

As Simple as Possible and as Complex as Necessary

A Communication Kit for Geothermal Energy Projects

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Abstract. The successful implementation of renewable energy projects – such as deep geothermal power plants – depends on the acceptance of the local public. Therefore an adequate communication strategy is needed. We conducted three empirical studies to get an empirical basis for a communication strategy. Based on that we created a toolkit for the communication of deep geothermal energy. It consists of several hierarchical arranged tools consisting of empirical based advices for a communication strategy. Basically, to reach acceptance communication should create knowledge, trust and transparency. Cornerstones to achieve this are information and participation.

Keywords: Information strategy · Geothermal energy · Communication kit · Project communication · Information guideline · Renewable energies

1 Introduction

Facing the climate change and its consequences, it is time for a change in energy policy. The finite nature of fossil fuels and their negative impacts on the whole environment show there is no choice other than to turn to renewables. To promote an energy transition its indispensable to support and implement renewable energy forms. Deep geothermal energy is one possible renewable energy form that could assist the changeover from fossil fuels to more renewable energy forms [1].

The implementation of renewables – as every other large-scale technology – is depending on social acceptance [2]. In general we see that the acceptance of renewable energy is overall high. But in Germany we could observe that people often start to oppose to concrete projects in their neighborhood [3, 4]. This is often caused by a bad or hardly existent communication between project managers and the local population. As a consequence an atmosphere of distrust and negative emotions like fear and anger occurs. This is supported by the unfamiliarity of a technology such as geothermal energy. We know from other contexts, such as for example the ICT context, that relatively unknown technologies lead to a higher risk perception and thus fear [5, 6].

Following that, an adequate communication strategy is needed to support the successful implementation and thus acceptance of innovative renewable energy technologies – in this case geothermal energy [1, 7–9]. In the past there was just few

(empirical) research on the topic of communication of geothermal energy [7, 9–12]. In this paper we present results from several studies that focus on the understanding of main factors of the acceptance of geothermal energy. The main focus was to examine what a good communication and information strategy should be like when its purpose is to involve, inform and educate people adequately about this relatively unknown technology. The aim is to create a bridge between the knowledge of professionals and the emotions of the non-experts that leads to an equal communication base level between all stakeholders.

2 Theoretical Background

As known from several studies social acceptance of renewable energies is a complex issue [1, 2, 6, 8, 12]. Social Acceptance is a product out of several influencing factors, such as user diversity (in terms of domain knowledge, gender or age) [13–16], but also the type of technology or usage context [17, 18]. Thus, every technical context has individual acceptance patterns. Geothermal energy thus has its own determinants of acceptance. There are several studies that focus on social acceptance of geothermal energy, but most of them stay superficial and provide no concrete specifications for an information strategy. Wüstenhagen et al. for example, emphasizes the need of social acceptance and constructed the so called triangle-model which consists of three dimensions *socio-political*-, *community*- and *market acceptance* [2]. Studies from Japan, Italy and Australia conclude that especially a lack of knowledge and a high risk perception affect the acceptance of geothermal energy in particular. Moreover, these studies show, that the general public misses common knowledge about geothermal energy in general is low. As a consequence distrust and risk perception in relation to geothermal power plants are rather high [19, 20]. Related results come from studies from Germany, which indicate little understanding in the broader public about geothermal energy production and highlight several concerns especially regarding seismic activity and water pollution [21].

There are also studies comparing social acceptance patterns of geothermal energy between different countries. Reith et al. identified four main issues of rejection of geothermal energy in Germany, France and Italy. These main issues were identified as environmental issues, financial issues, missing involvement issues and NIMBY issues (not in my backyard phenomenon) [22].

Wallquist and Holenstein follow a practical approach. They propose a community engagement process. This includes an analysis of the social site, an intense stakeholder dialog as well as a dialog with the general public. While this procedure is principal transferrable to other geothermal energy projects, there are no concrete recommendations for general communication guidelines provided [7].

Altogether the study of social acceptance and the resulting communication need in the geothermal energy context lacks of a concrete information and communication guideline with the purpose to enable the public to understand geothermal energy production, to engage in dialogue with stakeholders and thus prevent distrust and fear about risks and disadvantages associated with a geothermal energy project.

