How is evaluated acceptability of an EGS project in Europe: the Soultz-Kutzenhausen geothermal project?

Laure Lagache[1], Albert Genter[1], Jörg Baumgaertner[1, 2], Nicolas Cuenot[1], Thomas Koelbel[1, 3], Pauline Texier[4], Guerric Villadangos[1, 5]

[1] GEIE Exploitation Minière de la Chaleur, Kutzenhausen, France

[2] Bestec GmbH, Landau, Germany

[3] EnBW Energie Baden-Württemberg AG, Karlsruhe, Germany

[4] Université Jean Moulin, Lyon, France

[5] Groupe ES, Strasbourg, France

genter@soultz.net

Keywords: EGS, Social acceptance, Local population, Soultz-sous-Forêts, Kutzenhausen, France.

ABSTRACT

An opinion survey about acceptability of Enhanced Geothermal System (EGS) has been carried out in connection with the geothermal power plant of Soultz-sous-Forêts (Alsace, France). More than 200 individual interviews were conducted in summer 2012 with a representative sampling of the local population of the neighbouring villages of Kutzenhausen and Soultz-sous-Forêts. A questionnaire was presented in order to test the sensibility of the local population about this rather new technology. More than 200 adults fulfilled the questionnaire and detailed answers were collected and analysed. The biggest causes of nuisance are the noise generated by the technical equipment of the power plant and induced seismicity. Thus, geothermal energy is felt like a rather favourable technology by the local population, even if there are always some reluctant people. In conclusion, the risks related to the geothermal exploitation are rather accepted as a whole.

1. INTRODUCTION

The Soultz-sous-Forêts project located in Alsace (France) has been running for more than 25 years (Fig. 1). More than 20 km length of boreholes have been drilled at great depth (5 km), and hydraulically and chemically stimulated for developing an Enhanced Geothermal System (EGS) site. Thus, after various hydraulic circulation tests, a binary plant for producing electricity has been designed, built, tested and operated for its geothermal potential (Genter et al., 2010). At Soultz, many efforts have been dedicated for communicating either to specialists through conference, publications, or PhD thesis either to non-specialists such as public, schools, or politicians. However, over those 25 years of geothermal activity, the acceptability of the local population was never measured by an opinion survey which is the aim of this paper.

Figure 1: The Soultz power plant. In the back, the first houses of Kutzenhausen are visible.

2. SOCIAL ACCEPTANCE AND DEEP GEOTHERMAL ENERGY

Social acceptance by the local population is an obvious pre-requisite for the smooth implementation of any deep geothermal project. The probability of success of social acceptance is driven by three main conditions: (1) limitation of environmental issues, (2) prevention of negative effects on people's health, and (3) creation of real benefits for the local communities (Cataldi, 1999).

Deep geothermal energy is a quite unknown and rather complex technology for non-specialist. A key issue for whether a technology is accepted by society is how the technology and its associated risks are perceived. If society perceives the risks to be too great, it can delay, or stop the implementation of a new technology (Dowd et al., 2011).

As there is no large-scale educational programme in France about geothermal energy, its main advantages and drawbacks are not really known. Taking into

account that people usually do not have a clear understanding of what types of environmental impacts are linked with the introduction of a new technology, there is primarily no resistance during the initial phases of a given geothermal project such as exploration and drilling (Popovski, 2003). However, every new technology introduced in the market could generate some fear.

Populations of Western Europe are in favour of geothermal energy, even if it is relatively unknown. Reif (2011) illustrated this by pointing out that about 95% of Germans are in favour of renewable energy, but specifying "not in my backyard". For the public, it is difficult to distinguish between the various types of geothermal energy (geothermal heat pump versus deep geothermal energy). In addition, press is talking about these topics often negatively. Close to the Soultz area, it was illustrated by damages caused by shallow geothermal drilling at Staufen in the Black Forest in 2007 or those generated by induced seismicity during the hydraulic stimulation of a deep geothermal well in Basel in 2006. The short term effects of deep geothermal energy like induced seismicity and failures in communication may create anxieties and opposition among the affected people that could hinder the further development and diffusion of this technology (Leucht et al., 2010).

