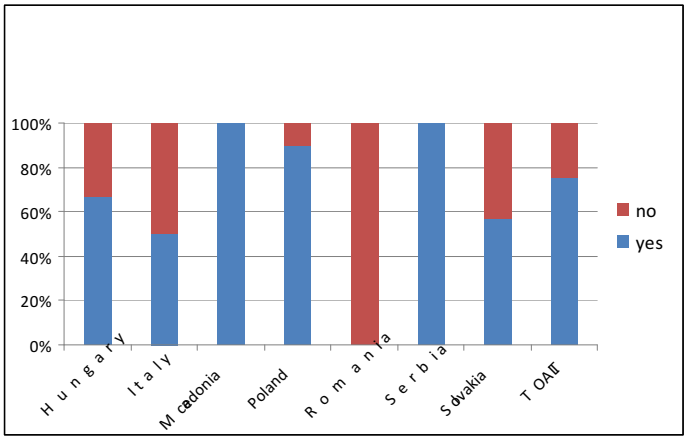

Fig. 13. Information activities on RES / geothermal addressed to the public, the GEOCOM countries

In addition to the promotion and education on RES / geothermal addressed to the mentioned various public groups, it is essential to carry on the regular programs of different levels of schools, academic institutions, as well as post-graduate studies. Owning own professional manpower is in fact essential for the optimal and faster RES / geothermal development in all countries, including GEOCOM states.

In the case of grammar and secondary schools, elements of these subjects are taken into account in all GEOCOM states, except for Serbia (fig. 14) but the percentages of positive information in this respect from particular countries are different: 15 – 100%; 75% on average for all states). The education is included in the scope of lessons on nature, geography, and also in separate projects dedicated to ecology and energy. Often, in this area there are extensive efforts to emphasize the importance of RES and associated benefits, impact on the society and environment. However, the general statement related to all CEOCOM states is that still it can not be stated that adequate attention in school programs and educational activities is given to these subjects. Not enough is conducted secondary vocational education in the field of RES, or post-graduate, despite the interest of young people and the potential RES market demand. For example, in Poland these are cases of individual schools only.

With regard to the universities – in all the GEOCOM countries respective education has been conducted (fig. 15) at various departments in some universities, the focus in on various aspects

(energy, environmental, geological). These are either single items, or thematic blocks and specializations. The interest in this area is large, an increase in the number of students is observed, new fields of study are opened in some cases (for example, at AGH UST Krakow, Poland – new field of study “Ecological energy sources” were inaugurated in 2012). In the case of Hungary the University of Szeged is the leading center of regional and national levels. However, for example, in Slovakia,

specialized studies are conducted only on the Technical University Kosice (one of the departments) – it is not enough for the RES potential of this country, especially in geothermal energy.

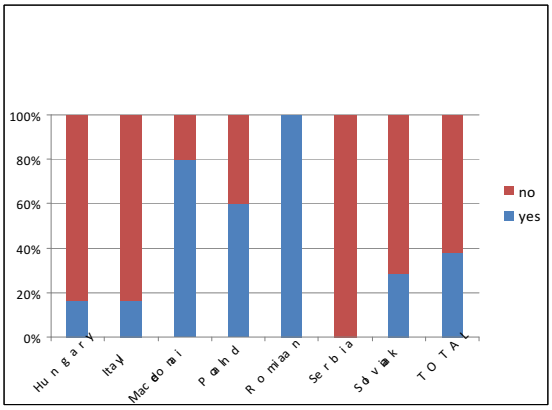

Fig. 14. Education on RES / geothermal included into the school teaching programs (grammar, secondary) in the GEOCOM countries

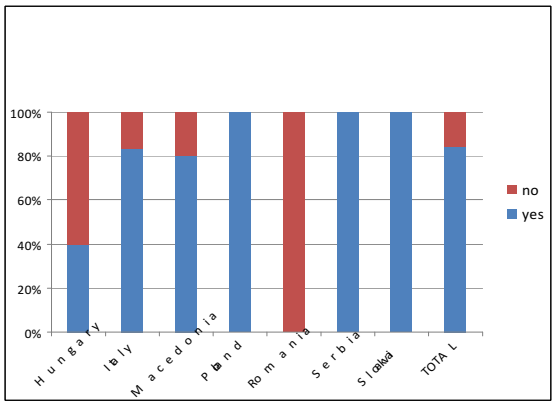

Fig. 15. RES / geothermal energy as subjects of university studying and specialization in the GEOCOM countries

5.9. Need for further education on geothermal energy – recommended tools

In view of the above, the current state of knowledge and acceptance of RES and geothermal energy, it is clear need for further comprehensive educational and promotional activities targeting wide social circles in the GEOCOM countries. According to experts, the general public is convinced about

this (fig. 16) and is waiting for proper actions (with the possible exception of some cases of Italy - for which some experts indicated that further education is not necessary.

