



D4.2

BUSINESS MODELS ON GEOTHERMAL DH SYSTEMS

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The present report is sub-task 4.2 - Business Models under the overall Work Package 4 (WP4). The overall objective of WP4 is to find possibilities to stimulate new investments for geothermal district heating (hereafter: GeoDH), e.g. through:

- Sustainable support schemes – this is sub-task 4.1 and a summary of this deliverable can be found in Annex 1: Summary of Deliverable 4.1 – Report on Support Schemes
- Innovative business models – the present report
- Presenting to public and private project developers how to manage a GeoDH with cascade uses – Sub-task 4.3 and to be completed primo 2014.
- Engaging with banks and financial institutions to support new projects – Sub-task 4.4 and are currently in working progress.

The target groups for this WP4 are the developers: municipalities developing GeoDH projects & DH companies, banks and financial institutions.

Prior to this report, other work packages including studies and analyses have been conducted in order to support the objective of the overall project GeoDH. This report will be based on that generated knowledge and summaries from the key reports have been collected in the annexes in order to give a better understanding of the knowledge of which the business model have been developed upon. The full reports will be published continuously at the project website: www.geodh.eu, where more info on GeoDH can be found.

Introduction

The present report on GeoDH Business models will be described including their financial rationality. The process of business model design is part of convincing municipalities and operators in their business strategy.

During the detailed description of the GeoDH business model, there will be described the core aspects of creating value for a GeoDH company, including: business strategies, infrastructure, organizational structures, trading options, core processes and influencing regulatory.

The costs of GeoDH have been analysed and compared with conventional DH systems costs and prices. The results hereof will be highlighted in the subsection regarding cost structure of the business model and in Annex 3: Summary of cost analysis on GeoDH and conventional DH.

Results presented in this report on the business model have carefully been considering that every country is different and therefore different variations of the business models will have to be used accordingly.

The business models for GeoDH will be presented to GeoDH project developers, in particular municipalities during the dissemination activities (WP 6), in order to encourage them to develop projects. In the dissemination phase, the workshops and the site visits will allow to illustrate these models in order to convince local authorities to implement them.

Business Model Generation

The overall objective of this phase is to generate business models that can act as possible stimuli and dissemination in order to attract new investments for GeoDH and convincing authorities.

The business models have been generated on basis of an open creative approach in order to contribute to the aim of generating new and innovative or differentiated business models which aims at being beneficial by accommodating unique opportunities or by advancing from unique resources and competencies also defined as being competitive advantages.

In order to promote the rationality of Geothermal District Heating, the business models define the structure of creating a business. In other words, the business rationality is described by the business models and therefore we define a business model as being: *“A framework for describing all factors influencing on creating value for a company, customers and environment”*.

The business model development has been carried out on the basis of Osterwalder & Pigneur’s (2010) business model canvas and will be supported by several of in-depth analysis. The objective of this business model canvas is to create an overview of micro-influencing factors which are necessary for a business model to succeed. The clarification is crucial because it creates a common framework for understanding and working with business model across all 14 involved countries, which is necessary in order to develop new business models and to analyse and evaluate the generated business models.

On the following page is the business model canvas illustrated. The canvas consists of 9 building blocks that together complete the business model. The canvas is the overall framework and later the business models of geothermal district heating is summarized in multiple canvases, in order to create an comprehensive understanding and the general overview.

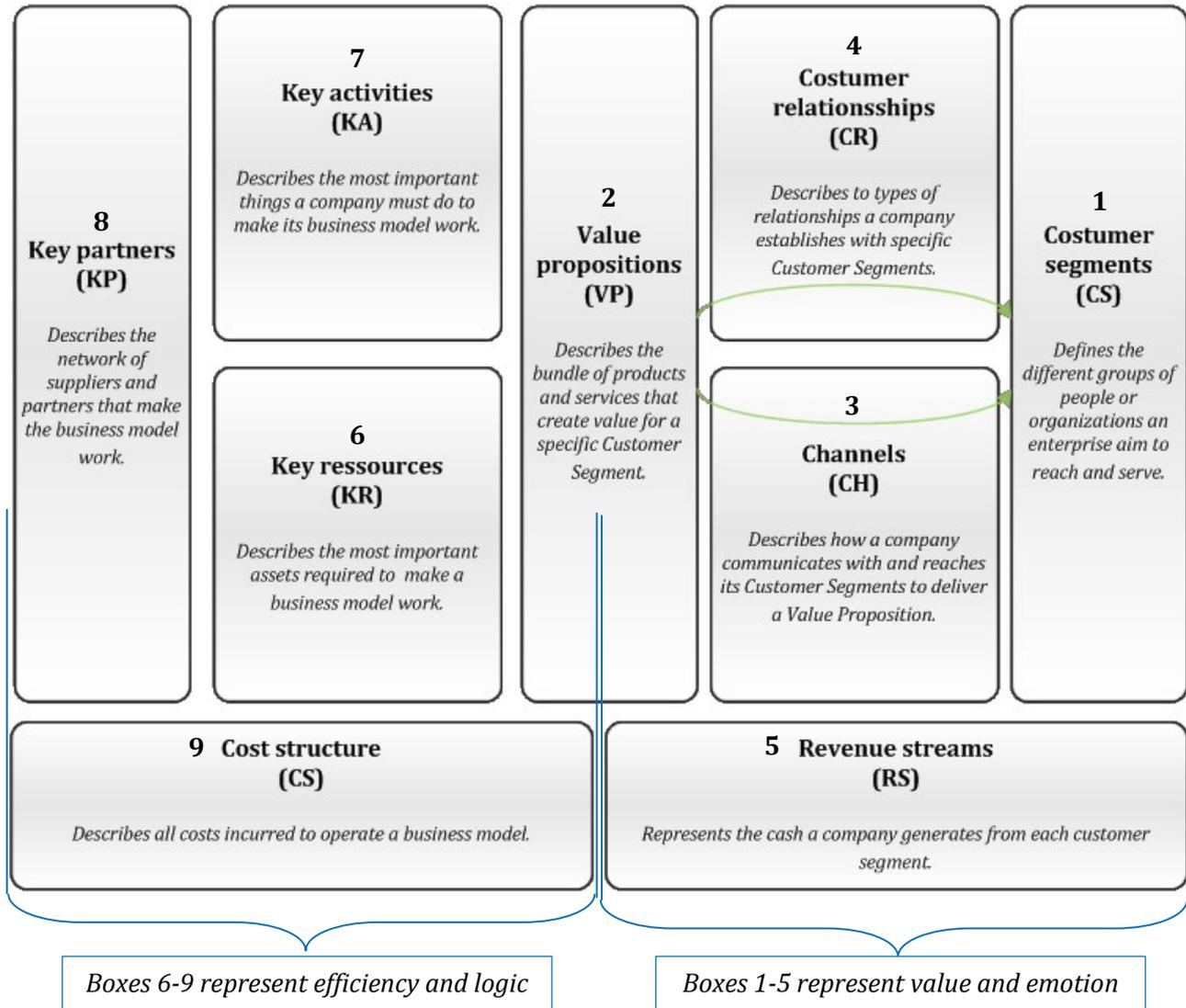


Figure 1: Business Model Canvas (Osterwalder & Pigneur, 2010)

The building block of the Business Model canvas consists of two main categories, on the left the block describe the logic and how the business model seeks efficiency and on the right side the business model describes the value and emotions of the business model. The value category represent building block 1 – 5: 1) Customer segments, 2) value proposition, 3) Channels, 4) Customer relationships and 5) Revenue streams. The efficiency category represents building block 6-9: 6) Key resources, 7) Key activities, 8) Key partners and 9) Cost structure. The building blocks will be described in that order in the sections below.

General GeoDH business model

Firstly the general business model for geothermal district heating in Europe will be presented. The business model has been developed on basis of inputs from partners in 14 different countries. This is the general business model for developing any GeoDH company across Europe and must be seen in that context. The overall objective is to deliver a stable and secure heat supply based on an infinite renewable resource.

