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Political and public acceptance of geothermal energy

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Abstract

Political and public acceptance of geothermal energy as a "green" and economically feasible energy source is much weaker than for most other "alternative" energy sources. The reasons for this are analyzed in this paper and a set of recommendations are proposed, setting the foundation for development of a successful strategy to increase political and public support for development of new geothermal projects.

1 Introduction

It has been proven that geothermal energy has numerous advantages in comparison with most other so called alternative energy sources. However, it is also true that alternative energy sources, such as wind and biomass, have quicker development rates during recent years than geothermal.

There are many reasons for such a situation. The primary reason is the weak political and public acceptance of geothermal energy as a "normal" and "friendly" energy source. In contrast, solar, wind and biomass are accepted as new scientific achievements which offer numerous benefits to society, and which are perceived to be friendly to the environment. Even though they may not be economically competitive to fossil fuels, it is generally believed that the development of these alternative energy sources should be strongly supported. Why is it like this? Is it possible to identify the mistakes made in geothermal energy promotion up to now in order to recover the present situation and enable better conditions for further (quicker) development?

By presenting positive and negative case histories, an effort shall be made to analyze the reasons for generally weak social acceptance, and to identify possible solutions for changing the situation.

2 Nature of the energy source

The lack of social acceptance of geothermal energy partly stems from fear. It is probably strange to start (now, in the 21st century!) with a background of fear towards geothermal energy use. However, depending on the culture, the fear exists. When having in front of the eyes a solar collector system or a wind power plant, anyone is immediately sure that these "technical devices" are not harmful to the surrounding nature. There is no change in solar radiation or wind velocity in the surrounding area, even in close proximity to the plants. What is also immediately obvious is the production of usable heat or electricity, which can be applied according to the specific needs of the user. In addition, there are no large power plants with huge infrastructure that require frequent inspections from strange scientists.

In contrast, when geothermal energy is in question, the initial phases of development often begin with visits from highly educated people and strange foreigners; test drillings (often on residential properties) with dirty, noisy equipment; and without contact with, or involvement of the local people. Then, steam or hot water comes to the surface, again resulting in dirty surroundings (bad smell, scaling, corrosion of used materials), and sometimes unregulated flow of water through the property. As a result, difficult questions arise:

- What shall happen with the balance of the underground water with this large artificial flow? The balance is important for many reasons, including fresh water supply, and crop irrigation. Scientists are saying to the locals that there is no reason for fear because the steam or hot water is coming from deeper horizons, but is this true? Doesn't the water from upper layers move down to deeper layers?
- Is it certain that emptying the underground water reservoirs will not trigger additional earthquakes? Is the word of a scientist who doesn't live in the region, a good guarantee that natural balances will not be disturbed?

After the initial completion of a geothermal system, local people and politicians have, in front of their eyes, a system of irregularly located boreholes, a "forest" of pipelines passing through properties in a "strange" way, and projects that require frequent visits from foreigners. Therefore, in the initial phase of development, benefits are not obvious, and appear to be outweighed by negative changes to the surroundings.

2.1 Case histories

2.1.1 Milos Island (Greece) (Popovski, 2002)

After discovering a geothermal field with very high potential, it was a "normal" decision of the State Power Corporation to move immediately into building a new power plant, thereby offering a long-term solution for a cheap supply of power to Milos and the surrounding islands. However, the main drill hole was located very close to the biggest town of the island Adamas, which was just beginning tourism development – promoting an easy life with "controllable" changes of one's life. In addition, the locals' experience with industrial plants on the island had been negative; a great part of it already destroyed by the local bentonite industry. Local reaction to the power plant: "no way!" It was believed to be undesirable to have an industrial plant using smelly steam with dirty effluent water in the town. Local perception was that this would negatively impact the efforts to build up tourism. "What tourist would come to have holidays near such a plant?" Up to now, negative reactions have not yet been resolved.

2.1.2 Nisyros Island (Greece) (Popovski 2002)

Nisyros is a volcanic island with frequent earthquakes. Local legend says that a giant sleeps below the island, and reacts to each change of the nature around him.

Again, the State Power Corporation came with a proposal to build a power plant in order to resolve the bad situation with the power supply of Kos, the neighboring island; with the developed tourist sector; and Nisyros itself. To clarify the situation, Nisyros is populated mainly with elderly people with modest needs, who are generally satisfied with the possibilities of earning money catering to tourists from Kos. These tourists make excursions to see the volcano (10-20 buses/day during the high season), and normally have lunch in local restaurants.

