

## Increasing the social acceptance of geothermal energy projects grounding on lessons learned and NIMBY interventions

### Introduction

Geothermal energy is a sustainable and promising source to meet global energy demand, despite facing challenges, including social resistance (Bertani 2016). Its acceptance is influenced by socio-economic, environmental, policy, governance, economic, cultural, and geographic factors. One major reason for poor acceptance is the lack of familiarity with geothermal energy compared to other renewables, leading to uncertainty about related technologies (Allansdóttir et al. 2019). Integrating geothermal projects with social sciences and humanities is crucial to fostering dialogue with local stakeholders.

Addressing the lack of knowledge and negative perceptions is essential. Viewing the local community as a barrier can worsen relationships with areas hosting plants. Social conflicts at the local level can directly or indirectly delay or stop geothermal projects (Wallquist and Holenstein 2015). Contestations can also affect national and European perceptions, damaging the sector's reputation.

As acceptance becomes increasingly important for project development, operators are striving to prevent contestations and the NIMBY (Not In My Backyard) syndrome. This paper proposes strategies identified within the report of the Horizon Europe COMPASS project on *Best Practices and Geothermal NIMBY Interventions* (Bonciani et al. 2023).

### Method

The findings of this study are based on a systematic literature review of existing case studies and research to raise the social risk-benefit awareness and acceptance to prevent the NIMBY syndrome on deep geothermal energy projects. The work started answering research questions on what, when, who, where and why actions involving different kind of stakeholders were implemented or suggested to face the NIMBY syndrome, raise the social risk-benefit awareness and engage with the civil society.

Boundaries of the literature review were set considering the following eligibility criteria:

- a) Source of information: Scientific literature, EU project results, reports, news on sector magazines and websites of sector associations, international organizations and operators;
- b) Geothermal technology: deep geothermal;
- c) Geographic coverage: more than 40 references on case studies from 8 European countries (France, Germany, Hungary, Iceland, Italy, Spain, Switzerland, Türkiye) and 7 countries in other continents (Chile, New Zealand, Kenya, Japan, Philippines) with different maturity levels of their national deep geothermal markets.

Data collected were analysed to identify and assess the lessons learned and examples to be considered best practices or not to increase acceptance. Strengths and drawbacks of the actions implemented or suggested, allowed to propose tips for the planning of communication and social engagement.

### Analysis of the case studies

The analysis shows that geothermal projects which engage local communities through third-party communication initiatives are more likely to gain approval from local authorities. For example, in St. Gallen, Switzerland, open and transparent communication about the risks of using deep geothermal resources helped secure public support, allowing the project to continue even after a seismic event of magnitude 3.5 occurred during drilling operations (Eyderyan et al. 2019).

The case studies conducted in Szeged and Mórahalom highlighted a strong social acceptance of geothermal energy, emphasizing the importance of positive attitudes, trust, and perceived local benefits.

Hildebrand et al. (2022) investigated geothermal energy projects and their social acceptance in Hungary, utilizing the Social License to Operate (SLO) model by Barich et al. (2022).

In contrast, partial or incorrect information can be a serious threat to geothermal development, so as the fragmentation of information, uncertainty, and doubts about the sources of data (Manzella et al. 2018). Imposed projects, without prior debate, that deny the right to have a say in environment and urban development and merely invoke energy transition, generate lasting and sometimes violent misunderstandings between operators, local elected officials, and residents. In these cases, communities protest because of environmental concerns, or because they do not see benefits linked to the project. Oppositions due to imposed projects may also be one of the causes for the project abandonment, as in the case of the Strasbourg area, where projects were abandoned because of contestations and other projects were approved despite objections (Chavot et al. 2018).

Two kinds of communications complete each other and are to be considered to allow the public to have a realistic opinion on deep geothermal projects: the public communication, which is usually conducted by independent experts, and the communication processes, which are managed by private companies (Allansdottir et al. 2019).

Ineffective communication without social engagement can lead to local contestations. For instance, a petrothermal project in Basel was halted after a 3.2-magnitude earthquake, partly due to lack of communication and risk assessment (Eyderyan et al. 2020). Monodirectional communication can also create public skepticism, as seen in Haute-Sorne, Switzerland, where residents preferred municipal council discussions over information meetings (Ejderyan et al. 2019).

