

Towards social acceptance of geothermal energy power plants

Spyridon Karytsas¹, Olympia Polyizou¹, Dimitrios Mendrinou¹ and Constantine Karytsas¹

¹ Center for Renewable Energy Sources and Saving (CRES), 19th km Marathonos Av., Pikermi 19009, Greece
spkary@cres.gr

Keywords: geothermal power production, social acceptance, local communities, public engagement, Corporate Social Responsibility.

ABSTRACT

Social acceptance is practically a prerequisite for the promotion and successful implementation of geothermal power production projects. Achieving social acceptance can empower trust between the developers/ operators and the local communities, reduce costly reactions/ conflicts/ time delays and strengthen companies' acceptance in relation to the implementation of the project. In order to achieve social acceptance, it is required to guarantee that local communities agree with the implementation of the project. The present study aims to present a framework including the best practices related to achieving social acceptance of geothermal power plant projects, taking into account all the work presented so far worldwide. The three pillars of this framework are a) engagement, b) prevention of drastic changes to the existing conditions and c) provision of benefits to the local communities.

1. INTRODUCTION

With concerns for climate change and increased energy dependency rising on a worldwide level, the development of geothermal power projects can offer a solution towards the achievement of sustainability. However, the development and operation of geothermal power projects depends strongly on their acceptance at the local level, where the installation is to be built. As transpires from academic writings, lack of social acceptance increases the risk of failures, cost escalation and project delays, and may even lead to the termination of the project (Jobert et al 2007; Batel et al 2013; Enevoldsen and Sovacool 2016).

Cases of social conflict involving geothermal power projects have been recorded globally: indicatively a mention could be made to the cases of Tiwi geothermal area in Philippines (Camu and Santiago 2000), Berlín power plant in El Salvador (Zepeda and Rodriguez 2005), Upper Rhine Graben in Europe (Schwellenbach and van Douwe 2016; van Douwe et al 2016), Milos and Nisyros Islands in Greece (Karytsas et al 2019).

In the past, different definitions have been given regarding the successful social acceptance of

geothermal projects. According to de Jesus (1995), "social acceptability is attained if the project activities do not result in drastic changes from the regular conditions of the area and if the affected sectors can see some advantages issuing from the project". On the other hand, Cataldi (2001) mentions that "social acceptability of a profit-purported project is the condition upon which the technical and economic objectives of the project may be pursued in due time and with the consensus of the local communities; consensus to be gained by acting in consonance with the dynamic conditions of the environment, and in the respect of the people's health, welfare, and culture". In addition, Popovski (2003) adds that "social acceptability is one of the most important parts of the process of geothermal energy development in a specific environment. It is not possible to complete a successful project if initially not identifying the elements of the local environment, which can influence its social acceptance; and not designing proper organizational, technical, economic, and other solutions in order to remove the negative opinions".

In this context, aim of the present study is to examine and present a review of the different strategies and practises applied so far, mainly by the geothermal development and operation companies, in order to move towards social acceptance of local communities.

2. REVIEW OF SOCIAL ACCEPTANCE PRACTISES

The examination of the social acceptance practises applied so far reveals specific differences between time periods and types of countries. Referring to emerging and developing economies, the first reports on social acceptance practises concerning specific geothermal power plants indicate that focus had been given mainly on providing benefits to local communities and minimizing any undesirable side effects. In such cases, the role of the local stakeholders was mainly to provide input for the planning of community development programs and / or Corporate Social Responsibility (CSR) activities, as presented for example for different cases in Philippines (Meidav et al 1995; Camu and Santiago 2000; Anaye and Cala 2005), Indonesia (Slamet and Moelyono 2000; Ibrahim et al 2005) and El Salvador (Zepeda and Rodriguez 2005).

On the other hand, Kenya seems to have given more emphasis on public engagement; this has been achieved on the basis of the Environmental Management and Coordination Act (EMCA) established in early 2000 (Ogola 2004). In this context, the relevant reports for Kenya describe the planning and implementation of information and consultation activities involving different local stakeholder groups, among which –in some cases– local inhabitants; relevant cases involve Menengai (Manyara and Mading 2012), Suswa (Chebet 2013), Olkaria I Units 4 & 5 and Olkaria IV (Barasa 2015b) and Eburru (Barasa and Mathenge 2015).