3. OPINION SURVEY

3.1 Motivation

Acceptability of geothermal energy in general and Enhanced Geothermal System (EGS) in particular is a topic that had not yet been investigated in France. Even with a quite long tradition in geothermal energy in France with more than 30 years of activity in the Paris basin area, there is no baseline study about acceptability. Thus, a first comprehensive acceptability study was carried out by the French-German industrial consortium (European Economic Interest Grouping Heat Mining) which exploits the Soultz plant with the academic input from sociologists of Lyon University (Lagache, 2012). Moreover, the mayors of Kutzenhausen and Soultz-sous-Forêts were involved and informed about the consultation launched in their villages.

3.2 Methodology and objectives

The study is mainly based on the localities of Soultz-sous-Forêts and Kutzenhausen, since these are the two villages surrounding the industrial group which operates the geothermal site. The opinion survey must be as representative as possible to the French population. It is the reason why demographic and socio-economic data from the French National Institutes of Statistics of Economic Studies (INSEE) served as a reference. Thus, we must ask as many men as women and try to respect ages according to their distribution in the two localities. The quota method used is a sampling method widely used in opinion polling. It is based on an analysis of the categories of persons by age, sex and social class in order to highlight their differences in perception, if they exist. This is to ensure the representativeness of a sample by assigning a structure similar to that of the base population.

For optimal effectiveness of the questionnaire, assumptions and targets were set in advance, which helped to develop relevant questions, which can provide meaningful information. Six main objectives have been identified:

- Objective 1. Assess the level of knowledge of the population on deep geothermal energy.
- Objective 2. Whether the local population is aware of the risks to which it is exposed.
- Objective 3. Assess the level of public information on deep geothermal energy.
- Objective 4. Whether the presence of the Soultz geothermal site is beneficial for the local population.
- Objective 5. Whether the presence of the geothermal site is a source of issue for the population.
- Objective 6. Know the perception of deep geothermal energy by the population.

Thus, a questionnaire of 79 questions was prepared and submitted to the local population. While asking questions and seeking to know the perception of the local population about deep geothermal energy, a series of educational flyers and brochures was systematically presented during the interview (Fig. 2).

Figure 2: Geothermal team conducting the interviews for the acceptability study in the Soultz village. Flyers, posters and brochures were systematically presented during the questionnaire.

Thus, a lot of information was given during those exchanges. The aim was to inform on the principle of geothermal energy and potential associated risks. Interviews were done inside the villages on specific places were local people are coming daily. Thus, we selected one supermarket area located down-town, the municipal hall for arts (cinema, theatre, dance, music

lesson, ...) and the public library of Soultz-sous-Forêts.

Thus, 203 interviews face to face, lasting approximately 15 minutes were conducted with a representative sample of the local population of Kutzenhausen and Soultz-sous-Forêts. The questionnaire was realized with people older than 18 years, between June 21 and July 13, 2012. The questionnaire was tested and validated in advance by the mayors of both towns.

3.3 Results

The primary objective of this survey was to assess the level of knowledge of the local population on deep geothermal energy. The results indicate that geothermal energy is moderately known from the public. Indeed, only 55% of people who have been living here for less than 5 years have some information about the Soultz geothermal plant. Moreover, women are much more informed than men about deep geothermal energy.

Regarding the level of awareness of risks associated with exposure to deep geothermal energy (objective 2), 83% of the people believe that there are no risks on their community. The main potential risks remain induced seismicity and noise (Fig 3).

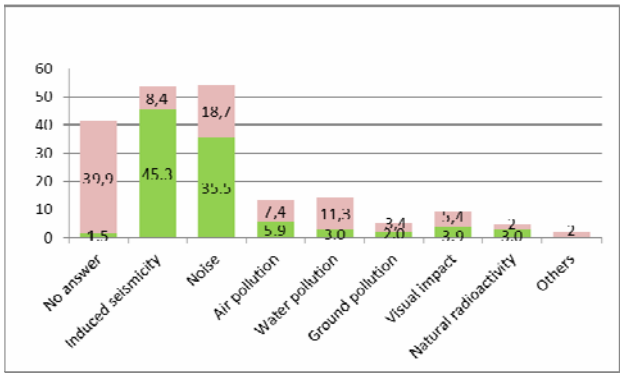
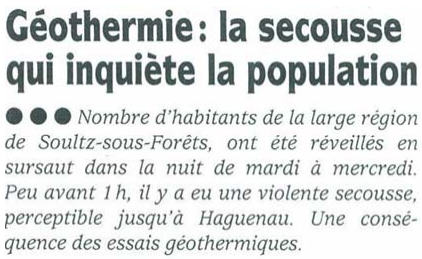


Figure 3: Main nuisances related to deep geothermal energy in percentage (Lagache, 2012). First and second mentioned nuisances are plotted in pink and green respectively.



