TOWARDS NEW BUSINESS MODELS FOR GEOTHERMAL COMPANIES: STATE AND TRENDS

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ABSTRACT

The present paper will describe the current business models for geothermal District Heating (DH) and geothermal power (including cogeneration), their financial rationality and the trends towards new models adapted to new market design regulations. The process of business model design is part of convincing clients such as municipalities and operators in their business strategy. The work will include a presentation of the different business strategies used to approach the consumers and a description of their financial rationality.

The paper will assess, for each geothermal technology, the core aspects of creating value for a company (public, private, mix), and contributing to defining business strategies, including: upfront costs, running costs, core processes, infrastructure, organizational structures, selling options, and influencing regulations.

The business model development will be carried out on the basis of Osterwalder & Pigneur's (2010) business model canvas. 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. It creates a common framework for understanding and working with business model across all European countries, which is necessary in order to develop new business models and to analyse and evaluate the generated business models.

On geothermal district heating, the focus will be on geothermal DH developers and operators. The costs will be analysed and compared with conventional DH and power systems costs and prices.

For geothermal power, the analysis will focus on both turbine manufacturers and project developers, and will describe the possibility to reduce time of project development.

1. INTRODUCTION

This paper aims at presenting how the business models are changing according to different parameters but mainly due to the market conditions. In Europe, the energy sector is seeing a revolution due to policy commitments regarding climate change, energy security and poverty. The geothermal DH and power companies will need to adapt.

Firstly, we have seen in Europe geothermal power plants built by utilities in situation of monopoly. For geothermal DH, the situation was different. If more power was needed in Europe due to the economic growth until end of the seventies, so more installed capacity was required; for DH the competition with individual applications like boilers, was key. We can also consider the fact that when a DH was installed the obligation of the customers to connect was nearly obligatory.

Then, several changes happened in the business models of the companies due to their strategies to be integrated vertically or horizontally; or due to the regulations like the liberalisation of the energy markets.

The trends towards a low carbon economy impose to the geothermal companies to adapt and to propose a new generation of geothermal 'products'.

2. THE STORY OF THE BUSINESS MODELS

In situation of monopoly, utilities developed geothermal projects being partially integrated: engineering, drilling for some companies, turbines, connection to the grid, operation of the plant, and transmission & distribution of the electricity. The prices were often fixed by the State, so the business models had to adapt to this fact. As mentioned above, the need for more power was an opportunity to develop geothermal plants without this constraint.

In the DH sector, the issue was more the competition with fossil fuels.

The main change for the business models in the geothermal sector has been the European legislation developed from the nineties to liberalise the electricity and gas markets.

A second key change has been the climate and energy package 2020 allowing an important development of renewable energy with support policies.

Today, geothermal companies seem less integrated than before. The newcomers are rather small companies and specialised. Integrated companies are

rather rare and often only specialised in the underground or the surface systems. Recently, some mergers and acquisition lead to a consolidation of the companies in the sector.

The business models of the geothermal companies will continue to evolve but more due to the customer behaviour than to a centralised decision.

2.1 The District Heating sector

The main actors are the project developers, the DH operators and the services companies. In order to define the business model of a geothermal DH project, the heat customers are a key element. The presence of one large heat consumer helps the economy of a project greatly. Local DH utilities with a need for renewable and flexible heat supply, and building owners with a need of heat supply are two interesting customer segments.

Generally geothermal DH offers the heat consumer the following:

• Stabile secure heat supply;

• Fixed, long term prices (for production and depreciation);

• Lower need for maintenance (compared to other conventional heat sources);

• Lower risks (when in operation);

• Ease and comfort for the end-user.

Geothermal DH technology is quite a mature one, in use for 50 years, and geothermal DH installations are competitive. However geothermal space and district heating systems are capital intensive, especially drilling the wells. Operating expenses, nevertheless, are rather low and much lower than in conventional systems. Generating costs and selling prices are usually around 60€/MWh thermal, within a range of 20 to 80€/MWh thermal. 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 publicand 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.