Local reaction to the power plant: "no way!" First of all, locals believe that it is dangerous to disturb the balance of the volcano; and second, why should the nature on Nisyros island be disturbed with an ugly industrial plant in order to offer (free of charge!) benefits to the more developed island of Kos?

2.1.3 Kocani geothermal system (Macedonia) (World Bank, 2002)

Kocani Valley in Macedonia has been the main producer of rice in ex-Yugoslavia, and thus depends very heavily on a regular water supply for irrigation. Then, it was learned that a huge amount of water (up to 300 l/s) would be used for very different purposes. Luckily, the centralized state government could control the situation. However, it has taken nearly 10 years to change opinions of the people.

2.1.4 Power plant in Guadeluppe (France) (Desplan, 2002)

The main motto of the public campaign for building a geothermal power plant by CFG (Companie Français de Geothermie) has been that they are bringing something new, which shall enable better development of tourism, cheaper electricity, and new employment opportunities. The local community has been continually involved in the design, plant erection and completion process. Esthetic arrangement of the surroundings, and incorporation of facilities for tourist visits have been part of project development, too. The result of such an approach is that all the local people were proud of having something particular in their town, and strongly supported the idea for building the second power plant, as well as the introduction of other types of geothermal energy use.

3 Environmental impact

When underlining that geothermal is a "friendly to the environment" type of energy, we are not telling the complete truth. First, it has significant impacts to the environment; and second, if some type of impact is "friendly" or not depends on the point of view of the local residents of the impacted community.

Taking into account that people usually do not have a clear understanding of what types of impacts are coming with the introduction of this "new" energy source, there is primarily no resistance during the initial phases of development, i.e. exploration, investigation, and project design phases. The differing opinions of local people depend on several local factors, including socio-economic conditions, cultural background, and individual or group interests. When news spreads about the possibility of having a geothermal project initiated in a given area, many residents eulogize natural heat with terms like clean, cheap, friendly, benign, green, and sustainable; thus creating a favorable climate for the implementation of the project.

However, individual and collective attitudes towards geothermal development usually change with time as the project reaches the drilling stage, and work begins for plant construction. Indeed, undesirable effects may result from these activities: (i) on ecosystems (air, land, flora, fauna, and superficial and underground water); (ii) human health (from water pollution, noise, and gas emission); and (iii) economy (detrimental impact on some production activities, tourism, and damages to crops and private properties) (Cataldi, 2000).

Moreover, reaction often grows against landscape modifications and alteration of natural features of cultural or religious interest, caused by civil and industrial works; and by changes in the use of public areas resulting from project activities. For all the above reasons, opposition by residents in the project area often increases as the project proceeds, especially in areas with resources suitable for geothermal-electric generation. Thus, the number of people who label geothermal energy with terms such as costly, polluting, and dangerous for people's health also increases. Furthermore, in areas with different energy options, opposition to geothermal development can be used as reinforcement by parties interested to foster the use of energy sources other than natural heat.

3.1 Case histories

3.1.1 Geothermal system "Smokvica" (Macedonia) (World Bank, 2002)

The geothermal system "Smokvica" was completed immediately after the one in Kocani, where geothermal water is potable and has very low mineralization. Local enthusiasts (supported by local politicians) were "hungry" to repeat the success in the shortest time possible. Local residents were happy to get such a clean, easy for exploitation and "free of charge" energy source. However, troubles began with the project completion phase:

- 9 km of pipeline visually disturbed the peaceful, agricultural environment, often passing through agricultural land.
- Leaking of geothermal water around the wells and along the pipeline caused dirty corrosive flows, and corrosion of the construction materials and equipment.
- All the boilers, used for covering the peak loadings, were destroyed after the first season of use (direct result of the corrosive water!).
- Similar corrosion occurred with the internal heating installations in greenhouses.
- Effluent water going to the neighboring river was continually dirty (after passing through steel pipes under corrosion) and smelly.

Most of these negative impacts were corrected later on, but the impression that geothermal energy is a dirty energy source, with negative impacts to the environment remains.

3.1.2 Geothermal power plant Ribera Grande (Azores, Portugal) (Popovski, 2001)

The effluent water of the power plant (90ºC) is discharged into the small river Ribeira Secca, which flows to the ocean. Highly mineralized, the water produces white deposits everywhere where flowing. Therefore, it is "proved" that this energy source disturbs the environment and should be avoided for use where it is possible to apply other "clean" energy sources. Result: Development of the direct application sector based on the use of effluent water goes with big difficulties. Even the cheapest variant energy is not accepted by the local people.

