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Social acceptance: a sine qua non for geothermal development in the 21st century

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ABSTRACT

In some zones on earth social acceptance is already at present an important condition for the smooth implementation of geothermal projects; but it will become a ***sine qua** non* in the next decades as more people will take awareness of the environmental issues, and news will spread on the impact that implementation of large geothermal projects may have on ecosystem and economy of the areas concerned.

Actions to gain social acceptance include minimisation of environmental impact, prevention of adverse effects on people's health, and creation of benefits for resident communities. These actions involve significant burdens for the project budget, as additional components of the external costs. After discussing the various aspects of the problem, an estimation is given in this paper of the costs of the social acceptability **for** groups of projects of different type and size. Expenses to win social acceptance, however, also yield external benefits for the project owner, the most important of which are saving of labour, reduction of passive interests on bank loans, and shortening of time for the return of investment.

KEYWORDS

Geothermal development, social acceptability, external costs, external benefits

1. Introduction

The world geothermal development 1965-1998 with projections to December 2000, and the average annual growth rates by 5-years periods are given in Table 1, both for electric generation and direct use. The table shows that a considerable growth has occurred in the last 35 years: a total average increase of 8.3 % per year for electrical generation, and of 4.6 % per year for all direct uses at T >35°C (excluding balneology).

However, looking at the increase trends in detail, three definitely different growth periods can be noted for geothermal-electric capacity: the first (until 1975 approximately) with an *on **the average*** growth rate, the second (1975 - 1985) with a ***rush*** growth, and the third (1985 - 1995) with a ***low*** growth. In the last few years, though, a certain relaunch is seemingly occurring at the global scale for electric capacity, but the growth rate still remains at a ***moderate*** level. Similar trends are not seen for thermal capacity, whose average growth rate has been always ***low*** (2.3 - 4.3% per year), except for the period 1980 - 1985 when it peaked some 10% per year.

The notable decrease in annual growth rate after 1985 is mainly attributable to reduced economic competitiveness of the natural heat as compared to other primary energy sources, to shortage in financial resources for several projects, and in certain cases also to difficulties arisen from the provisions regulating the energy sector in some countries with important geothermal potential.

However, local constraints have also contributed after 1985 in curbing development in some areas with high-temperature resources. Significant examples are: Milos and Nisyros in Greece, Mt. Amiata in Italy, Ohaaki in New Zealand, and Puna (Hawaii) in the USA. Constraints in these areas resulted from opposition by the indigenous populations, concerned with the impact that project activities could have on environment, economy, tourism, and cultural or religious traditions; but in each area people's opposition took site - specific forms. **A** similar situation is likely to occur also in other areas in the next future.

Table 1: Geothermal development 1965 - 1998, with projections to December 2000

Year (Dec.)	Installed Power Capacity		Installed Thermal Capacity for Inlet Temp. >35 °C (excluding balneology)	
	MWe	*Average annual growth rate by 5-years periods: %*	MWt	*Average annual growth rate by 5-years periods: %*
1965	550 (1)		2,400 (2)	
1970	800 (1)	7.8	2,700 (2)	2.3?
1975	1,180 (1)	8.1	3,100 (1)	2.3?
1980	2,110 (1)	12.3	3,468 (1)	2.3
1985	4,720 (1)	17.4	5,600 (1)	10.0
1990	5,840 (1)	4.4	6,900 (1)	4.3
1995	6,766 (3)	3.0	8,300 (4)	3.8
1998	~ 8,300 (5)	~ 5.9	~ 9,100 (6)	~ 3.0
2000	~ 9,000 (7)		~ 9,600 (7)	
Average annual growth rate Dec.1965-Dec.2000		8.3		4.6

(1) Cataldi, 1997; **(2)** Estimated (coherent data are not available for 1965 and 1970); (3) Huttrer, 1996, with amendments from later sources; **(4)** Barbier, November 1998, with amendments from other sources; (5) IGA Home Page, June 1998, with extrapolation to December 1998; (6) Estimated (data not yet available as of March 1999); (7) Forecasts based on construction programs underway.

2. Public opinion and geothermal energy in the project areas

In areas with important resources, most people know that natural heat can be used for electric generation and direct applications. Many of them are also acquainted with the benefits arising locally from geothermal development, whereas others are concerned with the impact that large projects (especially those for electric production) may have on environment and economy. Thus, public opinion in these areas always displays diversified positions, some supporting, other encouraging with reserve (yes, but..."not in my garden"!), and still other opposing geothermal development.