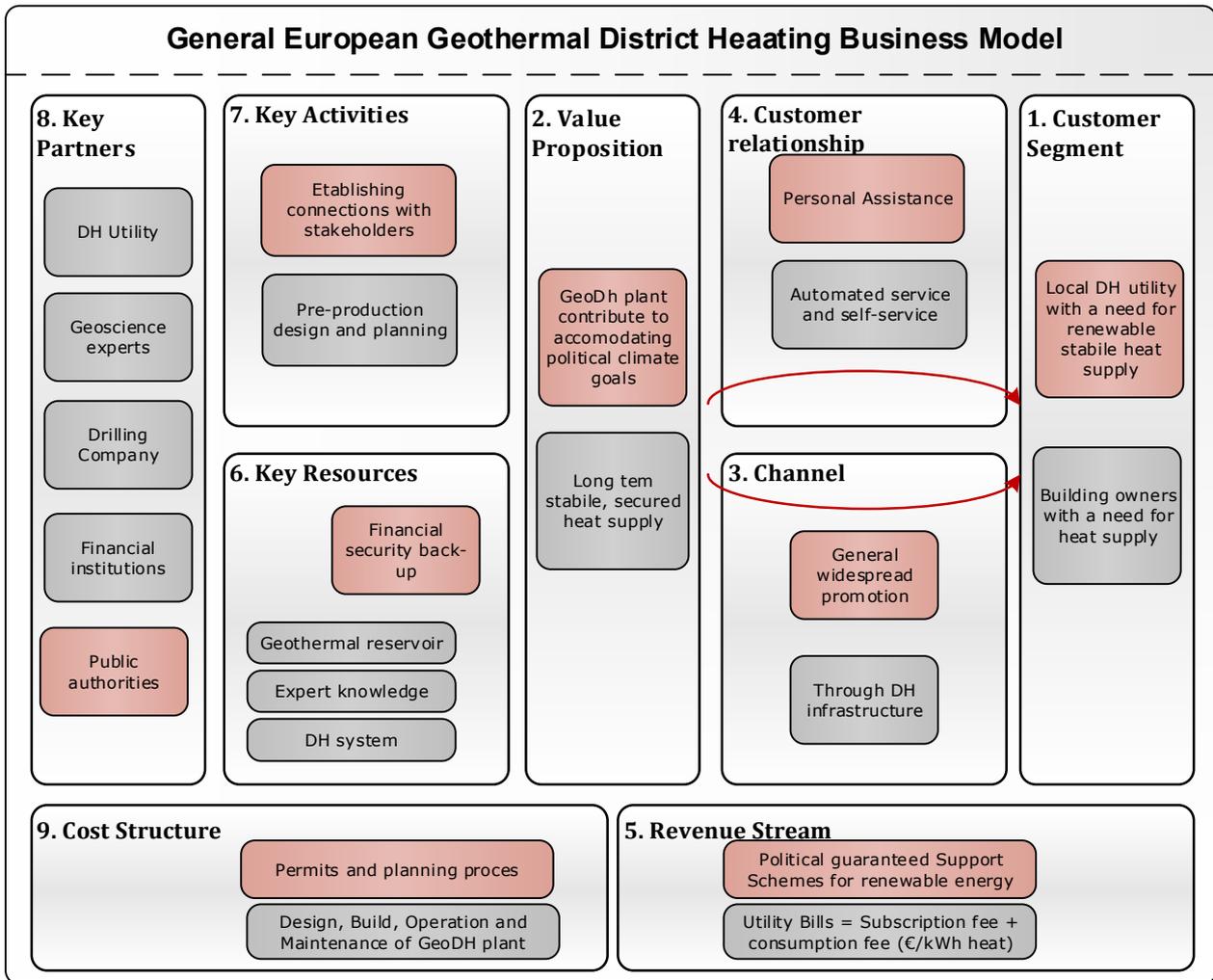
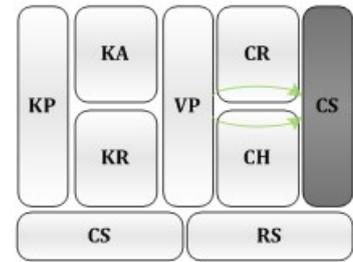


Figure 2: GeoDH general business model

In the following sections, each building block of business models will be described in detail, in order to explain their rationality and the different variations that exist country by country. Every section will firstly describe the overall concept of the specific building block, secondly the building block is explained according to the GeoDH business models and thirdly the variations from country to country is outlined.

1. Customer Segments

The customer segment building block defines the different groups of people or organizations the GeoDH Company aims to reach and serve. The customer segment is the most important building block as it is impossible for any company to earn money without customers. It is impossible to create and capture value without customers. When designing business models it must be determined which customer segments the GeoDH Company wish to serve and which ones they want to ignore. A good business model is designed on basis of a clear understanding of customer demands. There are several of definition of segmentation and segments. Osterwalder & Pigneur (2010) states that customer groups represent separate segments if; their needs require and justify a distinct offer, they are reached through different distribution channels, they require different types of relationships, they have substantially different profitability, they are willing to pay for different aspects of the offer. In general we distinguish between customer segments and customer segmentation. The customer segments depend on the business model and likewise are dependable on whether it is B2B segmentation or B2C segmentation because the segmentation drivers and parameters differentiate in between.



GeoDH Customer Segments

The customer segments for GeoDH can be any heat consumer, generally speaking. The inputs from partners in GeoDH states that the heat consumer varies in type of ownership and size and heat consumption.

The overall customer segment for GeoDH is building owners. They can be distinguished in these different groups, depending on heat demand and types of ownerships:

- Residential households
- Private owned building
 - o Business Offices, sport facilities, shopping centres, SME's, etc.
 - o Larger Industries, airports, (private) hospitals, agricultural etc.
- Public owned buildings
 - o Public offices, schools, hospitals, etc.

Indirectly the DH utilities can be regarded as a customer segment for the GeoDH company as they evidently are the buyers of the heat from the Geothermal plant, however the DH utility re-sell the same heat to the end-users aka the building owners.

Variations

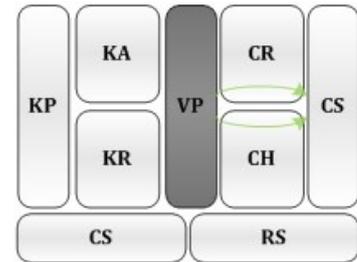
Evidently there are variations of the customer segments for GeoDH, depending on the distinct offer or value you want to deliver to that specific segment. Above is the general customer segment "heat customer" described, however the segment might vary further depending on the context within the heat supply is delivered, therefore there is a distinguishing between Dense urban area (both old & new buildings) and Peripheral areas (both old & new buildings), as the requirements of these segments vary.

Further it can be argued that there exists a segment for low temperature heat, that allow the GeoDH Company to expand their portfolio and offer a supplement for ex. businesses that require small amounts of heat to be connected to return pipes.

In some cases the GeoDH Company need to convince or involve public authorities and/or the energy policy makers, in order to be able to deliver geothermal district heating at all.

2. Value proposition

The value proposition building block describes the bundle of products and services that creates value for a specific customer segment (Osterwalder & Pigneur, 2010). In general the offered value proposition is the reason why customers select the company over another. Some value propositions can vary greatly from highly differentiated and innovative to barely differentiated. By accommodating the needs of the segments, the value proposition proposes value for the customer segment through a distinct mix of parameters. Some of the value creating elements could be; Newness, Performance, Customization, Brand, Cost reduction, Risk reduction and Convenience. In general it is important to be aware of the different types of value propositions.



GeoDH Value Proposition

Heat supply is in general a commodity with low differentiation potential, as heat is heat and the end-user tend not to care what type of heat they have or where and how it is delivered. Depending on the size of heat demand and the importance of heating is different from country to country. However GeoDH does have distinct parameters that differentiate from other suppliers of heat and that have a differentiation potential for the DH utilities. Depending on whom the customer segment is the mix of parameters that matters are different. Generally GeoDH offers the heat consumers the following:

- Stable secure heat supply
- Fixed, long term prices (for production and depreciation)
- Security of supply
- Lower need for maintenance (compared to other conventional heat sources)
- Lower risks (when in operation)
- Ease and comfort for the end-user

Further can GeoDH offer a range of Political advantages that can help the GeoDH companies to convince local authorities of geothermal potential and rationality:

- Renewable, sustainable energy
- Lower carbon emissions and clean air as renewable heat will improve the climate
- Public interest, including health issues (less carbon emissions)
- Domestic energy production instead of import
- Smart Thermal grid - possibility for innovation and R&D in the energy system

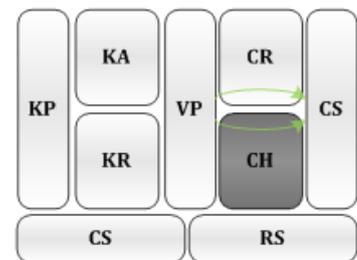
Variations

Depending on the country where the GeoDH company is established and delivers heat supply there is the great advantage in offering lower prices for heat and DHW. It cannot be a general advantage, as some countries are juvenile in geothermal energy and the limited experience contributes to uncertainty and higher investments costs. As well as the fact that in some countries, e.g. Poland, coal-fired heating plants or CHP are still the most common and heat prices from these plants are the lowest one (since coal prices are lower than gas prices). Even though affordable and stable heat supply in other countries can be a very powerful value proposition. In order to outline the most favourable advantages, the local context must always be considered.

Depending on the country there is an increased value of properties connected to a DH network and therefore it can further be an added value to a GeoDH project.

3. Channels

The third building block is the channels. The channels building block describes the different ways a company communicates with and reaches its customer segments to deliver value proposition (Osterwalder & Pigneur, 2010). It is often interesting to ask the question: *“Through which channels does our customer wish to be reached?”* The definitions of distribution channels vary and can be divided in to “Direct” or “Indirect” channels and are either an “Own” or “Partner” channel. Additionally the distribution channels are divided into five channel phases which accommodates to a buying process and are especially relevant to consider in a juvenile GeoDH country:



- Awareness: How can we create awareness about the Geo DH Company’s value proposition?
- Evaluation: How do we help customers evaluate the GeoDH organisation’s value proposition?
- Purchase: How do we allow customers to purchase specifically Geothermal Heat?
- Delivery: How do we deliver a Value proposition to customers?
- After Sales: How do we provide post-purchase customer support?

In general a mix of different types of channels could be used. By using a partner channel the profit is lowered but at the same time this channel type allows a company to expand and benefit from partner strengths.

GeoDH Channels

For GeoDH companies the existing district heating distributor can be a valuable partner that has the strengths of having well established channels to the consumers in forms of DH systems. By using own channel the company gain completely control over the channel. This, however involve a large investment and are not relevant for GeoDH projects currently. The mix of channels should be integrated in the right way in order to maximise the revenue and to offer the best customers

service. The right mix are depending on the country and existing partnerships and energy delivery channels e.g. tradition of district heating systems or individual heat supply.

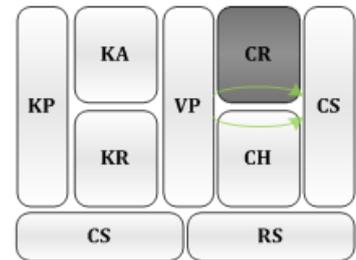
For a GeoDH company channels can be a mix of the following:

- Technical visits
- Invoices
- Emails and brochures
- Advertising on benefits of using RES-H and DH
- DH utility (public and private)
- Web site with info about prices
- Information desk
- Personal account for each customer (with info on consumptions, payments, etc.)
- Customer service toll-free number
- Annual meeting with reports from the past year

The choice of channels are highly depending on the local context of the specific country and must therefore be the optimal mix hereof.

4. Customer relationships

The customer relationships building block describes the types of relationships a company establishes with specific customer segments (Osterwalder & Pigneur, 2010). The customer relationship can in general range from being highly personal which is typical in B2B relationships where the company’s customer dependency is high due to a customized value proposition, to being automated such as in relation to mass market with undifferentiated value propositions.