In many considered cases for this review, the communication was proposed by (or involved) the local authorities, as these pursue the public interest and are to be considered to operate in the general interest. However, outcomes from a survey carried out in southern and central Italy by Pellizzone et al. (2015 and 2017) highlight how in some cases the local communities would prefer the involvement of local scientists (Pellizzone et al. 2019).

**Table 1** Positive and negative examples of strategies to raise social acceptance on geothermal projects

	Positive examples	Negative examples
Communication	<ul style="list-style-type: none"> <li>Communication starts from early stages of the project development.</li> <li>Communication tailored to different kind of stakeholders and local conditions.</li> <li>Communication of risks and mitigation measures.</li> <li>Involve local authorities and scientists.</li> <li>Clearly explain benefits (including heat direct uses).</li> </ul>	<ul style="list-style-type: none"> <li>Top-down communication.</li> <li>Communication only from operators.</li> <li>Partial or incorrect communication.</li> <li>Creation of high expectations.</li> <li>Communicate benefits only.</li> </ul>
Social engagement	<ul style="list-style-type: none"> <li>Engage with local communities and citizens from the early stages of the project development.</li> <li>Citizen involvement in decision making processes.</li> <li>Involvement tailored to different kind of local stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>Plan the actions without involving local actors and authorities.</li> <li>Top-down approach.</li> <li>“Closed doors” initiatives, without involving local communities.</li> </ul>

Although all the studies considered for this review agree that it is necessary to start involving all the local stakeholders, authorities and citizens from the early exploration stages of a geothermal project, there are no standard procedures for participation (Vargas-Payera 2020). Participative formats are different depending on the stakeholders and local perspectives and may change during a project’s lifetime. Despite positive or negative preconditions may exist in specific locations the engagement approach can influence these conditions (Ejderyan et al. 2019).

Local acceptance is achieved by highlighting community benefits, communicating the project, engaging communities in decision-making, and minimizing impacts (Ejderyan et al. 2020). It is crucial to clarify whether benefits are universal to avoid unmet expectations, as seen in Tolhuaca, Chile (Martinez-Reyes

2020). Additionally, benefits and communication without social engagement may still lead to opposition.

### Recommendations to raise acceptance in deep geothermal projects

The analysis of existing experiences and studies on social acceptance allowed to elaborate recommendations to promote the acceptance on geothermal projects, as reported in Table 2.

**Table 2** Multi-stage Recommendations for Enhancing Social Acceptance of Deep Geothermal Projects

Before the exploration – study of the local background	During the explorations – communication and information	Before the exploration permit submission – co-design process	After the exploration permit – communication
<ul style="list-style-type: none"> <li>○ Assess the energy strategies and local authorities, their awareness and position on geothermal.</li> <li>○ Analyse the political, social and cultural background.</li> <li>○ Map the stakeholders, analyse their interests and positions.</li> <li>○ Identify potential “allies”.</li> <li>○ Plan a strategy to start communications tailored to different stakeholders.</li> <li>○ Define acceptability-related topics: risks &amp; benefits for the environment, economy and society.</li> </ul>	<ul style="list-style-type: none"> <li>○ Liaise with local authorities.</li> <li>○ Communicate the project locally through transparent and bottom-up communication, including benefits and risks.</li> <li>○ Organize a first round of meetings with a selection of representatives to discuss risk, benefits and co-design aspects.</li> <li>○ Update the website with information on the project and provide contacts for details.</li> </ul>	<ul style="list-style-type: none"> <li>○ Elaborate a range of possible developments based on the meeting results.</li> <li>○ Second round of meetings to present and discuss project development.</li> </ul>	<ul style="list-style-type: none"> <li>○ Communicate the project and its locally agreed development.</li> </ul>

### Conclusions

The perception of deep geothermal energy projects is influenced by project activities, the engagement process, and the context. Good public acceptance requires transparent, continuous communication and active engagement of local communities in decision-making. Projects should be well-integrated into the locally, with clear communication about risks and mitigation actions. Proposing and communicating direct socioeconomic benefits for the local area is essential. Approaches to increase social acceptance should be tailored to local conditions and adapted over time. Effective communication, citizen engagement, and proposing tangible benefits are crucial to avoid project contestation.

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