In each area, the different positions are the result of many factors, such as political situation, socio-economic conditions, energy demand, cultural background, individual and group interests, and others. Most frequently, though, before a new project is started, many residents of the area eulogise geothermal resources with terms like clean, cheap, friendly, green, benign, sustainable, and similar, thus favouring their development.

However, individual and collective attitude towards geothermal energy often changes with time as activities reach the deep drilling stage and works begin for the installation of pipes, equipment and plants. With these activities, a number of adverse events may occur, causing undesirable effects on:

i) *ecosystem,* with impact on land, water, air, flora, and fauna;

ii) *human health,* resulting from pollution of superficial and underground waters, toxic gas, and noise;

iii) *local* economy, due to impact on some sectors of production actvities and tourism, and damages to private properties and cultivated fields; and

iv) *people's reaction* against modifications of original landscapes and alteration of natural features of cultural or religious interest resulting from civil and industrial works, and from changes in the use of public areas.

Adverse effects are minimal during the Reconnaissance and the Prefeasibility Studies, and moderate during the Feasibility Study; hut they may take on relevance during field development, plant construction and production activities.

Depending on their nature and the type of measures adopted to prevent their occurrence, such effects range from reversible and temporary to irreversible and permanent, and their relevance increases with the size of the project. In any case, the impact is notably higher in multi-purpose projects (electrical production + direct uses) than in projects for direct uses.

For all the above reasons, geothermal development in areas with high potential may undergo increasing opposition; in this case, geothermal energy is charged with terms such as polluting, costly, dangerous for people's health, and the like. Moreover, in certain areas, people's opposition to geothermal development is enhanced by conflicts of interests at the local scale; in other cases, public opinion is manipulated through counter-information campaigns promoted by parties interested in consolidating the use of conventional energy sources, or in fostering sources other than natural heat.

In short, people's opinion on the impact that geothermal development may have in a given area is a delicate issue involving economic and social aspects: a matter to be tackled with much attention by any entrepreneur wanting to implement a geothermal project in that area.

Principle **22** of the **"Earth** Charter (RIO DECLARATION 1992)" so states:

> ***Indigenous people and other** local **communities have a vital role in environmental management and development.***

3. Social acceptability of geothermal energy

Almost everywhere on earth, when a new industrial initiative is planned or about to start in a populated area, the debate on its acceptance at the local scale involves largely political parties, opinion-makers, administrators, entrepreneurs, and common people. This applies also to geothermal development, especially in the case of projects for electrical generation. Social accceptability thus becomes a key for the realisation of these projects.

Taking into account that no development initiative exists without an even minimal impact on the territory involved ("..to achieve zero pollution, or zero social concern is to achieve zero economic activity..." De Jesus pointed out in 1995), the problem of making that initiative acceptable by the resident communities consists in implementing activities as much as possible in harmony with the environment and people of the project area.

The following two definitions have been proposed in recent years for the social acceptance of geothermal projects:

i) "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); and

ii) "Social acceptability of a profit-purported project is the condition upon which the technical and economical 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, wellfare, and culture (CATALDI 1997).

The first definition addresses more attention on economic advantages for specific sectors than on benefits for people at large, whereas the second focuses more on environment and public benefits than on specific interests. However, both definitions point at minimisation of detrimental impacts on environment and people of the project area.

In this context, attainment of social acceptance of geothermal projects requires undertaking the following "external" actions.

3.1 Public relations and information campaign

Depending on the type and size of the project, some or all of the following activities should be considered for this campaign:

- contacts with regional authorithies and local administrators during the planning stage, not only to provide information on the objectives of the intended project, but also to start having an idea of the people's attitude towards the new initiative;
- preparation of public opinion through a timely and plain information campaign;
- presentation to regional authorities, and to local administrators, important entities, and cultural associations of the area, of a brochure outlining the main project characteristics, the environmental measures in program, and the social benefits expected from the project;
- dissemination of periodical information on the activities already completed and in program, through meetings with local administrators, and by means of media;
- promotion of project-related scientific meetings to be held in the work area;
- guided visits to drilling sites and plants for local students and interested people;
- possible creation in the work area of a "demonstration facility", with posters, models, photos, and information leaflets on the project;
- attention for territorial development plans, significant industry activities, and any other important initiative that might bear on the project objectives;
- consideration for traditions, culture, and modes of thinking of the indigenous communities.