3 Methodological Approach/Empirical Background

In order to develop a communication kit, a solid empirical basis is necessary. Overall, in a three-tiered approach we conducted several studies to examine the public opinion about geothermal energy. Using different qualitative and quantitative methods, we looked at prevailing fears, perceived benefits as well as seen risks. Possible ways and points in time for communication were also examined. Several questions were addressed:

- What should be the main goal of a communication strategy?
- What aspects should be mainly integrated into a communication concept?
- What topics have to be integrated?
- Which factor has the most influence on the acceptance?

The benefit of a mixed-method approach is to prevent blind spots that may appear depending on a specific method. By including different methods we can triangulate results and thus get deeper insights into our topic. Altogether, 698 participants volunteered to take part in these three studies. Each study had a different thematic focus, so that every needed facet for a communication strategy could be captured. In the following, we present the findings in the respective studies, with a focus on the third study, which will be presented in greater detail in comparison to the first two studies.

3.1 Interview Study: Mental Representation of Geothermal Energy

In the interview study we focused on the examination of the mental representation of geothermal energy in the public. For a deeper understanding of the general public's communication need, knowledge about the underlying cognitive attitudes towards the technology is important. $N = 170$ participants took part in the interview study. We assessed the acceptance-relevant cognitions by an open answer format. This has the advantage that people can freely associate what comes into their mind and thus we can examine the mental representation. Especially in the context of relatively unfamiliar topics, a study design with a given answer format would shape answers in a concrete direction. In the interview important topics were perceived benefits, perceived risks and the question what a transparent communication should be like. Additionally, we asked by which communication channel people prefer to get their information. More detailed results can be found in [11].

Main results of the study are:

- Transparent communication means to the people mainly the disclosure of expert opinions, involvement of the local population, and timely information.
- Perceived benefits of geothermal energy are mainly the ecological benefits of renewables in general and economical benefits such as local energy supply and its cost saving capacity.
- Perceived disadvantages were above all: unknown risks, earthquakes, and (unexpected) costs.

- The most often named source to get information about geothermal energy is direct mail to households.

3.2 Questionnaire: Identification and Quantification of Perceived Benefits and Barriers

The questionnaire focused on the influence of psychological factors on the acceptance of deep geothermal energy. On the users' side, we included factors that may impact the overall acceptance, as the individual level of environmental awareness, technical self-efficacy as well as attitudes toward renewable energies in general, but also the attitudes toward geothermal energy in specific. Additionally, arguments for and against geothermal energy were integrated as well as the question if people informed themselves about geothermal energy before. Items were formed on the base of the interview study. Overall $n = 360$ participants took part in this study. Based on the theory of planned behavior [23] a structure equation model was used to analyze the influence of psychological factors on the acceptance of geothermal energy. Additionally the participants were split in an informed and a not informed group to control the influence of knowledge on the acceptance. In Fig. 1, the constructed structure equation model is depicted [12].

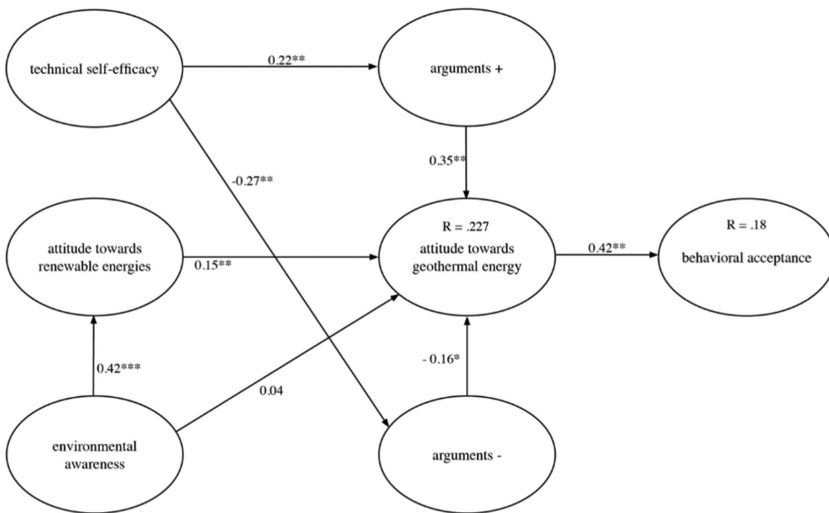


Fig. 1. Structure equation model of the acceptance-relevant factors for the overall behavioral acceptance of geothermal energy (from [12])