Two business models can be given as an example:

1. The case of a DH company decarbonising its heat supply in close cooperation with energy service companies (ESCOs). Here the main marketing strategy would be to combine sustainable heat supply (possibly with use of labels or certificates) and energy saving services so as to widen the scope of activity, and reducing the impact of the inevitable reduction in energy consumption.

2. The second case would concern a geothermal DH project developer (public or private) aiming at proposing a newDH system supplied by geothermal. The objective would be to convince heat users of the value of renewable energy sources which are stable and competitive.

Finally, specific attention should be paid to multi-purposes uses. It is sometimes presented as an obvious solution for improving the economy of (notably) CH P, but it seems less and less easy to develop them. Today few examples exist all over Europe.

2.2 The geothermal power sector

The geothermal electricity sector is composed by project developers, drillers, manufacturers, operators and utilities.

The business models aim at selling power at a competitive price, taking into account the high capital costs and the risk associated. Regarding economics of geothermal power technologies, where high-temperature hydrothermal resources are available, in many cases geothermal electricity is competitive with newly built conventional power plants. Binary systems can also achieve reasonable and competitive costs in several cases, but costs vary considerably depending on the size of the plant, the temperature level of the resource and the geographic location. EGS cost cannot yet be assessed accurately because of the limited experience derived from pilot plants.

Levelised generation costs of geothermal power plants vary widely. New plant generation costs in some countries (e.g. Tuscany-Italy) are highly competitive (even without subsidies) at ca. € 50/MWh for known high-temperature resources. They are largely depending on the main cost components: drilling which can be 30% for high-temperature plants 50% for low temperature and 70% for EGS. The very high capacity factor >90% (the highest of all energy technologies including nuclear) mitigates the capital intensity to render geothermal technologies competitive.

Project developers are diverse. Utilities are large companies but many developers in Europe are rather small and specialised in a phase of the project.

Utilities and oil&gas companies active in the geothermal sector are integrated vertically, having in general already the drilling rigs and crew.

For some years a new generation of developers in Europe proposes innovative business models. A Turbine manufacturer like Ormat is now proposing also to build power plants and sell electricity. The turbines manufacturer sector has been the most innovative. Mergers have led to horizontal integration (Turboden and MHI, Alstom and GE…). Small developers are specialised in project management and forms consortia to develop the project. One of them, Fonroche, decided to acquire a rig for not being too dependent of the drilling market. Finally, we have seen in Turkey holdings diversifying their portfolio in being active in the power sector by developing geothermal projects. They have financial resources and often they create a geothermal company for the project development.

3. TOWARDS A NEW MODEL:

3.1 Factors influencing a Business Model

The main factors which influence the business models of the geothermal companies are the following:

- Policies: market liberalisation, state aid

The market conditions in the EU electricity and heat sectors prevent geothermal from fully competing with conventional technologies developed historically under protected, monopolistic market structures where costs reduction and risks were borne by consumers rather than by plant suppliers and operators. The internal market is still far from being perfect and transparent. Firstly, in many countries electricity and gas prices are regulated, thus they do not reflect the full costs of the electricity and/or heat generation. Secondly, fossil fuel and nuclear sectors still receive many subsidies. Thirdly, there is lack of market transparency, including lack of information provision to customers and tax-payers and a clear billing.

- Heat and electricity demands:

The demand for more electricity in Europe is mainly linked with the economic development, and its increase is due to more demand for comfort and new IT applications. But energy efficiency policies and measures have an impact on the electricity demand. We can forecast a stagnation or a small decrease at the horizon 2030. The transition towards a low carbon economy means also more demand for green electricity replacing fossil fuels power plants. Finally, Customer behaviour has an impact on the power demand, and the trends towards decentralised production will affect the electricity sector and also the geothermal market.

- Geothermal Risk mitigation:

With the notable exception of a few European market participants operating in well-developed geothermal regions, project developers have very little capability to manage the financial risk owing to the poor knowledge of the deep subsurface, lack of technological progress and high cost. In effect the probability of success/failure weighted net present values of project cash flows tend to be overly negative, thus effectively shutting out private capital from investing in geothermal energy. However, with technology development (increasing the probability of success of finding and developing geothermal reserves) coupled with experience and thus reductions in cost, project developers will eventually be able to accept and, where appropriate, transfer project risks (technical, economical, commercial, organisational and political) in such manner that private funding will become available. Until then, a public Geothermal Risk Insurance Fund is seen as an appealing public support measure for geothermal.