3.2 Prevention and minimisation of adverse effects on environment and people

Planning project activities according to a block structure based on the main phases of work helps organising and implementing, before the beginning of any important project, an accurate environmental impact study (EIS). This could be carried out according to the sheme called ***product-activity matrix*** (OLADE-IDB 1994), or following a block-structure approach similar to that suggested by Cataldi **(1993).** Whatever its structure may be, however, the EIS should enable evaluation of the possible sources of impact for each working phase, leading to preparation of a plan of actions to prevent the occurrence of any type of undesirable effects.

In many important geothermal countries the EIS is already at present a pre-requisite to obtain authorisation for the project implementation; however, in the form it is usually carried out, the EIS focuses more on ecosystem and healthiness, than on economic impact and people's culture, which are also important factors for the smooth execution of large geothermal projects. Therefore, an effort should he made to include these aspects in the EIS of any such projects, or to consider them in a separate but parallel document which could be called Socio-Economic Impact Study (SEIS).

Apart from the above, since socio-economic situation, infrastructures, and environment conditions in the project area may change fastly with time, and considering that the same working schedule of the project often undergoes modifications as technical activities proceed, the **EIS** and the program of environmental measures should be revised and brought up to date periodically, each time that a new important phase of the project is ahout to start.

3.3 Indemnification measures

Even in areas with favourable cliiate for project execution, as activities reach the deep drilling stage and construction is near to begin of plants and infrastructures, a number of private land owners and some entrepreneurs with interests in the project area always appear worrying about possible impacts on their properties or activities. As a consequence, a certain "mental reserve" starts to spread among sectors of the public opinion in the area, which undermines the favourable climate mentioned above and strenghten the position of those who had opposed the project implementation since before its inception. This results in increasing operation difficulties, which may bear on the project schedule and budget.

To reduce these difficulties, the project experts should be prepared to adopt technically-equivalent alternatives for the siting of major works such as drillings, gathering system, plants and infrastructures. With these alternatives at hand, the project owner will be able to avoid business dealings with stubborn land owners, who aim in most cases at taking advantage of the situation so as to obtain unreasonably high prices for their commodity. Negotiations with other land owners, and readiness to pay in some cases a reasonably higher amount for a given commodity, eventually results in saving delays to the project works.

However, regardless of the possibility to apply the alternatives said above, a number of temporary and permanent rights of way, and praedial servitudes are always necessary for the execution of drillings and other works, whereas construction of permanent installations requires purchase of portions of land. In all such cases, negotiations should be conducted by the project owner with an open attitude, seeking for the most convenient solution in relation to the project objectives and work plan. In the event of notable difficulties in direct negotiations for a given commodity, an arbitration to settle the issue in an amicable and fast way is more desirable than any legal action.

The same applies to indemnification of damages caused by the project activities on cultivated fields, woods, livestock, and rural facilities, as well as to restoration of reparable damages to roads, bridges, pipes, and any other private property or public infrastructure in the area.

In any case, direct negotiations, fair indemnification of damages or adoption of other compensatory measures, and quick payments, are important elements to maintain good relations with the resident communities and to obtain their acceptance of the project.

3.4 Creation of local benefits

Especially in the case of large projects for profit making, social acceptance of geothermal development depends largely on the public perception that the new initiative will bring permanent benefits for the residents of the area concerned. To this purpose, some or all of the following measures can be taken:

- steady or temporary hiring of workers from the project area;
- use of local firms for the execution of as many as possible parts of work;
- training and steady hiring in the project firm of qualified natives (earth scientists, engineers and technicians), aimed at employing them in the project area as long as possible;
- opening of premises in the work area, equipped with recreation facilities and cafeteria;
- cession at the minimum cost (or at no cost, if possible) of residual steam or hot water for local use;
- share of costs with, and logistic support to local institutions for the restoration, or new construction, of parts of public infrastructures (road segments or junctions, bridges, green areas, and others), modified to allow for installation of project facilities and plants:
- economic contribution and sponsorhip to cultural, sport, and folklore events customarily held in the project area and its surroundings;
- grants to local scholars and students for research and publication of works on important aspects of development perpectives, history, traditions, and culture of the project area;
- in alternative, or in addition to some of the benefits above, the allocation of a fraction of the project profits may be negotiated with the local authorities for use in works of public utility.

The list is not exhaustive, but is enough to point out that measures can be taken to meet expectations of the local communities and to win their acceptance of geothermal projects.