Summing up, the main results of this study are:

- General attitudes towards renewable energies as well as environmental awareness do not lead to higher acceptance of geothermal energy.
- Information plays an important role in the acceptance of geothermal energy, because informed people show higher acceptance values.

- Informed people distrust the economical benefit.
- The arguments for geothermal energy influence the attitude towards geothermal energy more than the arguments against geothermal energy.

3.3 Conjoint-Analysis: Preference Simulation with Respect to an Appropriate Communication Strategy

Conjoint-analysis is a method to measure the weighing of several factors in relation to each other. In contrast to traditional questionnaires in which participants answer single factors separately from each other, conjoint analyses simulate real-world user decisions in which users weigh several potential benefits against perceived barriers. Therefore, a choice-based conjoint analysis approach was selected. It mimics the complex decision processes in real world scenarios in which users have to evaluate more than one attribute that influences the final decision [24]. In the context here, we analyzed the communication strategy users prefer by looking at different attributes which were formed to different scenarios. Methodologically, the given decision scenarios and tradeoffs consist of multiple attributes and differ from each other in the attribute levels. As a result, the relative importance of attributes deliver information about which attribute influences the respondents' choice the most. Each attribute had five or six levels:

- **Person that provides information**
Levels: external experts, independent journalist, politician, spokesman of operating company, director of operating company
- **Point in time and frequency of information during the project process**
Levels: in operation, strike, begin of bore, permission of seismology, preliminary planning
- **Source of information**
Levels: app, unofficial media, poster, article in daily newspaper, flyer/information brochure, website
- **Form of participation**
Levels: telephone service for the public, open house day, tours to other geothermal systems, roundtable discussion with project managers, information event

To examine if people think it is more important to get insights into expert opinions or participation in the project process, people were additionally asked to chose a combination of levels belonging to these attributes. Before participants started to choose possible information packages, they were asked for their wanted frequency of information.

Overall $n = 144$ participants with an age range from 16–85 years of age took part in this study. 41 % were female and 59 % were male.

Main results of the conjoint analysis and the included questions are:

- **The most trusted person to provide information is the external expert.**
Figure 2 answers the question who should provide information to the local public. It becomes obvious that the external expert reaches an utility value of 45.8 which is much more than the independent journalists score of 10.2. A political person, or persons connected to the operating company were rejected as trustful information

givers, presumably because participants distrust the independency and objectivity of the information and possible strategic alliances. Thus, for a communication strategy, a person to provide information should be independent from the operating company, neutral and well-informed.

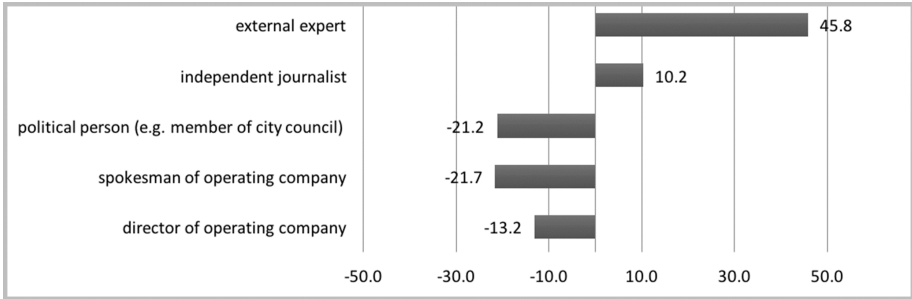


Fig. 2. Utility values for persons providing information

- **Citizens want to be informed as early as possible.**

A closer look at the results (depicted in Fig. 3) shows that people wish to have information about a regional geothermal energy project as early as possible. As we see in Fig. 3, the preliminary planning has the strongest utility value of 50.4. Second possible point in time for information is the permission of seismology, still with a positive but considerably lower utility score of 20.7 later than that, the point in time even gets to negative utility values, what means that these possibilities are disliked and lead to rejection. Thus it is extraordinarily important for the citizens to get information about a local geothermal energy project at a very early point in time.

