Report of the relevant needs of Stakeholders in the field of NSGE

Deliverable 6.2.2. - Report of the relevant needs of Stakeholders in the field of NSGE

Description of the Results obtained from the activities of data collection carried out to assess the Needs and Opinions of Stakeholders of GRETA project in the period 16.10.2016 to 15.07.2017 and a Comparative Analysis among the three Pilot Areas of GRETA Project

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TABLE OF CONTENTS

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1 Introduction

Following the methodology described in Deliverable 6.2.1., this document contains the results of relevant needs of stakeholders in the field of Near-Surface Geothermal Energy (NSGE) collected with activities carried out between 16.10.2016 to 15.07.2017 and a Comparative Analysis among the three Pilot Areas of GRETA Project. Focus Groups results are herewith presented and compared across the three Pilot Areas. It should be pointed out that the following is not an evaluation but the transcription of the Focus Group results for each country. The comparative contexts are a result of a discussion with the Partners in each Pilot Area explaining the context of the Focus Group results in detail.

2 Results from Focus Groups in the three Pilot Areas of GRETA

2.1 GERMANY

Activity 1-3 aimed at evaluating which sector and which region the participants were from. Most of the people at the German Focus Group were from SMEs and from the research sector. But there were also stakeholders from local and regional public authorities, service providers and from the general public. Altogether a total of 35 stakeholders participated at the Focus Group meeting.

Activity 4- Legislation / Regulatory issues (including selection, licensing, approval). This activity contains areas which need to be improved in regulation.

The Focus Group results revealed that the most important needs in terms of legislation are the following:

1. regulations avoiding on overexploitation
2. technical/quality requirements
3. interference analysis,

followed by other issues with a high votes: time needed for authorisation, clearness of regulation and guidelines, and standard for planners.

Other than voting and ranking salient issues that limit the growth of the Near-Surface Geothermal Energy field, further comments reflected local specific problems. Additional issues raised regarding legislation were:

- water rights for groundwater protection: planners/technicians is so good that we can avoid any interactions, or interference;

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- the factors «technical/quality requirements»; «technical reports required for authorisation»; «clearness of regulation and guidelines», «guidelines or standards for drillers» are important for quality and acceptance; the factor «regulations avoiding on overexploitation» is important in the long-term.

Further local and specific issues were pointed out regarding legislation in Germany in relation to NSGE and include certain constraints and permissions:

Named comments on constraints:

- constraints for the protection of the environment: more interexchange necessary
- water rights regulations; groundwater protections
- data/complexity of a plant is important: effects on the environment have to be taken into account; operating ability of the plant has to be ensured over a long period of time

Named comments on permissions:

- importance of the quality of technology and implementation; the better both are, the higher is the trustfulness in the company and the simpler it is to obtain a permission for a company;
- experience shows that small plants will always be approved in most of the cases;
- planning reliability is important for planers; permission procedure is different from one local water administration to another, depending on the person in the local administration; on the other hand, local water administration is based on regional competences and each local water administration has a scope of interpretation;
- time for permit procedure depends on number of persons in charge available; the faster the more experience the applicant body/company already has with the requirements to be met

Other issues regarding regulations pointed out include:

- universities should be more involved as they work better interdisciplinary
- adjustment of guidelines demanded; geothermal energy reduces CO_2, therefore, it should not only be focused on aspects of water regulations

Activity 5 - Financial issues. This activity deals with the barriers coming from the Financial sector. The three most important barriers pointed out in Germany:

1. large initial investment
2. lack or insufficient financial incentive
3. cost of eco-audit requested by authorities

Additional named financial issues which were provided by the German Stakeholders include:

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- electricity tariff for users
- existing contracts with suppliers
- coordination of infrastructure in public space (subsurface planning needed)
- risk for building-owner/cost risk; uncertainties in planning process (basic evaluation; test drilling)
- late/difficult access to information for private persons
- Restriction for fossil energies needed
- oil and gas have to be charged with costs for CO2-emissions (-> linking of sectors: renewable power for heat pumps
- possibly not enough consideration of long-term costs -> initial investments are often prioritised
- competition to air heat pump

Further additional issues discussed among German Stakeholders during the Focus Group Meeting include:

- Competition to other energy sector
  - not enough restrictions for fossil energies
  - CO2-emissions have to be charged differently
  - pricing in all consumption sectors important, not only in large projects, e.g. house builder
- Pricing
  - pricing with electricity tariffs; investor wants maximum depreciation after 10 years, which is not possible using electricity tariffs
- Planning
  - risk in planning process: geothermal planning should enter planning process as soon as possible, in many cases the energy planning take place to late in the construction planning process;
  - if in doubt, house builder decides for cheaper system, e.g. gas

Activity 6 - The original planned Activity 6 was skipped in the Focus Group Meetings because of redundancy.

Activity 7 - Technical issues including environmental framework; function & geological parameters. This activity deals with the issues, which parameters/ information are important, respectively missing for the implementation of NSGE-systems. The FG-participants named the three most important technical data for the planning processes in Germany.

Most of the participants decided not to rank but to just name the most important three issues; the table below displays the summarized voting without ranking and the ranked voting for those who did rank.

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Ranked results:

1. aquifer properties
2. polluted sites; Aquifer properties
3. geology: type of sediments/rocks up to 200m

Named / Voted results:

- aquifer properties
- geology: type of sediments/rocks up to 200m
- problematic geological conditions at depth; polluted sites

Further issues on important needed information for NSGE implementation, that have been listed and discussed during the Focus Group sessions include:

- time variation curve for groundwater temperature
- data availability:
    - Bavarian energy atlas (Atlas including available energy information in Bavaria, provided by the Bavarian Environmental Agency) should be more accurate on the first 200 m. However, should interested parties ask for information, is available.
    - 3D model in high resolution difficult to obtain; 1:50 000 is not accurate enough for planers, but can be requested from LfU.

Activity 8 - Research information. This activity comprises to name which available information the stakeholder use for NSGE planning, respectively as information source. The stakeholders should rank which of the sources they need most in their field.

Most of the participants decided not to rank but to just name the most important three issues; the table below displays the summarised voting without ranking (x) and the ranked voting (3, 2, 1) for those who did rank.

Results from ranking

1. geoportals with open/public access
2. written request to public administrations/institutions/agencies
3. field work / site-investigation

Results from Naming / Voting

- geoportals with open/public access

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- gield work / site-investigation
- scientific literature

Additional information regarding used research information, that have been pointed out during the sessions include:

- energy atlas (Energieatlas) provided by LfU
- ordinary news, internet in general
- geoportals: BIS, Umweltatlas Bayern (environmental atlas of Bavaria, atlas/portal of environmental data provided by the Bavarian Environmental Agency)
- advice/material of other experts you are in contact with

Activity 9 - Voting of the most important barrier in Organisation and Administration in Germany. This activity includes to assess the important barriers regarding with respect to various fields. The stakeholders voted the three main barriers as following:

1. time (e.g. timescale for developing the project from the design stage to the point of commercial operation)
2. lack of communication or mediation between areas (e.g. fragmentation of tasks in near-surface geothermal sector)
3. lack of technical flexibility (e.g. an increment of cooling needs, because of switching from residential to commercial use of a building, when an extra cooling power on the GSHP cannot be installed)

Further issues regarding the important barriers pointed out, within the German context in specific, include:

- charging of CO2-emissions (EU emission certificates)
- organisation: planning peaks; administration: permit procedure difficult; coordination with technical building planning

Activity 10 - Voting of the areas of opportunities that according to Stakeholders in Germany should be prioritised in order to expand the use of near-surface geothermal systems. In this activity the stakeholders ranked the sectors which have the highest importance to be further developed.