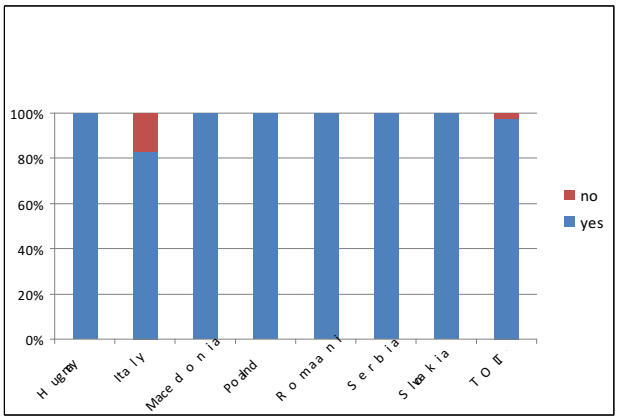

Fig. 16. The need for further RES/geothermal energy promotion and education addressing various social groups, the GEOCOM countries

The WP6.1 study gave some orientation what promotion and education forms would be the most proper and effective in the GEOCOM countries, depending of the characteristics of the target public groups (e.g. age, social and professional status, education level, etc.).
The following text does not cover an issues in a very exhaustive way, but rather it indicates them in relation to some of the distinguished groups.

Education and information is and should be directed to several "target groups", i.e:

Education and promotion in frames of states' education systems, i.e.:
- children of grammar schools (and teachers),
- teenagers at secondary schools (and teachers),
- university students (BC, MA, PhD),
- students of postgraduate studies.

"Adult" public:
- wide circles of general public,
- politicians, decision-makers,
- experts and public servants in charge of law and regulations related to power and heat generation, transmission, tariffs etc.,
- employees of regional local authorities and their leaders,
- investors interested in RES sector,
- journalists, mass-media workers.

With respect to the distinguished groups of public the following education and promotion tools were proposed as those that should effectively contribute to the growth of knowledge on RES and geothermal energy in particular (and thus their perception):

Education and promotion in frames of national education systems:

In general, the respondents pointed out the regular education in schools and at universities is regarded as a key for long-term successful development of RES and geothermal. In many aspects it may be not replaced by other forms. One shall pay more attention on introducing to the programs various attractive, modern and expressive teaching techniques which shall address children and teenagers accordingly to their age and possibility of perception. This means, among others:

- children – education through games (computer or performed on classes with the use of purpose – built educational material),
- teenagers – interactive e-learning,
- elderly – printed leaflets, brochures, booklets, video clips, Internet.

Basically, there were suggested better teaching programs at grammar and secondary schools, possibilities to specialize in RES in secondary and at post-graduation schools and trainings.

University education:

the issue is also very wide and important. The experts pointed out the following matters (other than those already indicated in this text):

- university education urgently needs stronger educational "foundation" of lower-level schools. This shall serve to acquire the basic knowledge and practical skills while the higher education shall be focused on acquiring highly specialized knowledge and skills for the development of high-professional and creative manpower (so not to act in some cases just as a kind of "replenishment" gaps in education at secondary school level),
- the realization of these purposes requires the laboratory facilities (which implies also financial expenditures) and cooperation with industry and practice, what is a rule still,
- more attention should be placed on the optimal use of already well-educated graduates from different high-specialized national and international high-specialized studies and training that were and are available to students from GEOCOM states. More efforts should be devoted to the field trainings, study visits and practises in utilities and countries leading the RES and geothermal uses. Such types of trainings shall be supported e.g. by the student and post-graduate scholarship systems.