Customer relationships are typically driven by motivations such as; customer acquisition, customer retention or boosting sales. It is important to consider customer relationships in order to reduce transaction costs and at the same time accommodate the customer segment’s expectations for relationships.

GeoDH Customer Relationships

For a GeoDH company the customer relationship varies depending on the customer segments and how valuable they are to the GeoDH company. Generally, the customer relationship is established on the basis of a trust & risk evaluation. Traditionally the small, low consumption customer is of less importance and the relationships are therefore more automated and consist of self-service. And the contrary tend to be the case for the large consumption customer, where the relationships should be more of a personal assistance character. However in the case of a juvenile or the “in transition” GeoDH market, every customer counts and the smaller customers should have a more personal relation to the GeoDH company as all customer contacts are essential.

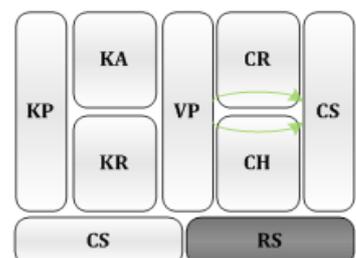
Variations

The regional differences have an impact here as well. Those areas where DH is tradition, often the DH is the cheapest alternative hence the customers have an interest in preserving a long term relationship. And those areas where it is an obligation to be connected and stay connected to the system for the entire pay-back period of the DH system investment; automatically a long-term relationship is established.

The concept of long-term agreement with the customer of GeoDH should be of a similar format e.g. with preliminary contracts for the connection that ensures the GeoDH company a substantial market for a long period and thereby more certainty of revenues when the GeoDH begins operation. Hence if a customer decides to disconnect from the GeoDH system, a paragraph in the contract should obligate a certain fee for breaching the contract.

5. Revenue streams

The revenue streams building block describes the cash a company generates from each customer segment (Osterwalder & Pigneur, 2010). This means that the revenue streams is the profit generated from delivery of value proposition. There are generally two types of revenue streams: 1) Transaction revenues resulting from one-time customer payments or 2) Recurring revenues resulting from on-going



payments to either deliver a value proposition to customer or provide post-purchase customer support.

It is important to consider which value the customer are willing to pay for, how much are the customer willing to pay and how are the customer willing to pay. The revenue streams can be extremely important in order to generate profit and are important to consider because the right revenue streams can attract or maintain customers while the selection of wrong revenue streams can result in a decrease in customer loyalty.

GeoDH Revenue Streams

A GeoDH company will deliver heat to the consumer in competition with all other utilities and therefore the payment will in general be offered through the building owners utility bills. The heat customer revenue typically consists of a subscription fee + consumption fee per used kWh heat. Especially for GeoDH customer is it important to consider Protection of customers connected to a collective heating system is important for the trust of the customers. If there is no protection of the customers in the regulation, the customer has a risk.

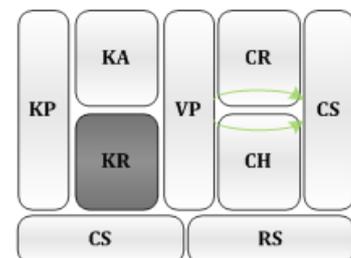
Variations

Besides the utility payments, there are other financial incentives established in order to promote renewable energy in a lot of countries in Europe. These contribute positively to the revenue streams and therefore important to the cash flow of the GeoDH business models. Generally there are three overall types of support schemes: 1) Risk Insurance, 2) Investments Aids and 3) Operational Aids. However they vary in great extension and the report on support schemes will give a comprehensive understanding hereof. For highlights from the report, see Annex 1: Summary of Deliverable 4.1 – Report on Support Schemes.

The focus of the business model now changes from the value oriented perspective (right side of the canvas) to the efficiency oriented perspective (left side). The focus of the buildings blocks are in the following regarding optimization of the business model.

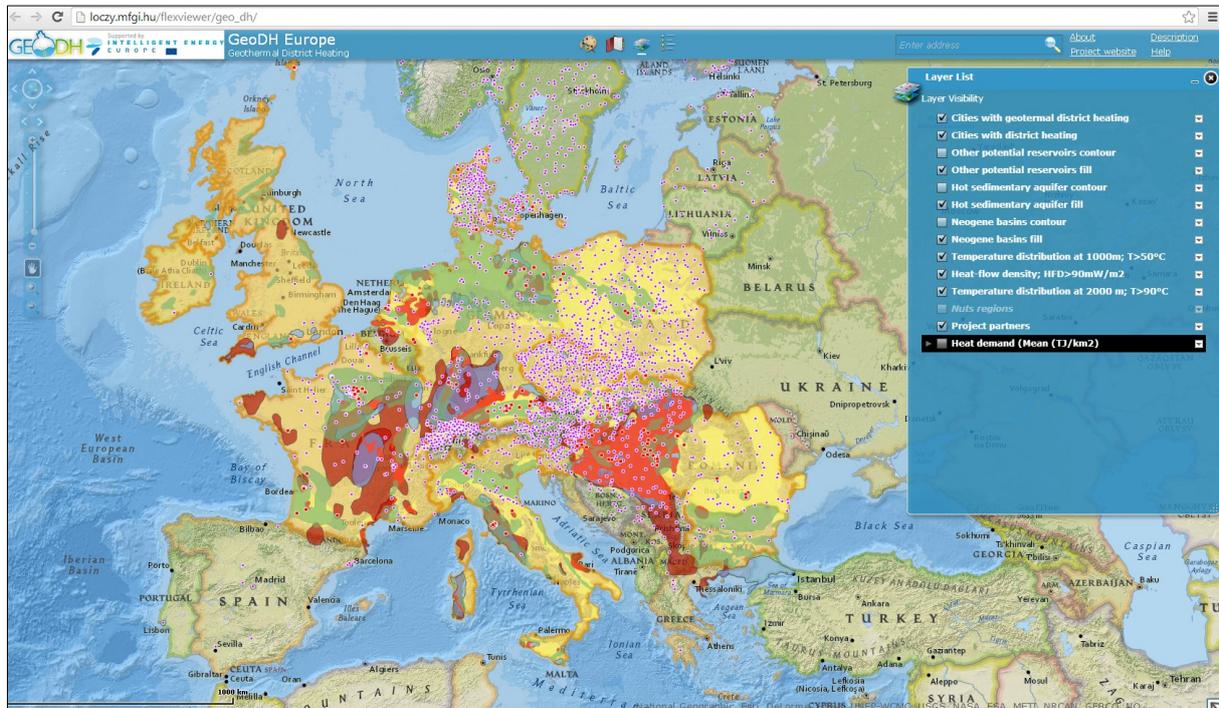
6. Key resources

The key resources building block describes the most important block for making the business model work. Key resources refer to the internal resources necessary to allow a company creating an offer or value proposition, reach market, and maintain relationships with customers and thereby creating a revenue stream. There are several definitions and ways to categorise key resources. Osterwalder & Pigneur (2010) define four categories of key resources; physical, financial, intellectual or human. The most important is to use the categorisations in order to include and distinguish between key resources.



GeoDH Key Resources

The physical key resources of a GeoDH project are access to geothermal resources and connection to DH infrastructure. If the DH infrastructure is not available, the business model will look very differently and therefore this business model anticipates that there is a DH system to connect to. Geothermal resources are key to a successful GeoDH business and the country specific information hereof has been collected at the interactive map of geothermal energy resources and more info about this can be found at: http://loczy.mfgi.hu/flexviewer/geo_dh/



Lastly the heat demand of the targeted area are a resource as that provides a solid foundation for the business model which is determined by urban density + industry process heat.

Access to financing is an important resource for GeoDH projects as it also will be highlighted in the following sections. Financial institutions are crucial as any GeoDH project involve relatively large investments and are potentially high-risk operations, which call for the necessity of a Risk Insurance Fund.

Variations

Depending on the country, there are in some countries massive intellectual resources available for GeoDH project in forms of DH systems with a massive customer database.

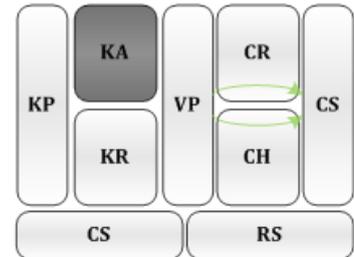
In other countries the geothermal expert knowledge on BATs, both to design and to build a GeoDH is massively available and represents a valuable human resource. This GeoDH research project aims to gather and distribute some of this knowledge across Europe, in order to optimise and improve the use of geothermal energy.

In order to increase the attractiveness of GeoDH, the knowledge of other local Renewable Energy Source (RES-H) availability (as well as geothermal) to be used into a DH can be a supportive

resource. It can be easier to promote hybrid DH systems with solar thermal and biomass as well as geothermal heat.

7. Key activities

The key activities building block is related to the most important activities a company must execute in order to make the business model work (Osterwalder & Pigneur, 2010). Like the key resources described above, key activities are fundamental in order to create and deliver a product or service offer also known as value proposition. Key activities, also known as capabilities, can be categorised as following: Production, Problem solving or platform/ network (Osterwalder & Pigneur, 2010). Regarding production activities, these can relate to designing, making and delivering a product in remarkable quantity or quality. Regarding problem solving this activity relates to designing new solutions to individual customer problems, which means that business models based on these types of activities require focus on knowledge management and training of employees. The final type of activity relates to designing, operation and maintenance of platform or networks in order to succeed.



GeoDH Key Activities

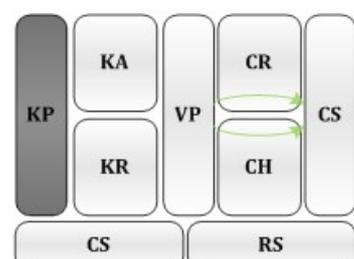
A GeoDH company can include all of the above categorised activities, depending on the specific project. Most activities for a geothermal business model revolve around designing the production. These activities are such as feasibility study in order to understand heat demand and evaluate this in relation to a resource assessment of geothermal availability. The business planning process including project management and organisation of business set up are important pre-production activities. Establishing relationships with public authorities, both to influence decision makers and to get licenses and authorizations are further important as well as ensuring agreement with financial institutions, community and the building owners. All of these activities regarding licencing and agreements are the most important activities of GeoDH projects, as the GeoDH company will not be able to deliver geothermal heat to the consumer without these.