1. regulation: consideration of shallow geothermal energy in national/local strategies
2. public utility
3. research

Participants have also indicated and discussed the following opportunities that would allow further expansion and which issues should be prioritised:

- lowering investment and operating costs
- research sector environmental impact mitigation, efficiency of machines, quality of basic data

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- costs equity of CO_2
- practice oriented technicians/processes; research sector
- data access for private house builder
- comprehension of linkage of geothermal and technical building planners
- increase in costs for fossil energies

Regarding decision processes the following issues were pointed out:

- underground needs to get same significance in planning processes like the surface planning
- obligation for synergies necessary
- strategy and responsibilities need to be defined

Regarding other issues:

- sector network - public space; licences and competences in public space are with energy supplier
- small projects: use of geothermal energy to complex, initial investment to high, permission necessary; builder will give up

Activity 11 - Voting the maps that according to Stakeholders will improve significantly the promotion and growth of the Near Surface Geothermal Energy sector in Germany. In Activity 11 the stakeholders voted from a provided list, which maps have the most importance for a further development of NSGE-implementations. The following three maps were voted:

1. hydrogeology
2. existing geothermal plants
3. geothermal potential (e.g., W/m)

Stakeholders have also pointed out that also the following map is of importance (which was not in the provided list):

- Map of heat demand (city, buildings) is needed

Activity 12 - Opportunities. Next Steps to advance the sector (and Opportunities for economic growth). This was an activity designed to capture desired and feasible future growth of the geothermal sector, in which participants had to calculate and approximate a 10-year process to carry out the necessary changes and transformations.

The German stakeholders pointed out the following aspects:

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Area/Regional/Land-use planning & politics **Power Supply** Decentralisation of power supply; grids by energy provider; extension of responsibilities of energy providers; centralisation of water supply; **Area/Regional/Land-use planning** Improvement of underground area planning; broad area planning with synergy effects; underground-3D-planning/-models; Realisation of large-scale master-plan; foster common/social exploitation; general solutions; holistic consideration instead of competition and single sites **Integrate Geothermal Energy** Targeted establishment and integration of NSGE in the regulation by the State; Overall management strategies should be developed for NSGE and within that framework options should be defined; integration of energy plans of municipalities/quarters; A public support programme for municipalities and industry gives -beside the financial component- a clear signal that it is politically desirable.	**Promotion & competition** **Promoting geothermal and renewable energies** Financial support; financial incentives; public support as with photovoltaic; advantages with regard to price; more explicit incentives of future compensation models esp. in contrast to conventional systems/facilities; public support programme for municipalities and industry; promotion **Competition to fossil and promotion with equivalent prices** Taxation of fossil energies; ban of fossil energy sources in new constructions; price increase for fossil energies; information of the general public about oil prices etc. in the future; CO2-tax; price for CO2-emissions in all consumer sectors, esp. heating and traffic (mobility); change of price relations; realistic energy prices, conventional energy -> competitiveness of heat pumping systems;
Advancement **Technical development** Development of cooling-heating combined systems for quarters; combination of different users such as heat emission and gain of heat; development of systems (also integrative); model projects; lowering of costs by using new technologies; **Promotion of development** Promotion of demonstration projects; energy-initiative: bail for explorationsrisks	**regulations** clear general regulations (e.g. temperature spread); unambiguous regulations -> planning reliability;

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implementation **guidance** Guidance expertise; compulsory advanced training for decision makers in municipalities and other actors ()building authority etc.); information of the general public about oil prices etc. in the future; general public: also constructors as they do the planning and can convince clients more easily; allocation of expertise information nationwide, also for small projects; public relations; **Planning process** appreciation/reward of gepothermal planning processes (e.g. VBI Leitfaden; AHO-Schriftenreihe); focus development planning & exploitation on renewable energies; auf regen. Energien ausrichten; updating of field manual for usage of geothermal energy (BHE) in Bavaria	**transparency** oil prices – today and in future; competitive systems;

German Stakeholders have also pointed out the following issues that may be unclear or general for the advancing of the sector:

- pushed applications
- risk minimisation
- lowering of costs
- knowledge transfer

In addition, an interesting note is that participants have discussed two important issues, and in their view:

- Watt/meter is not meaningful enough; planers use thickness as a measuring properties of aquifer instead of W/m and you have to bear in mind that W/m offers only a first clue for non-experts.
- Data available is mainly for 1:25 000, but for larger projects local exploration is essential.

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2.2 ITALY

Activity 1-3 aimed at evaluating which sector and which region the participants were from. Most of the people at the Italian Focus Group were relatively equal from SMEs and from regional public authorities and in lesser numbers stakeholders were from higher education and research, local public authorities and interest groups including NGOs. Altogether a total of 46 stakeholders participated at the Focus Group meeting.

Activity 4 - Legislation / Regulatory issues (including selection, licensing, approval).

The Focus Group results revealed that the most important needs in terms of legislation are the following:

1. develop guidelines for designers
2. improve legislation in terms of interference for geothermal plants
3. improve regulation to avoid the exploitation of geothermal energy

Other than voting and raking salient issues that limit the growth of the Near Surface Geothermal Energy field, further comments reflected local specific problems. Additional issues raised regarding legislation are:

1. technical requirements and the technical documentation required for permits
2. environmental protection: there is no specific legislation at regional level
3. qualitative - technical requirements

Activity 5 - Financial issues. The three most important barriers pointed out in Italy include:

1. difference between professionals and administrators: for professionals, barriers are related to the initial investment cost. For those who are on the institution the problem is the lack of financial incentives that probably could push the geothermal, to overcome these issues.
2. long-term costs to support the plants
3. costs of eco-audits requested by the authorities (the relative cost of authorisation, including the cost of time).

Additional financial issues provided by Stakeholders include:

1. initial cost and Lack of incentives were equally prioritised as first priority
2. eco-Audit cost
3. not well defined, initial cost could have been the latest priority

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Activity 6 - The original planned Activity 6 was skipped in the Focus Group Meetings because of redundancy.

Activity 7 - Technical issues including environmental framework; function & geological parameters. The three most important technical data to obtain in Italy are

1. aquifer properties
2. problematic geological conditions at depth
3. geology: type of sediments/rocks up to 200m

Activity 8: Research information - Rank which of these sources you need most in your field

1. scientific literature
2. field work & Public access geoportals
3. geoportals with private access

Additional information regarding research issues, that have been pointed out during the sessions include:

Participants have not all agreed on these data and pointed out that all the given choices were equally important, indicating that the geoportals, in Italy, are probably very well developed and they make a good use of them.