Wide circles of general public:

This general term relates to the very varied group (as to the age, education level, interest, etc.). Therefore also the efficient education and promotion shall embrace a wide spectrum of tools tailored to different receivers, e.g.:

Adults:

- mass-media campaigns including TV, radio, press, internet like, in that periodical TV shows on RES, education movies. All activities must be prepared on more professional and more regular basis as it was by now,
- movies – on TV, Internet, for individual purchasing (in an electronic form),
- internet - in case of all distinguished groups of public, many individual respondents from all states point out the importance of internet and the urgent need to use this tool for RES / geothermal education in wider and more efficient way as is now,
- distance education (e-learning),
- more “traditional” measures, e.g. brochures, flyers, etc.,
- educational events and promotional campaigns open to public: more workshops, seminars, meetings and interview with experts’ participation (shall be supported by governmental funds) organized at local and regional levels,

- demonstration ("demo-sites") and industrial utilities dedicated to RES, geothermal, RUE open for public (specially if financed or co-financed from public sources) – since real (publicly available) examples are always the best "promoters",
- study cases and usual promotion materials, along with excursions and site visits to operating installations addressed to various target groups (e.g. university students, grammar and secondary school students; experts with practical experiences including the employees of municipalities, public sector and ministries),
- outdoor advertising and promotion – shall be successfully introduced in many regions where RES / geothermal uses are implemented. Some experts pointed out this tool which has been not applied despite it can be very attractive and efficient in reaching thousands of people. This recommendation is supported by the following statements:

  The promotion of RES / geothermal uses and their benefits has been often neglected or underestimated by municipalities / administration as well as local leaders in places where such utilities are working. In fact, these should be one of the best ways to promote both the RES applied and the localities themselves - especially if the plants are situated in the areas of tourist attraction. For example, many geothermal installations in GEOCOM states have been operating for many years (and brought benefits) in extremely attractive localities of national and international renown - in Italy, Hungary, Poland, Slovakia etc., and these facts have been not considered as advantages in promoting these energies and the benefits of their applications on a local and even regional scale. One may tell that they are a kind of "shop windows" for RES education and promotion (!). For example – such way of promotion shall be introduced in the municipality of Zakopane and Podhale region (Poland) – where it has been operating one of the largest in Europe geothermal district heating system (about 40% of the heat market in Zakopane; ca. 400 TJ/a), several bathing and recreation centers were opened in last years. The area is visited by more tourists 4 million / year from Poland and abroad (main center of summer and winter tourism in the country). Therefore there is a perfect "case study" to attract this enormously huge group of public - at least by means of suitable outdoor banners, information boards, as well as information in the news and advertising materials on the city / region. Such promotion and education activities should be even required, especially if the projects are funded or co-funded from public sources (which is the case of many projects in the GEOCOM states).

Employees of regional local authorities and their leaders, experts and public servants in charge of environmental issues, law and regulations related to power and heat generation, transmission, tariffs, etc. - the education shall include, among others:

- professional trainings and courses,
- demo-sites dedicated to RES/geothermal/RUE.

For regional and local authorities and their leaders it is also recommended a special promotion campaign in collaboration with the respective ministries. It shall embrace e.g. seminars in order to promote the advantages of RES usage, and the information on the state and EU-funds dedicated to these subjects.

These proposals are exemplified by the Romanian case: the opinions of many local authorities on the issues in question are generally positive. However, they do not have the necessary funds and do not know well the economic aspects of their advantages. If they were more informed on the benefits they would invest more in RES/RUE technologies (also to make attempts to find the PPP partners or apply for EU-funds. However, they have to be better informed.

Investors interested in RES sector:
Many of already listed tools and activities are applicable to address this group, in that study cases, demo-sites and commercial installations open for visiting. One shall add also advisory activities, specially direct advertising.

Decision-makers:
In reference to this important group more attention shall be paid on self-education and updating the knowledge on RES / geothermal / RUE and their costs.

Journalists and mass – media staff:
Public and experts are convinced that it is a very influential group playing an essential role in education and promotion of each society and with growing importance at this field; disseminating information, shaping knowledge, opinions and acceptance for many matters - hence the importance of adequate preparation of the group, constantly updating their knowledge, contacts with RES and geothermal sector experts.

Many respondents from all states indicated several these same education and promotion tools ('universal") important for all groups of public, like Internet, study-cases and demonstration installations:

- Internet and the urgent need to use this tool for RES / geothermal education in much wider and efficient way as now,
- demo-sites dedicated to RES/geothermal/RUE open for wide circles of public since they give an ability to see the real installation, how their work, knowledge of the effects of their work and the impact on the environment. Both demonstration and working RES' installations and plants (or even "energy parks") open for visits, teaching, etc. accompanied by proper information tailored to the needs and level of perception of particular groups of public are placed among the best promotion / education forms tools (such facilities, their maintenance and employees shall be supported by governmental funds). ,
- study cases and site visits to operating installations addressed to various target groups. e.g. university students, grammar and secondary school students; experts with practical experiences including the employees of municipalities, public sector and ministries (can be organized in connections to the conferences with active participation of experts with practical experiences).