- Capital costs and financing:

Geothermal electricity development costs vary considerably as they depend on a wide range of conditions, including resource temperature and pressure, reservoir depth, location, drilling market etc. The capital costs per geothermal technology range from 3-4 €mio/MWe for high temperature to 6 €mio/MWe for low temperature and more than 7 €mio/MWe for EGS.

O&M costs in geothermal electricity plants are limited, as geothermal plants require few or no fuel. Commercial costs associated with developments also need to be included in costing a geothermal project. These include financing charges (including establishment costs and interest), interest during construction, corporate overhead, legal costs, insurances. For geothermal, risk insurance is the main issue. It depends on the origin of the resources invested and the way they are secured, as well the amount of initial capital investment.

- Prices options and new market design

Prices reflecting actual scarcity in terms of time, location, and available transmission capacity will indeed be key ingredients of the new market design, particularly to reward flexible production/consumption and a more balanced electricity technology mix having complementary specificities in terms of load factor, regional potential etc. As far as the generation side is concerned, flexibility should be rewarded also from the new generation of flexible renewable electricity technologies, including geothermal plants. Flexible RES technologies can be used in partial load operation and in certain cases can quickly ramp their output up and down on demand. These technologies even changes in the range of 20 to 100% with a speed of

2% per second could be achieved with proper management of turbine and by-pass valves, as has already been used according to the requirements of German legislation. Operators of flexible RES installations can therefore offer ancillary services to system operators and provide valuable short and long-term flexibility at a regional level (including transborder), a step between centralised and decentralised systems. In this regard, it is worth highlighting how most balancing regimes (Germany being an exception) and infrastructure planners rarely take the potential flexibility from these technologies into consideration. The new market design should contribute to change this picture including through prices better reflecting scarcity. This approach can reduce over-capacity and alleviate the need for additional transmission and distribution infrastructure as well as costly storage. Overall, this will result in improved system adequacy, lower system costs and more social support for the transformation of our energy system.

3.2 Towards geothermal products

Although the new growth in the geothermal DH and power sector, seen since 2010, the speed of this increase is not high enough to have an impact on the energy sector. Several reasons can explain this little development, and we will concentrate in this chapter in envisaging new business models for allowing a faster development of the sector.

If we consider the energy policies, the heat and electricity demands and the prices options and new market design mainly defined at a macro-level, the two micro-levels influencing the geothermal business models are the Geothermal Risk mitigation and the Capital costs and financing.

The risk associated with geothermal exploration and the huge capital costs required for project development are two important elements which need to be integrated. When presenting a geothermal project to a client or a financial institution, these two elements impose long discussion and negotiation. It has a cost.

One proposal to overcome this barrier would be to integrate all the geothermal development project phases into a ‘single geothermal product’ where the client receives proposal for electricity and heat supply.

The idea is not to hidden the risk associated with geothermal exploration and the huge capital costs required for project development, but to propose a package where the quality of the geothermal energy is highlighted, and the management of the project phases is done by the ‘geothermal product’ company or consortia.

There is a need to define the products: heat, power, or power&heat, base load or flexible supply, heat temperature etc.

It implies also some vertical integration, at minima in the form of a consortia: consultancy, services, manufacturing, building

Marketing will be a key aspect while selling a product to the customers. It will include price definition, location of the project, kind of geothermal product and promotion of the geothermal product.

When promoting a geothermal product, one should go beyond the tangible product itself – geothermal electricity, heating and cooling. It must be combined with an increased product: the added value of the product – security and firmness, installation and service, financing, etc; and by the product benefits offered: comfort, low operational costs, environmental.

Finally, adding more IT tools and applications in the geothermal product will increase its marketing power.

4. CONCLUSIONS

This topic has neither been really studied until now, but it is key to take the business models into consideration to ensure the development of the geothermal projects.

While living currently an energy revolution, the geothermal sector has to be more innovative not only technologically but also in terms of marketing.

The business models have to adapt, with companies being more integrated.

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