

# Reports on market actors mapping and engagement strategies

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## 1. Introduction

The GEOENVI project aims at answering environmental concerns in terms of both impacts and risks, by first setting an adapted methodology for assessing environment impacts to the project developers, and by assessing the environmental impacts and risks of geothermal projects operational or in development in Europe. The project will propose recommendations on harmonised European environmental regulations to the decision-makers and elaborate simplified LCA models to assess environmental impacts.

Deep geothermal has a great potential for development in many European countries. However, the advantages of using geothermal for power production and heating & cooling are not widely known. Recently, deep geothermal energy production in some regions is confronted with a negative perception, particularly in terms of environmental performance, which could seriously hamper its market uptake. Thus, environmental impact assessment is a prerequisite to the deployment of the deep geothermal resources.

The GEOENVI project focuses on six key countries with varying deep geothermal potential, markets maturity, and geological settings: France, Italy, Belgium, Iceland, Turkey and Hungary. These countries have been selected because they have a potential for deep geothermal and there are plants already operating or under development.

They also present different and complementary geological settings, as well as profiles of environmental concerns. By collecting information in these countries, knowledge gained in experienced markets can be made accessible and transferred to stakeholders in less developed markets all over Europe.

The objectives of this report are mainly to create a methodology and instructions for stakeholder analyses to be used in the EU funded GEOENVI project. This deliverable D5.1 introduces the market actor analysis carried out and the complementarity of this work with respect to activities carried out within WP4.

This part of the work belongs to Task 5.1: Geothermal market actors mapping. This mapping is done to ensure that our engagement effort is focused to stakeholders having highest potential towards the achievement of our objectives. This work started by identifying stakeholders and their relationships with geothermal projects. Past known experiences with the stakeholders that are relevant to the engagement strategy was also identified. This

includes, and is not limited to, geothermal developers, sub-contractors (drilling companies) and investors. Their relevance to the regulations is also evaluated as well as their openness to changes. Stakeholders mapping is normally called stakeholder analysis and we will use that term in this report.

## 2. Stakeholder analysis and the methodology adopted

### 2.1. What is stakeholder analysis?

Stakeholders in a process are actors (persons, companies or organizations) with a vested interest in a policy or a strategy being promoted (Schmeer, 2000).

As part of the development of any communication strategy or plan, it is essential that a stakeholder analysis is carried out at an early stage. This analysis typically refers to the range of techniques or tools to identify and understand the needs and expectations of major interests inside and outside the project environment (Smith, 2000).

The stakeholder analysis is a process of systematically gathering and analysing qualitative information to determine which interests should be taken into account (Schmeer, 2000) when developing and/or implementing an action, such as a policy or strategy. This technique allows to identify all key actors involved or affected by an action, and analyse their relationships and attitudes regarding potential changes. With these purposes, geothermal managers can use a stakeholder analysis to identify and map different groups of these actors, assessing their knowledge, interests, positions, alliances, and importance related to the strategy and behaviour on the market. This allows managers to interact more effectively with key stakeholders and to increase support for a given strategy or action on the market.

When a stakeholder analysis and other key tools are used to guide the implementation, the strategy or program is more likely to succeed (Schmeer, 2000).

The typical workflow for the stakeholder analysis, also adopted within Task 5.1 of GEOENVI Project, starts with planning and then selects and define the case. In GEOENVI the focus was the geothermal industry in project countries: Belgium, France, Hungary, Iceland, Italy and Turkey. Then, stakeholders have to be identified, tools have to be selected and implemented and information are collected and recorded. The stakeholder mapping may include their categorization in different groups, according to their role towards a thematic, as in the case of

GEOENVI, it is the geothermal market. Details on examples of stakeholder categorization in geothermal sector are detailed in the next chapter.

The work done allows to prepare a stakeholder matrix/table, to be then analysed. This typical workflow finishes with a monitor of expectations and their improvement.

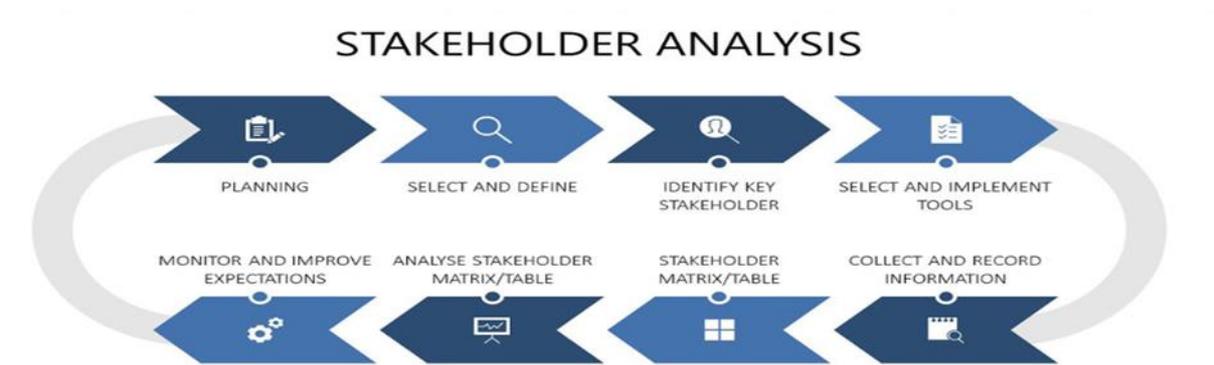


Figure 1. Typical workflow and sub-tasks.

## 2.2. Categories and matrixes/tables in geothermal industry

The stakeholder mapping adopted by the GEOENVI project grounded on two studies on the geothermal energy sector in Iceland. One was carried out in 2011 and was published by The Icelandic Geothermal Cluster and Arion bank<sup>1</sup>. The other is from 2016 and was published by Promote Iceland<sup>2</sup>, a governmental agency. This study includes an industry survey on the geothermal sector in Iceland, based on desktop analysis and interviews. It has the same approach to the Promote Iceland's work, but it lists more detailed categories of geothermal stakeholders.

Both of those studies were using the same matrix or framework for mapping the stakeholders in the geothermal industry of Iceland.

<sup>1</sup> <http://www.icelandgeothermal.is/cluster-members/>

<sup>2</sup> <https://promoteiceland.org/>

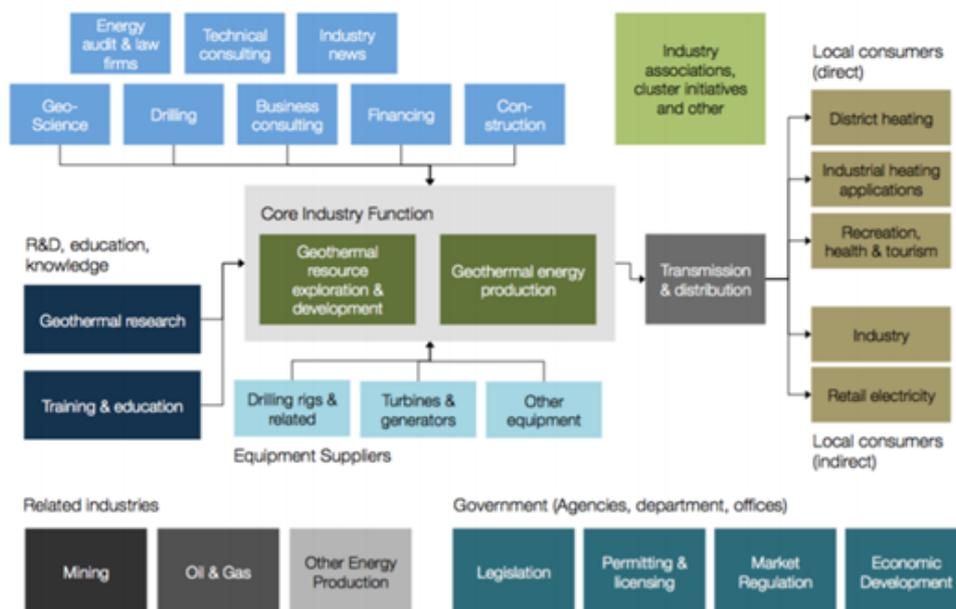


Figure 2. The geothermal value chain, adapted and updated from Icelandic Geothermal Cluster and GEOELEC .

The figure above shows an overview of the “Geothermal Value Chain” that defines the key stakeholders of the geothermal energy industry in Iceland, based on different roles they play.

### 2.3. Stakeholder analysis – the methodology adopted in GEOENVI

The stakeholder analysis carried out within Task 5.1 of GEOENVI project adopted the typical workflow and sub-task workflow described above. The methodology used for the first step of the stakeholder analysis was a *desk analysis*. This analysis is simple and it is basically involved in collecting data from existing resources, hence it is often considered a low cost technique as compared to field research, as the main cost is involved in executive’s time, telephone charges and directories.

After discussions between GEOENVI partners, it was decided to use a kind of a “best practice” mixture from the categories, which was introduced in Chapter 2.2 above.

Methodology 1: adapted from the Icelandic Geothermal Cluster and Arion bank (2011)	Methodology 2: developed by Promote Iceland (2016)	Methodology 3: mix of both categorisation of stakeholder
Geoscience **	Geoscience (sub-surface geo-scientific work and related activities)	Geoscience **
Drilling companies **	Drilling (the actual drilling activity, but also drilling services)	Drilling companies **
Construction **	Engineering (this includes among others design of plants and related activities)	Construction **
Geothermal energy production	Construction (activities related to the construction of plants, including civil work)	Core operation
Geothermal resource exploitation & development	Development (direct project development activities of both power and heating projects)	Equipment, suppliers and maintenance
Equipment suppliers	Operation (companies that are operating plants)	Distribution
Transmission & distribution	Equipment/ maintenance (equipment suppliers and companies providing services in the maintenance of power plants)	Direct consumers
Local consumers (direct)	Transmission & related (among others design, construction and operation of transmission infrastructure)	Indirect consumers

Figure 3. The two methodologies introduced in Chapter 4 and the mix of both categorizations

The methodology agreed by partners was then adjusted, to obtain following categories:

- **Academia and research:** universities, research centres and sub-surface geo-scientific work
- **Drilling companies:** companies carrying out drilling activities and services
- **Project developers and construction:** organizations carrying out construction of power plants and geothermal district heating, including civil works, drilling activities and services
- **Core operation:** public or private companies and/or local authorities managing district heating systems (networks and/or geothermal heat exchanger and pumping plants) and power plants
- **Equipment, suppliers and maintenance:** equipment suppliers and companies providing services in the maintenance of power plants and geothermal district heating
- **Distribution and indirect consumers:** companies distributing electricity, industry and retail electricity and their associations
- **Civil society representatives:** representatives of citizen associations (environmental associations, local associations for the promotion of the territories, etc.), NGOs, journalists and communication operators, district heating users, industrial heating applications, recreation, health and tourism sectors and their associations
- **Service providers:** consultancy in the fields of engineering and technical services.
- **Associations:** associations of professionals and/or of industries, with particular reference to those focused on geothermal sector

- **Supporters:** Public and private financial institutions and companies funding (also with European funds) mainly research, innovation and education, but also entities working in for the economic development and linked to the geothermal sector.

Particular importance was given to project developers, since they are one of the main target categories to present of project activities and results.

