LOW-ENTHALPY GEOTHERMICS IN FRANCE: ORGANIZATION AND ROLE OF THE STATE

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ABSTRACT

The rapid development of geothermal energy in France is due to a number of favorable factors that include not only technical feasibility and attractive economic conditions, hut also an appropriate government policy and organizational structure The geothermal sector being singularly different in many respects from those of other energ sources, it was necessary to construct a framework within which it could develop in a competitive environment. Moreover. geothermal energy is considered as a mineral resource with the State as licensor. The deliberate choice made by the government to encourage local administrations to take on the role of concessionaires, or 'owners', for these developments required specific training facilities. a Comité de Geothermic (Geothermics Committee), an insurance system to guarantee exploration and resource durability, etc. For their part. the 'owners' and the professionals had *to* adapt themselves to the specific situation ofgeothermal energy and its development

1. GEOTHERMAL ENERGY IN FRANCE

Geothermal energy in France has economized on other energy sourccs to the extent of 230,000 tonnes oil equivalent **(toe).**

- Very low temperature
  - -groundwater heat pumps 40.000 toe
- Low temperalure
  - - fish fanning - agriculture x.000 toe
  - -domestic heating 170,000 toe
- High temperature
  - -generation of electricity 12,000 toe

Some 200,000 dwellings are now heated by geothermal energy from 70 lowtemperature domestic heating plants

- 45 in the Paris Basin
- 18 in the Aquitaine Basin

2. BACKGROUND

The first operational geothermal system in France, dating from 1964, was set up in Paris to heat and air condition the Maison de la Radio (Broadcasting House): it tapped the Albian aquifer, which is shallow (600 m) with a moderate temperature (27°C). In order to tap the deeper, and thus hotter. Vogger aquifer it was necessary to resolve the problem of discharging highly salt laden water. The doublet system la production well associated with a reinjection well) was tried out for the first time in 1969 at Melun, this plant, still in service today. heats a group of 3400 dwellings.

The main period of geothermal development was from 1982 to 1986, when more than 60 plants were put into service in the Paris and Aquitaine basins These plants were helped by a combination of factors:

- -energy was very expensive hetween 1979 and 1985.
- -good adequation between a well-known resource and suitable surface heat requirements:
- . a government policy of inducement, notably through setting up a statutory framework and appropriate organizational structures.

Conditions changed afler 1986. The cost of enerby dropped considerably, upsetting the financial balance of cenain operations, and a number of plants were beset with technical problems Since this date, efforts have been concentrated on maintaining and strengthening existing operations, as much from the financial aspect as from the organizational and technical aspects.

3. ORGANIZATIONAL STRUCTURES

As pan of its energ policy the government set up a number ot organizational structures aimed at promoting the development of alternative energy sources, in particular geothermal energy.

3.1. Agence de l'environnement et de la maitrise de l'énergie (Ademe)

In 1982 the government set up the "Agence française de la maitrise de l'energie" (AFME - French Agency for the Management of Energy), a Public Institution reponing to bath the Ministry of Industry and the Ministry of Research. This agency later expanded its scope of activities to include the environment, thus coming under a third ministry, the Ministry of the Environment, and acquiring a new name - "Agence de l'environnement et de la maitrise de l'energie" (Ademe - Agency for the Environment and the Management of Energy). Ademe's role is to coordinate and promote activities that provide better efficiency and a greater respect of the environment

Where geothermal energy is concerned, AFME's (and then Ademe's) activities at first consisted of identifying and quantifying local resources, and then of supporting, validating and structuring the sector during its industrialization phase At the same time, the agency established a program of Research and Development and technological innovation. Ademe has also ensured that the various phases of geothermal development were accompanied by suitable communication. information and training.

3.2. Comité technique de géothermie

In 1977, before the creation of AFME, the Ministry of Industry had set up a "Comité technique de geothermic" (Technical Committee for Geothermal Energy), which was then attached to AFME when the agency was formed in 1982. This Cornminee is composed of specialists and representatives of the profession, the 'owners' and the administration. It is responsible for ensuring that policy is followed in maners of geothermal energy It is consulted on the programs proposed by Ademe and giver its opinion on projects likely to obtain government aid

3.3. SAF - insurance against geological risk

Geothermal energy is a mineral resource subject to geological risk (risk of not finding the anticipated resource) Local administrations, who are generally the 'owners' of these operations. are not in a position to bear this risk. The standard insurances cannot propose

specific solutions because of the nature of the risk itself and also because no statistics were available at the time The guarantee system thought up by the government consisted of setting up a two-part insurance. an exploration guarantee followed by a durability guarantee.