Moreover – many experts pointed out the need to allocate more public funds for all promotion and education activities, specially if conducted by professional entities, including NGOs (comparable e.g. with amount of public funds allocated in the past or planned by the state for fund the nuclear power promotional campaign).

6. General remarks, conclusions

The conducted research has indicated that generally public acceptance for RES and geothermal energy prevails in the GEOCOM countries. Its level can be evaluated as acceptable or partly even as high according to the opinion of about 60% of experts from seven countries covered by the study. This is important information, because the acceptance belongs to the main factors that contribute to the public perception and help to build a positive social approach to geothermal energy (as one of the renewable energy sources components), the development of investment projects and as a consequence – an increase in its use.

It should be noted that the formation of public awareness and acceptance for geothermal energy – one of the RES least commonly used so far (and with current smaller share within the RES group) is a long-term process that requires consistent actions in different areas and application of different measures (especially that other studies indicate that the energy issues occupy rather distant place in the hierarchy of issues important for European societies). This is the case for each new branch introduced for the wider circulation of public interest, which is at the beginning of its development and economic activity, and in a large extent this statement applies to the RES sector, especially geothermal. Geothermal energy has been not yet widespread, its learning and "convincing" to it by individuals and public groups take time. Almost every new project and a new, little-known technology always evokes different social attitudes, psychological and sociological reactions, especially in populated areas (which applies to most cases in geothermal; Cataldi, 1993).

The level of public awareness and perception is very essential because the higher it will be among the public at the regional and local levels, the easier it will be to develop geothermal projects (also – regional energy source). It is thus interdependence of social and economic aspects.

The fact that the public acceptance for geothermal energy prevails in the GEOCOM states, draws attention to the more that the current level of knowledge on geothermal energy is generally low there, even though the general public has correct orientation as to the main types of geothermal uses (the best from the economic and social points of view) and its role in everyday use and energy systems. However, sufficient promotion and education activities targeting different social groups have been not conducted yet, what is more – not everywhere regular education programs have been introduced in primary and secondary schools, as well as university education on RES / geothermal is still limited (although in each of the GEOCOM countries it has been carried in some academic centers).

Wider than ever, more accessible and effective education is therefore essential. One has to emphasize its role as a *conditio sine qua non* for increasing the level of social acceptance and understanding of geothermal energy. Therefore, the experts point this need suggesting several education and promotion methods directed to various groups. They should also upgrade the position of energy matters (including geothermal) in the hierarchy of important social issues.

The case of some countries, where both the level of acceptance and knowledge of RES and geothermal energy is predominantly low or even referred to as a "lack", requires some reflection – since in these states the renowned scientists and specialists have been working who were very much involved in geothermal education on international level. For instance – in FYROM the Macedonian

Geothermal Association (MAGA) operated for years the International Summer School on Direct Applications of Geothermal Energy of IGA – official school of International Geothermal Association (current name: ISS of the IGA European Regional Branch). Since early 1990s it organized over 30 education events in various states with the involvement of renown international lecturers. Some editions took place in Poland, Slovakia, Romania. However, in the mentioned country itself the activity of this School and its role in educating the public was very limited because of lack of interest and support from the government institutions. Therefore the existing highly-skilled professional manpower served in much effective way at international ground than in its own country. Certainly this is not an isolated case in other regions and countries.

The experts emphasize that the interest in geothermal energy, energy efficiency and their acceptance may arise as one of the reactions or additional effects if they are initiated actions embracing these issues and realignment of energy costs – in such circumstances the curiosity raises and even society itself will somehow "insist" on conducting educational activities and search for arguments justifying the introduction of these measures. Typical social approach will reveal then – if something applies to the interested parties, more pro-active attitude and approach in this regard will be observed.

What's significant – according to most experts, the public in five out of seven countries consider the costs of renewable and geothermal energy as acceptable (or even low). This is also a very important element of perception. However, in this respect the situation is different in the two countries (FYROM, Poland) where other traditional energy sources are cheaper (especially coal) or their actual costs are underestimated (because of subsidies or the fact that they do not include the external costs). This also applies to Serbia where low prices of electricity do not favor wider use of geothermal energy for agricultural needs even if there are number of geothermal well located in arable land. Therefore, urgent need was indicated to introduce adequate supporting measures to make geothermal more market-competitive comparing with other fossil and renewable energy sources.