Stakeholders belonging to each of the categories listed above were mapped by all project partners in Belgium, France, Hungary, Iceland, Italy and Turkey, identifying for each of them relationships with geothermal projects, potential impacts from the adoption of LCA (Life Cycle Assessment) methodology and their openness to change. The analysis also identified which impacts might occur to these market actors, from the adoption of LCA methodology (e.g. additional head counts, raise of their awareness on impacts of geothermal projects, etc.) and a proposal of scenarios for their engagement within GEOENVI, which can be e.g. Workshops, capacity building, newsletter, articles in newspapers, webinar, etc.

With these aims, all project partners were asked to fill the matrix reported below.

**G E O E N V I**

WP 5 Key Stakeholder mapping					
Partner Name:					
Country:					
Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
	Academia and research				
	Drilling companies				
	Project developers and con:				
	Core operation				
	Equipment, suppliers and m				
	Distribution and indirect cor				
	Civil society representatives				
	Service providers				

Figure 4. Excel form for the execution of the stakeholder analysis.

Results of stakeholder mapping were finally analysed, in order to elaborate engagement strategies of different categories, which will lead to their stimulation and involvement in GEOENVI project, for a successful implementation of projects results.

### 3. Results of GEOENVI stakeholder analysis in each project country

#### Belgium

In Belgium there are 46 geothermal stakeholders listed in the analysis.

The Belgian geothermal industry is still relatively limited in size. The largest potential for deep geothermal development is provided by sedimentary basins located in the Mons Basin in the South (Wallonia region) and Campine Basin in the North (Flanders). The use of shallow geothermal systems is more developed in the northern part of the country than in the South, because of cheaper drilling costs and favourable legislation. The cheaper drilling costs are due to difference in geology, in Flanders the first 150 m are mainly sediments (clay and sand), while in Wallonia hard rocks are cropping out or are near to surface. In Wallonia, the use of deep geothermal energy is currently limited to the Mons-Borinage area where 3 heating networks are operated and managed by a single operator, the regional economic intermunicipal IDEA.

Since the end of 2018 an insurance system for geological risk is in place in Flanders. Up to date two deep geothermal projects have benefited from this insurance scheme. These geothermal installations aim at supplying either heat and sanitary hot water for industrial processes and heat for a small district heating network. Additionally, the production of electricity is to be demonstrated at one of the sites by the use of an ORC. If the two projects are successful it will pave the way for new geothermal developments in the northern part of the country. The number of operators and project developers is still low in Belgium however there is a regain of interest for geothermal energy. For example, a company that focuses on the development of deep geothermal energy has recently been created in Flanders. With a primary focus on the Campine basin its ambition is to drill more than 1,000m deep in order to use the natural heat of the earth for heat networks and electricity production. Only two Belgian drilling companies active in the geothermal sector have been mapped in the analysis. This sector is not yet extensively developed for deep drilling and most of the deep projects involved international drilling companies.

Among the stakeholders listed, there are 8 distributions companies. In this category, regulating organizations are included as well as gas and electricity distribution companies and electricity producer and supplier.

Six “academia and research” organisations have been recognized as active in geothermal. There are involved in various research projects focussing either on technology innovation and development or on resource exploration and geothermal reservoir follow-up. Most of the institutions work together with industrial partners on these topics. Furthermore, 7 public and private financial institutions are active in the geothermal sector. Most of them provide financial support to project developers by investing in projects at various stage of projects. This category includes inter-municipalities, provincial development agencies and banks.

Six service providers are also included in the analysis. They are mainly consultants working as engineering partners and experts taking part either during feasibility stage of the projects are following the operation stage.

There are 3 associations of professionals and/or industries. Two entities in core operation (project development/operation), 2 equipment suppliers and maintenance Are also included in the list of stakeholders. In addition, there are 8 organisations labelled under the term “other”. They include an independent institutional actor in charge of nuclear control, a development agency which promotes geothermal and seek the roll out of deep geothermal energy in the Campine region, 3 drinking water related companies and a membership organization. Finally, the analysis includes 2 organisations regrouping civil society representatives.

See tables on key market actors mapping for Belgium in appendixes, chapter 7.

## France

The total numbers of geothermal stakeholders in France are 88. The largest single group of stakeholders for France are service providers, 22 consultancy organisations in the fields of engineering and technical services. There are 13 stakeholders in core operation of geothermal powerplants and/or district heating systems. There are other 13 entities defined as equipment suppliers and service companies. Eleven stakeholders are in academia and research, seven are civil society representatives, and six from associations. Finally there are 16 other stakeholders, including drilling companies, distribution, supporters etc.

The French geothermal district heating industry is well established and experienced, as many of the 74 existing installations have been installed since the 80s. Developments have increased again for the past 15 years, benefiting from the new ADEME Heat Fund. Geothermal installations supply heating and sanitary hot water to around 300,000 households. In the Paris area, around 200,000 households are currently supplied by geothermal heat, which amounts

to more than 240 000 tons of CO<sub>2</sub> avoided annually. Despite this installed capacity in GeoDH, France has been slowly caught up by other European countries, and on current trends, is likely to be passed by Germany in the role of first EU country in terms of installed geothermal district heating capacity.

(Source: In the Upper Rhine Graben (Alsace), building on the experience of Soultz-sous-Forêts power plant and Rittershoffen heat plant, several Enhanced Geothermal System (EGS) projects are under development to produce electricity and heat.)

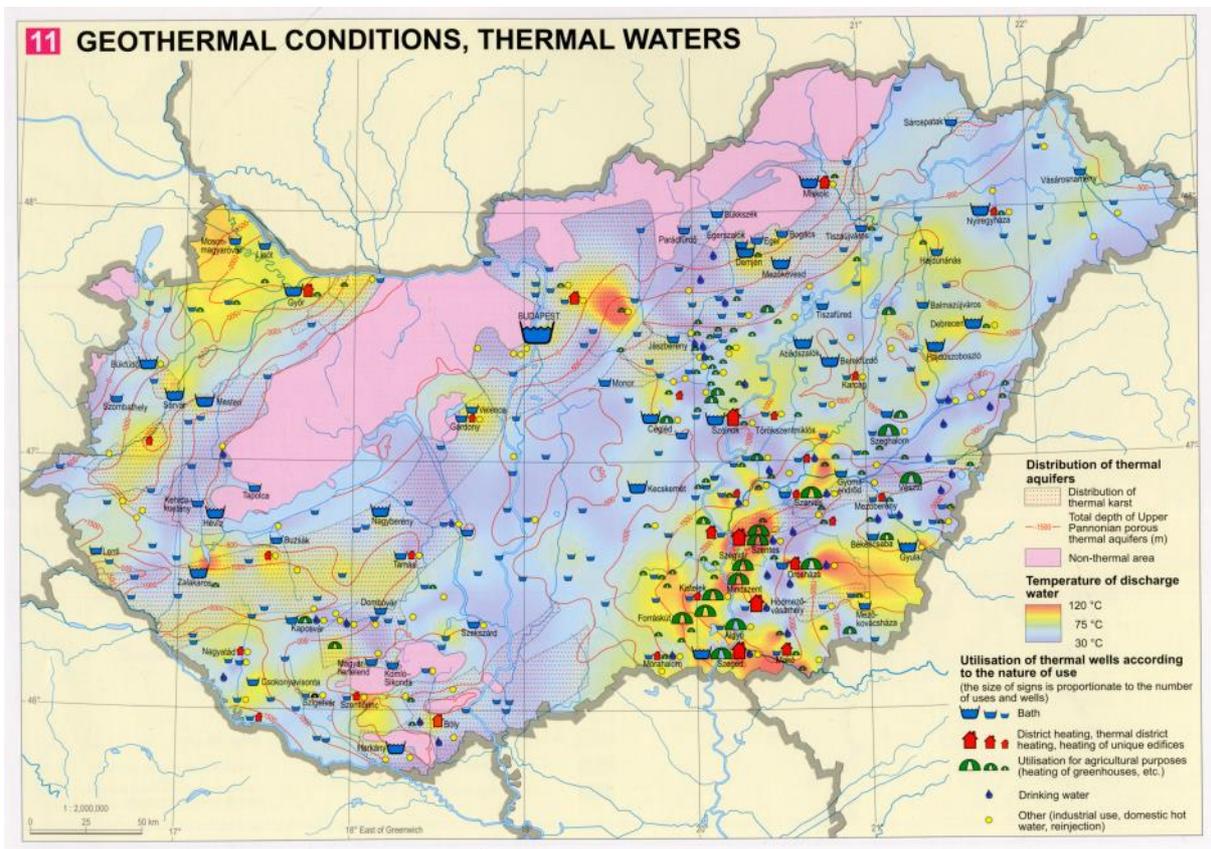
See tables on key market actors mapping for France in appendixes, chapter 7.

## Hungary

Hungary lies in the central part of the Pannonian basin, which is one of the European areas with a well-known positive geothermal anomaly, where the rich geothermal resources have been utilized mainly for direct use purposes since the 1960's, thus the Hungarian market can be considered as a mature one, with well developed technologies in drilling and operating 100-2000 m deep thermal water wells with outflow temperature between 30 and 90C on average, mostly used for various purposes of heating and balneology. There are nearly 900 operating thermal water wells (with outflow temperature higher than 30 C), and the several decade operation of the majority of these wells resulted in a significant experience accumulated over the decades. However it also means, that the Hungarian market is mostly represented by small companies (farmers heating their greenhouses, or local spas), whose operation is based on "traditions" and the in-depth knowledge of the local geology, and are less interested in new technologies and methods. There are a few larger operators and international companies entering the market to invest into large scale geothermal district heating, or power production projects, who are ready to face new challenges, e.g adapt LCA methodologies.

In Hungary, geothermal district-heating and thermal-water heating cascade systems represent a major part of direct use available in 23 towns representing about 223 MWth installed capacity and 636 GWhth/y annual production. Individual space heating (mostly associated with spas) is available at nearly 40 locations representing an estimated installed capacity of about 77,2 MWth and 83,1 GWhth/yr production. The agriculture sector is still a key player in direct use, especially in the S-ern part of the Hungary, where heating of greenhouses and plastic tents

have long traditions. These account for about 358 MWth installed capacity and 803 GWhth/yr production. Balneology – i.e. bathing in natural mineral waters for health and wellness - has historical traditions in Hungary, more than 250 wells yield thermal water, sometimes medicinal waters which represent a total installed capacity of 249,5 MWth with an annual use of about 745,5 GWhth/yr. Thus the total installed capacity for direct use is 908,06 MW. The first Hungarian geothermal power plant project has been implemented in Tura, NE from Budapest. Its actual gross electricity production is 2.3 MWe, of which nearly 1 MWe is the electricity demand of the power plant. Thus, it is capable of 1.3 MWe net. An 11-hectare greenhouse complex is also planned to use the remaining heat.