Activity 9 - Voting of the most important barrier in Organisation and Administration in Italy

1. not clear nor unified normative makes administration slower
2. other - cost of plants
3. time (e.g. timescale for developing the project from the design stage to the point of commercial operation)

Activity 10 - Voting of the areas of opportunities that according to Stakeholders in Italy should be prioritised in order to expand the use of near-surface geothermal systems

1. research finalised to protect the aquifer and spread of results
2. regulation: Consideration of shallow geothermal energy in national/local strategies
3. public utility

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Activity 11 - Voting the maps that according to Stakeholders will improve significantly the promotion and growth of the Near Surface Geothermal Energy sector in Italy

Voted equally:

- Maps of hydrogeology
- existing geothermal plants
- existing wells

Activity 12 - Opportunities. Next Steps to advance the sector (and Opportunities for economic growth). This was an activity designed to capture desired and feasible future growth of the geothermal sector, in which participants had to calculate and approximate a 10-year process to carry out the necessary changes and transformations.

Italian stakeholders, for this activity, after brainstorming what issues should be tackled and in which order, they have voted and prioritised those issues, indicating the following, in order of importance:

1. economic incentives/Support (for Eco-Audit and for geothermal plants installation)
2. information campaign
3. regulation (for example, by having one unified regulation/text)
4. mapping
5. evaluation of Eco-Audit
6. give priorities to close-loop or open-loop in terms of well defined cartography
7. define an energetic objective
8. define an energetic planning

2.3 SLOVENIA

Activity 1-3 aimed at evaluating which sector and which region the participants were from. Most of the people at the Slovenian Focus Group were mainly from SMEs and in minor scale from local and regional public authorities, service providers. Altogether a total of 19 stakeholders participated at the Focus Group meeting.

Activity 4 - Legislation / Regulatory issues (including selection, licensing, approval).

The Focus Group results revealed that the most important needs in terms of legislation are the following:

1. time needed for authorisation
2. technical quality requirement
3. clearness of regulation

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Other than voting and raking salient issues that limit the growth of the Near Surface Geothermal Energy field, further comments reflected local specific problems. Additional issues raised regarding legislation:

1. unauthorised drilling; closed loop systems (BHEs - vertical exchanges and horizontal collectors) are important issues to take into account regarding Regulations of near-surface geothermal installations. Also pointed that exact numbers of BHEs is difficult to assess, could be several thousand, because there are a lot of HP units connected to the small or large fields of BHEs.
2. different interpretation of legislation from two administrations
3. low prices, low quality. Procurement does not consider quality.

Activity 5 - Financial issues. The three most important barriers pointed out in Slovenia are :

1. large initial investment
2. large initial investment
3. cost of eco-audit

Additional financial issues provided by Stakeholders include:

1. long term variations of prices is absent in Slovenia
2. concession fees seem to be unbalanced and uncertain
3. technological water fees are a barrier for cooling applications
4. in places where there is a good potential for geothermal energy, the administration should provide incentives and/or encourage them

Activity 6 - The original planned Activity 6 was skipped in the Focus Group Meetings because of redundancy.

Activity 7 - Technical issues including environmental framework; function & geological parameters. The three most important technical data to obtain in Slovenia

1. problematic geological conditions at depth (e.g. karstic aquifers)
2. aquifer properties
3. ground temperature at depth

Further issues that have been listed and discussed during the Focus Group session include:

1. karstic aquifers issues
2. use of packers: 1- cost; 2- length of B.4 B.H
3. 60% of the plants in karst environment - caves

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Question 8 - Research information - Rank which of these sources you need most in your field

1. field work / site-investigation
2. geoportals with open/public access
3. written request to public administrations/institutions/agencies

Additional information regarding research issues, that have been pointed out during the sessions include:

- preliminary investigations are rarely carried out

Activity 9 - Voting of the most important barrier in Organisation and Administration in Slovenia

1. lack of communication or mediation between authorities (e.g. fragmentation of tasks in near-surface geothermal sector)
2. time (e.g. timescale for developing the project from the design stage to the point of commercial operation)
3. lack of technical flexibility (e.g. an increment of cooling needs, because of switching from residential to commercial use of a building, when an extra cooling power on the GSHP cannot be installed)

Activity 10 - Voting of the areas of opportunities that according to Stakeholders in Slovenia should be prioritised in order to expand the use of near-surface geothermal systems

1. regulation
2. cost of installation

Activity 11 - Voting the maps that according to Stakeholders will improve significantly the promotion and growth of the Near Surface Geothermal Energy sector in Slovenia

1. existing wells and boreholes piezometers
2. geothermal potential (e.g. W/m)
3. geology

note: Slovenia stated that would need traffic light maps + boreholes layers too. Map A (geothermal potential, e.g. W/m) is good for closed loop system.

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Activity 12 - Opportunities. Next Steps to advance the sector (and Opportunities for economic growth). This was an activity designed to capture desired and feasible future growth of the geothermal sector, in which participants had to calculate and approximate a 10-year process to carry out the necessary changes and transformations.

Participants from Slovenia have detailed how, according to them, the processes of change should take place and be tackled. They have indicated the following processes in the following phases:

phase 1

- change administration procedures
- good new projects (innovative small & big)
- more efficient legislation
- drilling chamber, make rules for all members (related to innovative small & big)
- give more subsidiaries also for drillers and efficiency of systems

phase 2

- good new projects (innovative small & big)
- to have a database containing a list of boreholes in the country

phase 3

- investments in/for improvement of measuring the efficiency
- strategy / map for good potential areas, give incentives for users (financial help to install), at national level

phase 4

- education; schools

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3 Comparative results from Focus Groups in the three Pilot Areas of GRETA

A Focus Group was carried out in the GRETA Project in each of the three Pilot Areas: Slovenia (22 March 2017), Italy (4 April 2017) and Germany (7 July 2017). The Focus Groups aimed at capturing barriers and needs within the geothermal field. Participants who came from different sectors offered differing barriers and needs that their nation would aim for to improve the geothermal development. The most salient barriers and needs are shown in the table below. In the section that follows the table, a comparative analysis will approach what common traits are in these accounts among the three nations, and what and in which way factors are responsible for their differences.

	GERMANY	ITALY	SLOVENIA
REGULATIONS	1. regulations avoiding over exploitation of aquifers 2. technical/quality requirements. 3. interference analysis	1. develop guidelines for planners 2. improve legislation in terms of interference for geothermal installations 3. improve regulation to avoid the exploitation of aquifers	1. time needed for authorisation 2. technical quality requirement 3. clearness of regulation
FINANCIAL	1. large initial investment 2. lack or insufficient financial incentive 3. cost of eco-audit requested by authorities	1. large initial investment 2. long-term cost to support the plants 3. cost of eco-audits requested by the authorities	1. large initial investment 2. cost of eco-audit 3. concession fees seem to be unbalanced and uncertain
TECHNICAL	1. aquifer properties 2. polluted sites; aquifer properties 3. geology: type of sediments/rocks up to 200m	1. aquifer properties 2. problematic geological conditions at depth 3. geology: type of sediments/rocks up to 200m	1. problematic geological conditions at depth (e.g. karstic aquifers) 2. aquifer properties 3. ground temperature at depth