Variations

Depending on the country where the GeoDH project is being established, the demand for licensing and pre-agreements can vary in great deal. The level of activities must always be seen in the local context. Also the level of agreements can vary depending on the partnerships and financial set up, which will be described in the following sections.

8. Key partnerships

The eight building blocks is the key partnerships building block that describes the network of suppliers and partners that make the business model work (Osterwalder & Pigneur, 2010). There can be several reasons for not establishing a partnership; Availability of



capabilities, protection of proprietary technologies, controlling technology development and use and building and renewing capabilities. However, establishment of partnerships has become an important factor in most successful business models. Key partnerships are advantageous in relation to; optimizing allocation of resources and economic of scale, reduction of risk and uncertainty and acquisition of particular resources and activities. There are several types of partnerships and collaboration; Strategic alliance (between non-competitors)/ strategic partnerships between competitors, joint-venture, licensing and outsourcing.

GeoDH Key Partnerships

The GeoDH projects highly benefits from partnerships in order to optimise the business model in general. A close partnership with a DH utility for every phase of the project including the build, management and operation is the most important partnership to establish. And secondly the DH owners that often are the municipalities. (Again it is anticipated that there exist a DH system for the GeoDH project to be connected to.)

As will be highlighted in the next section, the partnerships with financial institutions are crucial as any GeoDH project involve relatively large investments and are potentially high-risk operations.

A partnership with geoscience experts and/or engineering companies carrying out geothermal explorations is further very important, especially if the project is located in an area new to geothermal exploitation.

Public authorities, primarily Urban Planner and Decision Makers authorizations regarding support measures can be important to have a close collaboration with as they can act as barriers for the project. Informing and collaborating with the public authorities in order to highlight their political advantages are mutually beneficial.

When establishing the GeoDH plant, the drilling companies and civil working companies are important to have a partnership or strategic alliance with, in order to ensure the most effective and smooth-running building process, beneficial for all partners.

Generally a close cooperation with all the partnerships is very beneficially as the long term agreement lowers the risk and uncertainty that are the main challenge for promoting and expanding the use of geothermal energy.

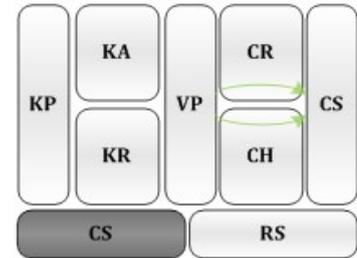
Variations

Owners of large buildings both private and public as well as owners of larger collective buildings can be valuable as partners as they can significantly contribute to smooth and economic operating with positive attitude toward GEODH. Thereby the promotion and knowledge of GeoDH will expand.

In some countries will the fossil energy industry propose a significant market player and are therefore to be recognised as important influencing factors of the GeoDH success in these countries. Often the Coal, Oil & Gas energy companies dispose of large investment capacity and in many cases they have an interest in diversify and “greening” their business in order to have better public branding. Thereby relevant partnerships can be formed and help to promote GeoDH.

9. Cost structure

The cost structure describes all cost incurred to operate a business model in relation to creating and delivering value, maintaining customer relationships and thereby generating revenue (Osterwalder & Pigneur, 2010). Obviously it is preferably to minimise the cost at all areas, however some business models are more cost-driven than others and in relation to developing new business models it is important to be aware of the cost-structure. Generally there can be distinguished between two cost structures: cost-driven and value-driven, however most business models are somewhere in between these.



GeoDH Cost Structure

Geothermal heat has a value-driven cost structure, primarily due to the high investments costs. Financial resources to invest in a GeoDH projects are crucial.

GeoDH technology is quite a mature one, in use for 50 years, and GeoDH installations are quite competitive. However geothermal space and district heating systems are capital (CAPEX) intensive. The main costs are generated by initial investment costs for production and injection wells, down-hole and surface feed pumps, pipelines and distribution grids, monitoring and control equipment, peaking stations, and storage tanks. Operating expenses (OPEX), nevertheless, are much lower than in conventional systems, consisting of pumping power, system maintenance, operation and control.

Generating costs and selling prices are usually around 60 €/MWh thermal, within a range of 20 to 80 €/MWh thermal.

The development period of a GeoDH project are long, demands careful planning and time to gather the needed licenses, authorizations and permits. This is all high cost elements that accommodate a need for insurance and risk coverage, that too are a cost.

A specific analysis of the costs of GeoDH in relation to conventional DH has been conducted in relation to the development of the business models for GeoDH.

The detailed analysis of an example taken in Ile de France shows that typical investment costs for a new geothermal doublet is about 14 to 15 M € and the annual benefit of expenses using geothermal calculated at around 2 M€. The resulting rough pay back is of 7-7,5 years excluding the financial approach and the fact that the community as to borrow the main part of the investment.

A calculation taking into account a project life of 20 years, a discount rate at 6%, interest rate at 3,2, inflation rate at 2%, annual escalation electricity price at 2%, annual gas escalation price at 5%, annual heat escalation price at 3% and electricity purchase at 70€/MWh shows a possible selling price to the final consumers at 70 €/MWh. (See Annex 3: Summary of cost analysis on GeoDH and conventional DH)

Variations

Other factors that can have an influencing effect on the cost structure and thereby economic logic of a GeoDH project could be other benefits, such as externalities where no/low impact on the surrounding environment benefit to reduce emissions etc. e.g. there is no payment for CO2 taxes. In order to calculate this, there has to be an internalisation of external costs for fair costs comparison regarding the regulatory regime on taxes.

Depending on the project and specific set-up of the GeoDH company, an added cost could be a decision to a lifetime extension of the plant by establishing a triplet well, where a doublet produces heat for 30 years but by construction a triplet the plant is adding up to 20 more years of production, increasing lifetime of the system so improving even more profitability.

10. Synthesis

Generally for GeoDH business models the risk factor regarding exploitation and high up-front investments before guaranteed heat production has to be divided between multiple partners and insurance set-ups, and thereby decrease the risks. However it is important to recognise that when more partners are involved the decision making process becomes more complicated as more people has to agree as well as the resources regarding this area increases.

In the end, is the best business model a combination of the local value adding elements and at the same time insure the most efficient resources. The optimal business model for any GeoDH project is depending on local (regional or national) surroundings.

Extended GeoDH business model variations

It can be challenging when establishing a GeoDH company and GeoDH plant as the conditions for the specific project can have significant influence. In the previous sections it has been anticipated that the GeoDH plant was to be connected to an existing district heating system. However that will not always be the case as district heating has different dissemination depending on the country. This offers an obstacle regarding convincing municipalities and financial institutions in the business case of GeoDH.

In this section an extended business model will be elaborated regarding optimisation of energy consumption for the customer connected to the system hence the objective is to increase the value for the customer and improve the economic logic. The collaboration form known as ESCO.

The ESCO business model presented in the following is based on an energy saving principle where a part of the payment consists of the savings and their relatively value. The value generated can have many different names, terms and forms.

Other contracting forms can also be relevant and are similar to ESCO, like Energy supply contracting (ESC); energy performance contracting (EPC) and the combination of those could be used. The ESC set-up is where the contractor implement measures that insures the heat supply (build and operate the whole system or a part of it) and also finance them. It is repaid from the payments for heat. In the EPC model, the contractor implements measures that reduce energy use and also finance them. It is repaid from the savings. Very similar to ESCO, the EPC and ESC offers an added value to the business model and thereby increases the profitability.

In the following the ESCO business model is the only model elaborated, however it is important to recognise that the other models exists and can supplement to the positive business case of GeoDH.

The next section will elaborate how the ESCO business model differs from the previous elaborated business model building blocks and therefore it is only the added boxes (green) on the figure below that are elaborated, as the rest of the business model will still be a part of the ESCO business model. As an example, the Key Resource of geothermal reservoir is still essential for the GeoDH ESCO business model.