Main thermal water utilisation types and sites in Hungary

This extensive use underpins that many stakeholders (especially users) exist in Hungary, however their great majority are small individuals or companies (e.g. farmers, local spas) who have less interest in LCA, therefore in the current study only 29 stakeholders were mapped. There are seven organisations in core operation of geothermal activities, these are the largest companies for exploration, exploitation and operation of large-scale (10 MW or bigger) projects,

(e.g. Pannergy Ltd, CEGE Ltd, Mecsekérc Plc, Sztáv Ltd, etc). Six stakeholders are defined as associations, these are clusters of smaller companies, users in geothermal, or renewable energy. The five service providers comprise the best acknowledged technical and engineering consultants, such as Mannvit, Geotermia Express, or companies specialized in certain services, such as e.g. geophysical logging of wells (Geo-Log), or well-testing (Golder Associate). Then there are four drilling companies, three in academia and research, who represent the most prominent Hungarian Universities with trainings on geothermal. Other stakeholders are supporters, in geoscience and one is not defined.

See tables on key market actors mapping for Hungary in appendixes, chapter 7.

## Iceland

Iceland is a pioneer in the use of geothermal energy for space heating. Generating electricity with geothermal energy has increased significantly in recent years. In 2018, roughly 90% of primary energy use in Iceland came from indigenous renewable resources. Geothermal sources accounts for 65% of Iceland's primary energy use.

Even though geothermal utilisation is large in Iceland low population means that stakeholders or active organisations are very few compared to the other countries in GEOENVI. The total stakeholders in this mapping are 19 in Iceland. There are 4 large core operators, excluding many small district heating operators and four organisations are defined as academia and research. There are also four supporters, e.g. public and private financial institutions and funding companies. Then there are two companies providing services in the maintenance of power plants and geothermal district heating. The other entities are drilling companies, project developers, service providers and civil society representatives.

See tables on key market actors mapping for Iceland in appendixes, chapter 7.

While the energy companies are either state-owned, like in the case of Landsvirkjun (National Power Company), municipality-owned (Orkuveita Reykjavíkur), privately owned (HS Orka, HS Veita), they have played a crucial role in the international positioning of the Icelandic geothermal sector. Through the development of projects, they essentially helped to create the geothermal industry of Iceland as it exists today. The energy companies have been going to great lengths to promote geothermal energy often in partnership with government activities, but also private sector initiatives and business development efforts internationally. This was paired with ambitious development and development plans in Iceland.

The energy companies source most of their equipment from international vendors, with limited use of components manufactured in Iceland. While using Icelandic engineers and contractors, the energy companies have cooperated only on a limited basis on technology development with potential suppliers and manufacturers in Iceland.

The service firms of the geothermal sector, such as engineering firms and consultancies were facing huge challenges following the financial crisis of 2008. With the sudden stop of development in Iceland, the companies had focus on finding work internationally. This also increased the competition among the companies that often found themselves bidding for the same projects abroad. Some of the companies partnered up on specific projects or markets, but there have been limited concrete cooperation efforts to possibly offer more complete packages of services that would cover a larger part of the development of geothermal projects. Overall there are limited concerted efforts being made to go after specific regions or markets to offer the capabilities of the Icelandic geothermal sector as a package. Furthermore, presenting themselves internationally, service companies such as the engineering firms, often present the same reference projects in Iceland. The role of ÍSOR in this context, as state-owned service firm, is special, but the company is often a crucial partner for the private service firms to originate business abroad.

There is little technical development taking place in Iceland with the majority of plant components being sourced internationally. There are though R&D efforts by both the energy firms, but also private sector companies. With the startup accelerator program, Startup Energy Reykjavik, an incentive is given for some innovation and development of actual products for the energy market, and this also applies to possible components and products being used in the geothermal sector. There are though a variety of companies, both larger, but also small firms focusing on specific components. While all on a very small scale, there are large opportunities for these firms to apply their products and know-how on opportunities internationally. But so far the efforts of these companies are mostly underestimated and unknown with little visibility.

## Italy

Italy has a mature and developed deep geothermal market, mainly referred to power production, also thanks to its long experience in using deep geothermal energy, since it was the world's first country using geothermal steam to produce electricity. Since then, the geothermal power production has been grown continuously and in 2017, Italy had a total

installed capacity of 915,5 MWe, generating 6,1 TWhe of electricity, making Italy one of the main producers of electricity from geothermal energy in Europe and the first in UE-27 (EGEC 2019). All the 34 Italian geothermal power plants are in Tuscany, in the two geothermal areas of Larderello-Travale and Mt. Amiata.

In 2010, the legislative decree n. 22 liberalized the Italian geothermal sector, making the market become more open to new developers (EGEC 2019). This resulted in about 120 applications for new research permits for deep geothermal resources, for power generation, cogeneration and district heating. Despite in Italy there is a large untapped potential, this initial rush, few projects completed the surface exploration and, in most cases, the Environmental Impact Assessment (EIA) procedure required for the mining lease is still ongoing. A further development of the geothermal sector requires high investments and should be supported with a stable authorization framework and guarantee schemes to cover the mining risk, as well as greater social acceptance of geothermal technologies, which is limited due to misinformation and environmental concerns.

Regarding heat uses of deep resources, in 2017 Italy had 146,6 MWt of geothermal district heating, supplying 253,5 GWth (EGEC 2019), and 1,28 GWt, supplying 2,89 GWth for other direct uses in agriculture, industrial processes, buildings (not heated by a DH network), balneology and other minor uses (Manzella et al. 2019). Unlike power generation, examples of geothermal heat uses are well widespread also in other region and in particular into the northern part of the country.

The GEOENVI Italian partners mapped 100 stakeholders, with different relationships with geothermal projects and mainly located in Central and Northern Italy.

There are 20 mapped subjects belonging to the category of geothermal developers, of which Enel Green Power is member of the GEOENVI consortium and 6 are members of Rete Geotermica, the association of geothermal stakeholders, which is partner of GEOENVI. 19 developers own research permits, but only Enel Green Power owns and manages operating geothermal power plants so far and it is one of the world's leading company for installed capacity. 5 actors belonging to project developers are owners of mining leases: 1 for district heating, 1 for flash plants and 4 for pilot plants. In general, project developers could benefit from the adoption of LCA methodologies, since this analysis could help in identifying possible environmental impacts of their activities and thus in finding solutions for their mitigation. However, they might need staff trained on how to carry out LCA.

Academia and research organisations are 18 (e.g. universities, research centre's and sub-surface geo-scientific providers), of which CNR (National Research Council) and CSGI (Center for Colloid and Surface Science) are partners of GEOENVI and Universities of Firenze and Siena are directly involved in GEOENVI, as members of CSGI. Apart from these last two universities, very few research centers worked on LCA for geothermal plants, despite this kind of analysis on geothermal projects could be and added value for teaching and researches for all subjects belonging to this category.

Mapped associations and clusters of geothermal stakeholders are 10. Rete Geotermica is partner of GEOENVI project and it is one of the two associations focused on geothermal energy. Tuscan Technology cluster on energy and green economy is managed by CoSviG (partner of GEOENVI) and has many actors involved in the geothermal supply chain of Tuscany. Some other associations provided a support letter to GEOENVI. In general, this category can play an active role in disseminating project results and LCA methodologies for geothermal projects to their members.

12 associations or groups of citizens have been mapped within GEOENVI in Italy. Most of them have the protection of the environment as main objective. This category includes both associations against industrial geothermal energy and associations promoting geothermal energy. Besides, civil society representatives include trade unions of citizens working in geothermal sector, journalists and communities living in geothermal areas. Stakeholders belonging to this category should be favourable to a transparent LCA and results from the adoption of LCA should raise their awareness on geothermal energy.

Companies belonging to core operation only are 2 and manage geothermal DH networks. They can provide information on energy used by DH systems, connected to geothermal power plants.

Mapped actors belonging to distribution and indirect consumers are 4, including the high voltage grid manager.

Main drilling companies involved in geothermal projects are 3 and they can benefit from the adoption of LCA methodologies, since they could mitigate possible environmental impacts during drilling activities, also using best methods and innovative components.

Among mapped geothermal market actors in Italy, there are 16 subjects which provide plant equipment (e.g. systems for binary plants, turbines, pipelines, heat exchangers, etc.), or consultancies in maintenance operations on geothermal power plants or district heating. The adoption of the LCA methodology and its results could be of help for them to better understand

environmental performances of their products. Some of them are involved in testing new components, including those with a lower environmental impacts.

Finally, regarding service providers, there are 15 mapped actors in Italy. The GEOENVI partner CoSviG is a public owned company of Tuscan geothermal areas and its core business is promoting the development of its territories, but it also proposes consultancies on direct heat uses and corrosion and scaling prevention, innovation technology transfer and best environmental technologies and methods. Most of actors belonging to this category provide services on power and DH plant designing, resource identification (including reservoir modelling) and in carrying out environmental studies for EIA. These last companies might need staff trained on LCA methods for geothermal energy, whereas other service providers may benefit from results of LCA to identify solutions for a lower environmental impact.

See tables on key market actors mapping for Italy in appendixes, chapter 7.

## Turkey

Turkey's geothermal history goes back to the 1960s. It has a large geothermal potential with 94% of the geothermal resources are low and medium heat, and suitable for direct applications (heating, thermal tourism, the output of minerals, etc.), while 6% are suitable for indirect applications such as the generation of electricity. Up to now, nearly a total of 1,200 geothermal exploratory, production and reinjection wells have been drilled, and nearly 80% of these wells have been drilled in the Western Anatolia of Turkey. With 1,347 MW installed capacity for power production Turkey is now a part of five countries that have more than 1 GW installed capacity, with a further target of 4,000 MW of capacity to be reached by 2030. Besides power production, Turkey exploits geothermal energy for district and greenhouse heating, taking second place within Europe with 872 MWth installed capacity following Iceland (See Pieter Valkering and Sarah Delvaux, GEOENVI report D4.1. Decision-making process mapping).

Turkey has the largest number of stakeholders among the six participating countries in the GEOENVI project, with the total of 104 organisations. Almost 70%, or 69 in total, of the stakeholders in Turkey are core operators of public, private geothermal energy companies or district heating. Then there are nine service providers, eight drilling companies and four project developers. Stakeholders from academia and research organisations are four, three from

associations and other three from civil society representatives. Other four are not defined in a certain category.

See tables on key market actors mapping for Turkey in appendixes, chapter 7.

## Comparison between countries

It can be interesting and useful to compare the mapping and different emphasis between the six countries involved in this analysis.

*Table 1. Number of stakeholders belonging to each category in Project countries.*

Categories/countries	Belgium	France	Hungary	Iceland	Italy	Turkey	Total
Academia & research	6	11	3	4	18	4	46
Drilling companies	2	3	4	1	3	8	21
Project developers				1	20	4	25
Core operation	2	13	7	4	2	69	97
Equipment, suppliers	2	13		2	16		33
Distribution	8	4		1	4		17
Civil society	2	7		1	12	3	25
Service providers	6	22	6	1	15	9	59
Associations	3	6	6		10	3	28
Supporters		4	1	4			9
Public	7						7
Other	8	5	2			4	19
<b>Total</b>	<b>46</b>	<b>88</b>	<b>29</b>	<b>19</b>	<b>100</b>	<b>104</b>	<b>386</b>

As can be seen from the table above, there are 386 stakeholders listed in this analysis. The number of stakeholders listed in each member country is most likely reflecting the size of the population, industry and infrastructure in each country. It is clear that the numbers of stakeholders in each of the categories can be quite different between the six countries. While the number of stakeholders in academia and research is quite high in Italy, it is low in Turkey. The highest difference is the category of core operation stakeholders, with 69 in Turkey but only 2 in Belgium and Italy. The number of distributors is high in Belgium, but relative low in the other countries.