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	GERMANY	ITALY	SLOVENIA
RESEARCH	1. geoportals with open/public access 2. written request to public administrations/ institutions/agencies 3. site-investigation 4. energy atlas (Energieatlas) provided by LfU	1. Scientific literature 2. Field work & Public access geoportals 3. geoportals with private access	1. site-investigation 2. geoportals with open/public access 3. written request to public administrations/ institutions/agencies
ORGANISATION & ADMINISTRATION	1. time (e.g. timescale for developing the project from the design stage to the point of commercial operation) 2. lack of communication or mediation between areas (e.g. fragmentation of tasks in near-surface geothermal sector) 3. lack of technical flexibility (e.g. an increment of cooling needs, because of switching from residential to commercial use of a building, when an extra cooling power on the GSHP cannot be installed)	1. not clear nor unified normative makes administration slower 2. other - cost of plants 3. time (e.g. timescale for developing the project from the design stage to the point of commercial operation)	1. lack of communication or mediation between authorities (e.g. fragmentation of tasks in near-surface geothermal sector) 2. time (e.g. timescale for developing the project from the design stage to the point of commercial operation) 3. lack of technical flexibility (e.g. an increment of cooling needs, because of switching from residential to commercial use of a building, when an extra cooling power on the GSHP cannot be installed)
MAPS	1. hydrogeology 2. existing geothermal plants 3. geothermal potential (e.g. W/m)	1. maps of hydrogeology, 2. existing geothermal installations 3. existing wells	1. existing wells and boreholes piezometers 2. geothermal potential (e.g. W/M) 3. geology
OPPORTUNITIES	1. regulation: consideration of shallow geothermal energy in national/local strategies 2. public utility 3. research	1. research finalised to protect the aquifer and spread of results 2. regulation: consideration of shallow geothermal energy in national/local strategies 3. public utility	1. regulation 2. cost of installation 3. change administration procedures

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3.1 Comparative regulations context of geothermal energy field in Germany, Italy and Slovenia

Results from the Focus Groups carried out show that participants pointed out three main barriers that affect the development of the geothermal energy field. These are

1. regulations avoiding over exploitation of aquifers,
2. guidelines or standards for drillers and Technical/quality requirements;
3. environmental protection.

It appears to be that there is not a unified opinion about regulations in Germany. The authorisation sector, wanting to be sure about what they have to decide, fear possible accidents or inaccurate installations as a consequence of scarce geological knowledge and this rather conservative approach (especially in Bavaria) results in having high standards for authorisations. For instance, some installations which are allowed to be drilled in the area of Baden-Württemberg would not be allowed in Bavaria, where it is forbidden for environmental protection reasons to drill through the first aquitard. Consequently, in this case the available depth for BHEs can be sometimes very limited (thus inconvenient). In this case, qualitative evaluation of water rights for groundwater protection is going in the same direction as with drilling regulations. This is because in Bavaria it is not allowed to drill through the first aquifer, or to the second ground water level, respectively.

In contrast to the conservative administration, the technical sector has a different view regarding permissions. An example of this is various procedures to test the grouting quality that are currently being under discussion. A crucial point at the installation of borehole heat exchangers is the risk of connecting separated groundwater level. If the grout is filled correctly, a sealing of the borehole prevents a hydraulic connection and a test of the grout quality would overcome concerns about water protection.

A filling material which has magnetic properties must be used in order to test whether the grout is distributed along the borehole without gaps or not. This is perceived as a rather sophisticated method in other regions of Germany, as recommendations on quality tests can differ in Germany. Generally, planners and technicians sustain that the technique for drilling safely through aquitards is actually good enough. Still, both planners and water protection agencies think that the guidelines and standard developed by the government have to be updated, according to recent technical developments. German drillers retain these guidelines as a barrier hindering them in some way, because they have to take extra efforts to fulfil the standards and in certain ways they think that the standards are slightly too high. This situation creates a rather wide gap between the technical improvements and the older standards: technical improvements should be integrated in the standards and the standards should be adapted to the risks that the technical improvements encounter. Stakeholders of the Italian Focus Group, contrarily, during Focus Group and interviews have prioritised

1. development of guidelines for planners,

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2. need to improve legislation in terms of interference for geothermal plants and to improve regulation to avoid the exploitation of aquifers

as main barriers to concentrate on to develop the geothermal field in this country.

The Italian standardisation body (UNI) released three standards regulations - UNI 11466:2012, UNI 11467:2012 and UNI 1146:2012 –UNI 11466:2012, UNI 11467:2012 and UNI 1146 designs, installations and indications on how to address environmental issues related to the installation of NSGE systems (e.g. interference between geothermal systems, overexploitation). Guidelines (UNI 11466, 11467 and 11468) in Italy contain elements related to specific requirements, from the planning phase to the injection. Still, these guidelines should be presented in a rather clearer way. An integration of the guidelines in each institutional normative system would help the overall comprehension and facilitate the implementation of these instructions. It is worth to note that the cost of these norms (around 140 euros each) represents an economic barrier for most of geothermal installation planners. A proposal should be made for guidelines to be part of a decree, so that the cost could be almost completely absorbed. The Ministry of Economic Development has shown its interest towards the incorporation of the UNI normative contents into a National Guideline draft that was supposed to be released within the Legislative Decree 28/2011 about Renewables, but that hasn't been delivered yet. After a quite unsuccessful attempt to create a decree that was related to the installation of borehole heat exchangers, six years later, the Ministry of Economic Development is finally going to release the National Guidelines concerning the closed-loop system. Yet, normative for the open-loop system are still to be edited, and it seems to represent a bigger task from the administrative point of view.

Without national guidelines, the whole approving process is left to the hands of the knowledge/expertise officer who receives the application. The authorisation process is based on the so-called "Conferenza dei servizi (CdS)" where relevant stakeholders (i.e. public authorities, neighbours, environmentalist associations, etc.) are entitled to an opinion and can oppose their will against the installation. This can potentially lead to a situation in which it is impossible to obtain the authorisation for the abstraction. At the same time, in the absence of a specific regulation, the decision is completely based on whether the officer in charge wants to approve the procedure or not. The risk of having biased decisions is therefore really high. This scenario clears out the impelling need to edit guidelines for planners to improve legislation in terms of interference for geothermal installations and to improve regulations to avoid the exploitation of geothermal energy. In the end, these measures might prevent administrators from ending up into conservative positions, since the approving decision can represent a responsible action, exposed to potential legal consequences. This situation is to be considered with a particular attention since the geothermal field is just one of the many renewable issues concerning nowadays institutions. With a national guidance it would be easier to see that under certain specific geological and technical circumstances the installation can be efficiently achieved.

As stated above, the authorisation process of open-loop systems is based only on the CdS, where applications are evaluated by a public office and remarks can be posed by entitled stakeholders. Guidelines would be of help for public officers to deal with such remarks and to set the right prescriptions for applicants and for designers to present the appropriate technical documents.

Moving to the results obtained from Focus Groups carried out at GRETA in Slovenia, these indicate that the main barriers are

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1. time needed for authorisation,
2. technical quality requirement
3. clearness of regulation.

Applications are too time consuming for authorisation. The situation is not helped by the unclearness of the regulations themselves. It is the case that different interpretation of legislation from two administrations could take place that slows the process of approval. Legislation is, as a matter of fact, not harmonised, not clear, in Slovenia, bringing the consequent problem of delays, by misinterpretations between offices in the process.

There are also issues regarding the technical quality requirement. Standards do exist in Slovenia for installations deeper than 300 m but it lacks guidelines for the near-surface (0-300 m). The problem is aggravated by the fact that despite having standards, it seems to be that drillers are not being controlled. Unauthorised drilling is relatively common in Slovenia, a situation that exists probably because fines are directed to the planner, and due to the low numbers of controls aforementioned. As a matter of fact, Slovenia lacks an Environmental Agency as an authorisation body, although this agency do release permits, these are not for quality or data control.