A guarantee fund, known as the "Shon-Term Fund", covers the geological risk during the drilling of a well: the amount of settlement in case of failure is fixed at 90%; it can go up to 100% in the Paris region due to an additional regional fund

A second fund, known as the "Long-Term Fund, covers the risk of a decline in the resource with time, as well as of geological accidents during exploitation. This guarantee is valid for a period of 15 years. hut a study is underway to evaluate the possibilities of extending this period

The management of these funds has been entrusted to SAF, a company created especially for this purpose by the government. The shares of SAF are held by mainly public sector, hut also private sector, financial institutions

This specific system has in many cases overcome the hesitations of investors Having been in operation for more than 10 years, the system has proved its effectiveness. A French proposal for the ALTENE program includes the study of an equivalent system operating at European scale

3.4. IMRG - a research organization

The "Institut mixte de recherches géothermiques" (IMRG - Combined Institute for Geothermal Research) was created jointly by Ademe and BRGM in 1982, involving some 20 researchers and research students Since 1987, the work of the Institute has been focused mainly on trying to solve plant operating problems. and particularly those of corrosion and scaling in the Pans region. This work has not only led to a better understanding ofthese phenomena, hut has also developed methods and techniques that conriderahly reduce the effects of corrosion.

Research was also continued in a number of other fields: modeling of high-enthalpy fields, development of clayey-sandy reservoirs. underground heat storage, etc

Although the organization was dissolved in 1994, the specialized research teams have been maintained within BRGM and their essential work continues

3.5. CITEG - a geothermal data center

The "Centre d'information technique sur l'energie géothermique (CITEG - Center for Technical Information on Geothermal Energy) is a BRGM organization working in close collaboration with Ademe Its role is to collect and circulate technical information concerning French geothermics The center is responsible *for* coordinating BKGM research into gcathennics and for providing expertise outside the commercial sector. In addition, it manages the automatic data acquisition system monitoring the exploitation parameters of the Dogger aquifer from some 40 geothermal doublets in the Paris region

It also, in conjunction with Ademe, carries out information and training activities both in France, for the partners in geothermai industry, and abroad.

CITEG publisher an information bulletin entitled "Geothermic-Info"

4. REGULATIONS

The subsurface of France is the property of the State, which grants concessions for developing resources within the framework of the Mining Code The resources are well known as a result of appropriate legislation, which provides far the public domain to be supplied with the geological information obtained through drilling (including oil wells)

Geothermal resources are classified as "mines", with a distinction between low-enthalpy and high-enthalpy geothermal deposits. As such, geothermal energy is regulated by mining legislation, the main objectives of which are to
- fully optimize the development of subsurface resources;
- minimize the risks and pollution created by this exploitation. hoth for natural and human environments;
- guarantee the health and safety of workers.

Geothermal energy is also concerned by the water legislation insofar as it covers the pumping of and discharge into surface water and groundwater

The mining legislation deals mainly with:
- legal aspects, these define the status ofthe different phases in the life of a geothermal project, including the attribution of mining claims (their renewal, withdrawal, waiver, transfer or leasing) and the relationships between the explorers/operators and the surface 'owners';
- administrative aspects. including supervision of the work exercised from the beginning to end ofthe geothermal project.
- applicable technical regulations
- the registration of excavations and geophysical surveys.
  the reporting of offenses and penalties

Two main decrees of the Mining Code concern the geothermal industry, for which the following pants should he noted:
- an exploration permit is obligatory before drilling begins, and a mining or exploitation permit is required before the resource is used.
- the authorization process includes a public inquiry and the presentation of an environmental impact study for each project

The mine and quarry policy is exerted by Head of the Prefecture (Departmental representative of the government) under the authority of the Minister responsible for mines. he is assisted in this by the Regional Director for Industry Research and the Environment, who proposes any measures he considers useful. The administration is able to impose individual measures on each of the operators and decree regulations of general behavior on a national level

For geothermal operations in the Paris region. the Prefectorial order granting the exploitation permit specifies the rules by which the operator is bound for the control and monitoring of his operation In addition to information concerning the identification and precise location ofthe operation. the order makes provision for

- technical monitoring of the installation and its equipment and of the geothermal fluids.
- regulations for protecting the groundwater, the environment and the safety of personnel and the public.
- treatment of the geothermal tluid to prevent corrosion and fouling ofthe pipes (the types of authorization and control).
- providing the administration with monitoring repons on the exploitation

A new water bill was passed in 1992 which deals with surface water and groundwater pumping and discharge in terms of hoth quantity and quality The Mining Code is also being revised with the aim of harmonizing and distributing the abilities of the various administrations responsible for enforcing arid supervising the legislation.

5. STRUCTURES

5.1. 'Ownership'

As mentioned above, the 'ownership' of the operations is generally assumed by public bodies such as
- municipalities alone;
- groups of communes;

-syndicates involving several common public organizations; low-cost housing **office,** hospital, etc.