4 Social acceptance

One of the negative aspects of geothermal energy is that it is a "local energy source", i.e. it is not economically feasible to transport the fluid to users over long distances. On the other hand, for direct application purposes, the economics of usage depends on the annual heat-loading factor, conditioning composition of different users. This result, both for electricity production or direct application, results in changes to the social environment, i.e.:

- Building of a large industrial plant for electricity production with complicated infrastructure. New people with higher living standards and different ways of life move into the area. Young locals leave the traditional local economy and way of life by getting these better paying jobs.
- Introduction of new and different economic sectors, based on low-energy costs from the use of a new energy source. Often this creates strong competition to the existing traditional production (greenhouses, aquaculture).
- New, strange buildings and houses appear in the traditional environment, resulting in changes to existing estimations of values.
- Feasible economic benefits are coming, but only for a limited number of people. Not everybody can "join the club", not even the ones whose property has been damaged during project construction.

On the other hand, usually, better life infrastructure and organization comes with a new project, i.e. better road connections, potable water supply, better management of the effluent water, better supply to the local market with everyday goods, etc. The type of social acceptance in a local community depends on the level of culture and existing economy, but also on the organization of the initial approach to development of the new economy sector.

4.1 Case histories

4.1.1 Ulumbu project at Flores Island (Indonesia) (Christiono, 2000)

Very careful studies were performed before building the geothermal plant, because strong resistance from the poor community was expected. First, the negative sides of local life conditions were analyzed, and a trial was made to identify which conditions could be positively changed by the completion of the plant. The results were encouraging. Problems included: (i) the existing electricity supply (small diesel plants) was very expensive (normally taking 10-20% of the income of local people); (ii) the fresh water supply of the neighboring village was not adequate; (iii) the quality of the water from the local river was lowered by the smell of geothermal waters, discharged from natural springs just above the village; (iv) continual problems with irrigation water were present due to the seasonal rains; and (v) erosion of the agricultural land was causing severe problems to most of the families making their living from agriculture.

It was discovered that many problems the local residents were experiencing could either be removed, or improved significantly with project completion. Therefore, it was possible to give a list of promises to the local community without risks not to fulfill them. Project completion consisted of the following:

- Building a small dam, above the geothermal site, for fresh water collection. It is bigger than needed by the power plant, but enables regulation of the supply of irrigation water for the village and provides a clean, fresh water supply.
- A demonstration area how to arrange the orchid plants and local fruits was completed, stopping the erosion of the terrain. It was immediately accepted by the local people because this offered security for their “normal” production.
- A fresh water supply system for the village was completed, and a demonstration of healthy toilets was made. That decreased the rate of infective illnesses.
- And last, but not least, the price of electricity significantly dropped.

The result: no trace of resistance for further development of geothermal energy use exists. In fact, there is now very enthusiastic local support.

4.1.2 Milos Island (Greece)

The negative example, already presented in 2.1.1.

4.1.3 New district heating system in Iceland (Popovski, 2001)

After 25 years of successful development, both in the electricity production sector, and direct development (the city of Reykjavik is totally heated by geothermal energy), the question of social acceptance practically doesn’t exist.

5 Political acceptance

Political acceptance is very important because real geothermal development cannot begin without strong State support. However, this is one of the weak points of the public treatment of geothermal energy, due to several reasons:

- Development of a geothermal project lasts for a long time, i.e. the results are realized after 10 or more years from the beginning of activities. That is too long a period for local politicians needing "quick results", and even for the State having on hand other "quicker and cheaper" possibilities.
- Technologies mostly use products and equipment designed for other uses, so essentially there does not exist a "geothermal" industry needing political support for its existence and further development, except for geothermal heat pumps where the development is fastest.
- There is no widely accepted strategy for scientific and commercial promotion of the "new" energy resource. It is understood as important only in a few (rich) countries at higher cultural levels, and with good State organization.

5.1 Case histories

5.1.1 Geothermal development in Macedonia (World Bank, 2002)

After first getting positive results from geothermal development during the "energy crisis" of the 70s, the stable and long-lasting socialist governments kept the support for development, and maintained very positive results during the 80s of the last century. However, in the 90s, the political and economic transition of the country came, destabilizing the political situation, with short-lasting political careers. All the politicians were interested in "quick results" in order to keep their political positions. Much more important questions emerged, which needed to be resolved, and geothermal development has now been completely stopped.