It should be noticed that there can be some overlaps between categories, like project developers, equipment and suppliers and service providers. This can also be the case between civil society, associations and supporters. Then, Belgium is the only country that use the category “public” financial institutions. This can be explained by different habits, culture, industrial structure and languages in the six countries.

## 4. Engagement strategies to be adopted for mapped actors

The main engagement strategies or scenarios are already decided in the stakeholder mapping for each country and they take into account following tools: workshops, data collaboration, newsletters, articles in newspapers, webinars or other channels. This can simply be shown in the matrix below.

*Table 2. Engagement scenarios for each stakeholder category.*

Stakeholders/tools	Workshops	Data collab	Capacity build	Newsletters	Articles	Webinar	Other
Academia & research							
Drilling companies							
Project developers							
Core operation							
Equipment, suppliers							
Distribution							
Civil society							
Service providers							
Associations							
Supporters							
Public							
Other							

It is possible that different engagement tools or strategies should be used for different groups of stakeholders. However the stakeholder mapping results show that in most cases workshops and webinars would be used as an engagement strategy in all countries involved. For the preparation of the engagement of stakeholders it is important that each partner and persons use their professional and social network to contact different stakeholders. Each partner might have contact lists, databases and lists of customers. Social media as LinkedIn, Facebook, Twitter, Instagram, etc. are also good examples of networks that can be useful for stakeholder engagement.

It has already been decided to organise workshops and/or webinar in each of the 6 countries in the project. Market stakeholders will be invited to inform and investigate the interest in using LCA guidelines that will be developed and published during the GEOENVI project.

Engagement strategies are going to be organized accordingly as a means of spreading the knowledge of the new approach as well as of feedback gathering from the market actors. This feedback will serve to improve the previous-established recommendations. Stakeholder

engagement at the national level will typically pivot around 3 workshops organised by national lead partners.

## 5. Conclusions

The stakeholder analysis is a process of systematically gathering and analysing qualitative information to determine which interests should be taken into account (Schmeer, 2000) when developing and/or implementing an action, such as a policy or strategy. In GEOENVI the focus was the geothermal industry in project countries: Belgium, France, Hungary, Iceland, Italy and Turkey. After discussions between GEOENVI partners, it was decided to use a kind of a “best practice” mixture from previous analysis and categories, which was introduced in Chapter 2.2 above. Stakeholders belonging to each of the categories listed in Chapter 2.3. were mapped by all project partners in Belgium, France, Hungary, Iceland, Italy and Turkey, identifying for each of them relationships with geothermal projects, potential impacts from the adoption of LCA (Life Cycle Assessment) methodology and their openness to change. Results of stakeholder mapping were finally analysed, in order to elaborate engagement strategies of different categories, which will lead to their stimulation and involvement in GEOENVI project, for a successful implementation of projects results.

The number of stakeholders listed in each member country is most likely reflecting the size of the population, industry and infrastructure in each country, and the numbers of stakeholders in each category can be quite different between countries. It is also obvious that there can be some overlap between the categories.

When it comes to engagement strategies and next steps it is clear that the most common tools or methods for stakeholder engagement are workshops and webinar. Other means like data collaboration, capacity building, interviews, newsletters and articles will also be used.

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## 7. Appendixes

### Tables on key market actors mapping in Belgium

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
VITO	Academia and research	Flemish research center, expert and partner in deep geothermal projects	YES		partner
Geological Survey of Belgium	Academia and research	The geological survey of Belgium, expert and partner in geothermal projects	YES	Should be favorable to a transparent LCA	Workshop
SCK-CEN	Academia and research	Research center on radioactivity, interested in potential environmental impacts of geothermal projects	?	LCA methodology could be an added value	invitation to webinar
Royal Observatory of Belgium	Academia and research	Federal Scientific research institute studies and monitors the seismic activity in Belgium	?	LCA methodology could be an added value research	Workshop
KU Leuven	Academia and research	Teaches and researches, involved in deep geothermal projects via PhD students	?	LCA methodology could be an added value for teaching and research	invitation to webinar
University of Mons	Academia and research	Teaches and researches, involved in several deep geothermal projects in Walloon region ( e.x. GEOTER-WALL and Porte de Nimy project)	YES	LCA methodology could be an added value for teaching and research	Workshop
Janssen Pharmaceutica	Direct consumers/Project developer	Pharmaceutical company, developer of a geothermal project to serve their heat consumption	?	LCA simplified model could be interesting for the company	Workshop

Smet Group	Drilling companies	Family enterprise specialized in underground techniques such as water treatment, geothermal energy, and drilling. Involved in the drilling of first geothermal wells in Flanders.	?	Need to integrate in the management system LCI Drilling with lower environmental impacts	invitation to webinar
GEBO	Drilling companies	GEBO is a major player in drilling in the market for groundwater extraction and energy applications.	?	Need to integrate in the management system LCI Drilling with lower environmental impacts	Invitation to Webinar
VS. GEOFORMA	Service providers	Geological and hydrogeological research and consulting company providing services to public authorities and private companies	?		invitation to webinar
Flemish Network of Entrepreneurs of the Kepen (VOKA)	Indirect consumers	Network of entrepreneurs in Flanders. Interest in geothermal projects, involved in roadmap exercise	?	Need to associate LCA and economical studies	invitation to webinar
PWC	Service providers	Is in charge of mission for the Walloon government regarding renewable energy	?	Interest in simplified LCA	Workshop
IDEA - intercommunale de Développement Economique et d'Aménagement de la région de Mons-Borinage Centre	Core operation	project developer (3 geothermal licene)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assessment Plant design with lower environmental impact	Workshop

HITA	Core operation	Company that focuses on the development of deep geothermal energy to be able to use the natural heat of the earth for heat networks and electricity production. The HITA business model ensures that municipalities and companies can step into a deep geothermal project, always with a limited risk.	YES	LCA simplified model could be interesting for the company	Workshop
Igretec	Public and private financial institutions	IGRETEC is an inter-municipal in charge of economic and territorial development of the Charleroi and South Hainaut region. It extends its vocation from 'economic developer' to include the role of 'investor' for local energy projects in favour of the town/cities and communes of the Charleroi and Thuin districts.	YES	Need to associate LCA and economical studies	Workshop
Rabobank Project Finance	Public and private financial institutions	Bank that can invest in geothermal projects	?		invitation to webinar
ING Belgium	Public and private financial institutions	Bank that can invest in geothermal projects	?		partner
Inter-municipal development agency for the Campine region (IOK)	Public and private financial institutions	Member of AFPG and GEODEEP, exploration, reservoir, drilling and plant engineering, project developer (8 geothermal licenses), 1 plant under construction	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop

Reconversion Society of Limburg (LRM)	Public and private financial institutions	Investment company attached to the Administration of Economy, Science and Innovation of the Flemish Region that provides support to companies and other entities that seek the economic transition and the development of employment in the Limburg Province.	?	interest in simplified LCA?	Invitation to Webinar
Provincial development Agency of Antwerp (POM –Antwerpen)	Public and private financial institutions	Development agency for the province of Antwerp, aiming at developing business parks and sustainable infrastructures, attracting investment in the province and enhance targeted sectors.	?	Should be favorable to a transparent LCA	invitation to webinar
Participatiemaatschappij Vlaanderen (PMV)	Public and private financial institutions		YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
Atlas Copco	Equipment, suppliers and maintenance	ORC supplier, involved in Matching H2020 project	?	Need to develop management system to provide LCI Plant design with lower environmental impacts	Workshop
Flemish Regulator for electricity and gas market (VREG)	Distribution and indirect consumers	Commission in charge of the regulation of the gas and electricity market in Belgium			Data collaboration
Fluvius	Distribution and indirect consumers	Fluvius is the distribution system operator (DSO) in Flanders for electricity and natural gas. Fluvius works independently of energy producers and suppliers	?		

Ores	Distribution and indirect consumers	Ores is the electricity and gas distribution systems operator in 75% of the communes in Wallonia.			Invitation to Webinar
Fluxys	Distribution and indirect consumers	Fluxys is a fully independent gas infrastructure group. TSO gas.			
Elia	Distribution and indirect consumers	Elia is Belgium's transmission system operator for electricity.			
Engie-Electrabel	Distribution and indirect consumers	Producer of Electricity			Invitation to Webinar
Luminus	Distribution and indirect consumers	Electricity supplier			
Engie-Fabricom	Equipment, suppliers and maintenance	Engie-Farbicom was involved in deep geothermal development in Flanders, it was in charge of building and maintaining the structures on the surface	?	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Invitation to Webinar
Walloon Commission for Energy (CWaPE)	Distribution and indirect consumers	Regional independent regulators for electricity and gas market.	?		Data collaboration
Deplasse & Associés	Service providers	Consultant involved in studies for Walloon government about deep geothermal. Consultant in district heating, and renewable energy projects	?	Need to associate LCA and economical studies	Workshop
ABO-Group	Service providers	Consultant involved in studies for Walloon government about deep geothermal	?	raise awareness about geothermal energy LCA	Workshop
Terra Energy	Service providers	independent, specialized consultancy firm in renewable thermal energy systems	?	interest in simplified LCA?	invitation to webinar

EDORA	Other	EDORA is the federation of companies developing products and services geared towards the energy transition.	?	raise awareness about geothermal energy LCA	Workshop
Tractebel Engie	Service providers	engineering partner for realizing sustainable, competitive and reliable projects	?	intrest in simplified LCA?	Workshop
The Economic, Social and Environmental Council of Wallonia, Environment Pole	civil society representatives	Consultative organ representing civil society in Wallonia composed of members from organizations representing industry, medium class, agriculture, labor organizations, and federations or environmental associations.	?	Should be favorable to a transparent LCA	Invitation to Webinar
GoodPlanet Belgium	civil society representatives	Civil organization working for the promotion of sustainable development. They develop projects, campaigns and events to raise awareness and promote sustainable development, especially through the education of the youth. They organized the visit of students to the Balmatt site	?	raise awareness about geothermal energy LCA	Invitation to Webinar
AGEOP- Association pour la Géothermie profonde en Wallonie et en Belgique	Associations	Promotion of deep geothermal energy	?	raise awareness about geothermal energy LCA	invitation to webinar
TWEED Cluster Wallonia	Associations	Its first mission is to pave the way for the setting up of high quality and industrial-size projects in the fields of production and exploitation of sustainable energy, profitable enough to attract appropriate financial means.	?	LCA methodology could be seen as an added value	invitation to webinar