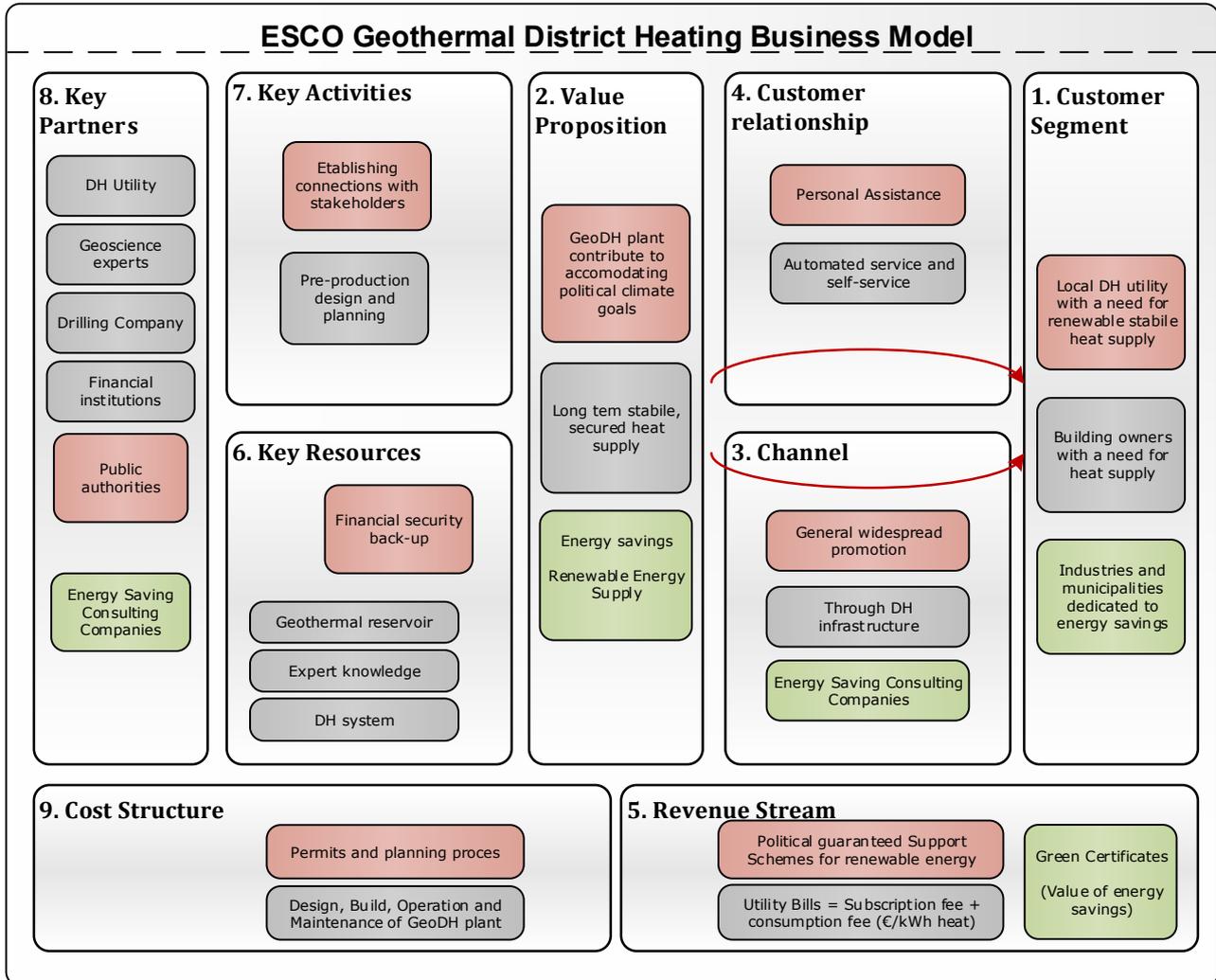


Figure 3: GeoDH ESCO business model

The customer segments that are relevant to the GeoDH ESCO business model does not vary greatly from the customers segment of general GeoDH, but opens for other segments that are dedicated to energy saving, either by political or strategic goal or by simple economical regards. For example in Denmark, the municipalities have been frontrunner in establishing ESCO partnerships due to ambitious political goals regarding reducing emissions, saving energy and having a greener energy consumption. The EU is committed to renewable energy, energy efficiency and long-term decarbonisation goals which can help the implementation the GeoDH ESCO business model proposes a substantial option.

The GeoDH ESCO business model creates added value by creating energy savings aka lower energy consumption and a documented renewable energy production. These are both valuable elements that increase the profitability of the business model. Imagine a DH company eager to decarbonise its heat supply in close cooperation with a ESCO partner. They thereby can combine sustainable heat supply, possibly with use of green labels, and energy saving services consequently to widen the scope of their business activities and market attractiveness and hence reducing the impact of the inevitable reduction in energy consumption, which again will save them money on CO₂ taxes/ get money in the carbon /energy efficiency obligations markets.

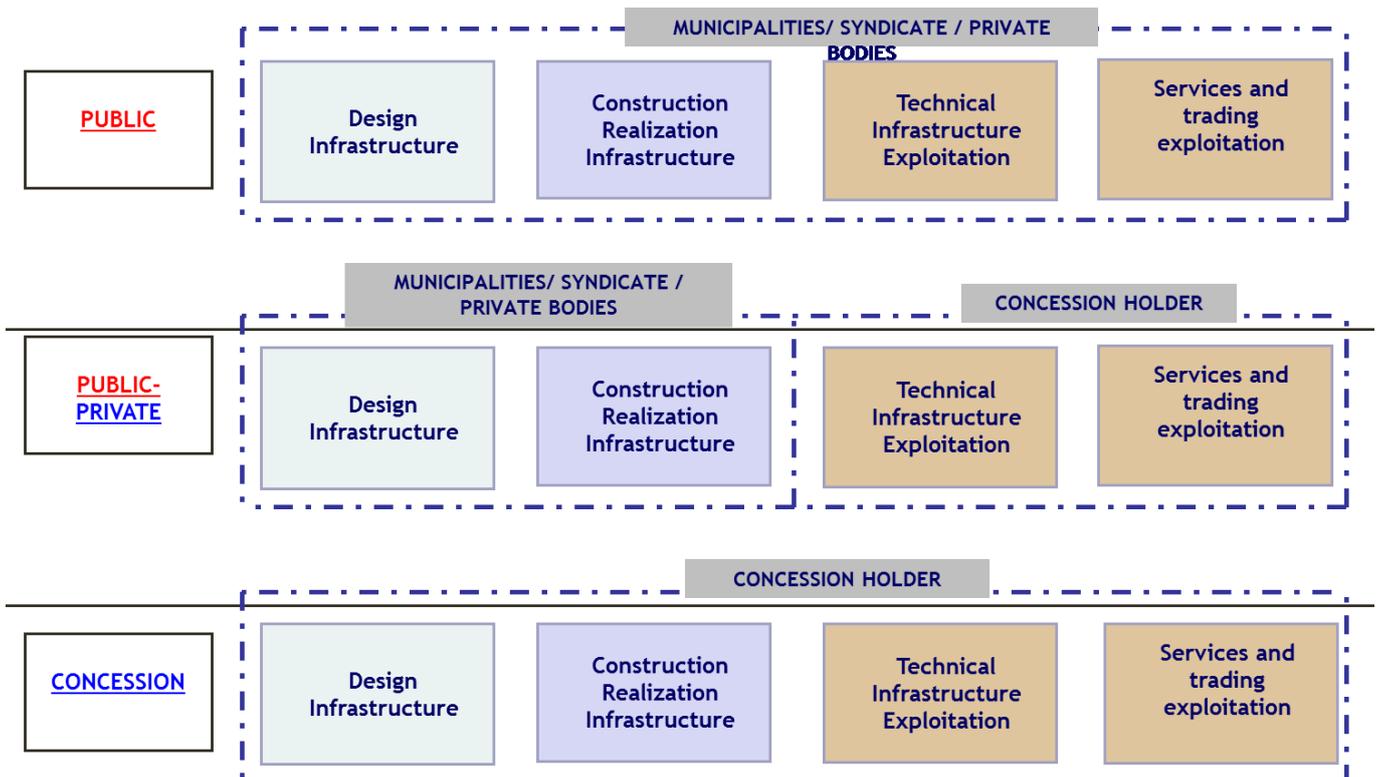
Energy efficiency activities propose a value that can either be traded, added as an extra differentiating parameter or increase profitability. The energy savings can be converted into energy saving obligations called white certificates, supplier obligations, distributor obligations or utility obligations. There exists a international system for energy efficiency measures resulting in certified energy savings that then become tradable white certificates, TWC allowances etc. The tradable certificates can also be a Guarantee of Origin certificates, where renewable energy production becomes certified “green” and thereby proposes a value on the energy trading markets.

Obligations can be coupled with various trading options: trading of certified energy savings, trading of eligible measures without formal certification, or trading of obligations. More info specifically regarding this see article linked at: References

Additionally to the GeoDH ESCO business model, the profitability can be increased by formally constructing partnerships between public and private partners in order to spread out the risk on multiple partners and by involving public partners the demands regarding payback time and return on investment tend to more accommodative. Regarding the responsibility of the different partners, the model gives a brief overview. More info from the French experiences can be found in Annex 4: Comparison between French business models.

An example of the increased use of alternative business model is the Hungarian case where the change in use of business models in the GeoDH market are a clear example hereof. Today 3 of the 19 systems are operated in a Public-Private Partnership (PPP), the majority being managed by local public authorities; 11 of the 17 GeoDH ongoing projects are developed by a private operator: the company Pannergy. They aim at establishing PPP with municipalities.

Hungary introduced recently a newly concessional system targeting exploitation of reservoirs



below 2500m depth. This new scheme aroused much interest with 16 proposals being submitted in 2013. This should help Hungary reach the 2020 objective of 357 ktoe.

Generally, there are three frequently used financing models:

- 1) Firstly, public investment undertaken by the local or regional authority (usually at municipal level);
- 2) secondly, private sector investment which in turn is granted the opportunity to sell the heat directly to the grid-connected subscribers over long duration (20 to 30 years contracts);
- 3) finally a 'mixed' solution, which entails the creation of companies dedicated to the development of the geothermal with capital investment shared by both public and private entities.

The first model (public scheme) has been developed mainly in Austria, Germany, and Denmark. The second (private DH utilities) is today used in France and the UK, among others. The third model, (a Public private Partnership) applies elsewhere and is gaining popularity in several European countries.

Finally, specific attention should be paid to cascade uses. It is sometimes presented as an obvious solution for improving the economy of (notably) CHP, but it seems less and less easy to develop them. Today few examples exist all over Europe. The managerial issue is not the only one preventing the deployment of this technology, the difficulty to find adapted consumers to the heat supply seems even more an important challenge. These challenges will be elaborated in the following work package WP4.3 on developers how to manage a GeoDH with cascade uses.

Business Model Environment

Inevitably there are country specific and even regional and local specific conditions that affect and influence the GeoDH business models. The GeoDH project and business rationality must always be evaluated regarding the conditions of the specific environment.

The figure below illustrates areas of the external conditions that must be mapped in order to have complete grasp of the external influencing factors of the business model. All of these influencing external factors are very important for the rationality of the specific business model, therefore it is highly recommended to analyse the external factors for every specific GEODH project as the country specific conditions vary in great deal, as the previous reports and work on GeoDH has illustrated.