3.2 Comparative financial context of geothermal energy field in Germany, Italy and Slovenia

The three most important barriers in the financial context related to the development of the geothermal sector in Germany are

1. large initial investment
2. lack or insufficient financial incentive
3. cost of monitoring requested by authorities.

In Germany, a proposed strategy from the Focus Group to overcome financial barriers was to implement a legal instrument to tackle installations that use more CO_2, by charging them higher in form of taxes. This tax should apply to all renewable systems. This would be rather effective than implementing subsidies for renewables. But it was also stated that subsidies for fossil based systems, which are still in place, must abolished.

Another factor that constitutes a barrier linked to the financial context of geothermal sector in Germany is the common budget law of administration in regard to public buildings. It constrains the choice of systems that can be installed in public buildings and is at the moment very restrictive pushing administrations to choose the cheaper system and not necessarily a renewable choice.

Regarding the lack or insufficient financial incentives, there are new national incentives for heat pumps, that started in 2016 in Germany. It is hoped that they will have an impact on the development of the sector.

Data collected from the Focus Group indicate that

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1. large initial cost
2. long-term costs to support the installations
3. cost of eco-audits requested by the authorities

are the main barriers in Italy.

The Italian context sees the initial costs as a major barrier to the distribution of NSGE systems. Planners and installers mostly agree on this issue, while public officers' main concerns highlight the lack of incentives.

The long-term costs of maintenance of NSGE systems represent the second hardest barrier for the realisation of a geothermal project, while the third is represented by the cost of the production of the eco-audits. These are requested by the authorities and they require both monetary expenses and investment of time.

In the geothermal field the perception of investment, disadvantages the technology of geothermal. Cultural context can influence a society to such an extent that even trends in loan preferences can be culturally conditioned. As for Italy, people are less inclined to borrow money compared to other nations with a rather high consumer credit, e.g. Americans. Besides, in the Italian peninsula, companies can only have access to loans that usually have high interest rates.

Another explanation to the complexity of the spreading of geothermal installations through the Italian context is that geothermal energy is little known as an energetic solution and almost irrelevant on a public debate scale. This aspect is likely to prevent long-term investments in this field of application and it will probably take some time to orient more investments toward the distribution of a geothermal culture.

The large initial investment is a true barrier in Slovenia as well. The cost of preliminary investigations poses a problem, and are rarely carried out in favour of saving money. Preliminary investigations are important for the understanding of below surface quality. Water fees seem to be unbalanced and uncertain, constituting also a barrier in this country.

Concession fees seem to be unbalanced and uncertain, constituting also a barrier in this country. Charge for cooling water abstraction is much higher than for heating. Cooling is counted as industrial category, and therefore the cost is much higher. The uncertainty comes from the idea that everybody is afraid that fees will increase in the next years. It is believed that in places where there is a good potential for geothermal energy, the administration should provide incentives and/or encourage new investors.

3.3 Comparative technical context of geothermal energy field in Germany, Italy and Slovenia

Technical issues that emerged in the Focus Group in Germany show that the knowledge of aquifer properties, polluted sites and type of sediments up to 200 m are the main barriers to the development of shallow geothermal installations. These technical issues are in line with the regulations context. In

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the regulations, the extent to the bottom of the aquifer is restricted on how far to drill. As a consequence, the extent of the aquifer is the most important figure, which has to get analysis and then depending on the system how that property conductivity would be compromised. Aquifer properties are not linked to legislation, as aquifers are linked to better information, which GRETA project will provide. It is forbidden to drill through lower than the first groundwater level but in some cases it is not known where it is. Location of first groundwater level is the problem. Regarding the polluted sites, in Germany they are not public, so the information is restricted, so this information must be additionally requested at the Water Protection Agencies.

The current discussion in Germany is also including the need of 3D information to understand the thermal exploitation of the deep underground more and as basis to manage the underground.

Aquifer properties, problematic geological conditions at depth, geology (type of sediments/rocks up to 200 m) have been pointed out as barriers in Italy. Practitioners in the geothermal field remark the scarcity and, sometimes, the low reliability of data on aquifer properties, problematic geological conditions or, more generally, geology, and the type of sediments/rocks up to 200 m of depth. It is for this reason that a comparison of the suitability for different NSGE technologies (closed- vs open-loop) would be highly desirable.

Geological conditions are heterogenous in Slovenia. A large part of Slovenia is karstic environment. Geological settings and geothermal parameters are rather well known. Nevertheless, data are available on regional scale (Geological Survey of Slovenia) and have to be adapted and interpreted for the spatial planning scale. Without NSGE evidence of publicly important data obtained from the water and mining rights holders, a lot of essential data are lost, and next investor is faced up, in fact, with reinvention and unnecessary costs.

3.4 Comparative research context of geothermal energy field in Germany, Italy and Slovenia

Moving to needs and barriers in research area, in Germany “geoportals with open/public access”, followed by the “written request to public Administrations and site-investigation” were put forward by German participants as barriers. It has been pointed out that more field data availability is needed in Germany, as it is in line with the technical issues mentioned earlier. Similarly as a need in research area, regarding written requests to the public administration in Bavaria, the situation is that at the moment it is linked to the issue of the restriction to drill up to the bottom of the aquifer and at the moment there is no detailed information available. Administrations have a rather conservative position, which means that most of the time if specific requests in drilling deeper than allowed are put forward on the drilling depths specifying that it will be deeper than first shown in the Geoportal. This explains why it is important for planners to have a Geoportal for local specific requests, in order to obtain the information to respect the allowed depth for drilling.

Italian participants have not all agreed on these data and pointed out that all the given choices (scientific literature, site data and geoportals with private access) were equally a barrier, while the

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opposite group, indicated that the geoportals, in Italy, are probably very well developed and they make a good use of them, without specifying.

In Slovenia, data gathered at the focus groups indicate that data from site-investigation is a barrier to the geothermal development, because the heterogeneity of the geology does not allow a routine or "rule of thumb" approach. This problem is aggravated by the fact that there is no special geoportal for NSGE in Slovenia. Absence of preliminary investigations with excavations/undersurface surveys is a barrier in Slovenia. Information already exists but data is scarce and not prepared for public use.

3.5 Comparative administration context of geothermal energy field in Germany, Italy and Slovenia

The general consensus from Focus Group activities carried out in Germany about organisation and administration timing of applications for approval resulted as the main barrier. Applications for installations take too long to get approved. Timing is not so different between regions. The lack of communication and knowledge are factors that have a direct effect on timing. For example, the Regional Water Agency and the decision if permission is granted or how long it takes, that depends on the knowledge of the people that work in the administration. And there are lots of differences on knowledge of administrations about geothermal and geology and on how they handle the requests. This is also a main issue, specially in Bavaria, the Regional Water Agency has a different handling of the regulations. In different regions, with different responsible Regional Water Agencies the handling of regulations is also different, hence a harmonisation of handling is a need, which is also seen from the perspective of the federal administration unit. In Germany, the application has a maximum time for the approval agency to reply; once this period is reached, the application gets approved automatically. Drillers know that if they are early enough planning of the installation is good. This timing is also a two-fold view, because timing for geothermal installations is being compared with other sort of installations. For conventional systems, for instance, if you are building a house, in a situation of a tight schedule, for a geothermal installation, one has to be aware of the schedule for things to be done on time, specially in comparison to other systems.