Streekplatform Kempen	Associations	Network association of the local authorities of the Campine, the Province of Antwerp, political parties, social partners, and interested parties which all aim to promote socio-economic development of the Campine region	?	Should be favorable to a transparent LCA	Invitation to Webinar
Federal Agency for Nuclear Control (FANC)	Other	independent institutional actor in charge of nuclear control, look at issues related to radioactivity	?	Should be favorable to a transparent LCA	invitation to webinar
Inter-municipal development agency for the Campine region (IOK)	Other	Development agency which promotes sustainable building, energy efficiency, and sustainable mobility. They are an active actor in the Balmatt site project and seek the roll out of deep geothermal energy in the Campine region	?	raise awareness about geothermal energy LCA	invitation to webinar
Aquawal	Other	Professional Union for water cycle operators in Wallonia	?	Should be favorable to a transparent LCA	invitation to webinar
De Watergroep	Other	De Watergroep is the largest drinking water company in Flanders.		Should be favorable to a transparent LCA	invitation to webinar
PIDPA	Other	Pidpa is an operator of a public water distribution network within the meaning of the decree concerning water intended for human use.	?	Should be favorable to a transparent LCA	invitation to webinar

Flux50	Other	Flux50 is the membership organization that helps Flanders gain international recognition as a Smart Energy Region. Flux50 brings together relevant players from industry, academia and government and provides them with project support, networking opportunities and a knowledge-sharing platform.	?	raise awareness about geothermal energy LCA	Invitation to Webinar
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## Tables on key market actors mapping in France

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
BRGM	Academia and research	French Geological survey, expert and partner in deep geothermal projects	YES		partner
Ecole des Mines	Academia and research	LCA specialist, Partners of GEOenvi project through Armines	YES		partner
ENSEGID, National High School for environment, georesources and sustainable development engineering, Bordeaux	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
ENSG, Geology National High School, Nancy	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
EOST, School and Observatory of Earth Sciences, Strasbourg	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
IFPEN	Academia and research	French National Institute for Petroleum and new energies, expert and partner in deep geothermal projects			invitation to webinar
INERIS	Academia and research	French National Institute for Industrial Environment and Risks, expert in deep geothermal projects	YES		Workshop
Laboratoire Geoazur, Nice	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar

LaTEP, Laboratory of Thermal Engineering, Energy and Processes, Pau	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
Université des Antilles – which includes LARGE, Pointe-à-Pitre	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
UnilaSalle, Beauvais	Academia and research	Teaches and researches	?	LCA methodology could be seen as an added value for teaching and research	invitation to webinar
Actemium	Construction	Member of AFPG and GEODEEP, Electrical EPC at Rosny sous Bois, Villejuif	?	Need to develop management system to provide LCI Plant design with lower environmental impacts	Workshop
DALKIA	Core operation	Member of AFPG, heat district and plant engineering, geothermal plant operator (18)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
Electerre de France	Core operation	Member of AFPG and GEODEEP, exploration, reservoir engineering, project developper (2 geothermal licences)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
ENGIE	Core operation	Member of AFPG, project developper (1 geothermal licence in Indonesia, 3 in Mexico)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop

ENGIE Réseaux	Core operation	Member of AFPG, heat district and plant engineering, geothermal plant operator (10)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
ES-Géothermie	Core operation	Member of AFPG and GEODEEP, General manager president of AFPG, exploration, reservoir and plant engineering, geothermal plant operator (2)	YES	Need to integrate LCA methodology for project impact assesment Plant design and operation with lower environmental impacts	partner
Fonroche Géothermie	Core operation	Member of AFPG and GEODEEP, exploration, reservoir, drilling and plant engineering, project developper (8 geothermal licences), 1 plant under construction	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
Géothermie Bouillante	Core operation	Geothermal plant operator (1), new drilling planned	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
Groupe ES	Core operation	Member of AFPG, project developper (6 geothermal licences)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop

IDEX	Core operation	Member of AFPG, heat district and plant engineering, geothermal plant operator	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
SEMHACH	Core operation	Member of AFPG, district heating and geothermal plant operator (3)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
STORENGY	Core operation	Member of AFPG and GEODEEP, exploration, reservoir, drilling (Gentilly, Bordeaux...), project developer (1 geothermal licence)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
TERANOV	Core operation	Exploration, reservoir engineering, project developer (1 geothermal licence)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
TLS Geothermics	Core operation	Member of AFPG and GEODEEP, exploration, reservoir engineering, project developer (2 geothermal licences)	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
CRE	Distribution and indirect consumers	Commission in charge of the regulation of the gaz and electricity market in France	Yes		Data collaboration

CPCU	Distribution and indirect consumers	District heating operator	YES	Need to associate LCA and economical studies Need to integrate LCA methodology for project impact assesment Plant design with lower environmental impact	Workshop
ENEDIS	Distribution and indirect consumers	distributes 95% of the electricity in France			
RTE	Distribution and indirect consumers	has the monopoly of electricity transport in France			
Entreprose drilling	Drilling companies	Member of AFPD and GEODEEP, drilling company (50 wells in France)	?	Need to integrate in the management system LCI Drilling with lower environmental impacts	Invitation to Webinar
Foragelec	Drilling companies	Drilling company	?	Need to integrate in the management system LCI Drilling with lower environmental impacts	Invitation to Webinar
SMP	Drilling companies	Member of AFPD, drilling company	?	Need to integrate in the management system LCI Drilling with lower environmental impacts	Invitation to Webinar
Aqseptence Group SAS	Equipment, suppliers and maintenance	Member of AFPD, provider of filtration solution	?	Need to develop management system to provide LCI	Invitation to Webinar
Aquaprox	Equipment, suppliers and maintenance	Member of AFPD, provider of inhibitors	YES	Need to perform LCA on inhibitors Developpement of "green" inhibitors	Invitation to Webinar
Cryostar	Equipment, suppliers and maintenance	member of GEODDEP, turbines manufacturer (Alasehir, Turkey, Unterhaching, Germany...)	?	Need to develop management system to provide LCI	Invitation to Webinar
DRILLSTAR	Equipment, suppliers and maintenance	Drilling equipment supplier	?	Need to perform LCA on drilling equipment	Invitation to Webinar

Enertime	Equipment, suppliers and maintenance	Member of AFPG, ORC supplier	YES	Need to develop management system to provide LCI Plant design with lower environmental impacts	Workshop
ENOGIA	Equipment, suppliers and maintenance	ORC supplier, involved in MEET H2020 project	YES	Need to develop management system to provide LCI Plant design with lower environmental impacts	Workshop
Funke	Equipment, suppliers and maintenance	Member of AFPG, heat exchangers supplier	?	Need to develop management system to provide LCI	Invitation to Webinar
ITECO	Equipment, suppliers and maintenance	Member of AFPG, casing supplier	?	Need to perform LCA on casing	Invitation to Webinar
NALCO	Equipment, suppliers and maintenance	Provider of inhibitors	YES	Need to perform LCA on inhibitors Developpement of "green" inhibitors	Workshop
SERCO	Equipment, suppliers and maintenance	Casing supplier	?	Need to perform LCA on casing	Invitation to Webinar
SUEZ WTS	Equipment, suppliers and maintenance	Member of AFPG, provider of inhibitors	YES	Need to perform LCA on inhibitors Developpement of "green" inhibitors	Workshop
Vallourec	Equipment, suppliers and maintenance	Casing supplier	?	Need to perform LCA on casing	Invitation to Webinar
Varel Europe	Equipment, suppliers and maintenance	Drilling equipment supplier	?	Need to perform LCA on drilling equipment	Invitation to Webinar
CLER	civil society representatives	NGO proactive force in the transtion debate, promotes ENR	YES	Should be favorable to a transparent LCA	interview
Environnement magazine	civil society representatives	Journalist, reports on some geothermal energy topics	yes	raise awarress about geothermal energy LCA	invitation to webinar
France Nature Environnement	civil society representatives	NGO, Regional branch supports direct use of geothermal energy but against EGS (fears aquifere contamination)	YES	Should be favorable to a transparent LCA	interview

Green Peace France	civil society representatives	NGO, Position regarding geothermal energy unclear	YES	Should be favorable to a transparent LCA	interview
La gazette des communes	civil society representatives	Journalist, reports on some geothermal energy topics	yes	raise awareness about geothermal energy LCA	invitation to webinar
Ligue de protection des oiseaux	civil society representatives	NGO, Focuses on bird protection but present in the transition debate	YES	Should be favorable to a transparent LCA	interview
Sciences et Vie	civil society representatives	Journalist, reports on some geothermal energy topics	yes	raise awareness about geothermal energy LCA	invitation to webinar
Ademe/fonds chaleur	Supporters	Funds RES projects	Yes		workshop
Caisse des dépôts et Consignations	Supporters	Offers guarantee to cover geological risk and protects operators against the risk faced during the exploration and exploitation phases of geothermal projects.	?		Invitation to Webinar
Investment for the Future (SGPI - ADEME)	Supporters	Funds projects for the future	YES		Invitation to Webinar
BPI (FUI)	supporters	Funds R&D projects	YES		Invitation to Webinar
ALTO Ingénierie	Service providers	Member of AFPG, engineering and Assistant to the Contracting Authority	YES	Need to adopt LCA during procurement process	Workshop
Antea Group	Service providers	Member of AFPG and GEODEEP, engineering, drilling EPC	YES	Need to develop management system to provide LCI Drilling with lower environmental impacts	Workshop
BURGEAP	Service providers	Chairs the geothermal energy commission of the SER, Members of AFPG			Workshop

CFG	Service providers	Member of AFPG and GEODEEP, reservoir engineering, well design, drilling supervision, workover	YES	Need to develop management system to provide LCI Drilling with lower environmental impacts Adoption of LCA for project impact assesment, well design and drilling programs	Workshop
CGG	Service providers	Geophysical servicing company	?	Need to develop management system to provide LCI	Invitation to Webinar
CHEMFOR	Service providers	Drilling fluids company	?	Need to perform LCA on drilling fluid	Invitation to Webinar
CLAMENS	Service providers	Fluid and solid waste treatment	?	Need to perform LCA on fluid and solid waste treatment	Invitation to Webinar
EDF CIT	Service providers	Member of AFPG, engineering	YES	Need to associate LCA and economical studies District heating and plant design with lower environmental impacts	Workshop
Flodim	Service providers	Member of AFPG, logging company	?		Invitation to Webinar
G2H Conseils	Service providers	Member of AFPG, engineering	YES	Need to adopt LCA during procurement process	Workshop
GALLEGO	Service providers	Geophysical servicing company	?	Need to develop management system to provide LCI	Invitation to Webinar
GPC	Service providers	Member of AFPG and GEODEEP, general manager president of EGEC, reservoir engineering, well design, drilling supervision, workover (56 wells)	YES	Need to develop management system to provide LCI Drilling with lower environmental impacts Adoption of LCA for project impact assesment, well design and drilling programs	Workshop

ITERM Conseil	Service providers	Member of AFPG and GEODEEP, district heating and plant engineering	YES	Need to associate LCA and economical studies District heating and plant design with lower environmental impacts	Workshop
Magnitude SAS	Service providers	Seismic motinoring services	?	Participation in a research project to integrate induced seismicity in LCA studies	Invitation to Webinar
Paterna services	Service providers	Cementing and stimulation services	?	Need to develop management system to provide LCI	Invitation to Webinar
Petro LS	Service providers	Logging company	?		Invitation to Webinar
S2T	Service providers	Member of AFPG, engineering	YES	Adoption for project impact assesment	Workshop
Schlumberger S.A.	Service providers	Logging company, drilling mud, cementing and stimulation services	?	Need to perform LCA on mud, cementing and stimulation services	Invitation to Webinar
SDP Logging	Service providers	Logging company	?		Invitation to Webinar
SEMM logging	Service providers	Logging company	?		Invitation to Webinar
SERMET	Service providers	Member of AFPG, district heating and plant engineering (Cachan, Orly, Courneuve...)	YES	Need to associate LCA and economical studies District heating and plant design with lower environmental impacts	Workshop
Smart Seismic Solution	Service providers	Seismic aquisition	?	Need to develop management system to provide LCI	Invitation to Webinar
AFPG	Associations	brings together the geothermal energy professionals and promote geothermal energy	yes	Should benefit from LCA tools and comparaisons it allows in the promotion of deep geothermal energy	Workshop