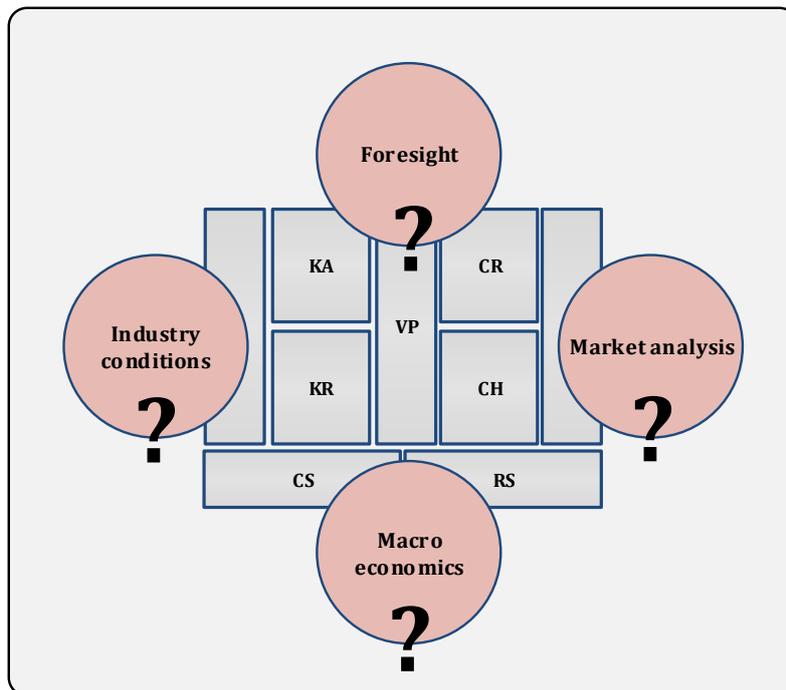


Figure 5: Factors influencing the specific environment

Experiences from the partners of the GeoDH project indicates that there are several external factors affecting the GeoDH business model success in a negative direction. This could be in countries where the coal and gas sector has a strong position of at heat market and their lobbying is making GeoDH being treated as competition in the local heat markets. Added to this generally there are in some countries lower prices of heat from the coal-fired heating and CHP plants, resulting in difficulties for GeoDH to be competitive.

Multinational energy companies tend to have a differentiated business strategy and interest depending on the local market, where in some countries they are interested and involved in GeoDH projects, typically the mature market, while in others, juvenile or in transition markets, they have minor interest in the GeoDH development even in regions where there are favourable conditions for geothermal and existing DH networks, to which geothermal can be incorporated.

This results in an investment behaviour that might not support the best GeoDH projects. Therefore it can be recommended to address these companies in order to prove GeoDH profitability and make them allied.

In the previous work package regarding the country specific administrative barriers, some of these influencing factors have been identified and proposes to overcome them have been gathered in a report. To get more info on the identified barriers see: Annex 5: Summary of Deliverable 3.2 – Table (excel) presenting the results of the survey on existing administrative barriers

The survey on existing administrative barriers was carried out in each project country by screening of existing previous studies and by collecting information from websites and direct contacts such as interviews. All results of the survey were summarized and gathered in an excel table, in order to present and compare barriers identified in each of the 14 project countries.

Generally main identified barriers may be summarized as follow:

- In many countries, especially in those with juvenile and, to a lesser extent, in those with transition geothermal DH market, geoDHs are not taken into account into NREAPs, although geothermal development is considered;
- RES directive 28/2009/CE (especially as regards articles 13.1, 13.3, 14.1) is transposed in almost all project countries, however sometimes the implementation of these articles does not appropriately consider DHs (e.g. as in the Netherlands) or geothermal energy (e.g. as in Ireland);
- In some countries the administrative procedure to obtain permits to develop a geoDH plant (surface and subsurface structures) is rather complex, it may change by region and often it requires long time. Moreover the legislation concerning authorizations may have several gaps and contrasts, while in other countries the permitting phase is easier for shallow geothermal;
- Lack of enough qualified specialists and expertise, both among companies and at administrative level;
- GeoDH projects are capital intensive, mainly due to the drilling phase, which may entail high mining risk and it is rarely covered by financial support schemes such as guarantee funds or insurances;
- Financial supports to geoDHs are often inadequate or do not exist;
- Prices of heat delivered with geoDHs may be less competitive for end users than using other heat sources (e.g. gas or fossil fuels);
- The lack of specific provisions on the kind of service offered by DH plants and on the ownership of networks may lead to market competitiveness concerns, since DHs are “natural monopolies”;
- The lack of lobbies on geoDH and of an independent office or professional service may slow down the development of new geothermal DHs in Europe.

For more details about administrative barriers to the geothermal DH development, please read other deliverables available on the section “library” of the project’s website www.geodh.eu:

- Deliverable 3.1: Workshops reports including questionnaire, main conclusions and feedback analysis

- Deliverable 3.2: Table (excel) presenting the results of the survey on existing administrative barriers;
- Deliverable 3.3: 14 Reports on evaluation of the (market) barriers: at national level and local market barriers in region/cities of 14 European Countries and proposals for their removal.

In this report these areas of external influencing factors will not be further analysed as the objective of this report is to present the general rationality of geothermal district heating to widespread audiences and promote the knowledge hereof across 14 different European countries.

References

Theory on Business Model Generation:

Osterwalder, A. & Pigneur, Y., 2010. *Business Model Generation*. 1st ed. New Jersey: John Wiley & Sons Inc.

Energy saving obligations and tradable white certificates:

http://ec.europa.eu/energy/efficiency/studies/doc/2009_12_jrc_white_certificates.pdf

Word explanation

DH: District Heating

GeoDH: Geothermal District Heating

RES-H: Renewable Energy Sources for Heat

BATs: Best Available Technology

ESCO: Energy Service Company

ESC: Energy Supply Contracting

EPC: Energy Performance Contracting

PPP: public private partnership

BOOT: Build – own – operate - transfer

Annex 1: Summary of Deliverable 4.1 – Report on Support Schemes

Executive summary / key messages

- Support schemes are crucial tools of public policy for geothermal to compensate for market failures and to allow the technology to progress along its learning curve. By definition, they are temporary and shall be phased out as this technology reaches full competitiveness;
- Innovative financing mechanisms should be adapted to the specificities of geothermal technologies and according to the level of maturity of markets and technologies;
- A Geothermal Risk Insurance Fund (is seen as an appealing public support measure for overcoming the geological risk. As costs decrease and markets develop, the private sector will be able to manage project risks with, for example, private insurance schemes, and attract private funding
- Geothermal heat technologies are heading for competitiveness, but support is still needed in certain cases, notably in emerging markets and where a level-playing field does not exist. In addition, there is a need for an in-depth analysis of the heat sector, including about the best practises to promote geothermal heat, the synergies between energy efficiency and renewable heating and cooling, and barriers to competition.

Project partner AFPG has delivered this annex content



Annex 2: Summary of Deliverable 3.4 – “Regulatory Framework for Geothermal District Heating (GeoDH) in Europe”

(note: The Regulatory Framework is being finalised during spring 2014 and can be followed at the geodh.eu; BK)

Proposing the removal of regulatory barriers in order to promote the best circumstances and simplifying the procedures for operators and policy makers interested in geothermal district heating systems (GeoDH) development in European countries is among the main objectives of the GeoDH Project. It will be met by the elaboration of the “*Regulation Framework for Geothermal District Heating Systems in Europe*” (“Framework ...”) – main outcome of WP3.

One shall point out that despite the fact that many regions possess deep geothermal energy potential suitable for district heating systems, such systems have been poorly developed so far. This is mainly due to the lack of adequate national and regional policies. Hence relevant “Framework ...” has been elaborated as one of the main outcomes of the GeoDH Project. It is mainly addressed to regional public authorities in charge of regulations and local development since they are deeply involved in licensing and other procedures related to geothermal exploration, exploitation, use and management.

The “Framework ...” covers the following main issues:

- Definition of geothermal energy resources and related terms,
- Geothermal resources ownership and regulations,
- Licensing systems for geothermal exploration and development concerning GeoDH systems,
(including simplification of the procedures),
- Licensing for district heating (DH),
- Geothermal energy (GeoDH) and the licensing authority,
- Access to information on geothermal resources suitable for GeoDH,
- GeoDH in national, regional and local energy planning and management,
- Role of public (decision makers, regional/local governments, administrations) and private stakeholders (ESCOs, DH operators, etc.).

The document was prepared on the basis of:

- Selected outcomes of former IEE project ‘Geothermal Regulations Framework – Heat’ (GTR-H), in particular provisions included in “Final Regulations Framework” of that Project (2006 – 2008),
- Outcomes of 14 national workshops and a questionnaire,
- Screening of selected literature,
- Some findings of the IEE GEOELEC Project.

Main recommendations of the “Framework...” are:

1. Administrative procedures for geothermal licensing should be fit for purpose – they should be streamlined wherever possible and the burden on the applicant should

reflect the complexity, cost and potential impacts of the proposed geothermal energy development,

2. The rules concerning the authorisation and licensing procedures must be proportionate. The administrative process must be reduced.

The proposal of “Framework ...” was the subject of national consultations in 14 GeoDH Project countries. The next step will be to engage relevant authorities involved in decision making for endorsing this document. Eventually it will be presented as recommendations to consider while updating or elaboration legal and administrative acts and provisions for district heating and geothermal district heating systems in particular countries and regions.