Semi-public organizations have **also** been **set** up; these may consist of:
- public planning corporations **(new** towns):
- limited liability development companies for low-cost housing;
- semi-public companies with public and private partners.

Finally. private companies formed by large groups specialized in running thermal installations have assumed the 'ownership' of a few operations.

Generally, operations under public 'ownership' are helped during their development phase by **a** national company called "Géochaleur" (Geoheat), which is **a** subsidiary of the largest French financing group. In such cases. Géochaleur acts as a sort of deputy 'owner'.

5.2. Exploitation

Exploitation is generally assigned to a thermal development company. Their contract with the 'owner' gives them varying degrees of responsibility depending on the situation; the organization charts given in Figures 1 and 2 illustrate different levels of responsibility and the most common organizational structures used in the development of French geothermal energy.

In the first case the 'owner' manages his operation; he awards contracts directly with the different service and supply companies, and issues and collects the subscriber fees

In the second case the owner signs a "lease" contract with a specialized company, which is then responsible for running the installation and collecting the heating fees from the subscribers, paying part of these to the 'owner' for reimbursing the investment

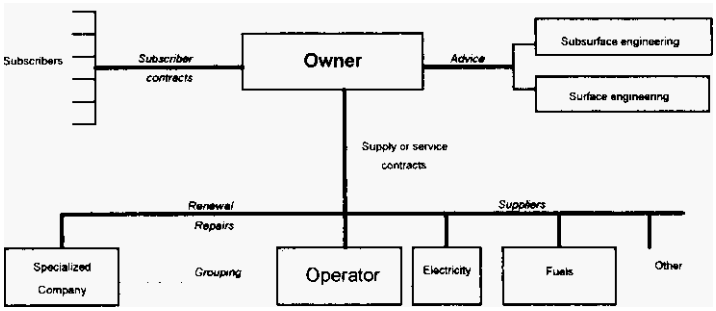

Figure 1 - Organization chart showing maximum involvement of the 'owner'

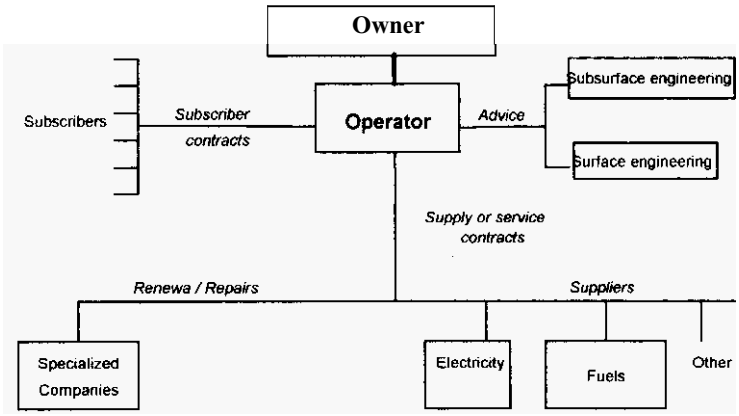

Figure 2 - Organization chart showing minimum involvement of the **'owner'**

Whatever the **case,** major incidents that may arise concerning the wells **or** the loop are the responsibility of the 'owner' of the operation, Granting **a concession** for part of the subsurface to **a** specialized company is **a** system that could prove attractive: this has not yet been done, but active consideration is being given to it.

5.3. Pricing

Invoicing methods used for networks supplied by fossil fuels are difficult to apply to networks supplied by geothermal energy The systems that were established in the early days of geothermal operations were based on **a** logic heavily stamped by the then existing situation. So as to induce users to connect to the system. a so-called safeguard clause was introduced, this clause states that the subscriber would never pay more than he would have paid for the energy he used before linking up to the geothermal network. This principle was not without incident **on** the financial balance of the operations when the price of fuels began to fall in 1986. **A** good pricing system **must** be based **on** a certain number of principles.
- true prices **and** legibility of the tariff:
- full control of the energy the tariff must induce maximum use of the geothermal energy, notably by taking into account the return temperature of the utilizations;

- full control of exploitation costs: the tariff must induce the 'owner' to extend his network, thus lowering the fixed costs charged to each subscriber;
- equal treatment for subscribers under similar conditions;
- flexibility of application, notably so as to be able to compete with alternative solutions.

6. CONCLUSIONS

The government's policy at the beginning of the 1980s provided a significant boost to geothermal energy

The experience acquired over the last 15 years has made it possible to test the provisions that were set up.

As a result, it is now possible to determine the optimum conditions for new operations. The areas in which changes appear necessary concern the 'ownership' structure and the financing structures for this type of investment. Considering the specificity of a geothermal operation and the technical and economic hazards attached to it. local administrations are probably not the most suitable organizations for handling all the responsibilities involved in an activity that is both industrial and mining in character.