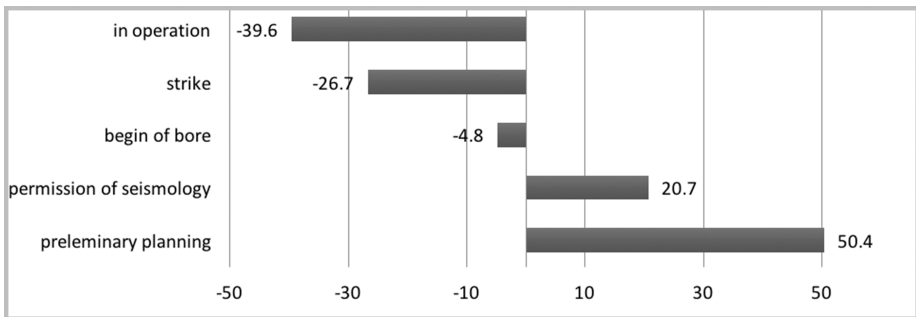


Fig. 3. Utility values for point in time of information

- **Crucial for the decision of one of the presented information combinations is the point in time.**

As we see in Fig. 4 the kind of information is the least decisive attribute in contrast to the person who provides information and the point in time. Thus, the essential

point for a communication concept is first of all the point in time when starting to inform the local public.

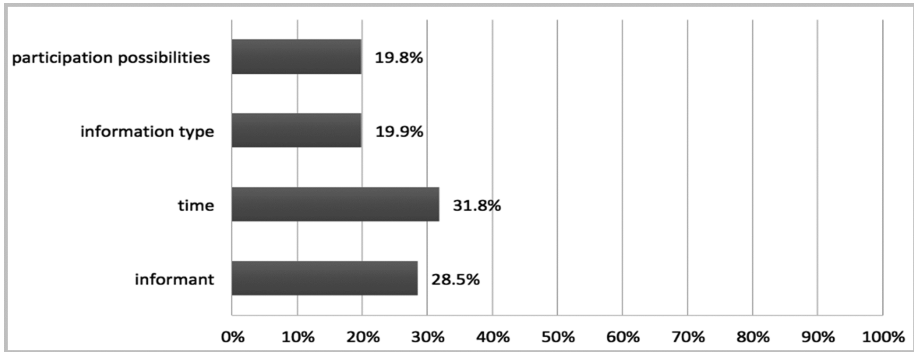


Fig. 4. What attribute is crucial for the decision of one combination?

- **People prefer a regular process of information.**

Being asked in which time interval information about a local geothermal power plant project should be provided, people decided predominantly for the option weekly (29.20 %) or monthly (39.60 %), as shown in Fig. 5.

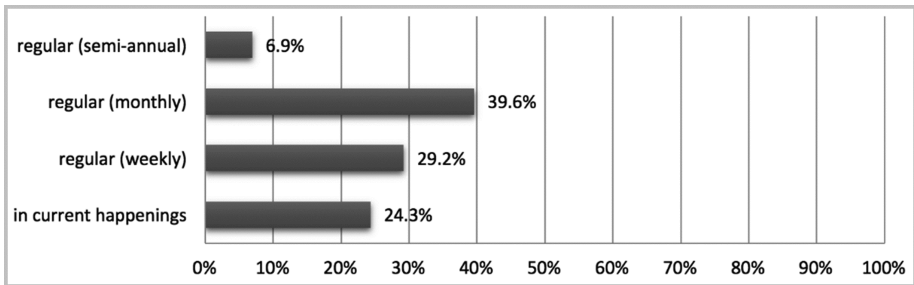


Fig. 5. Preferred frequency of information about a local geothermal project

- **Local newspaper, direct mail to all household and websites are the preferred information channels.**

Several possible information channels were included in the conjoint-analysis. As Fig. 6 shows, articles in the daily news paper were evaluated with the highest utility values (approx. 21) and thus represent the most important source of information and media. This might be due to the fact that newspapers are coming in each day and are read, in contrast to extra flyers or brochure (8.7) or information delivered on the website (5.5), which are also acceptable but less welcome. However, there were also

media and information channels hat received negative scores. Apps (-11.8), unofficial media (-10.7) or posters (-12.5) were disliked by the participants. Thus, especially the local newspaper, direct mail and websites should be information channels for a communication strategy in the geothermal context.