4. Externalities of social acceptability in geothermal development

4.1 General concepts

"Externality" is not an exclusive concept of geothermal energy, but a general one, applied to any development initiative or industrial project requiring high capital investment: public works, large infrastrucures, exploitation of natural resources, industrial processes, and others.

"Externalities" are costs and benefits different from those strictly related to the primary scope of a given project, but that always appear during the project implementation. Though having an "outside origin" and no technical justification, "external" costs and benefits are added to the normal costs and benefits of the project. Among them, important components are costs and benefits issuing from adverse and beneficial effects caused by project activities on environment and people of the area concerned.

Externalities can be quantified economically and introduced in the cost-benefit analisys of each project according to the following two conceptual equations:

- ***TOTAL EXPENDITURES = COST OF TECHNICAL ACTIVITIES + EXTERNAL COSTS***
- ***TOTAL BENEFITS = ECONOMIC PROFITS + EXTERNAL BENEFITS.***

By evaluating the results of these equations, and by comparing the various items of the external components, one can get an idea of the social acceptability of a given project.

4.2 Costs of social acceptability of geothermal projects

Data on these costs are not available in the literature; thus, no sure figures can be provided for them. However, based on this Writer's direct experience and on information obtained at the personal level on environmental and social expenditures in a number of projects of different type and size, an estimation can be given here of the costs in question, expressed as share to the total project construction cost.

To this end, figures concerning two different types of projects are shown in Tables 2 and 3, for direct uses and electrical generation + direct uses, respectively. To allow for a certain flexibility in the use of these figures, a range of values is given for each group of projects, broken down into groups of different total construction costs.

Values shown in these tables are indicative figures. On the other band, much caution should be taken when comparing these values with those of practical cases, not only because of the unicity of each real project, but also because a number of measures that can be adopted for safeguarding environment and people's health are ***de facto*** necessary to optimise field management; reinjection of spent water into the same reservoir of origin is the most significant, but not the only example in this regard.

Project size	A) Total construction cost (Range: in 10^6 EURO)	B) Share of social acceptability costs (B / A x 100: %)
Small	1 – 5	0.5 – 1.0
Medium	5 – 10	1.0 – 1.5
Large	10-20	1.5 – 2.0

Table 3: Share of costs of social acceptability for multi-purpose projects (electric generation + direct use) as a function of total construction cost (except electric network, and hot water distribution network in space heating projects)

Project size	**A)** Total construction cost Ran e: in 10^6 EURO	B) Share of social acceptability costs B / **A** x 100: %
Very small	10 - 20	1.2 – 1.5
Small	20 - 50	2.0 – 2.5
Medium	50 - 120	3.0 – 3.5
	120 – 250	3.5 – 4.0
Ve _ lar_e	250 – 400	2.5 – 3.0

4.3 External benefits

Tables 2 and 3 evidence that the share of the social acceptability costs to the total project construction costs is rather modest in relative terms; but it is not modest at all if considered in cash terms of the project budget, especially for large multi-purpose projects. Nonetheless, they are a necessary burden for the project owner because they enable minimisation of the environmental impact and creation of tangible benefits for the local communities, which are indispensable factors to obtain the social acceptance of the project.

This acceptance, in turn, allows for the project to proceed in the fastest way possible, and results eventually in considerable benefits for the geothermal entrepreneur, consisting mainly of saving of labour, reduction of passive interests on bank loans, and shortening of time for the return of investment.

Conclusions

Social acceptance by the resident communities is an important requisite for the smooth implementation of geothermal projects, especially those for electrical generation. The three main conditions to win social acceptance are minimisation of environmental impact, prevention of adverse effects on people's health, and creation of tangible benefits for the local populations.

These conditions involve burdens for the project budget, which usually constitute the most significant components of the external costs. Their amount depends on the type, size and location of the project, and may aggregately sum up to 2% and **4%** of the total construction costs, respectively for direct use projects and multi-purpose projects.

Though modest in relative terms, these components of external costs may represent sizeable amounts in cash terms. However, not only they allow for protection of the ecosystem and the people's health, and for creation of tangible benefits for residents in the project area, but also produce notable return benefits for the project owner. Therefore, environmental safeguard and social acceptance are the mutual convenience of both resident communities and project developers.

This writer feels that social acceptance will take on increasing importance in the next future as more people will be acquainted with the environmental issues. In this framework, social acceptance will become a ***sine qua** non* to foster geothermal development in the coming decades.

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