Interest and positive attitude to the development of RES / geothermal energy from a number of local self-governments results also from their expectations that investments in this area can generate several positive effects on the local economy, e.g. revenues to their budgets (taxes and fees), for local businesses, as well as places of employment, benefits for natural environment. Such a positive attitude observed among part of local administrations in their areas of operation results also from the need to fulfill their tasks in the sector of local energy management and requirements regarding the share of local RES. However, among the main obstacles to the involvement of local governments in investments one shall indicate the lack of sufficient own funds at the often lack of government support.

It is characteristic that some experts indicate that at the higher levels of administration and governmental agencies, among the decision-makers and ministerial employees the lack of sufficient knowledge and acceptance has been observed (and even expressed skepticism about the credibility of geothermal energy). These may give negative signals to the general public and potential investors, and thus hamper the development of geothermal projects and put them at a disadvantage compared to other RES, much stronger promoted and lobbied. This results also, among others, in decisions on the priorities of different types of RES development and placing of various support tools without considering experts' opinions and sufficient economic criteria (here, geothermal can have better efficiency of public support use than some other sources but this is not generally taken into account, though). Such a situation does not create a positive image of geothermal energy by the state.

In some states and regions where more geothermal installations are working, people may have a "physical" contact with geothermal energy or water and personally experience their benefits. As result, one observes better perception and understanding of its role in everyday use and energy systems as in cases of Hungary and Slovakia.
However, not everywhere, because Italy is somehow surprising in this respect – experts point to a low or even a lack of acceptance for this energy, despite the country has a long history of geothermal uses, its proven role in power production, heating, agriculture, etc. in some regions. Such an approach may be affected by the case of Larderello – Monte Amiata area (Tuscany) where some residents express critical approach to the presence of surface geothermal installations (pipelines, other) in some places in the area of high scenic and historical values (eg. Cataldi, 1993). Sociological syndromes known as NIMBY ("*not in my back yard*"), or BANANA ("*built absolutely nothing, anywhere near anything*") show up in this way. The more one shall expect that properly designed and executed the GEOCOM investment project in Montieri demonstration site located just in this area will contribute to the increase of social acceptance for geothermal energy in this very valuable area.

It results from the research that in the process of creating the perception and understanding of geothermal energy role it is very important to have consistent cooperation and contacts among different social groups, participants of public, economic and political life as well as to maintain the consensus on the long-term priorities in the above respects. It will in fact serve the objectives of interested groups and national targets – today and in the long term, and simultaneously will facilitate the realization of national, EU- and other international policies and obligation related to renewable energy sources, etc.

Public awareness and perception must be enhanced by education (as already mentioned), as well as demonstration sites and study visits available for wide public, school children, students, administration, potential investors, journalists, and, last but no east, decision makers. In the case of a group of the GEOCOM states, for example, one shall arrange study visits and contacts among partners and groups of interested persons. The role of study visits was pointed out all the more that the implementation of new geothermal district heating projects in recent years also encouraged interest of further municipalities in prospective areas. Certain mistrust in geothermal energy uses is noticeable among employees of ministries, what is probably caused by lack of information. Therefore excursions and site visits to existing successful geothermal application should be organized and detailed information about implementation and operation conditions should be provided.

Very responsible task falls journalists, traditional and electronic mass media (Internet specially) – information disseminated by them and creation of social approach shall be systematic and objective, as well as plainly given, tailored to the abilities of perception of their receivers. Such activities can not be carried out "occasionally", showing simplified picture, or focus on isolated, but attractive media cases. The more that even one biased but publicized example can affect much more the public perception than dozens of positive but not publicized examples.

In terms of this Project and in the light of conducted research it also appears that the Geothermal Mayors Club (one of the GEOCOM tasks) may play a significant role in upgrading the public perception and understanding of geothermal energy. Its activity should give at least the local dimensions of the strong foundation and support for dissemination campaigns among the local citizens and for the geothermal projects development. The Club can also act as an effective lobbying group for this type of energy in front of relevant national authorities and decision-makers. Furthermore, its actions shall be more efficient if done in conjunction with other initiatives focused

on renewable sources, energy efficiency and rational energy management, like for instance the Covenant of Mayors (the mainstream European initiative of local and regional authorities aimed at increasing the energy efficiency and the use of renewable energy sources).