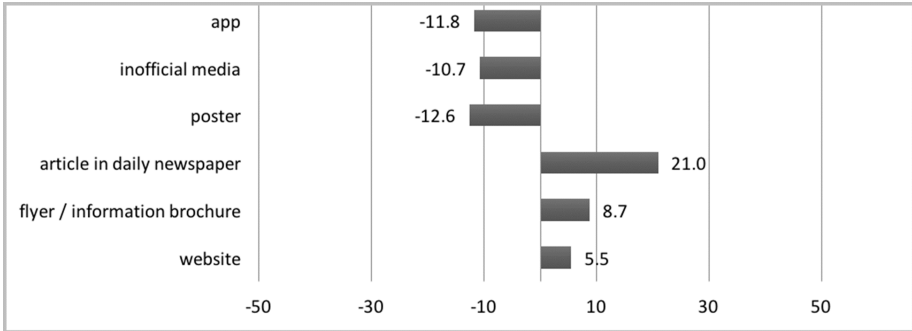


Fig. 6. Utility values for the preferred information channel

- **Participation and disclosure of expert opinions are both important to the people. Participation, however, is even more important.**

As our studies clearly showed, participation and disclosure are very important facets of a trustful, timely and appropriate communication strategy (cf. 2.1). As Fig. 7 shows, participation in the project process has been evaluated as even more important to the people than the disclosure of expert opinions. Thus, this should be an essential part of an information strategy.

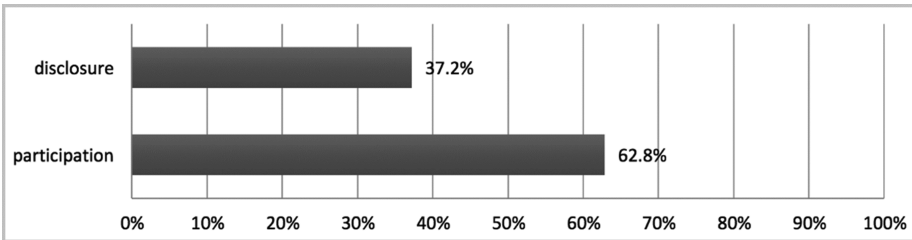


Fig. 7. Relevance of disclosure in contrast to participation

4 Communication Kit

All results of our studies are joining to a broad base for communication and information recommendations. For an easy handling of this complex resource of results and information also for practitioners, we developed a communication kit, in form of a tool kit. It consists of the empirical results, results from literature study and contains the essential conclusions.

This toolkit should be easy to understand and at the same time include all relevant information. Thus we built the kit as a construct with all relevant components that are needed for basic communication demands in a geothermal energy project process. Figure 8 shows the base version of the kit. The overall aim of a good communication and information strategy should be public acceptance. Moreover the creation and development of public knowledge, trust in persons and actions involved, as well as transparency of information, actions and processes [11, 12] are subject to social acceptance. People fear unknown risks in the context of geothermal energy. These fears are a consequence of a low level of information (leaving space for negative feelings, concerns and distrust) and thus have detrimental effects on the acceptance [5, 6, 11, 12]. This is closely intertwined with the need for trust and transparency. As other studies could show, transparency is crucial for a good communication between stakeholders of a geothermal project [1–3, 7]. In our examination we could see that transparent communication is directly linked to trust in the project managers. This arises from the strong wish for the disclosure of expert opinions as an expression of the wish for control. This in turn is caused by the distrust against the operating company and connected representatives.