Project partner PASMEERI has delivered this annex content



Annex 3: Summary of cost analysis on GeoDH and conventional DH

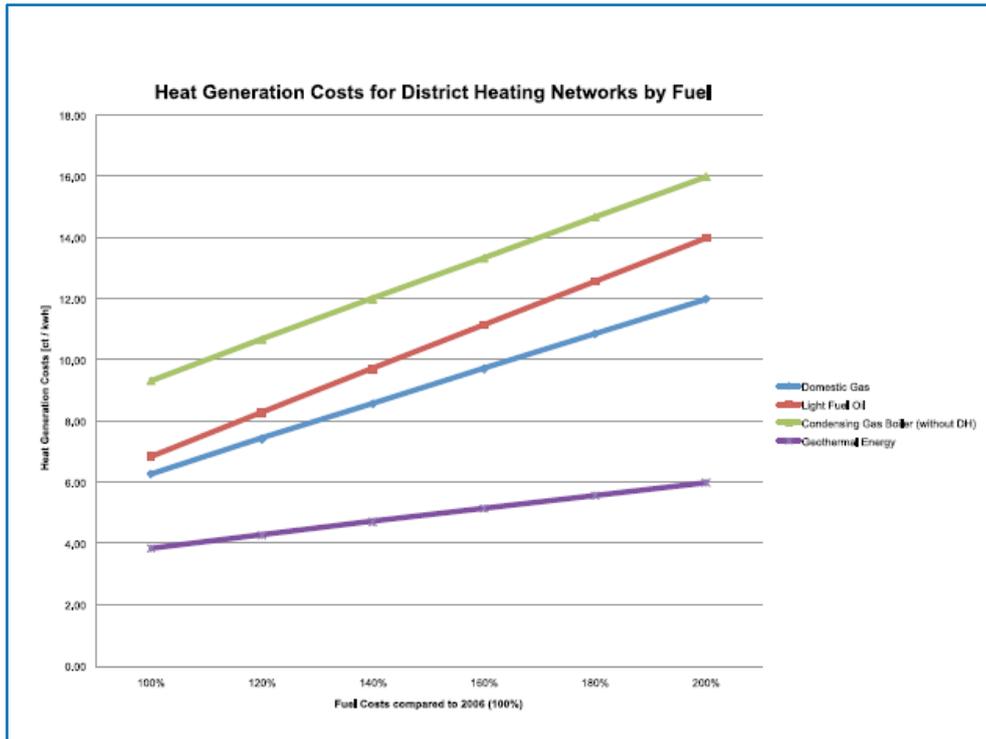
Comparison of the heat generation costs of geothermal/fossil Fuels

Deriving an average cost of generating heat from fossil fuels in Europe is not easy, because of the high proportion of the operating costs. Approximately 60% of the heat generation costs derive from the operating costs and thus, the price for fossil fuels is the main parameter of the heat generation costs. As the prices for fossil fuels are very different from country to country and the prices for fossil fuels are, very volatile a meaningful assessment of heat generation costs is not possible. For example, in Italy, the prices of light fuel are 120% higher than those in Luxembourg, which is due to the high taxes for light fuel in Italy. In the case of gas prices, the gap between the highest priced country, i.e. Denmark, and the country with the lowest prices, i.e. Romania, is about 215%.

Due to the high differences in the costs for fossil fuels in each EU country, a comparison of the heat generation costs is nearly impossible. In that study, the correlation of heat generation costs with the increase in prices of fossil fuels are monitored and compared to geothermal energy. Operating costs for both geothermal and fossil-fuel heat generating plants ultimately depend on the price of primary energy. But the primary energy of geothermal plants is not entirely dependent on fossil fuels, while that of fossil-fuel plant is.

Thus, in the case of ever-increasing fossil fuel prices, fossil fuel plants will see their operating costs rising much more rapidly than the costs of geothermal plants.

The following figure clearly highlights the advantages of geothermal energy when assuming an increase in prices for fossil fuels compared to the fuel prices in 2006.



Comparison of geothermal heat generation costs with gas and fuel

The heat generation costs of geothermal energy are low in absolute terms due to the assumption of a high rate of utilization of geothermal energy, e.g. up to 8500h per year. This cost advantage in absolute terms is not based solely on the technical suitability of geothermal energy, but, also, on its economic characteristics, that is on its low variable costs and its high fixed costs. The cost advantage in absolute terms is additional to the relative cost advantage of geothermal power, in case primary energy prices rise rapidly.

2. Comparison between a DH network using natural gas and a geothermal DH in the Paris area.

2.1 Description of an existing project located in Ile de France in the Val de Marne department

The geothermal doublet has been producing heat for 31 years. The wells were built using the first technology established in the Paris basin and consequently the producing casing was only in 7" at the top of the reservoir at 1860m depth. The deposits and corrosion in the first ten years of exploitation has caused severe problems which were managed using patches and work overs in the two wells. The corrosion was managed using injection at the bottom hole of filming molecules and the doublet is actually producing a flow of 175 m³/h. The geothermal water flow rate is decreasing and the quantity to produce each m³/h is increasing.

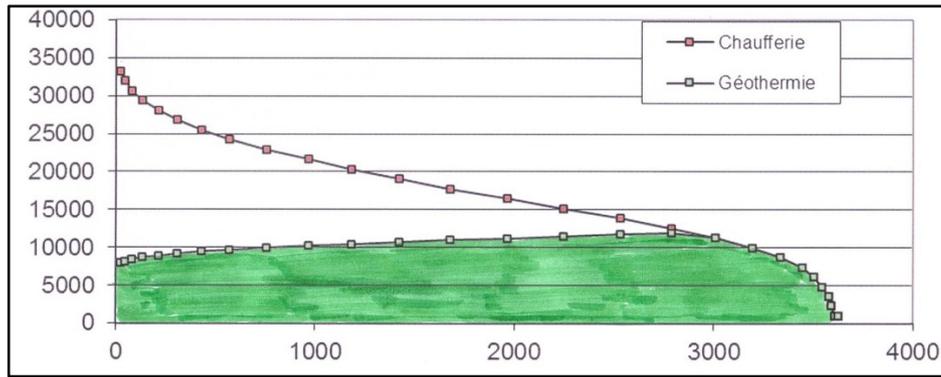
The municipality has taken the decision in 013 to re-drill a new doublet in order to continue to exploit the heat underneath the city. Due to the preparation (permits, call for tender, subsidies files, insurances...), it is expected to drill the two deviated wells in 2015 and put in production the new doublet in the winter 2016. At that time the old doublet will continue to produce geothermal water at a limited rate before to be plugged and abandoned.

The new doublet is design in big diameter in order to allow the production of 350 m³/h, which represent a heat power of 12,2 MW assuming a production temperature at 70°C and a reinjection at 40°C. These new doublets can be re-cased after 35 years of exploitation and start again an exploitation period of 35 years even at reduced production flow rate. Consequently, the new doublet will be exploited for a minimum time period of 70 years from 2016 to 2086.

2.2 Technical aspects of the project

- Heating needs of the existing network: 67 480 MWh/year
- Total needs including the losses: 81980 MWh/year
- Geothermal station power 15000 kW
- Geothermal annual production: 5 300 MWh
- Pumping system power for production: 400 kW and 1650 MWh/year
- Pumping system power for injection: at 600 kW and 1900 MWh/year
- Back up and complementary energy used is natural gas
- Back-up power installed at 41MW with boiler efficiency at 90%
- Annual gas consumption: 20347 KWh

The heating curve is the following for 2016 (cumulative hours of heating in abscissa and power in kW in ordinate), and the green zone is ensured by geothermal energy.

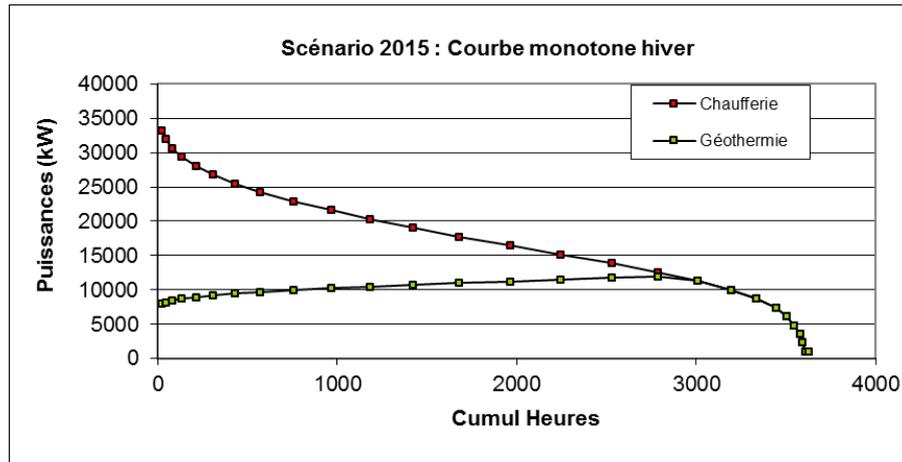


The geothermal covers 75,2% of the heat production and sanitary hot water avoiding 16967 tons of CO2 emissions per year.

2.3 Comparison table between an exploitation of the DH powered 100% with natural gas and Geothermal+ natural gas

Annual expenses (K Euros without VAT)	Gas solution	Geothermal solution
Gas to be purchase on the market	3830	
Gas to be purchase on the market		1099
Electricity consumption for gas plant	22	22
Electricity for geothermal pumping		240
Ordinary geothermal maintenance		550
Ordinary gas station maintenance	423	
Ordinary gas station maintenance		200
Ordinary network maintenance	326	326
Geothermal installation replacement		246
Total annual expenses	4601	2683

This table shows that the annual cost to exploit the DH network using the geothermal doublet is of 1918 K€.



2.4 Investment cost to build a new geothermal doublet

The first table below correspond to a doublet of drilling in 9”5/8 casing at the top of the reservoir with a maximum deviation of 50°. The second correspond to all the equipment in the well and at the surface to exploit the geothermal water. The total investment is 14300 K€.

Drilling of 2 deviated wells	K Euros
Grant application ADEME	10
Insurance application SAF Environment	10
Geothermal lease and application for permits	95
Civil works (platform, fence, anti-noise , cellars)	700
Cranes works, transportation, storage	60
Drilling rig mob, demob and moving	650
Drilling (energy included)	2 200
Overreaming	250
Drilling mud	520
Drilling tools	170
Deviational including personal	700
Electrical logging	520
Casings	920
Installation of casings (accessories , screwing)	310
Cementing	900
Stimulation and development	85
Acidizing jobs	130
Mud treatment and cuttings removal	960
Well heads and valves	130
Geological follow up	410
Supervision on site 24/24	400
Cleaning of the platform	500
Insurance SAF short and long term	630
Engineering	190
Provision for unexpected	480
Total	11 930

Geothermal loop at the surface		K Euros
Production pump (300 m ³ /h)		215
Pumping tubing (DN 175 coated)		140
Transformer		100
Piezometric tubing		10
Inhibitors line and accessories		180
Injection pump		60
Frequency variators		80
Regulation cos phi		20
Titanium plate heat exchangers		215
Handling of equipments		20
Geothermal water piping at the surface		210
Filters station		25
Monitoring of the loop including instruments		15
Water tank (4m ³)		25
Digital systems		20
Architect, engineering and control		300
Heat station surface piping (DN 200 to 350)		450
Connection to the grid		90
Electric rack		95
Pumps for secondary loop		100
Total		2 370

2.5 Operating cost of a doublet (OPEX)

The operating and maintenance costs are ventilated into four sections for both systems: geothermal loop including the well to the main heat exchanger and surface and network installation downstream from the heat exchange with hot geothermal water).