The examination of the, rather limited, reports on geothermal power plant social acceptance activities in developed countries reveals that emphasis has been given to organized engagement activities, including different implementation phases and stakeholder groups. One of the first works belongs to Beck (1990), providing a guide towards public information activities for Hawaii. More recent efforts focus both on information and consultation activities involving local stakeholder groups, as described for the cases of ARRC/Pawsey Geothermal in Australia (Carr-Cornish et al 2011), Groß-Gerau in Germany (Wallquist and Hostenstein 2015) and the Upper Rhine Graben (van Douwe et al 2016).

2.1 Prevention and minimization of undesirable effects

One of the main concerns towards social acceptance is the prevention and minimization of undesirable effects on the environment and people; based on the recorded experiences, practises that can assist this goal include: a) the development of an environmental action plan, focusing on the measures necessary to avoid or minimize any undesirable effects (Cataldi 2001; Wetang'ula 2010), b) appropriate environmental management and design practices, and organization of works during the project's construction and operation phases (ENGINE, n.d.; Zepeda and Rodriguez 2005), c) integrated procedures for ensuring compliance with health, safety and environmental standards (Zepeda and Rodriguez 2005), d) the creation of an environmental guarantee fund, with the intention to be used in cases of rehabilitation and compensation for damages that may be a result of the project's operation (de Jesus 2005), as well as e) the organization of various environmental actions, e.g. afforestation of the affected areas in order to preserve the ecosystem (Wetang'ula 2010). Furthermore, the identification of cultural sites and the creation of a plan to preserve them can minimize the possibility of creating disturbance to them due to the construction and operation of the project (Chebet 2013).

The direct compensation for damages caused by the project's activities to private or public property, e.g. crops, animals, facilities, buildings, roads and infrastructure is of equal importance. According to Cataldi (2001), in these cases it is necessary for the project manager to have a flexible attitude, to adopt

compensatory measures and to conclude the negotiations in a short time, in order to maintain good relations with the local communities.

2.2 Creating benefits for local communities

The creation of benefits for local communities can be achieved either by directly granting money to local authorities (municipalities, regions, etc.), which is usually defined by the relevant legislative framework (Anaye and Cala 2005; de Jesus 2005), or through the realization of local development programs. The provision of funds to local administrative authorities can have either the form of a share of the company's profits -representing the usage rights of the region's energy resources- (Anaye and Cala 2005; de Jesus 2005), or a percentage of any levy, right or fee for the development and exploitation of geothermal resources (Camu and Santiago 2000). The collected funds can be used to subsidize the price of electricity in the areas where the energy source is located [due to the subsidy, the region may become attractive for further investment, leading to more jobs and economic benefits for local people (Camu and Santiago 2000)], as well as for the implementation of development projects (infrastructure construction, provision of services, etc.) for the local communities (Anaye and Cala 2005; de Jesus 2005).

Through local development programs, the economic, social and human development of communities close to the project can be supported. This way, the company responsible for the project can fulfill the objective of providing benefits to the communities in which it operates, recognizing their contribution to national security and development by hosting the project (Zepeda and Rodriguez 2005; Wetang'ula 2010; Chebet 2013). These actions can also be part of a Corporate Social Responsibility (CSR) program implemented by a company (Wetang'ula 2010; Barasa 2015b). Through these actions, the company can improve its trust and relationships with stakeholders (Slamet and Moelyono 2000; Musembi 2010), thus reducing tensions and delays that affect geothermal projects (Zepeda and Rodriguez 2005); this way it can acquire a "license to operate", that can lead to several long-term financial and non-financial benefits (Musembi 2010). In order to plan actions that meet the needs of local communities, it is advised that the company should a) investigate and record local economic, social, etc. conditions, b) discuss with local authorities, local organizations and associations, etc., and c) continuously monitor the actions, so that the future programs can be improved through the recorded experience (Meidav et al 1995; Barasa 2015b). The following actions can be included in the above mentioned framework:

- Improving education: Building new educational facilities, improving educational infrastructure, providing equipment and supplies (e.g. books) to schools, providing scholarships to local students and providing meals for students in areas where this is

needed (Chebet 2013; Barasa 2015b; Kurgat and Omwenga 2016).