5.1.2 Geothermal development in Italy (Popovski, 2001)

Italy has always been one of the world leaders in geothermal development. However, the interest has always been directed towards power production. Presently, one can identify two situations caused by the lack of political support, i.e.:

- Privatization of ENEL (Italian National Utility for Electricity Production) resulted with orientation towards "cheaper" solutions, i.e. import of electricity. Practically, further development of the geothermal power production sector is stopped.
- After completion of a district heating scheme in Ferrara, there is no other direct application project in Italy.

Positive changes in ENEL ("Green" energy program) during recent years shall probably contribute to change the situation for the better.

5.1.3 Geothermal development in Iceland (Popovski, 2001)

Continued success of previous geothermal development has created a positive atmosphere for political support and further development. There is no serious Icelandic politician who has a negative approach to this indigenous energy source.

6 Technologies for geothermal application

Available technologies for geothermal application also have certain influence on public opinion. The problem is that they are case sensitive, i.e. each project conditions a particular set of technical solutions, and that means the need for engagement of different specialists (increase of necessary investments and risks for failure). Practically, the required complex approach is not possible for smaller project development, resulting in unacceptable simplifications and difficulties in exploitation. Neither the economic feasibility, nor the final positive opinion for the energy source can be reached in that way, at least when higher mineralized waters are in question. In contrast, when "clean" technologies are in question, successful development comes immediately.

6.1 Case histories

6.1.1 Geothermal heat pumps (Sanner, 2002)

Application of geothermal heat pump technology is very clean and simple. After getting the proper design and specifications from the producer, the user has nothing particular to do during operations, except proper maintenance. The result: Even though this is quite an expensive solution in comparison to the ones based on fossil- fuel use, this type of geothermal energy application is in quick development in many countries of the world.

6.1.2 Down-hole heat exchanger (Lund, 1999)

A similar situation (as in 6.1.1), at least in the countries where geothermal heat is available at shallow depths.

6.1.3 Low mineralized water (World Bank, 2002)

Effluent water of the geothermal system "Bansko" in Macedonia has been used for heating numerous small greenhouses around the spa complex. Very primitive floor heating systems have mostly been applied. However, this offered the advantage of having much earlier production free of charge. Result: The problem in getting the "right" to use the effluent water is a "life" question for the small producers. There are always more candidates than the water on disposal.

6.1.4 Highly mineralized water (Popovski, 2001)

The greenhouse project at Ribeira Grande (Azores, Portugal) is a successful demonstration project. Initial difficulties with the highly mineralized water (e.g. scaling) have been resolved after the first year of exploitation. However, already existing negative opinion about the "dirty" water and initial difficulties resulted with the stopping of further development of this type of use.

7 Possible conclusions

From the case histories and discussions presented in this paper, some important conclusions can be drawn, connecting the relationship between public opinion and development of geothermal energy use in a specific area or region. First, and the most important one, is:

Public opinion crucially influences the conditions for geothermal development.

It is probably possible to complete a geothermal project "by force" in some areas, but development is not possible if not positively accepted by the local community.
Elements of public support to geothermal development are:

- *Nature of the energy source*. It was found that many elements of the complex nature of geothermal energy can be the reason for weak public support in some areas. Still, a lot of work is necessary to change the resistance by spreading proper information in an understandable way, accommodated to the culture and cultural level in question.
- *Environmental impact*. Development of most, and particularly the big geothermal projects, do have environmental impacts, which change with the different phases of development. Elements of the impact can contribute positively or negatively to local public opinion, depending on the quality of the organizational approach of project development, quality of project design, organization of work during construction and completion, and quality of the operations. General positive opinion can be reached when most of the elements are done in a proper way.
- *Social acceptance*. As the changes to local life and habits, introduced by geothermal energy project development, get bigger in a specific area, it is more difficult to get quick social acceptance – even if resulting in quick and favorable benefits to the community. Sometimes, it's better to start with smaller projects to accommodate local people to the presence and benefits of a new energy source, than to go immediately into completion of big projects. However, if taking the responsibility to resolve some urgent problems of the community in parallel or, better said, as a part of the project completion, chances to accelerate the process of public acceptance are much better.
- *Political acceptance*. Political support for geothermal development is important for two reasons, i.e. as a support to get public acceptance, and as support to get necessary State support for the initial development phase. Presently, geothermal energy does not have strong enough political support (with some exceptions).
- *Technologies for geothermal energy application*. Absence of simple and easily applied technologies is also one of the reasons for weak social acceptance of geothermal energy as a competitive energy source. In addition, absence of standardized technologies, materials, and equipment result in the absence of industrial support.