- P1 represents the energy consumption electricity and natural gas for peak production and back up
- P2 is the regular maintenance
- P3 is the heavy maintenance and equipment replacement if needed
- P'3 geothermal loop is the work over provision for the two wells
- P'3 surface is stock for repair and insurance

Operating costs and maintenance			K Euros
Geothermal loop			
P1	Electricity		240
	Corrosion inhibitors		70
	Water		5
P2	Regular maintenance		30
	Electrical Logging		20
P3	Heavy maintenance		88
	Equipment replacement		40
	Work force and 24/24h follow up		15
	Stock ,for repairs		15
P'3	Work over in the wells		55
	Insurance		45
District heating network surface installations			
P1	Electricity		20
	Natural gas		1 100
P2	Work force and 24/24h follow up		420
P3	Equipment replacement		320
P'3	Stocks for repair		50
	Insurance		150
Total			2 683

2.5 Payback time of the geothermal CAPEX

The CAPEX for geothermal is 14300 K€ and the annual benefit of expenses using geothermal calculated at 1918 K€, the resulting rough pay back is of 7, 45 years excluding the financial approach and the fact that the community as to borrow the main part of the investment.

The financial approach presented in the table below shows the impact of the loans to be contracted. The rate of interest chosen here at 3,2% is a mix 50/50 between a commercial bank offer at 4,2 and the Caisse des Dépôts et Consignations (CDC) loan reserved to public entities such as municipalities at 2,2%.

The table has been built using the following input: project life is 20 years, Discount rate at 6%, interest rate at 3,2, inflation rate at 2%, annual escalation electricity price at 2%, annual gas escalation price at 5%, annual heat escalation price at 3%, and electricity purchase at 70€/MWh.

The investment is 14300 K€ and the equity at 400 K€.

YEARS	base	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
BASIC DATA																						
project life (years)	20																					
investments 10 ³ €	14300	7150	7150																			
debt 10 ³ €	12297																					
debt 10 ³ €																						
debt 10 ³ €																						
equity 10 ³ €	4000																					
discount rate %	6																					
interest rate %	3,2																					
inflation %	2																					
annual OM costs 10³ €		0	0	2683	2737	2791	2847	2853	2910	2968	3028	3088	3357	3424	3493	3562	3634	3706	3781	3856	3933	
geothermal production		0	0	78161	78161	78161	78161	77223	77223	77223	77223	77223	77223	80662	80662	80662	80662	80662	80662	80662	80662	80662
geothermal selling price €/MWhr	70	0,00	0,00	70,00	72,10	74,26	76,49	78,79	81,15	83,58	86,09	88,67	91,33	94,07	96,90	99,80	102,80	105,88	109,06	112,33	115,70	
equity depreciation (linear) 10 ³ €	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
profit taxation rate %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
geothermal revenues 10³ €		0	0	5471	5635	5804	5979	6084	6267	6455	6648	6848	7367	7588	7816	8050	8292	8541	8797	9061	9333	
ECONOMIC ANALYSIS																						
years of loan repayment	20	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
years of loan repayment	14							0	1	2	3	4	5	6	7	8	9	10	11	12	13	
years of loan repayment	9												0	1	2	3	4	5	6	7	8	
debt 1 repayment annuity 10 ³ €		1008	989	969	949	930	910	890	871	851	831	812	792	772	753	733	713	694	674	654	635	
debt repayment annuity 10 ³ €								0	0	0	0	0	0	0	0	0	0	0	0	0	0	
debt repayment annuity 10 ³ €																						
debt repayment annuity 10³ €		1008	989	969	949	930	910	890	871	851	831	812	792	772	753	733	713	694	674	654	635	
interests on debt 10 ³ €		394	374	354	334	315	295	275	256	236	216	197	177	157	138	118	98	79	59	39	20	
interests on debt 10 ³ €								0	0	0	0	0	0	0	0	0	0	0	0	0	0	
annual interests on debt (debt)																						
interests on debt 10³ €		394	374	354	334	315	295	275	256	236	216	197	177	157	138	118	98	79	59	39	20	
net income 10 ³ €		-8358	-6339	1619	1749	1883	2021	2141	2286	2435	2589	2748	3018	3192	3371	3555	3745	3941	4142	4350	4565	
cost effectiveness		0,00	0,00	0,30	0,31	0,32	0,34	0,35	0,36	0,38	0,39	0,40	0,41	0,42	0,43	0,44	0,45	0,46	0,47	0,48	0,49	
FINANCIAL RATIOS																						
net present value (NPV) 10 ³ €	12727																					
internal rate of return (IRR) %	12,17																					
profitability index (PI)	1,99																					

2.5 Comparative costs between a kWh produced by natural gas and geothermal

The example of this doublet in Ile de France is demonstrative.

The actual production cost of the heat generated using 100% gas is of about 56€/kWh for a final selling price to the consumer at 70 € including everything. The same kWh produced with a mix of natural gas (24, 82%) and geothermal (75, 18%) is of 32, 7€/kWh. The difference which is 23, 3 €/kWh will allow to finance the construction of the doublet.

The production of the network is 81980 kWh/ year representing a turnover of 5739 € and the annual economy using geothermal is 1918 €, consequently eight year after 2016, the community will start to gain about 2 million euros per year. Depending the structure of the exploiting company, the price of the kWh could be sold lower.

Regarding this possibility, some municipalities has achieved that already just maintaining the price without any escalation.

Project partner AFPG has delivered this annex content



Annex 4: Comparison between French business models

Different French Business Model	Financial package	Financial advantages	Financial limitation
Public	Creation of a subsidiary budget The public body finance the works (in general using loan) and takes over the operation.	Internal profitability Rate (I.P.R.) can be lowered because the public body have theoretically better borrowing conditions than a private actor. Nevertheless, it is sometimes difficult for a municipality to borrow because strongly dependent of the former credits already subscribed and the level of municipal debt.	Public body undertakes all the financial risks. The public participation level and the sales conditions initially planned are not guaranteed and will be adapted each year in relation with the annual balance of the project.
Public/private	The public body finance the works (in general using loan) and delegates the operation and the exploitation Public body transfers annuity to the delegate (« farmer ») who includes it inside the tariffs billed to the DH users.	The public body have theoretically better borrowing conditions than a private actor. Nevertheless, it is sometimes difficult for a municipality to borrow because strongly dependent of the former credits already subscribed and the level of municipal debt.	The potentially longer works raise the costs of the operation. Public body undertakes several risks (during the investment and the exploitation phases) The public participation and/or tariffs cannot be guaranteed a priori. Monitoring costs are added.
Concession	Public body delegates the full service The exploitation principle is the same as those existing in the public/private model. Moreover the delegate should realise investments of capital costs (CAPEX) and the costs inferred to create a new company (in general a subsidiary of the utilities selected by the municipality).	Public body takes, a priori, less risk which means that initial parameters are better guaranteed Care should be taken to the fact that concession does not mean « full risk transfer » Minimization (but not neutralization) of the monitoring costs	Higher I.P.R., but to be modulated according the effective risk which depends strongly on the contract to be signed.

Project partner AFPG has delivered this annex content.

Annex 5: Summary of Deliverable 3.2 – Table (excel) presenting the results of the survey on existing administrative barriers

The survey on existing administrative barriers was carried out in each project country by screening of existing previous studies and by collecting information from websites and direct contacts such as interviews. All results of the survey were summarized and gathered in an excel table, in order to present and compare barriers identified in each of the 14 project countries.

Generally main identified barriers may be summarized as follow:

- In many countries, especially in those with juvenile and, to a lesser extent, in those with transition geothermal DH market, geoDHs are not taken into account into NREAPs, although geothermal development is considered;
- RES directive 28/2009/CE (especially as regards articles 13.1, 13.3, 14.1) is transposed in almost all project countries, however sometimes the implementation of these articles does not appropriately consider DHs (e.g. as in the Netherlands) or geothermal energy (e.g. as in Ireland);
- In some countries the administrative procedure to obtain permits to develop a geoDH plant (surface and subsurface structures) is rather complex, it may change by region and often it requires long time. Moreover the legislation concerning authorizations may have several gaps and contrasts, while in other countries the permitting phase is easier for shallow geothermal;
- Lack of enough qualified specialists and expertise, both among companies and at administrative level;
- GeoDH projects are capital intensive, mainly due to the drilling phase, which may entail high mining risk and it is rarely covered by financial support schemes such as guarantee funds or insurances;
- Financial supports to geoDHs are often inadequate or do not exist;
- Prices of heat delivered with geoDHs may be less competitive for end users than using other heat sources (e.g. gas or fossil fuels);
- The lack of specific provisions on the kind of service offered by DH plants and on the ownership of networks may lead to market competitiveness concerns, since DHs are “natural monopolies”;
- The lack of lobbies on geoDH and of an independent office or professional service may slow down the development of new geothermal DHs in Europe.

For more details about administrative barriers to the geothermal DH development, please read other deliverables available on the section “library” of the project’s website www.geodh.eu:

- [Deliverable 3.1](#): Workshops reports including questionnaire, main conclusions and feedback analysis

- Deliverable 3.2: Table (excel) presenting the results of the survey on existing administrative barriers;
- Deliverable 3.3: 14 Reports on evaluation of the (market) barriers: at national level and local market barriers in region/cities of 14 European Countries and proposals for their removal.

Project partner COSVIG has delivered this annex content.