- **Improving health and sanitation:** Contributing to residents' access to health services through the provision of medicine and healthcare services, improving access to clinics, delivering food to weak population groups (Musembi 2010; Wetang'ula 2010; Chebet 2013).
- **Local environment protection:** Environmental awareness actions, environmental cleaning activities, participation in actions dealing with emergency disasters (e.g. community aid in case of a flood or during a drought) (Musembi 2010; Chebet 2013; Barasa 2015b).
- **Strengthening the local economy and entrepreneurship:** Training programs for improving / developing locals' skills and knowledge in business management and organization issues, skills related to their work etc. (possibly focusing on specific groups such as women and younger people) (Anaye and Cala 2005; Ibrahim 2005; Musembi 2010), offering jobs related to the project to the locals (depending on the skills required by the project) (Wetang'ula 2010; Manyara and Mading 2012; Kurgat and Omwenga 2016), preferring to purchase supplies from local resources and services (Musembi 2010; Kurgat and Omwenga 2016), business opportunities for locals (Slamet and Moelyono 2000; Kurgat and Omwenga 2016), technology transfer for local production improvement (Musembi 2010), funding research beneficial to the local community (e.g. research on agricultural activities) (Barasa and Mathenge 2015), encouraging local economy diversification in rural areas through the development of ecotourism and aquaculture units that can utilize geothermal resources (Musembi 2010).
- **Improving infrastructure:** Construction or improvement of roads, bridges, multipurpose halls, markets, electricity networks, water supply networks and provision of transport services (Musembi 2010; Chebet 2013; Kurgat and Omwenga 2016). Providing discharged steam or hot water with a low cost or no cost, for use in public buildings, cultural centers and other public facilities (Cataldi, 2001).
- **Promoting culture and sports:** Organization and sponsorship of sports and cultural events (Musembi, 2010; Wetang'ula, 2010; Chebet, 2013), construction of sports infrastructure (Ibrahim et al 2005), participation in the restoration of buildings / areas / parks, etc., with the aim of promoting cultural heritage and tourism (Camu and Santiago 2000), providing grants for research or publication of studies on important aspects of the development potential, history, traditions and culture of the project's area (Cataldi 2001).

2.3 Community engagement activities

Engagement activities involving local communities are of major importance for achieving social acceptance of a geothermal power plant project, as they enhance trust between the company and the community, reduce reactions / controversies, and increase the company's acceptance level concerning the implementation of the project. Engaging with the local communities can assist the activities presented above -referring to undesirable effects prevention and minimization, and benefit provision- thus improving the relation between the local community and the company in terms of procedural and distributional justice.

In order to achieve these objectives, the implementation of a comprehensive action plan is essential. Based on the examination of previous geothermal project development action plans, the following practices have been performed concerning engagement, in the context of communication and collaboration with local communities:

- **Realization of a socio-economic study of the area of interest during the early stages of the project's development.** The study should include issues such as administrative boundaries, land uses and forms of ownership, population, natural resources, infrastructure, public services, sources of income, transport, cultural attractions, historical sites, energy use and demand, identification of stakeholders and their views on geothermal energy, benefits that are valued by local communities (Wallquist and Holenstein 2015; van Douwe et al 2016). Based on the findings of the study, the process of public engagement should be adapted to the particular circumstances (Wallquist and Holenstein 2015).
- **Creation of a group of local stakeholders with participation of local government, representatives from all local communities, environmental protection groups, representatives of the agricultural and business sector, etc.** Provision of information to the group about the company's actions and future plans and dialogue in order to achieve common trust. Through this group a forum can be created, where environmental and social concerns of the local communities can be presented in time to the company responsible for the project, in order to address all controversial issues and lead to a mutual agreement, that will contribute to the acceptance of the project (Manyara and Mading 2012; Thompson 2014; Barasa and Mathenge 2015). This approach allows the integration of local knowledge, experiences and different interests, as well as an excessive exchange of information between all participants (Wallquist and Holenstein 2015).
- **Discussion involving a large part of the local communities.** Provision of detailed information on geothermal energy, the project under development, as well as the opportunities and risks that accompany it. Participants should have the opportunity to discuss the

benefits and risks of the project, ask questions and express their concerns to the project's representatives (Carr-Cornish et al 2011; Wallquist and Holenstein 2015; van Douwe et al 2016).