SER, geothermal energy commission	Associations	gathers geothermal energy professionals and promote geothermal energy, together with others RES	Yes	Should benefit from LCA tools and comparisons it allows in the promotion of deep geothermal energy	workshop
FNCCR	Associations	gathers local authorities and professionnals managing networks	Yes	Should benefit from LCA tools and comparisons it allows in the promotion of deep geothermal energy	workshop
AMORCE	Associations	brings together local authorities involved in the ecological transition	Yes	Should benefit from LCA tools and comparisons it allows in the promotion of deep geothermal energy	workshop
SNCU (FEDENE)	Associations	brings together professionnals involved in district heating	?	Should benefit from LCA tools and comparisons it allows in the promotion of deep geothermal energy	invitation to webinar
AGEMO	Associations	brings together representatives of territories using deep geothermal district heating	?	Should benefit from LCA tools and comparisons it allows in the promotion of deep geothermal energy	workshop
Pole Avenia	Other	cluster in the geosciences sector, Pau	yes		Invitation to Webinar
Pole fibres energivie	Other	cluster dedicated to materials for the construction industry, Illkirch	?		
Synerg'île	Other	association that promotes innovation in Guadeloupe	?		
GEODEEP	Other	French geothermal Cluster for heat and power	YES		Invitation to Webinar

## Tables on key market actors mapping in Hungary

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
MOL Plc	Geoscience	Hungarian National oil company with the largest subsurface datasets and models	yes		Workshop
Cege Geothermal Concession Ltd	Core operation	geothermal daughter company of MOL Plc. Holder of one of the geothermal concessions, which is now under exploration for a CHP project (deep overpressured fissured reservoir)	yes	simplified LCA models in EIA	Workshop
Pannergy Ltd	Core operation	exploration, exploitation and operator of the 2 largest HU geothermal district heating systems (Miskolc 55 MW, Győr 52 MW) as well as a 3rd smaller one at Szentlőrinc (3 MW)	moderate	simplified LCA models in EIA	Workshop
KS Orka - Turawell Ltd	Core operation	exploitation, first geothermal power plant operator in Hungary	yes	simplified LCA models in EIA	Data collaboration
Mannvit Hungary Ltd	Service providers	technical consultation, reservoir engineering, project development	yes		Data collaboration
Mecsekérc Plc	Core operation	exploration for geothermal resources	yes	simplified LCA models in EIA	Workshop
Smaragd Ltd	Service providers	technical consultation, hydrogeology, environmental aspects of thermal water production	yes		capacity building
Geotermia Express Ltd	Service providers	technical consultation, reservoir engineering, project development	yes		capacity building

Porció Services Ltd.	Service providers	surface engineering and construction of geothermal heating projects	moderate		Workshop
Geo-Log Ltd	Service providers	geophysical logging of wells	moderate		Workshop
Golder Associates Plc	Service providers	testing of wells	yes		Workshop
Aquaplus Ltd	Drilling companies	drilling thermal water wells	yes		Workshop
VIKUV Plc	Drilling companies	drilling thermal water wells	yes		Workshop
Aquaprofit Ltd	Drilling companies	drilling thermal water wells	yes		Workshop
Rotaqua Ltd	Drilling companies	drilling thermal water wells	yes		Workshop
Hungarian Geothermal Association	Associations	cluster of mainly agricultural direct heat users	moderate		Workshop
Hungarian Thermal Energy Association	Associations	cluster of SME-s interested in geothermal	no		Workshop
Association of Renewable Energy Organisations	Associations	geothermal together with other RES (mainly solar)	moderate		Workshop
Association of Hungarian District Heat Service Providers	Associations	district heating operators	yes		capacity building
Hungarian Energy Society	Associations	interested in general in geothermal	no		Workshop
Hungarian Baths Association	Associations	balneology use only	no		Workshop
Miskolc University, Faculty of Applied Geosciences	Academia	strong faculty on deep geothermal, also combined use (e.g. metal extraction from geothermal brines)	yes		Data collaboration
Eötvös Loránd University, Dept. of Geology	Academia	mainly hydrogeological aspects of thermal karst systems and complex assessment of geofluids	yes		capacity building

Szeged University, Dept. of Mineralogy, Geochemistry and Petrology	Academia	complex expertise on developing geothermal DH systems: planning, pre-feasibility studies, modelling, reinjection	yes		data collaboration
Regional Centre for Energy Policy Research	Supporters	economic aspects of geothermal projects	yes		data collaboration
Mining Property Utilization Ltd	Other	manager of state-owned abandoned hydrocarbon wells (possible future use for geothermal)	no		workshop
Szetáv Ltd	Core operation	currently largest geothermal district heating development in the city of Szeged	yes	simplified LCA models in EIA	data collaboration
Hódmezővásárhely Municipality	Core operation	operator of one of the oldest geothermal district heating systems	moderate	simplified LCA models in EIA	workshop
Árpád Agrár Zrt	Core operation	largest operator of geothermal energy use in agriculture (greenhouses)	moderate		workshop

## Tables on key market actors mapping in Iceland

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
Landsvirkjun	Core operation	The national power company. Running 2 large geothermal plants. EU projects.	Yes	LCA is used at Þeystareikur power plant	Workshop
Reykjavik Energy	Core operation	2 large geoth. plants. Cover 100% district heating in Reykjavik area. EU projects.	Yes	LCA is used at Hellisheiði power plant	Workshop
HS-Orka	Core operation	2 large geoth. plants. Cover 100% district heating in South-west area. EU projects.	?	LCA is used in the DEEPEGS EU project	Workshop
Iceland Drilling	Drilling companies	Main drilling company in Iceland. National and international projects and activities.	?	LCA could be implemented in drilling projects. Lower environmental impacts	capacity building
ISOR	Academia and research	Geothermal exploration, logging and training. Research, consultancy and EIA.	Yes	Partner of GEOENVI	Workshop
Orkustofnun	Supporters	Public agency. Main advisor for government on energy issues.	Yes	Partner of GEOENVI	Workshop
GEORG	Supporters	Geotherman Research Cluster. Project building, management and evaluation.	Yes	Partner of GEOENVI	Workshop
Samorka	Supporters	Associations of power and district heating companies. Guarding interest in projects.	Yes	Excelent platform to introduce LCA amog partners	Data collaboration
Verkís	Service providers	Engineering, consulting, developing and construction of geothermal plants.	Yes	Need to implement LCA. Plant design with lower environmental impact	Workshop
Mannvit	Project developers and construction	Engineering, consulting, developing and construction of geothermal plants.	Yes	Need to implement LCA. Plant design with lower environmental impact	Workshop
Landsnet	Distribution and indirect consumers	Engineering, consulting, developing and construction of geothermal plants.	Yes	Need to implement LCA. Plant design with lower environmental impact	capacity building
INCA	Civil society representatives	NGO Iceland Nature Conservation Association. Nature protection.	Yes	NGO's can put pressure on industry to implement LCA methods.	Workshop

UN University	Academia and research	UN Geothermal University. Teachers and researchers. International projects.	Yes	LCA methodology could be seen as an added value for teaching and research	Workshop
University of Iceland	Academia and research	Leading in geoscience and geothermal development. International projects.	Yes	LCA methodology could be seen as an added value for teaching and research	Workshop
Reykjavik University	Academia and research	Running the Iceland school of Energy with focus on geothermal studies and projects	Yes	LCA methodology could be seen as an added value for teaching and research	Workshop
Institution of Environment	Supporters	It's role is to promote the protection as well as sustainable use of Iceland nature	?	Could help with introducing LCA and to prepare the legislation and political system	Data collaboration
VHE	Equipment, suppliers and maintenance	Leading in design and construction of geothermal power plants.	?	Develop management system for LCI. Plant construction with lower env. Impact	capacity building
Stálsmiðjan Framtak	Equipment, suppliers and maintenance	Leading in design and construction of geothermal power plants.	?	Develop management system for LCI. Plant construction with lower env. Impact	capacity building
RARIK	Core operation	Operation of several geothermal and district heating plants in rural areas.	?	Simplified LCA models	Workshop

## Tables on key market actors mapping in Italy

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
AIRU	Associations	It is the association of stakeholders of DH sector, including geoDH	YES	They can disseminate LCA methodologies. Their companies can benefit from the adoption of GEOENVI LCA methodology.	newsletter
Turboden	Equipment, suppliers and maintenance	design, manufacture and maintenance of Organic Rankine Cycle (ORC) systems	YES	Need to develop LCA for ORC power production modules. They might need staff trained on how to carry out LCA on their products. Plant components with lower and more detailed environmental impacts	Workshop
Magma energy Italia	Project developers and construction	Involved in GEOENVI project through Rete Goetermica Developers of CHP binary geothermal power plants They own an Italian GEOENVI case study Owns resource exploration permits	YES	They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	
Sorgenia geothermal	Project developers and construction	Developers of CHP binary geothermal power plants Owns resource exploration permits	YES	Need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building

Graziella Green Power	Project developers and construction	Developers of CHP binary geothermal power plants Owns resource exploration permits	YES	Need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
GEC - geothermal energy consulting	Service providers	Consultancies in geothermal project development and feasibility studies	YES	They might need staff trained on how to carry out LCA, to support their customers in carrying out LCA. Plant design with lower environmental impacts	capacity building
Steam	Service providers	Consultancies in resource assessments, drilling, feasibility studies, O&M	YES	They might need staff trained on how to carry out LCA, to support their customers in carrying out LCA. Designing of plants with lower environmental impacts	Workshop
CoSviG	Service providers	GEOENVI project partner Consultancies on direct heat uses and corrosion and scaling prevention, consortium of geothermal municipalities aimed at promoting the local sustainable development and best environmental technologies		They will organize capacity building activities on LCA for geothermal stakeholders. They can disseminate LCA methodologies	
DTE2V - Tuscan Technology cluster on energy and green economy	Associations	Managed by CoSviG. Regional Cluster. Many of its members are geothermal stakeholders	YES	They can disseminate LCA methodologies	Data collaboration
LE2C - Lombardy Energy Cleantech Cluster	Associations	Regional Cluster. Some of its members are geothermal stakeholders	YES	They can disseminate LCA methodologies	Data collaboration