Géothermie : la secousse qui inquiète la population

Nombre d'habitants de la large région de Soultz-sous-Forêts, ont été réveillés en sursaut dans la nuit de mardi à mercredi. Peu avant 1 h, il y a eu une violente secousse, perceptible jusqu'à Haguenau. Une conséquence des essais géothermiques.

Figure 4: Example of a local newspaper (DNA: Dernières Nouvelles d'Alsace, 16/06/2003) showing the fear about induced seismicity felt in the Soultz area in June 2003.

Various pollutions, visual impact of the geothermal plant or natural radioactivity represent minor nuisances (Fig. 3). Induced seismicity is well-known from a part of the population based on the occurrence of previous induced seismic events felt at Soultz after hydraulic stimulation experiments done in 2000 and 2003. A local maximal magnitude event of 2.9 was felt and generated some fear in the local population as it was mentioned in some articles published in local newspaper on June 2003 (Fig. 4). Following those felt events of July 2000 and June 2003, a total of about 70 complaints against potential house damages were done by local inhabitants. In 2003, the complaints were located closed to the geothermal site at a maximum distance of 15 km (Fig. 5). Most of the complaints came from Soultz-sous-Forêts and Betschdorf villages (Fig. 5). Presumed damages were mainly fissures which were evaluated by experts from insurance companies. They concluded that there were no damages related to induced seismicity.

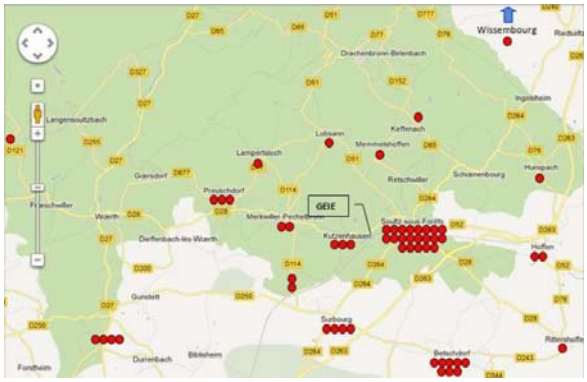


Figure 5: Local map of the population complaints for presumed house damages related to induced seismicity felt in 2003 (Lagache, 2012). GEIE indicates the site location.

The answers related to the level of awareness of the population (objective 3) show that for 61% of the people, information regarding the Soultz geothermal site is poorly known from the general public. More the respondents are young, the less they are informed about deep geothermal energy. Respondents argue that there is very little information available on the geothermal plant. They would like to get more regular and frequent information about geothermal site activities based on various media (television, radio, local newspapers, digital information panels, flyers, brochures, website).

In terms of economic benefits (objective 4), population is puzzled. According to 95% of respondents, the presence of a geothermal plant near their homes does not affect their lifestyle. Indeed, as this geothermal site has no district heating, people cannot perceive some direct benefits. Moreover, there is no visible heat application such as greenhouses which reinforces the idea of minor economic feed-back for locals.

The opinion survey also shows that geothermal energy and risks associated are not really an issue for 62% of the local population. The most disturbing nuisance is the noise generated by the plant (objective 5).

However, this kind of nuisance can be easily reduced by investing in appropriate isolating equipment.

Finally, the perception of respondents on deep geothermal is relatively positive (objective 6). In fact, 80% of people believe that risks arising from the use of this resource are manageable and therefore accept the installation of a geothermal power plant close to their homes. Geothermal plants cannot however be the only source of energy because, as some people have pointed out, geothermal energy cannot be used everywhere. But this energy available at any time would be a good complement to other renewable energy sources such as solar or wind.