Data from Italy administration barriers pointed out that not clear and not unified regulations make applications slower, is affecting the timing of applications. As it is easy to deduce, unclear and not unified regulations slow down the application process, affecting the timing of applications. In Austria the regulative framework is clearer, the procedure is very specific and so are the steps under which the application has to go through.

On the contrary, in Italy the timing depends on the institution itself, i.e. on the knowledge, capability and availability of the officers that take care of the procedures. For example, In Lombardia Region data are transmitted digitally and therefore faster than in most of other regions, where paper copies of documents are still requested.

In Slovenia, the lack of communication or mediation between authorities, worsened by the fragmentation between sectors, has been pointed out as a main barrier to the development of the

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geothermal sector. Similarly, the timescale for developing the project from the design stage to the point of commercial operation is a barrier. It is believed that responses take too long. The problem seems to be aggravated by the fact that the competences required for the approval procedure, specially in small administrations, not having specialists in each procedure step becomes a problem at the application's authorisation.

3.6 Comparative opportunities context of geothermal energy field in Germany, Italy and Slovenia

The main barrier regarding areas of opportunities was pointed out to be within an improvement in regulations, with special regards to the consideration of shallow geothermal energy in national/local strategies. In Germany, there is an act that fulfils 50% of the demand with renewable energy when a new house is built. This is from the regulations side. And this could be strengthened considerably, to 70, 80, 90%. It has been pointed out that in national strategies in Bavaria for example, there is not a national strategy which tells you to use national shallow energy when is available. This could be strengthened and it is going more in that direction regulations in terms of strategies that include the encouraging of finding alternative, innovative ways of fostering it. That explains also why German participants considered that the "underground needs to get same significance in planning processes like the surface planning": the energy planning should become more relevant in the planning process of constructions and should take place in the very beginning of the planning process, not somewhere between or at the end. Also, strategies and responsibilities need to be defined, that is who is the carer, who is responsible for how to manage the underground.

In Italy, not clear or not unified normative slowing down the administration, the initial costs of installations and the timing of application, from the design stage to the point of commercial operation, are three areas, already introduced and discussed, that are the opportunities which would enhance the development of the geothermal sector.

Research finalised to protect the aquifer and spread of results is an area where geothermal can expand, in order to understand which measures to adopt. In Italy, there is a cultural perception that the geothermal could pollute the aquifers. And this aspect needs clarification, perhaps enhanced with information and education campaigns.

In Italy, it would be very important to include shallow geothermal energy in national/local strategies. This is the work that EURAC is doing as a partner of the GRETA project. The geothermal technology by itself and specially when compared to other renewables, is not an immediate straight choice to people, for the reasons listed in this analysis. And that is why it needs to be included in a national strategy in order to make this technology more available among other renewable types. It would be very important for the public to create schemes of information and education, to ease the choices that the public will have to go through.

In Slovenia, it appeared that a major effort should be undertaken to improve the regulation. Regulation could be then more effectively focused and directed, and less bureaucratic in Slovenia. Simplifications

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can be achieved by known techniques: one-stop shop, online application platforms, maximum time limit for procedures, automatic permission after deadline, facilitated procedures for small scale producers, identification of geographical site. Easy accesses to official information about administrative procedures, shallow geothermal potential, constraints, and subsidies are very important non-financial incentives. Financial incentives are the most important issue to tackle for the geothermal development in Slovenia. Financial incentives granted depending on the efficiency (e.g. feed-in tariff) are significantly in favour of NSGE.

3.7 Comparative mapping context of geothermal energy field in Germany, Italy and Slovenia

In Germany, the rank between a hydrogeological map, an existing geothermal installations map and a map of geothermal potential (e.g. W/m) was actually quite even, showing not much differences between the three needed maps. It is safe to say that it probably reflects the evenness of the audience of the Focus Groups as well. Administrators and technicians are naturally more interested in the hydrogeological map. For planners the hydrogeological map is the most needed in the German geothermal energy sector because for planners is important to have the main parameters, for example, how much volume flux of groundwater is actually in the thermal exchange. Regardless of these assumptions, the current discussion in Germany at the moment revolves around the need of a map of heat demand by city or by buildings.

In Italy, hydrogeological maps, together with cadastres of existing ground source heat pumps and water wells, have been voted equally, because the three types are needed in Italy.

Maps needed in Slovenia are the existing wells and boreholes piezometers as the most needed one, followed by the geothermal potential (e.g. W/m) and the geology. Still, Slovenia stated that it would need traffic light maps and boreholes layers as well.

3.8 Comparative opportunities and future steps to advance the sector in Germany, Italy and Slovenia

In Germany, the most salient opportunity for expanding the geothermal sector would be to put forward a competition to fossil and promotion with equivalent prices. Some examples include: taxation of fossil energies, ban of fossil energy sources in new constructions, together with an information campaign focused on the general public about oil prices, pricing includes the traffic (mobility) for recharging oil, among others. In Germany, it is worth noting that there are still incentives for oil system installations. What would be needed is to embark in a strategy of competition to fossil and a promotion with equivalent prices, which would involve from getting politicians to get a statement fostering geothermal (so change of regulations can be fostered and incentives to geothermal can be provided) to informing the general public about oil prices. It is worth reflecting upon a strategy of taxation of fossil energies or ban of fossil energy sources in new constructions by not encouraging incentives for

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the conventional system and rather rise the taxes to make it more expensive. Furthermore, a statement from a politician would be needed in order to get rid of conventional energy systems, to convert into renewables as a unique strategy to foster, to make change happen. This strategy applies to all the renewables, and pricing CO_2 emissions include all consumer sectors, specially heating and traffic (mobility).

In Italy, there should be financial incentives, including those for eco-audit as representing the cost of monitoring. This aspect depends in final instance to the authorising body dealing with the application. The knowledge linked to the geothermal technology needs to be spread around and the technology itself needs to be further developed, this is why an information campaign could be of help, not only to users, but to administrators, too. As for the closed-loop, Lombardia Region seems to be leading the geothermal development on this subject, and it will probably be the same for open-loops with the passing of time. The fact that Lombardia made the effort to digitalise all the paperwork required for the applications has speeded up and facilitated the geothermal procedure.

An important opportunity to expand the geothermal field in Slovenia would be to change the administration procedures, by making them easier to learn and to implement. Also good new innovative projects, both small and large, with demonstration projects are very rare and there is no public monitoring data about energy efficiency of these installations. The purpose of each data provided from users to authorities should be clearly defined: how these data will be evaluated and accessibility of these data (privacy policy). The data should be used for public services to facilitate procedures and saving costs for new interventions and investments.

More efficient legislation in the form of one-stop shops, online applications, a maximum time limit for procedures, automatic permission after deadline, facilitated procedures for small scale producers, identification of geographical site would be advantageous.

The foundation of a drilling chamber, could promote the interest for all members (related to innovative small and big enterprises). This is because at present there is no NSGE chamber or association which would liaise drillers, installers, sellers, producers of NSGE field in Slovenia.

Opportunities also include to give more subsidies also for drillers and not only for heat pumps, based on criteria of efficiency of systems. This could be followed by the creation of a database containing a list of boreholes in the country, as there is a considerable loss of important data from boreholes, which are not in the register.

This could be followed by the creation of a database containing a list of boreholes in the country, as there is a considerable loss of important data from boreholes, which are not in the register.