Baker Hughes, a GE Company	Equipment, suppliers and maintenance	Steam Turbine & Generators, Expanders for ORC systems, compressors, Submersible Pumps, Drill bits, Cementing services	YES	They might need to develop LCA for drilling activities and components of geothermal power plants. They might need staff trained on how to carry out LCA on their products. Plant components with lower and more detailed environmental impacts	Workshop
University of Pisa	Academia and research	Reservoir modelling and resource assessment, monitoring and risk assessment. Researches in plant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
CNR	Academia and research	GEOENVI project partner Biggest public italian research center Technologies and solutions for geothermal energy, in particular for resource and potential assessment, exploration technologies, social studies, environmental and health assesment		They can disseminate LCA methodologies. LCA methodology could be seen as an added value for teaching and research.	
University of Florence	Academia and research	Involved in GEOENVI project through CSGI LCA experts, Researches in plant engineering, reservoir modelling and resource assessment, monitoring and risk assessment.		They can disseminate LCA methodologies. They can build up skills of geothermal stakeholders on LCA	
University of Siena	Academia and research	Involved in GEOENVI project through CSGI		They can disseminate LCA methodologies. They can build up	

		LCA experts and environmental aspects of geothermal energy		skills of geothermal stakeholders on LCA	
Sant'Anna School of Advanced Studies	Academia and research	LCA experts, socio-economic studies and on social acceptance, innovative business models for geothermal, economic studies on RES and environmental aspects of geothermal energy	YES	Updates on LCA methodologies from GEOENVI could be seen as an added value for teaching and research	Data collaboration
University of Padova	Academia and research	Geothermal resource assesement	?	LCA methodology could be seen as an added value for teaching and research	Data collaboration
Studio Idrogeologico GEOECO	Service providers	Enviromental assessment, geothermal resource assessments, mostly in projects for heat uses	YES	They might adopt the LCA methodology in assessments of environmental impacts	Workshop
Rete Geotermica	Associations	GEOENVI project partner Cluster of industrial geothermal stakeholders, covering the whole geothermal supply		They can disseminate LCA methodologies. Their companies can benefit from the adoption of GEOENVI LCA methodology.	
Exergy	Equipment, suppliers and maintenance	design, manufacture and maintenance of Organic Rankine Cycle (ORC) systems	YES	Need to develop LCA for ORC power production modules. They might need staff trained on how to carry out LCA. Plant components with lower and more detailed environmental impacts	Workshop
Idrogeo	Service providers	Management of exploration permits and EIA studies, design of exploratory drilling and administrative procedures for mining concessions	YES	They might adopt the LCA methodology in assessments of environmental impacts. They might	Workshop

				need staff trained on how to carry out LCA.	
PES	Equipment, suppliers and maintenance	Commissioning, monitoring and maintenance of geothermal plants	?	LCA methodology can help in reducing environmental impacts of power plants	Workshop
PM Technology Consulting Srl	Service providers	Support companies in PLM (product lifecycle management), mechanical design, consultancies on software platforms (e.g. CAD and PLM)	YES	LCA methodology can help in reducing environmental effects of power plants	Workshop
CND Service controlli non distruttivi SRL	Equipment, suppliers and maintenance	Non-destructive testing in industrial plants	?		
COMIMP SRL	Equipment, suppliers and maintenance	maintenance of industrial plants and steam lines	?		
CPTM - CONSORZIO POLO TECNOLOGICO DELLA MAGONA	Equipment, suppliers and maintenance	test site for plant components	YES	They may test new components, if needed	Workshop
Opus automazione	Equipment, suppliers and maintenance	Services to optimize drilling activities and components. Tests on plant components	YES	They may test new components, if needed	Workshop

Sintecnica	Service providers	multidisciplinary engineering and contracting company, carrying out feasibility studies, identification and choice of sites, drilling supervision, process engineering, construction and commissioning, environmental impact studies and modelling, permitting analysis and support; public consultation and stakeholder engagement management		They might need staff trained on how to carry out LCA, to support their customers in carrying out LCA. Designing of plants with lower environmental impacts	Workshop
Renewem	Project developers and construction	Owners of resource exploration permits Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations Mining lease for pilot plants	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
GES	Core operation	geothermal DH operator in most of networks in Tuscan geothermal areas	YES	They can provide information on energy used by DH systems, connected to geothermal power plants	Data collaboration
Amiata Energia	Core operation	geothermal DH operator in a Tuscan municipality	YES	They can provide information on energy used by DH systems, connected to geothermal power plants	Data collaboration
Primetec SRL	Service providers	Designing of geoDH plants	?	Designing of plants with lower environmental impacts	newsletter

Enel Green Power s.p.a.	Project developers and construction	GEOENVI project partner Owners of an Italian GEOENVI case study To date, the only operators of geothermal power plants in Italy. It owns research permits and mining leases. It develops technologies for improving the management of geothermal power plants, including environmental technologies (e.g. abatement systems) and hybrid plants	YES	They might need to develop LCA for the whole life cycle of geothermal flash steam plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	
Isolver SPA	Equipment, suppliers and maintenance	Supplies of insulating materials for thermoducts and steam pipelines	?		articles in newspapers
Larderello Impianti Srl	Equipment, suppliers and maintenance	Support in plant maintenance	?		articles in newspapers
Techno system	Equipment, suppliers and maintenance	suppliers of plate heat exchangers	?		articles in newspapers
UGI - Unione Geotermica Italiana	Associations	the national geothermal association representing industrial and research entities, has the main role of promoting geothermal energy and communicating facts, technologies, benefists		They can disseminate LCA methodologies. Their companies can benefit from the adoption of GEOENVI LCA methodology.	newsletter

Ansaldo Energia	Equipment, suppliers and maintenance	Steam turbine designers and producers		Need to develop LCA for steam power production modules. They might need staff trained on how to carry out LCA on their products. Plant components with lower and more detailed environmental impacts	Workshop
B&W-SPIG	Equipment, suppliers and maintenance	Suppliers of Air-Cooled Condensers (e.g. for binary systems)		They might need staff trained on how to carry out LCA on their products. Plant components with lower and more detailed environmental impacts	Workshop
Rotork	Equipment, suppliers and maintenance	Suppliers of electric and pneumatic actuators			articles in newspapers
Legambiente	Civil society representatives	environmental association	YES	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Scientific journalists	Civil society representatives	All journalists involved in scientific communication and in popular science		raise awareness about geothermal energy LCA	
WWF Italia	Civil society representatives	environmental association	?	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop

Fonti Rinnovabili Castelfiorentino	Project developers and construction	Holders of exploration permits Developers and operators of geothermal DH in Castelfiorentino	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal district heating. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Kyoto club	Associations	No profit organization of companies, local authorities and associations involved in reducing GHG emissions	YES	raise awarness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Greenpeace	Civil society representatives	environmental association	YES	raise awarness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Italia Nostra	Civil society representatives	environmental association	?	raise awarness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Hera	Project developers and construction	Developers and operators of geothermal DH in Ferrara	YES	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal district heating. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building

<p>Saipem</p>	<p>Drilling companies</p>		<p>?</p>	<p>Lower environmental impacts for drilling activities, by the use of the best methods and innovative components</p>	<p>Workshop</p>
<p>Elc</p>	<p>Service providers</p>	<p>Consultants for resource exploration and assessment, drilling, engineering</p>	<p>?</p>	<p>They might need staff trained on how to carry out LCA, to support their customers in carrying out LCA. Designing of plants and drillings with lower environmental impacts</p>	<p>Workshop</p>
<p>GEO THERMICS ITALY</p>	<p>Project developers and construction</p>	<p>Owners of resource exploration permits Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations</p>	<p>?</p>	<p>They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts</p>	<p>capacity building</p>
<p>GESTO ITALIA</p>	<p>Project developers and construction</p>	<p>Owners of resource exploration permits and a mining lease for pilot plants Consultancies in feasibility studies, exploration and mining lease</p>	<p>?</p>	<p>They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts</p>	<p>capacity building</p>

LA R.E.P. AMBIENTE	Project developers and construction	<p>Owners of resource exploration permits            Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations</p>	?	<p>They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts</p>	capacity building
MALPAGA	Project developers and construction	<p>Owners of resource exploration permits            Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations</p>	?	<p>They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts</p>	capacity building
SARAS	Project developers and construction	<p>Owners of resource exploration permits            Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations            Owns resource exploration permits</p>	?	<p>They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts</p>	capacity building

TERRA ENERGY	Project developers and construction	Owners of resource exploration permits Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Futuro Energia Srl	Project developers and construction	Owners of resource exploration permits Consultancies in feasibility studies, exploration and exploitation permits, documentations to obtain authorizations Owns resource exploration permits	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Elettricità futura	Associations	main association of companies operating in the electricity sector in Italy. They gave support in organizing the first GEOENVI Italian Workshop	YES	They can disseminate LCA methodologies. Their companies can benefit from the adoption of GEOENVI LCA methodology.	newsletter
Comitato geotermia SI	Civil society representatives	group of citizens from Tuscan geothermal areas, aimed at promoting geothermal energy and its public acceptance	YES	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Rete nazionale NOGESI	Civil society representatives	environmental association against industrial geothermal energy	?	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop

Local newspapers (and agencies)	Civil society representatives			raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
National Newspapers (and agencies)	Civil society representatives			raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
Associations of consumers	Distribution and indirect consumers			Should be favorable to a transparent LCA	articles in newspapers
GIGA	Civil society representatives	Non-profit ecologist association that has among its main purposes the conservation of geothermal aquifers and their cultivation	YES	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	
University of Rome	Academia and research	Reservoir modelling and resource assessment, monitoring and risk assessment. Researches in plant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
Politecnico di Milano	Academia and research	Researches in powerplant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
RSE - ricerca sistema energetico	Academia and research	Researches on electric systems, it also develops research programs in the electrical-energy sector	YES	raise awareness about geothermal energy LCA. LCA methodology could be seen as an added value for their research. They might need staff trained on LCA	Data collaboration
Franco Tosi	Equipment, suppliers and maintenance	Steam turbine producers		Need to develop LCA for steam power production modules. They might need staff trained on how to carry out LCA on their products. Plant components with lower and	Workshop

				more detailed environmental impacts	
Eni S.p.A.		interested in recovering heat from unused O&G wells		raise awareness about geothermal energy LCA.	newsletter
E-DISTRIBUZIONE SPA	Distribution and indirect consumers	low and medium voltage grid managers		raise awareness about geothermal energy LCA. Can provide data on electricity distribution	newsletter
Trade Unions	Civil society representatives	groups of citizens working in geothermal sector		Should be favorable to a transparent LCA. Application of LCA methodologies could result in an increase of jobs	articles in newspapers
STUDIO MANCHISI - Ingegneria e Servizi Integrati	Service providers	Consultants in engineering sector	YES	LCA methodology can help in reducing environmental impacts of power plants	newsletter
CSGI	Academia and research	inter-university consortium			
onda group	Distribution and indirect consumers	electricity retailers			articles in newspapers
EDRA	Service providers	geological consultants. Many of their works are aimed at demonstrating the non-sustainability of the use of deep geothermal resources	?	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop
GEPlan Consulting	Service providers	Consultants in geosciences and reservoir characterization		raise awareness about geothermal energy LCA.	Workshop
Coordinamento FREE	Associations	Aims at promoting RES and energy efficiency and the decarbonization of the economy	YES	raise awareness about geothermal energy LCA. Should be favorable to a transparent LCA	Workshop