Finally – one must also keep in mind the need to refer to the non-physical aspects and higher categories of motivation and action imperatives, emphasizing the responsibility of individuals and society for the environment and sustainable development, preservation of non-renewable resources for future generations (including those from families of local public).
These categories are, and will certainly be important, at least for part of the public (just as they were one of the main arguments for the European Union and individual countries to introduce energy policies considering renewable sources (packet “3x20").

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Country: ……

Expert name: ……

Generals

1. According to your opinion what types of geothermal energy uses are the best in your country from economic point of view (you may choice more than one option):

a) ❑ power generation

b) ❑ power and heat generation (CHP)

c) ❑ space heating production (centralized, individual systems)

d) ❑ agricultural uses (heating greenhouses, ground heating, etc.)

e) ❑ balneotherapy and recreation

f) ❑ other – please underline or write in addition (aquacultures, drying, snow melting, de-icing) other …….. ……...…….…...…

2. According to your opinion what types of geothermal energy uses are the best in your country from social point of view (you may choice more than one):

a) ❑ power generation

b) ❑ power and heat generation (CHP)

c) ❑ space heating production (centralized, individual systems)

d) ❑ agricultural uses (heating greenhouses, ground heating, etc.)

e) ❑ other – please underline or write in addition (aquacultures, drying,

snow melting, de-icing) other …….. ……...…….…...…

f) ❑ balneotherapy and recreation

3. What tools are / should be introduced in your country to support RES and RUE uses:

a) ❑ grants, subsidies, low-rate loans / credits

b) ❑ feed-in-tariffs

c) ❑ green certificates (other types of certificates)

d) ❑ RES and RUE should not be supported

e) ❑ other tools – please specify in few words what kind of ……...

4. What tools are/shall be introduced in your country to support geothermal energy uses:

a) ❑ grants, subsidies, low-rate loans / credits

b) ❑ feed-in tariffs

c) ❑ green certificates (other types of certificates)

d) ❑ geological risk insurance fund

e) ❑ no support is needed

f) ❑ other – please specify in few words what kind of .....

Issues related to RES and geothermal energy's public perception

5. Level of public knowledge on RES and possibilities of uses	1	2	3	4
6. Level of public knowledge on geothermal energy and possibilities of uses	1	2	3	4
7. Level of public acceptance of RES' uses	1	2	3	4
8. Level of public acceptance of geothermal energy uses	1	2	3	4
9. Level of public knowledge on national and EU-strategies and documents related to RES and geothermal energy	1	2	3	4

Rank of knowledge for the above issues: 1 – lack of, 2 – poor, 3 – sufficient, 4 – good

10. Are any information activities on RES /geothermal /RUE addressed to the public in your country? ❑ Yes ❑ No

11. Is education on RES / geothermal /RUE included into the school teaching programs (grammar, secondary) in your country? ❑ Yes ❑ No

12. Are RES / geothermal energy introduced as separate subjects of studying and specializations at universities in your country? ❑ Yes ❑ No

13. Is there a need for further RES / geothermal / RUE promotion and education addressing various social groups (tenants, adults, students) in your country? ❑ Yes ❑ No

14. What promotion / education forms will be the most proper and effective in your country, depending of age, social status and other circumstances
– please specify …….
……

15. Public opinion on costs of RES' uses (comparing with traditional energy sources)* 1 2 3

16. Public opinion on costs of geothermal energy uses (comparing with traditional energy sources)* 1 2 3

** Rank of costs for the above issues: 1 – low, 2 – acceptable, 3 – high*

Other issues, comments
(in case of lack space, please insert comments on separate pages)

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Expert expressions and opinions on public perception of RES and geothermal energy in particular GEOCOM country

Country: ……

Expert name: ……

Dear Expert,

You are kindly asked to share (in addition to the Questionnaire) in an open form your expressions and opinions related to public perception of RES and geothermal energy in your country including among others: availability and parameters of various local RES, environmental, social, economic, legal, administrative, etc. factors. If you find it proper, please show various local and country-specific circumstances affecting this perception.

Your role as a GEOCOM Expert will essentially contribute to objectively assess the state of geothermal energy perception by the public, including:

- Cross-national, comparative analysis of public understanding and attitudes towards geothermal energy,
- Assess and evaluate the society's understanding of the functioning and role of geothermal energy in energy systems and everyday use.

Thank you very much for your cooperation and contribution to GEOCOM works!