There are clear opportunities for the investments for better performances of NSGE installations, for example, in measuring the efficiency, as there is none or little data about efficiency of existing NSGE installations. Also an important opportunity could be non-financial incentives in the form of information about administrative procedures, shallow geothermal potential, constraints and subsidies.

Last but maybe the most important opportunities are education schemes in schools, together with certification of geothermal drillers.

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4 Considerations

Two important common considerations emerge from the comparative analysis of barriers and needs in the geothermal sector of three Pilot Areas of the GRETA project, Germany, Italy and Slovenia. One is the «Culture of Administration», which seems to condition, shape and challenge legislation and administration matters with the geothermal approval of applications. The second consideration is the large initial investment, which was the most salient barrier in the three nations. Both issues will be discussed in this section.

4.1 Considerations on large initial investment

This barrier was the most voted among the barriers and needs of the geothermal sector in Germany, Italy and Slovenia and deserves a separate further consideration.

Geothermal energy is a technical solution that has a high investment, which means that to embrace the general public and develop the sector into a rather mass expansion, it is important to consider any sort of credit or incentive scheme that suits the problem of the first investment.

Investment is about 8-10 times more the cost of any other form of heating. For the matter of discussion on cost of installations, on a small-scale application of 10 kW, a boiler will cost 300 € against the 20 k€ of a geothermal heat pump. Despite state contributions and incentives, and the amortisation of the costs for 6-8 years, lay people still feel discouraged about geothermal installations.

It has been said above that in the geothermal field the perception of investment disadvantages the technology. It appears to be that in the geothermal context the perception of the investment seems to be culturally shaped and this condition often disadvantages the spreading of technological innovations. This kind of conception towards investment is more focused on short-term return expectations rather than on long-term ones. This is because investments can be seen as a natural human-like condition of how human make choices. That is, in front of a choice, in which there is an initial cost which then is spread throughout time to get the investment back, the so-called behavioural economics with its utility, rational choice theory that explains that under situations of scarcity humans tend to maximise.

Another factor to take into consideration in the process of choosing a geothermal system is the cost of electricity used in this installations. For example, the high cost of electricity in Italy is quite an obstacle since reducing the operational saving margins of a heat pumps systems. Typical costs for residential users are of about 0.18-0.20 €/kWh, in Austria and Slovenia from 0.20-0.28 €/kWh, while in France, Sweden and Finland, the price falls to some 0.13 €/kWh. The difference of these figures is mostly due to differences in taxation and, to a lesser extent, to the type of energy source used to gain electricity. It is worth noting that France, Sweden and Finland still have nuclear plants and that Sweden, in addition, has a large production from hydropower and, more recently, from wind. For this reason, a

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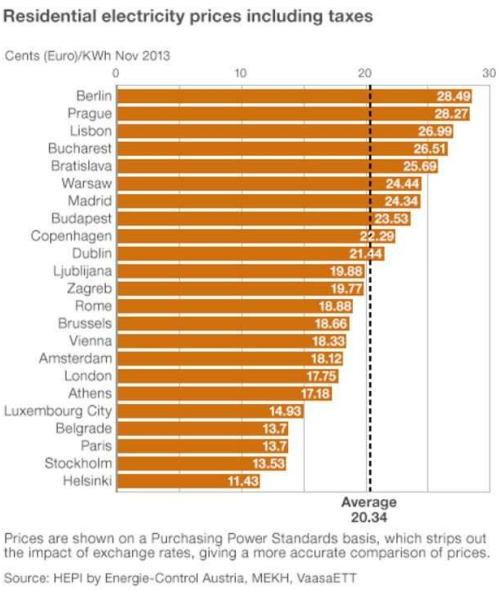
special taxation on the electricity for heat pumps should be established, considering that heat pumps when compared to fossil fuels, have no emission on site and, on the contrary, reduce overall ones.



Source: http://www.bbc.com/news/business-25200808

For geothermal installations, the highest expenses are due to the drilling costs and to the cost of the heat pump itself. The heat pump is indeed a mature technology, that already counts more than century old research studies. The drilling of borehole heat exchangers is a mature technology too, and hence borehole heat exchangers have not significantly lowered their cost through time. Regarding heat pumps, a price reduction could be achieved with scale economies as the production increases.

As far as the probe is concerned, it is difficult to imagine innovations such as to reduce the cost and be able to drill at 5-10 €/m, so for this component of the cost, it will hardly be affected by the scale factor.

Analysing the installation parts, the heat pump is, in simple words, a "refrigerator", a technology that has also been present for quite a few decades. What we can imagine is that there can be improvements in performance. The increase in performance makes the system more efficient but does not necessarily reduce the investment cost, it certainly makes the investment more interesting but it is not said to lower the cost.

It is at the pump level where it could be a scale factor. Trying to imagine the heat pump market in the next few years it will grow by a factor of one thousand, so one may predict that the price may not be a thousandth but more a tenth is realistic. Probably a more realistic prediction of a reduction could be a 10%, or optimistically, up to 30% reduction.

Moving to the heat distribution system, here as well the scale factor can have a major impact on the overall installation price. In the end the workforce is the most important part and the system itself is generally a simple technology, water pipes, air ducts and therefore, the cost will remain roughly stable.

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Taking into account that the probe counts for about 40-50 % of the total costs, that the heat pump for about 20-30 % and that the rest is of the other components of an installation and of the distribution system, imagining that in future the price of the pump is halved due to scale factors, which is difficult to believe, we would still have a decrease in the total cost that is 10-15 %.

Concluding, the saving on home heating expenses could be a powerful trigger for the geothermal heating method. A good example could be the Sweden one. Besides low electricity prices, Sweden also has a scarcely developed gas network (which makes fossil fuels more expensive than, say, Italy and Germany) and people have therefore high heating bills because of the cold climate (although houses are generally well insulated). In addition, air-source heat pumps are penalised by long hours below 0 degrees. It is for this reason, that the initial investment on a NSGE system would generally be way more convenient than in other countries.

Regarding the initial investment compare to other renewable systems, geothermal installations are the most expensive regarding the initial investment. That is why it is crucial to work hard with the education and information to the public, to assure that lay people understand the advantages of this renewable source of energy, comparing the maintenance costs as it seems at the moment the emission limitations are so not in the focus of the geothermal expansion. Perhaps one way to do this education and information campaign is through re-labelling the source of energy.

4.2 Considerations on Culture of Administration

The logical consistency of a culture of administration behind regulations, administration and organisation's performance should not go unnoticed. Cultural dimensions play a role in the development of administration.

Culture of administration or «organisational culture», defined as the values and behaviours decision-making processes, activities and stories of organisations (Pacanowsky and O'Donnell-Trujillo 1982). It includes an organisation's management style, that is the way organisations conduct their business, the extent to which freedom is allowed in decision making, how power and information flow through its hierarchy, among others. It affects the organisations's productivity and performance, and the written and unwritten rules that develop over time (The business dictionary).

Organisational culture is equated with different areas such as politics, governance, public and private sector, public policy, civil society, civil service, international development agencies, organisational behaviour, public reforms, administrative laws, local government, among others. Organisational culture can manifest itself in a variety of ways, including leadership behaviours, communication styles, internally distributed messages and corporate celebrations, organisation's customs, traditions, rituals, behavioural norms, symbols and general way of doing things are the visible manifestation of its culture. Given that organisational culture comprises so many elements, it is not surprising that terms for describing specific administration cultures vary widely. Some commonly used terms for describing cultures of administration include aggressive, customer-focused, innovative, fun, ethical, research-driven, technology-driven, process-oriented, hierarchical, family-friendly and risk-taking (SHRM

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Series). In this Comparative Analysis, we have talked of conservative, over-apprehensive and fragmented administrations.