- Implementation of information activities targeting all different stakeholders, i.e. local administrative bodies, government agencies, local residents, non-governmental organizations, local organizations (consumers, residents, etc.), private enterprises, etc. Information activities should be implemented throughout the planning and implementation phase of the project. The information content may concern the geothermal resource, description of the project, potential effects on the environment, measures and benefits for local communities (Leucht et al 2010; Wallquist and Holenstein 2015; Shoedarto et al 2016). Tools that can be used to inform different types of stakeholders include project site visits, lectures, a website, newsletters / brochures, press releases, an information centre, a liaison office, social networks, construction of a demonstration unit, participation in events (participation in scientific / commercial / environmental fairs, university events and NGOs), organization of scientific meetings, networking with groups with similar interests (Beck 1990; Carr-Cornish and Romanach 2012; Manyara and Mading 2012; Schwellenbach and van Douwe 2016).

2.4 Principles governing engagement activities

The engagement activities reported above should be governed by specific principles in order to assist their successful implementation. Through the examination of completed geothermal project development action plans, the following principles have been identified:

- Engagement activities should be the fundamental step in the overall development process of a geothermal project (Chebet 2013; Thompson 2014).
- Engagement activities should not be performed only behind "closed doors" (i.e. in meeting rooms, offices or hotels) which cut off the local community, but should be organized outdoors, close to the local community. This way, transparency can be ensured, as the risk of community representatives transferring distorted or incomplete information to the community can be mitigated. In parallel, "open" activities can support the better understanding of all local groups - even the weakest ones (Barasa 2015a).
- Honest information should be provided to the locals, in an understandable way and adapted to the local culture (ENGINE n.d.; Leucht et al 2010; Shoedarto et al 2016). The information should come from reliable and objective sources (Leucht et al 2010; Carr-Cornish et al 2011).
- The heterogeneity of the public should be recognised, on the basis of its demographic characteristics, knowledge, power, values and interests (Leucht et al 2010; Wetang'ula 2010).

- All involved stakeholders should be addressed as equal, in order to create a proper relationship, based on honesty and trust (de Jesus 2005).

- Any issue concerning the project should be openly addressed, even the negative ones. A "common" language / terminology should be created, to ensure clear, effective, and accurate communication among all associated parties (Schwellenbach and van Douwe 2016).

- All interests, including those not represented or represented to a limited extent, should be taken into account during the distribution of impacts, damages and benefits (de Jesus 2005; Wetang'ula 2010).

- A specific person should be designated to be the "face" of the project, and communicate in an appropriate manner with all related stakeholders (Schwellenbach and van Douwe, 2016). Additionally, it should be noted that the participation of high representatives from the organization's administration in the dialogue can be interpreted by the local stakeholders as sincerity and recognition of responsibility (de Jesus 2005; Wetang'ula 2010).

- The activities of the project should be monitored by a group composed of local government representatives, local communities, etc., pointing out the company's willingness to run transparent operations (de Jesus 2005).

- Careless practices should be avoided, especially at the beginning of a geothermal project, as they can lead to the creation of an initial negative view from the part of the local communities; in that case, the re-establishment of a positive image may require huge investment in effort and time. Thus, appropriate technical / technological and organizational practices should be applied during all phases of the project, from research up to operation and maintenance (ENGINE n.d.).

- All commitments made in the context of engagement with local communities should be actually implemented (de Jesus 2005; Wetang'ula 2010).