Mineral and Energy Economy Research Institute of PAS, WP6 leader

Summary of experts' expressions and opinions on public perception of RES and geothermal energy in particular GEOCOM country

Country: ……

Expert name: ……

Dear Leader of Expert Group,

You are kindly asked to summarize and conclude the of results of the issues answered in Questionnaire by individual experts from your country and to summarize and conclude open expressions and opinions on public perception of RES and geothermal energy in your country shared by individual experts from your country.

Please also provide an information on geothermal resources base, main prospective areas, main geothermal parameters (temperatures (in the reservoir, at the outflows from the wells, geothermal water flow rates, TDS), list of operating geothermal installations (at least the main ones). General map showing some of these issues will be very welcome, too. Please make use e.g. of the-so-called "Country update reports" or similar elaborations prepared e.g. for WGC2010 Indonesia or for more recent events and purposes.

Your role as a Leader of GEOCOM Expert Group will essentially contribute to objectively assess the state of geothermal energy perception by the public, including:

- Cross-national, comparative analysis of public understanding and attitudes towards geothermal energy,
- Assess and evaluate the society's understanding of the functioning and role of geothermal energy in energy systems and everyday use.

Thank you very much for your cooperation and contribution to GEOCOM works!

Questionnaire 2

Expert expressions and opinions on public perception and understanding of RUE measures

(pilot-site case studies)

WP-6. Socio-economic research, WP.6.2. Public perception and understanding of RUE measures (pilot-site case studies)

Pilot-site, country: ……

Expert name: ……

Generals

1. According to your opinion what kinds of RUE measures are the most efficient for electricity use (try to quantify the percentage - the sum should give 100%):

a) ❑ change/improve of technology (e.g. using LED lighting) ……...….%

b) ❑ individual measurements of electricity consumption ……..…….....….%

c) ❑ customer awareness of her/his impact on energy consumption …...%

d) ❑ legal and administrative solutions that enforce/promote the energy consumers' specific behaviors ……..…..%

2. According to your opinion what kind of RUE measures is the most efficient for heat energy use (try to quantify the percentage - the sum should give 100%):

a) ❑ change/improve of technology (e.g. more efficient equipment) ……..%

b) ❑ thermal retrofitting of buildings ……...…..……...%

c) ❑ use of energy saving constructing materials ……..……...%

d) ❑ change of heating system (e.g. use of floor heating instead of radiators) …….……%

e) ❑ individual measurements of energy consumption ……..……..%

f) ❑ customer awareness of its impact on energy consumption and environment ……...%

g) ❑ legal and administrative solutions that enforce/promote the energy consumers' specific behaviors ……..……...…...…%

3. What heating system is the most effective in conjunction with geothermal energy at your country:

a) ❑ radiators

b) ❑ inflate heating (air-forced heating)

c) ❑ floor/wall/ceiling heating

Questionnaire 2

Expert expressions and opinions on public perception and understanding of RUE measures

(pilot-site case studies)

Issues related to RUE measures applied at GEOCOM pilot-site:

4. Evaluation of users' satisfaction with applied RUE measures at GEOCOM pilot-site*:

a) type of introduced energy source	1	2	3
b) effects of thermal retrofitting	1	2	3
c) methods to control and optimize the energy consumption	1	2	3
d) energy costs: before and after retrofitting	1	2	3

5. Users' satisfaction with information campaign on the GEOCOM Pilot-project*

6. Users' satisfaction with information campaign on RES / RUE measures introduced by GEOCOM works* 1 2 3

7. Users' satisfaction with energy advise* 1 2 3

8. Users' satisfaction with feedback system on consumption* 1 2 3

* *Rank of satisfaction: 1 – no change comparing with situation before RUE implementation, 2 – moderate satisfaction, 3 – high satisfaction*

9. Users' involvement in GEOCOM Project*:

a) own contribution to energy efficiency measures (RUE)	1	2	3
b) organized/participation in local agencies/organizations	1	2	3
c) participation on local tenants organizations concerning RUE	1	2	3