The results of this acceptability study thus show that the feeling of lack of information of the population is unquestionable although there is a new website online since 2011 (www.geothermie-soultz.fr) and an average of 2000 visitors per year. Thus, the knowledge of deep geothermal energy and its challenges are limited. The biggest cause of trouble is the noise generated by the plant equipment (Fig. 6). Other risks, such as induced seismicity, pollution or natural radioactivity do not seem to concern too much residents. The older people pay more attention to induced seismicity than the younger (Fig. 6). It is due to the fact that the largest felt earthquake occurred in June 2003 that means 10 years ahead before the opinion survey. From 2007, seismicity activity is quite moderate during the geothermal exploitation (Cuenot et al., 2011).

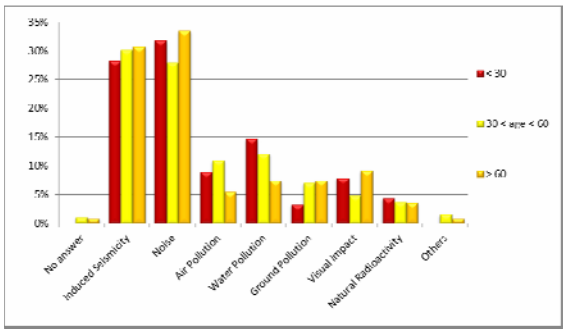


Figure 6: Main potential nuisances of deep geothermal energy versus age known from Soultz-sous-Forêts and Kutzenhausen population (Lagache, 2012).

In order to improve the image of geothermal energy and its associated risks, recommendations (improving communication and technical improvements) have been made. An information leaflet was distributed to all residents of Soultz-sous-Forêts and Kutzenhausen. Thus, the results of the opinion survey were presented directly on the geothermal site during two public meetings.

4. CONCLUSIONS

This study brought major lessons learned on the acceptability of deep geothermal energy and risks around the Soultz geothermal site. However, as it is the first study of its kind in France, no comparison is possible. In addition, it was complex to accurately assess the acceptability of the risks associated with geothermal energy because it is a subjective concept, and there is no threshold from which a person can say that it accepts the risk or not. Only people who felt a seismic event or have been disturbed by the noise from the geothermal plant, have a concrete vision.

Even if the EGS Soultz site is well-known world-wide within the geothermal community due to its extensive scientific publications, at local-scale, intense communication must be conducted permanently to inform inhabitants about this rather new technology.

REFERENCES

Cataldi, R.: Social acceptance: a sine qua non for geothermal development in the 21st century, Bulletin d'Hydrogéologie, No 17 (1999), Centre d'Hydrogéologie, Université de Neuchâtel, 467-476.

Cuenot, N., Frogneux, M., Dorbath, C., Calo,' M.: Induced microseismic activity during recent circulation tests at the EGS site of Soultz-sous-Forêts (France). Proceedings 36th Stanford Geothermal Engineering Workshop, California, US, 31st January-02s February 2011.

Dowd, A.-M., Boughen, N., Ashworth, P., Carr-Cornish, S.: Geothermal technology in Australia: Investigating social acceptance, Energy Policy, 39, (2011), 6301-6307.

Genter, A., Evans, K.F., Cuenot, N., Fritsch, D., Sanjuan, B.: Contribution of the exploration of deep crystalline fractured reservoir of Soultz to the knowledge of Enhanced Geothermal Systems (EGS). C.R. Geoscience, 342, (2010), 502-516.

Lagache, L.: Étude sur l'acceptabilité des risques liés à la géothermie profonde, GEIE EMC report & Master Thesis, Université de Lyon, 161 pp, (2012).

Leucht, M., Kölbel, Th., Laborgne, P., Khomenko, N.: The role of societal acceptance in renewable energy innovations. Breakthrough in the case of deep geothermal technology, Proceedings of World Geothermal Congress, Bali, Indonesia, 25-29 April 2010.

Popovsky, K.: Social acceptance and deep geothermal energy, Proceedings of geothermal training programme IGC2003, Short Course, September 2003, Reykjavík, Iceland, 31-41.

Reif, T.: Geothermal energy. How to promote the unknown / misjudged champion? Conference GeoPower Europe, Milano, Italy, December 6, 2011.

Acknowledgements

The authors acknowledge the respective mayors of the Kutzenhausen and Soultz-sous-Forêts villages who provided some assistance during this acceptability study as well as Ademe and BGR/BMU for financial support.