5. CONCLUSIONS

The current study presents an overview of the strategies and practises implemented so far, towards the achievement of social acceptance of geothermal power projects. The experience recorded up to now indicates that project developers / operators enhance the social acceptance procedure through a) the engagement of local communities, b) the prevention and mitigation of undesired effects and c) the creation of benefits for local communities. It should be noted that the recorder engagement activities focus mainly on communication and consultation, while the aspect of active participation (in decision making, etc.) of local communities is still not so common in geothermal power projects.

In parallel, public authorities -on a national, regional and / or local level- can contribute to reaching social acceptance mainly through the implementation of suitable legislative frameworks (e.g. distribution of specific percentage of the profits for the development of the area, realization of socioeconomic impact studies) and participation in the development of required social infrastructure.

The principles that should govern all the above-mentioned practices and activities include honesty, objectivity, adaptation to local conditions, equality, trust, openness, taking into account interests of all involved parts, accountability and actual realization of the commitments made.

REFERENCES

- Anaye, J. and Cala, C.L.: Geothermal energy development as a medium towards total community development: the Philippine example, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey, (2005), 24-29.
- Barasa, P.J.: Integration of environmental management system in monitoring of environmental and social aspects associated with operation of Olkaria II geothermal power plant in Naivasha sub-county, Nakuru County, Kenya, *Proceedings of the 40th Workshop on Geothermal Reservoir Engineering Stanford University*, Stanford, California, (2015a).
- Barasa, J.B.: Public participation in the implementation of 280MW geothermal power projects at Olkaria in Naivasha sub-county, Nakuru County, Kenya, *Proceedings of the World Geothermal Congress 2015*, Melbourne, Australia, (2015b).
- Barasa, P.J. and Mathenge, R.W.: Stakeholder engagement through participatory research: a case study of Eburru geothermal wellhead generator in Nakuru County, Kenya, *GRC Transactions*, 39, (2015), 233-238.
- Batel, S., Devine-Wright, P. and Tangeland, T.: Social acceptance of low carbon energy and associated infrastructures: a critical discussion. *Energy Policy*, 58, (2013), 1-5.
- Beck, A.G.: Dealing with controversial facts: geothermal public information in Hawai'i, *GRC Transactions*, 14(1), (1990), 583-588.
- Camu, M. and Santiago, R.: Social development in the Philippines' Tiwi geothermal area, *Proceedings of the World Geothermal Congress 2000*, Kyushu - Tohoku, Japan, (2000).
- Carr-Cornish, S. and Romanach, L.: Exploring community views toward geothermal energy technology in Australia, *CSIRO*, Pullenvale, Australia, (2012).
- Carr-Cornish, S., Huddleston-Holmes, C. and Ashworth, P.: The ARRC/Pawsey geothermal demonstration project: an example of how to engage the community, *Proceedings of the 2011 Australian Geothermal Energy Conference*, Melbourne, Geoscience Australia, (2011).
- Cataldi, R.: Social acceptance of geothermal projects: problems and costs", *Proceedings of the European Summer School on Geothermal Energy Applications 2001*, Oradea, Romania, (2001), 343-351.
- Chebet, S.K.: Community engagement in Suswa geothermal prospect, *GRC Transactions*, 37, (2013), 779-784.
- de Jesus, A.C.: Socio-economic impacts of geothermal development, *Proceedings of the World Geothermal Congress 1995*, Florence, Italy, Pre-Congress Course on Environmental Aspects of Geothermal Development. IGA / CNR-International School of Geothermics, (1995).
- de Jesus, A.C.: Social issues raised and measures adopted in Philippine geothermal projects, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey, (2005).
- Enevoldsen, P. and Sovacool, B.K.: Examining the social acceptance of wind energy: practical guidelines for onshore wind project development in France, *Renewable and Sustainable Energy Reviews*, 53, (2016), 178-84.
- ENGINE – Enhanced Geothermal Network of Europe: Increasing policy makers' awareness and public acceptance, *WP5*, Deliverable 38, (n.d.).
- Ibrahim, R.F., McCloskey, B., Sutisna, E., Pranoto, R., Munaf, I., Gordon, R. and Stevensen, R.: Corporate Social Responsibility implementation in the Darajat geothermal project, Garut, West Java, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey, (2005).
- Jobert, A., Laborgne, P. and Mimler, S.: Local acceptance of wind energy: factors of success identified in French and German case studies, *Energy Policy*, 35(5), (2007), 2751-2760.
- Karytsas, S., Polyzou, O. and Karytsas, C.: Social aspects of geothermal energy in Greece, in: *Geothermal Energy and Society*, Manzella, A., Allansdottir, A. and Pellizzone, A. (Ed.), 123-144, *Springer, Cham*, (2019).
- Kurgat I.K. and Omwenga J.: Impact of power generation project on the livelihoods of adjacent communities in Kenya: a case study of Menengai geothermal power project. *International Journal of Scientific and Research Publications*, 6(10), (2016), 610-624.
- Leucht, M., Kölbel, T., Laborgne, P. and Khomenko, N.: The role of societal acceptance in renewable energy innovations breakthrough in the case of deep geothermal technology, *Proceedings of the World Geothermal Congress 2010*, Bali, Indonesia, (2010).