Eisenberg and Goodall (1993) observe that the Organisational Culture Theory relies heavily on the shared meaning among organisational members, or more precisely, their *alignment,* which make them "unique for every organisation and one of the hardest things to change" (Pacanowsky and O'Donnell-Trujillo 1982). The degree of urgency, one important element of culture of administration, defines how quickly the organisation wants or needs to push decision-making and innovation. Some organisations choose their degree of urgency, but others have it thrust on them by the marketplace, or in the case of the nations analysed here, by the apprehensiveness linked to responsibility which is linked in its turn to the application decision process. Timing of geothermal installations' applications approval could fall within this analysis, by seeing factors such as lack or unclear regulations, lack of expertise and the apprehensiveness to take on understanding the technical aspects of regulations, as ways of culture of administration justified and understood within each of these three nations.

Despite everything seems shaped by culture, and data shows that stablished alignments cannot be changed, this does not mean there is no room for changes and improvements that the geothermal sector needs in the three case studies analysed here. Culture itself has vague boundaries and fortunately cultures are in constant movement, adapting and changing.

This study is hoped to have served to understand the impossibility of disclaiming the significance of the culture of administration and organisational behaviour and serves to view future schemes that acknowledges the culture of administration factor in any analysis and how it could influence new adaptations and changes and hopefully can work through the barriers and needs pointed out by technicians, administrators and citizens in finding solutions to expand the geothermal sector.

5 Conclusion

On the basis of the results presented from Focus Groups in the Pilot Areas of Germany, Italy and Slovenia, the understanding of differences and similarities of barriers and needs regarding the expansion of the geothermal system in the given countries have identified the initial installation cost as a common barrier.

The data analysed in this comparison reveal each of these countries having different needs and barriers in regulations, financial, technical, research, organisation and administration, geological maps and opportunities areas. The strong association between these barriers and local and national administration dynamics suggests own directions for policy makers and the geothermal private sector within these sampled countries to be sought for the expansion of own national geothermal sector.

While data gathering was not aimed at going into depth at cultural aspects as factors hindering the expansion of the sector, this analysis brought into light interesting aspects of the Culture of Administration or the way each society performs own management of administration-regulations, which would be worth going into depth in future analysis. Data on organisation and administration has

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reflected dynamics and activities which can help to explain gaps and over imposition for which the development of the geothermal sector may find obstacles.

By expanding the analysis of barriers, needs and opportunities, current patterns to include a deep analysis of the initial installation cost and the culture of administration practitioners and policy makers gain additional insight into opportunities for promoting the geothermal energy field in Germany, Italy and Slovenia. This systemic analysis also gives insights to further nations and cultures to use the present analysis as a guide for possible paths where to look for own answers to own barriers and opportunities.

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Annex

Focus Groups in Pilot Areas of GRETA - Activities carried out

Activity 1 - To which group you belong to: place your post-it (TARGET GROUPS SHEET. Target groups of GRETA: Local public authority; Regional public authority; Sectoral agency; Interest groups including NGOs; Higher education and research; SME; General public; Infrastructure and (public) service provider; enterprise, excluding SME)

Activity 2A - MAP OF ITALY/SLOVENIA/GERMANY: place where your institution is based.

Activity 2B- MAP OF ITALY/SLOVENIA/GERMANY: place the area your institution deals with

Activity 3 - Brainstorming of Barriers

· Commercial Barriers
· Technical Barriers
· Next Steps to advance the sector (+ Opportunities for economic growth)

Activity 4 - [Legislation / Regulatory issues in your country (including selection, licensing, approval)]. Rank which of these areas need improvement in regulation

(a) environmental protection

(b) technical/quality requirements

(c) technical reports required for authorisation

(d) clearness of regulation

(e) guidelines or standards for drillers

(f) guidelines or standards for designers

(g) interference analysis for the evaluation of effects on other existing geothermal plants

(h) regulations avoiding an overexploitation of the Near-Surface Geothermal Energy

(i) time needed for authorisation

(j) Other (please specify)

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Activity 5 - [Financial issues]. Rank the three most important issues to you

(a) Large initial investment

(b) Lack or insufficient financial incentives (e.g. low interest loans)

(c) Cost of eco-audit requested by authorities (e.g. environmental monitoring)

(d) Other (please specify)

Activity 6 - [Financial Technical; environmental framework; function & geological parameters. Rank the three most important barriers in the development of NSGE to you

(a) Insufficient technical/economical comparison (efficiency, CO2 emission, etc.) of Near-Surface Geothermal Energy systems with other heating/cooling systems

(b) Insufficient integration of the Near-Surface Geothermal Energy systems with other renewable systems

(c) Insufficient knowledge of the local geological and hydrogeological setting

(d) Insufficient preliminary identification of potential environmental impacts

(e) Difficulty to evaluate costs and payback times of Near-Surface Geothermal Energy system

(f) Other (please specify)

Activity 7 - [Financial Technical; environmental framework; function & geological parameters]. Rank the three most important technical data to obtain

(a) Geological hazards (e.g. landslides)

(b) Problematic geological conditions at depth (e.g. karstic aquifers)

(c) Geology: type of sediments/rocks up to 200m

(d) Ground temperature at depth

(e) Aquifer properties (permeability, groundwater depth, etc.)

(f) Other (please specify)

Activity 8 - [Research information]. Rank which of these sources you need most in your field

(a) Scientific literature

(b) Field work / Site-investigation

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(c) Written request to public administrations/institutions/agencies

(d) Geoportals with open/public access

(e) Geoportals with private access or subscription

(f) Other (please specify)

Activity 9 - [Organisation and administrative function]. Vote which issue you think is a barrier.

(a) Time (e.g.: timescale for developing the project from the design stage to the point of commercial operation)

(b) Lack of technical flexibility (e.g.: an increment of cooling needs, because of switching from residential to commercial use of a building, when an extra cooling power on the GSHP cannot be installed)

(c) Lack of communication or mediation between areas (e.g. fragmentation of tasks in near-surface geothermal sector)

(d) Lack of communication or mediation between areas (e.g. fragmentation of tasks in near-surface geothermal sector)

Activity 10 - [Opportunities]. Vote which areas should be prioritised in order to expand the use of near-surface geothermal systems

(a) Regulation / Normativa: Consideration of shallow geothermal energy in national/local strategies

(b) Public utility

(c) Potential increase in commercialisation of materials (e.g.: HDPE or other) in the business market

(d) Research

(e) Other (please specify)

Activity 11 - [Opportunities]. Vote which of the following maps will improve significantly the promotion and growth of the Near Surface Geothermal Energy sector

(a) Geothermal potential (e.g., W/m)

(b) Hydrogeology

(c) Geology

(d) Existing geothermal plants

(e) Existing wells and existing borehole/piezometers

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(f) Other (please specify)

Activity 12 - [Opportunities]. List areas of expansion or opportunities that should be given priority. Here are some examples: Adaptability; Communication; Fiscal Management; Risk Management; Teamwork; Technical; Other (please specify).

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