** Rank of involvement: 1 – no involvement, 2 – moderate, 3 – active*

10. Please try to estimate the real retrofitting effect by comparing energy consumption by the users before and after GEOCOM investment works:

a) before: heat ..... GJ/year, electricity ..... MWh/year

b) after: heat ..... GJ/year, electricity ..... MWh/year

11. Please try to estimate energy uses costs in [EURO/GJ] before and after GEOCOM activities in annual period:

a) before: ..... Euro/GJ

b) after: ..... Euro/GJ

12. Please try to estimate conventional primary energy consumption (derived from natural gas, coal, fuel oil, electricity, etc.) in total energy consumption in the group of GEOCOM investment beneficiaries [% = GJ conventional / GJ total * 100%].
Please give average values or intervals from – to:

a) before: ..... %

b) after: ..... %

13. The users are satisfied with retrofitting works and RES introduction because:

a) ❑ energy consumption decrease

b) ❑ energy costs decrease

c) ❑ optimisation and rationalization of energy consumption

d) ❑ safety and comfort of use

e) ❑ ability to control and monitor the energy consumption

f) ❑ users' individual contributions to reduction/avoidance of CO_2 and other greenhouse gases

g) ❑ increase of living standard because of locally cleaner environment thanks to RES/RUE introduction

h) ❑ introducing modern, innovative solutions and technologies in individual buildings

i) ❑ benefiting from EU- and other financial supports for important purposes

j) ❑ increase of users' awareness and knowledge on RUE, geothermal and other RES

k) ❑ other – please specify ……...

Other issues, comments
(in case of lack space, please insert comments on separate pages)

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Opinions by Mayors / representatives of GEOCOM pilot-sites responsible for energy management

WP-6. Socio-economic research, WP.6.2. Public perception and understanding of RUE measures (pilot-site case studies)

Municipality, country: ……

Name, position: ……

1. The GEOCOM retrofitting works, RUE and RES' introduction in my Municipality were needed ❑ Yes ❑ No

2. The results and benefits of retrofitting, RUE and RES introduction in my Municipality are as follows (you may select several ones)**:**

a) ❑ energy consumption decrease by particular beneficiaries and by the municipality in general

b) ❑ decrease of energy costs paid by municipality

c) ❑ optimisation and rationalization of energy use

d) ❑ reduction/avoidance of CO_2 and other greenhouse gases (GHG)

e) ❑ contributing to fulfillment the country's obligations resulting from national, EU- and global documents

f) ❑ introducing modern, innovative solutions and technologies to the municipality

g) ❑ modernization of existing job places

h) ❑ creation of new places of employment

i) ❑ stimulation of local economic activity

j) ❑ increase of public awareness and knowledge on RUE, geothermal and other RES

k) ❑ municipality and local community became examples of good RUE and energy practices to follow by other entities on national and international scale

l) ❑ excellent opportunity to promote the municipality and its region on national and international scale

m) ❑ fulfillment of ethical obligation to care for environment and sustainable energy management in my municipality for the benefits of inhabitants

n) ❑ possibility to obtain and effectively use EU- and state supports for important purposes

o) ❑ initiating and strengthen the ties and cooperation among local society on the occasion of realization of project important for all community

p) ❑ other – please specify ……..

Other benefits, issues, comments

(in case of lack space, please insert comments on separate pages)

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Pilot-site, Country: ……

Expert name: ……

Dear Expert,

You are kindly asked to share (in addition to the Questionnaire) in an open form your expressions and opinions on levels of perception and understanding of applying rational use of energy (RUE) measures' in GEOCOM Project pilot-site in your country.
Please also report the users' opinions on changes / benefits before and after applying RES and RUE measures in general, and – if possible - taking into account various user groups, if they can be distinguished (e.g. due to age, type of used/operated building, etc.).
Please consider the following:
- user's satisfaction (with the implemented measures, with information, energy advice, with feedback-systems on consumption, etc.),
- users' involvement (investing in energy efficiency measures, organized in local agencies, tenants' organizations),
- analysis of different stakeholders/inhabitants perceptions about changes in the affected districts / communities and acceptance of the GEOCOM measures,
- other issues related to the subject.

Your role as a GEOCOM Expert will essentially contribute to objectively assess the state of public perception and understanding of RUE measures in GEOCOM pilot-site in your country.

Thank you very much for your cooperation and contribution to GEOCOM works!

Pilot-site, Country: ……

Expert name: ……

Dear Leader of Expert Group,

You are kindly asked to summarize and conclude the results of issues answered in Questionnaire related to GEOCOM pilot-site in your country as well as open expressions and opinions shared by individual experts on the issues related to WP6.2 (perception and understanding the RUE measures expressed by the users in pilot site). Please consider the users' opinions on changes / benefits before and after applying RES and RUE measures in pilot-site (described by individual experts).

Your role as a Leader of GEOCOM Expert Group will essentially contribute to objectively assess the state of public perception and understanding of RUE measures in GEOCOM pilot-site in your country.

Thank you very much for your cooperation and contribution to GEOCOM works!