Altogether, Cataldi (2001) presented two definitions for successful social acceptance of geothermal projects, which should consist of all the listed elements:

- "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" (De Jesus, 1995; Cataldi, 2001).
- "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" (Cataldi 2001).

I shall add the third one:

- 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.

Finally, it is always necessary to repeat: It's better not to start with geothermal development if not certain that the first project shall be an absolute success, particularly in an environment with lower cultural standards! Initial negative impressions require a lot of effort, time and investment to be modified. Proper technical/technological and organizational solutions should be applied for all phases of project development, i.e. exploration; planning; design; implementation; technical acceptance and trial work; and, finally, operations and maintenance. Furthermore, before starting the work for project implementation, all the elements of social acceptance within the local environment should be identified, with proper solutions developed to remove the negative opinions, and proper strategies developed for promotion of benefits.

8 Some recommendations

According to the experience of successful case histories, the following approach to development of geothermal projects can be recommended.

8.1 Exploration/investigation phase

Initial contact with local administration, particularly for the technical part of the project. Promoting the initial information on extremely positive possibilities and benefits for the community, if it is expected that positive results will be reached.

8.2 Project planning

Preparation of a set of pre-feasibility studies, i.e.:

- Identification of possible consumers; technical characteristics of their heat consumption; annual diagram of heat consumption; disposition to the heat source and possibilities and conditions for implementing connections; possibilities for completion; necessary interventions; environmental impacts of performing the works; and other conditions for completing the utilization of the heat source (or power plant) at a specific location.
- Techno/economic feasibility of the application of concrete technical solutions, resulting with a proposal for choice of concrete project composition.
- Identification of social conditions for project implementation, i.e. elements of possible negative and positive influence of project implementation. If a large project is in question, identification of present problems of the community which can or cannot influence project implementation, but can be partially or completely removed with project completion. Proper definitions of the benefits.
- Determination of basic economic conditions for project implementation and possible timetable for the organization and performance of project financing and implementation.

The results of this phase should be used for the information and lobbying campaign to get local and regional support for project completion. It should be properly planned and performed by proven professionals, who are able to give proper answers to any possible questions! The political sector, business sector and private citizens should pay attention in order to avoid identification of the action with the present political party in power, or a concrete business group! During this phase of implementation, the local "hero(s)" should be chosen.

8.3 Project implementation phase

This phase does not consist of only technical work but also:

- Resolving quickly and clearly the problems of property rights, where some part of the project should be completed, or some property through which a pipeline is passing.
- Continually "scanning" the changes of local public opinion, and taking measures to remove negative opinions or support the positive ones.
- Keeping collaboration with the local government, moving in a continually positive direction.

When social acceptance is in question, the following elements should be under particular attention:

- Work should be planned and performed in the shortest possible time. Lengthy projects, followed with "dirty" engagements, always result in the development of a negative attitude from people living around the project site.
- All problems with properties should be clearly resolved in advance. Prolongation of such problems during the implementation phase gives good "food" for negatively-oriented journalists (who have somebody else's interests behind them).
- Each part of the work should be carefully planned and performed to have the least possible impact to the environment. After finishing, the surroundings should always be returned to the previous state, or even improved!
- Use local firms and workers for project implementation as much as possible!
- Performance of periodic dissemination of information on the activities already completed, and in progress, through regular meetings with local administrators, and by means of the media.
- Strong promotion of advances in the work and completed activities which remove local communal, or other problems in parallel with project implementation.
- Using the presence or visits of experts for positive consultancy with the local community; and for possibilities to open new initiatives for improving the local economic situation.
- Composing the team for project execution using as many local people as possible; and providing education and training for candidates with affordable financing.

8.4 After project completion

After project completion, it is also necessary to take some measures in order to keep the positive public opinion (to enable easier project development in the future). Things to be considered include:

- A proper technical review should be performed, and all mistakes removed.
- A long enough work trial should be enabled before any public presentation of the project.
- Information on all the benefits of project implementation should be collected and arranged for presentation.
- A well-planned presentation and information campaign should be performed.

Altogether, it should be clear, and present in the minds of project developers that:

- Social acceptance is one of the crucial factors for successful project implementation and further development.
- Activities to get social acceptance are one of the phases of project development, and should be executed in a professional way.
- Costs for performing necessary activities for getting social acceptance are an unavoidable part of project implementation costs. They are site and project specific, and should be planned in advance and incorporated into any economic feasibility study or analysis connected to project development and implementation.

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