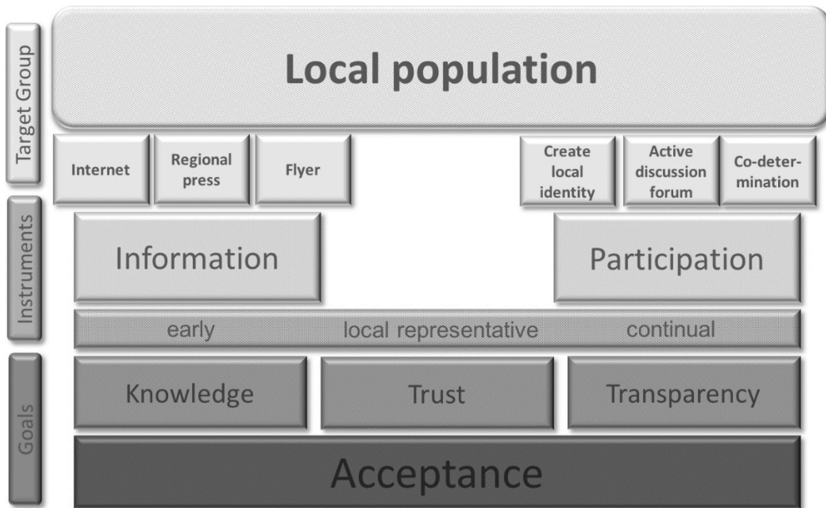


Fig. 8. Communication toolkit

The basic modules (acceptance, knowledge, trust and transparency) can be achieved by a continual and timely communication, as well as by a person that is trusted in.

As our conjoint-study showed, communication from an early point in time is crucial for the people. Also continual communication is essentially for an adequate communication strategy.

The instruments to reach these goals are mainly information and participation.

Information is an essential part of a communication strategy that provides knowledge for the broader public, especially as we know that knowledge about geothermal energy

is very low in the general public and is – as we saw in the questionnaire study – essential for the acceptance [5, cf. 2.2].

Ways to provide information in an adequate way are the local newspaper, internet and direct mail, as our studies showed (cf. 2.1).

The second cornerstone for communication is participation. As our empirical base showed, the involvement into the project process is crucial for the public. Participation creates a feeling of trust because people have the feeling of getting insights into the project and the people behind in contrast to an anonymous operating company that often is perceived as not caring for the local requirements.

Ways for participation are to provide a local identity, discussion groups and co-determination. To provide a local identity a proper way is e.g. to order local craftsmen for the power plant construction. Discussion groups may be advisably to inform people on the one hand, and discuss their issues around the project fairly and thus educate and inform the people and additionally create an atmosphere of trust and acceptance on the other hand.

This grounded version of our communication toolkit can be seen as fundamental communication advice in the context of geothermal energy projects, but could also be transferred to other energy infrastructure projects, such as local district heating networks [25], electricity storage technology [26] or transmission technology [27]. Our empirical base provides much more information. Thus, the communication toolkit can be differentiated depending on the focus. It is for example possible to get deeper insights into the topics that should be communicated or find answers to questions like which topic should be communicated by which communication channel and which are negative and positive topics that have to be included into a communication and information strategy. Also, it is possible to change the focus depending on the region that one is interested in (rural area vs. urban area). The communication kit provides a solid foundation of knowledge about communication in the context of geothermal projects and is in this version just as complex as absolutely necessary.

5 Outlook and Future Works

Deep geothermal energy is an innovative and relatively unknown technology. It has high potential for the renewable energy sector. As we know from other technical contexts, the implementation of technologies, unfamiliar to the broader public is difficult and needs acceptance. Without acceptance action groups may build and in the worst case stop a project, which has economical and ecological consequences for all stakeholders. To prevent this communication that educates and informs the local public and enables them to build their own opinion is indispensable.

The here presented communication toolkit for deep geothermal energy is the result of a broad empirical base. It is a version kept as simple as possible. Thus the recommendations for communication are easy to understand and easy to put into practice. The empirical base provides much more information than included here. Next steps will be to include more information and conduct more complex versions. Also we have to examine if this toolkit is transferrable to other large-scale-technology contexts.

Another focus of our future work will be the special communication needs of protest groups. Those groups are an important player in large-scale projects and they have to be included in thoughts about communication strategies.

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