ITW LKW Geotermia Italia S.p.a.	Project developers and construction	Owners of resource exploration permits Consultancies in feasibility studies, exploration and exploitation permits,	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
ANIM - National Association of mining engineers	Associations			raise awareness about geothermal energy LCA.	Workshop
National Council of Geologists	Associations			raise awareness about geothermal energy LCA.	Workshop
Politecnico di Torino	Academia and research	Researches in powerplant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
University of Trieste	Academia and research	Reservoir modelling and resource assessment, monitoring and risk assessment. Researches in plant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
OGS - National Institute of Oceanography and Applied Geophysics	Academia and research	internationally oriented public research institution, and performs basic and applied research in the field of geophysics	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
University of Torvergata (uniroma3)	Academia and research	Reservoir modelling and resource assessment, monitoring and risk assessment.	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
University of Bari	Academia and research	Reservoir modelling and resource assessment, monitoring and risk assessment.	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration

Waterstones Srl	Service providers	service company that operates in the wireline log as well in the geotechnical, geomechanical, hydrogeological and geophysical monitoring	?	raise awarness about geothermal energy LCA.	newsletter
Local communities	Civil society representatives	Citizens living around geothermal projects		raise awarness about geothermal energy LCA. Should be favorable to a transparent LCA	articles in newspapers
Terra Energy srl	Service providers	Reservoir modelling and resource assessment	YES	raise awarness about geothermal energy LCA.	Workshop
GeothermEx	Service providers	Reservoir modelling and drilling of geothermal wells		raise awareness about geothermal energy LCA	
Hydrodrilling	Drilling companies	Member of Rete Geotermica	YES	raise awareness about geothermal energy LCA	
INGV - Italian Institute of Geophysics and Volcanology	Academia and research	the main research institution working in seismology and volcanology, also involved in environmental aspects and georesources. It works in geothermal assessment and environmental impacts and risks.	YES	LCA methodology could be seen as an added value for research	Data collaboration
Confindustria					
University of Naples Federico II	Academia and research	Researches in powerplant engineering	YES	LCA methodology could be seen as an added value for teaching and research	Data collaboration
Schlumberger	Drilling companies	Reservoir modelling and drilling of geothermal wells		raise awarness about geothermal energy LCA.	Workshop

ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development	Academia and research	carries out research and analyses of the national energy system	YES	LCA methodology could be seen as an added value for research	Workshop
Termomeccanica srl	Equipment, suppliers and maintenance	Industrial holding producing pumps		raise awareness about geothermal energy LCA, plant components with lower environmental impacts	newsletter
Cogeme Nuove Energie S.r.l.	Project developers and construction	Owens resource exploration permits	?	Need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Reggelbergbau S.r.l.	Project developers and construction	Owens resource exploration permits	?	Need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Tosco Geo Srl	Project developers and construction	Owens resource exploration permits Mining lease for pilot plants	?	Need to develop LCA for the whole life cycle of geothermal binary plants. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building

AIM Vicenza SpA	Project developers and construction	Holders of a mining lease for DH Developers and operators of geothermal DH in Vicenza	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal district heating. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
Svolta geotermica Srl	Project developers and construction	Owens a mining lease for pilot plants	?	They might adopt the LCA methodology in assessments of environmental impacts. They might need to develop LCA for the whole life cycle of geothermal district heating. They might need staff trained on how to carry out LCA. Plant design, building and operation with lower environmental impacts	capacity building
TERNA	Distribution and indirect consumers	high voltage grid managers			

## Tables on key market actors mapping in Turkey

Stakeholder name	Stakeholder category	Relationships with geothermal projects	Openess to change	Impacts from LCA methodology adoption	Engagement scenario proposed
Zorlu Energy	Core operation	Geothermal power producer	high	Simplified Model	Data collaboration
Menderes Geothermal Energy	Core operation	Geothermal power producer	high	Simplified Model	Data collaboration
Tuzla Geothermal Energy	Core operation	Geothermal power producer			
Bereket Geothermal Energy	Core operation	Geothermal power producer			
Gürmat Geothermal Energy	Core operation	Geothermal power producer	high		
Zorlu Natural Electric Production	Core operation	Geothermal power producer	high		
Maren Electric	Core operation	Geothermal power producer	high		
Gümüşköy Geothermal	Core operation	Geothermal power producer			
Çelikler Geothermal	Core operation	Geothermal power producer			
Çelikler Pamukören Geothermal	Core operation	Geothermal power producer			
Türkerler Geothermal Energy	Core operation	Geothermal power producer			
Akça Energy	Core operation	Geothermal power producer			
MTN Energy	Core operation	Geothermal power producer	high	Simplified Model	Data collaboration
Karyek Karadeniz Energy	Core operation	Geothermal power producer	high		
Bestepeler Energy	Core operation	Geothermal power producer			
Greeneco Energy	Core operation	Geothermal power producer			
KenKipas Energy	Core operation	Geothermal power producer	high		
Enerjeo Kemaliye Energy	Core operation	Geothermal power producer			
Sanko Geothermal Energy	Core operation	Geothermal power producer			

Maspo Geothermal Energy	Core operation	Geothermal power producer			
Turcas Kuyucak Geothermal Energy	Core operation	Geothermal power producer			
Çelikler Sultanhisar Geothermal Energy	Core operation	Geothermal power producer			
Afyon Geothermal Energy	Core operation	Geothermal power producer			
Sis Energy	Core operation	Geothermal power producer			
Limgaz Energy	Core operation	Geothermal power producer			
Mis Energy	Core operation	Geothermal power producer	high		
3S KALE Geothermal Energy	Core operation	Geothermal power producer			
Kiper Geothermal Energy	Core operation	Geothermal power producer	high		
Transmark Renewable Energy	Core operation	Geothermal power producer, under construction			
Yerka Energy	Core operation	Geothermal power producer, under construction			
DEU-GERAC	Academia and research	Research entity	high		
İTÜ-PDGM	Academia and research	Research entity	high		
METU-PDGM	Academia and research	Research entity	high		
IYTE-GEOMER	Academia and research	Research entity	high		
Turkish Geothermal Assoc.	Associations		High		
JESDER- Geothermal Electric Power Plant Investors	Associations		High		
Assoc . of Energy Cities	Associations		High		
Exery Inc.	Project developers and construction	Binary power plant producer	High		

ORMAT Inc	Project developers and construction	Binary power plant producer	High		
Gonen - Balikesir Geothermal District Heating Inc.	Core operation	Local authority ,District Heating			
Simav - Kutahya District Heating Inc	Core operation	Local authority ,District Heating			
Kirsehir District Heating	Core operation	Local authority ,District Heating			
Kizilcahamam - Ankara District Heating	Core operation	Local authority ,District Heating			
Balcova - Narlidere - Izmir Geothermal District Heating	Core operation	Local authority ,District Heating	high		
Afyon Geothermal District Heating	Core operation	Local authority ,District Heating			
Kozakli - Nevsehir Geothermal District Heating	Core operation	Local authority ,District Heating			
Sandikli - Afyon Geothermal District Heating Inc.	Core operation	Local authority ,District Heating			
Diyadin - Agri District Heating Inc.	Core operation	Local authority ,District Heating			
Salihli - Manisa District Heating Inc.	Core operation	Local authority ,District Heating			
Bergama İzmir District Heating	Core operation	Local authority ,District Heating			
Dikili İzmir District Heating	Core operation	Local authority ,District Heating			
Saraykoy-Denizli District Heating	Core operation	Local authority ,District Heating			
Edremit-Çanakkale District Heating	Core operation	Local authority ,District Heating			
Bigadiç District Heating	Core operation	Local authority ,District Heating			
Yozgat-Sorgu District Heating	Core operation	Local authority ,District Heating			

Yozgat-Yerköy Geothermal District Heating	Core operation	Local authority ,District Heating			
Güre Geothermal District Heating Inc.	Core operation	Local authority ,District Heating			
Kuzuluk- Sakarya District Heating Inc.	Core operation	Local authority ,District Heating			
Armutlu-Yalova District Heating Inc	Core operation	Local authority ,District Heating			
NTU Geothermal Energy Inc	Service providers	Consulting firm	High		
Pozitif Energy	Service providers	Engineering firm	High		
GKM Engineering	Service providers	Engineering firm	High		
Güney Yıldızı Inc	Drilling companies	Drilling			
Geopet Inc.	Drilling companies	Drilling			
Viking Drilling Inc.	Drilling companies	Drilling			
Oceanmec Inc.	Drilling companies	Drilling			
ME-Drilling	Drilling companies	Drilling			
TPIC	Drilling companies	Drilling			
Pars Anatolian	Drilling companies	Drilling			
Maren Drilling	Drilling companies	Drilling			
Dikili-Agrobay Greenhouse	Core operation	Geothermal heat producer and consumer			
Dikili-YDA Geenhouse	Core operation	Geothermal heat producer and consumer			
Dikili-Vegevital Greenhosu	Core operation	Geothermal heat producer and consumer			
Salihli-LiderGıda Greenhouse	Core operation	Geothermal heat producer and consumer			
Salihli-Bostan Tarım Greenhouse	Core operation	Geothermal heat producer and consumer			
Sandıklı-Bostan Tarım Greenhouse	Core operation	Geothermal heat producer and consumer			

Turgutlu-Hisarcıkloğlu Greenhouse	Core operation	Geothermal heat producer and consumer			
Turgutlu-M.Göncüoğlu Greenhouse	Core operation	Geothermal heat producer and consumer			
İzmir-Balçova Greenhouse	Core operation	Geothermal heat consumer			
Salavatlı Sultan Sera Greenhouse	Core operation	Geothermal heat consumer			
Denizli-AS Tarım Greenhouse	Core operation	Geothermal heat producer and consumer			
Denizli-Menderes Tekstil Greenhouse	Core operation	Geothermal heat producer and consumer			
Denizli Kızıldere TZDK Greenhouse	Core operation	Geothermal heat consumer			
Denizli Kocabey Greenhouse	Core operation	Geothermal heat producer and consumer			
Aydın-Gümüşköy	Core operation	Geothermal heat producer and consumer			
Ağrı-Diyadin	Core operation	Geothermal heat consumer			
Simav-Kütahya Greenhouse	Core operation	Geothermal heat consumer			
Hisaralan-Sındırgı-Balıkesir Greenhouse	Core operation	Geothermal heat consumer			
BM Agro Greenhouse	Core operation	Geothermal heat producer and consumer			
AYÇEP	Civil society representatives	environmental organization			
Gülpınar Sustainable Life Assoc.	Civil society representatives	environmental organization			
Salihli Environmental Assoc.	Civil society representatives	environmental organization			
Greenchemicals	Equipment, suppliers and maintenance	chemical provider			
Genda Ltd. Inc.	Service providers	Manufacturer of inhibitor dosing systems			

SMT Ltd. Inc.	Service providers	Manufacturer			
VANSAN	Equipment, suppliers and maintenance	Pump manufacturer (LSP and other pumps)			
Cougar	Service providers	Directioanal Drilling			
Viking	Service providers	Directioanal Drilling			
Ilbe Minerals	Service providers	Chemical provider for drilling mud			
Layne Boyler	Service providers	Pump manufacturer (LSP and other pumps)			



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