- Manyara D. and Mading P.: Environmental and social considerations in geothermal development: case study Menengai, Kenya: moving towards green and clean economy, *GRC Transactions*, 36, (2012), 1227-1232.
- Meidav M.Z., Calica M.C. and Enalpe E.E.: Model of social responsibility and community service: case history of Unocal/ Philippine geothermal INC's experience with the Mak-Ban and Tiwi fields, *Proceedings of the World Geothermal Congress 1995*, Florence, Italy, (1995).
- Musembi R.: Corporate Social Responsibility (CSR) in geothermal development: the case of the Geothermal Development Company (GDC), Kenya, *Proceedings of the ARGEO-C3, 3rd East African Rift Geothermal Conference*, Djibouti, (2010), 516-521.
- Ogola, P.F.: Appraisal drilling of geothermal wells in Olkaria Domes (IV), Kenya: baseline studies and socioeconomic impacts, *Geothermal Training Programme, The United Nations University*, Reykjavik, Iceland, (2004), 267-306.
- Popovski, K.: Political and public acceptance of geothermal energy, *Geothermal Training Programme, The United Nations University, IGC2003 – Short Course*, (2003).
- Romanach, L., Carr-Cornish, S. and Ashworth, P.: Towards an understanding of social acceptance for the development of geothermal energy in Australia, *CSIRO Science into Society Group*, (2012).
- Schwellenbach E. and van Douwe A.: The citizens' initiative in deep geothermal energy, *Proceedings of the European Geothermal Congress 2016*, Strasbourg, France, (2016).
- Shoedarto, R.M., Aries, F.R., Irawan, D., Perdana, F., Arisbaya, I. and Indrawan, B.: Raising public acceptance of geothermal utilization through direct application in Indonesia, *Proceedings of the 41st Stanford Workshop on Geothermal Reservoir Engineering, SGP-TR-209*, (2016).
- Slamet, U. and Moelyono, D.G.: Maximizing community benefits and minimizing environmental impacts in the Gunung Salak geothermal project, Indonesia, *Proceedings of the World Geothermal Congress 2000*, Kyushu - Tohoku, Japan, (2000).
- Thompson, R.: An assessment of the socio-economic and marine environmental impacts associated with the St. Kitts and Nevis geothermal energy project, Graduate Project, *NS: Dalhousie University*, Halifax, (2014).
- van Douwe A., Stahl L.K. and Kreuter H.: Acceptance of geothermal projects in a critical environment in the Upper Rhine Graben, *Proceedings of the European Geothermal Congress 2016*, Strasbourg, France, (2016).
- Wallquist, L. and Holenstein, M.: Engaging the public on geothermal energy, *Proceedings of the World Geothermal Congress 2015*, Melbourne, Australia, (2015).
- Wetang'ula, G.N.: Public participation in environmental and socioeconomic considerations for proposed 2.5 MW pilot Eburru geothermal power project, Kenya, *Proceedings of the World Geothermal Congress 2010*, Bali, Indonesia, (2010).
- Zepeda, N. and Rodriguez, A.: Socially responsible geothermal development in El Salvador, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey, (2005).

Acknowledgements

The work is supported by GEMex project which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727550.