WORKSHOP ON GEOLOGICAL RISK INSURANCE

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The french geothermal risk guarantee system

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1. French context

1.1. Geothermal resources in France

As shown in illustration 1, France has a plentiful resource with numerous shallow and deep aquifers which are suitable for direct geothermal use or as cold source for heat pumps.

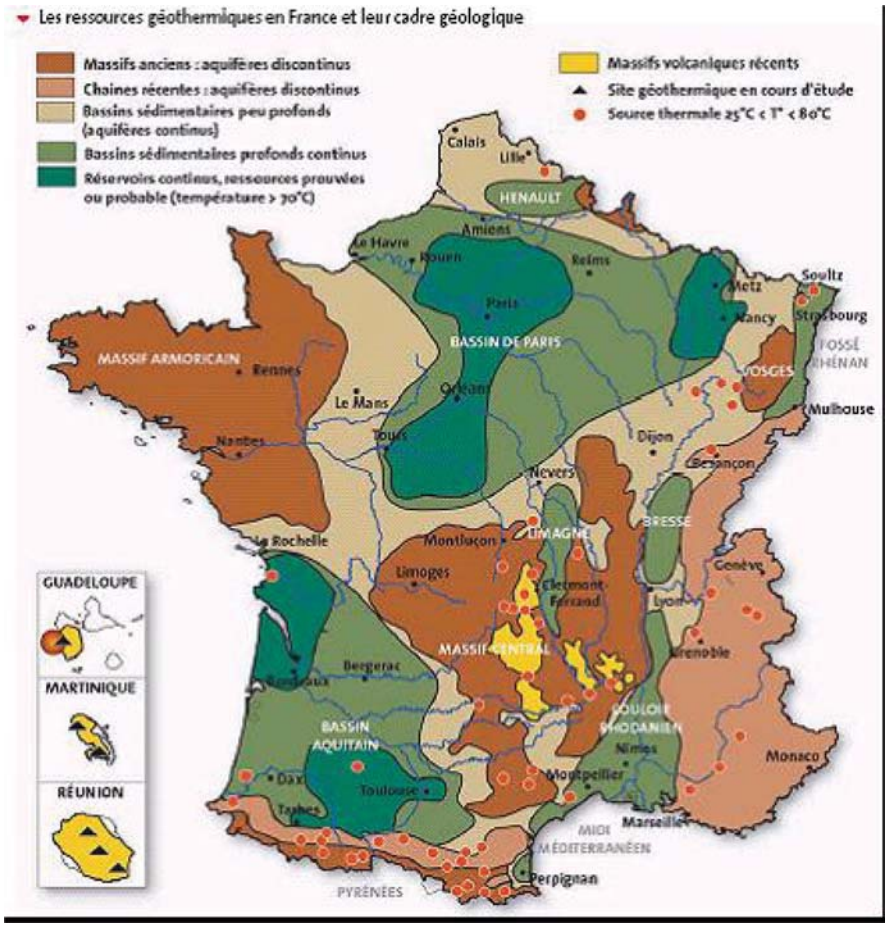

Illustration 1 : Geothermal resources in France

The shallow resource is well distributed in the territory whereas the deep resource is concentrated in the mains sedimentary basins local areas like the Paris Basin and the Aquitain Basin.

1.2. First stage of development

The first stage of development for geothermal energy began with the oil's crisis (1973 and 1979), in the 70's. They stimulated researches for alternative energy as the geothermal one, but, obstacles to the development of geothermal energy remained :

- The success of such projects mainly depends on the properties of the geothermal resource that directly impact the exploitation costs, but are only known at the end of drilling work ;
- Traditional insurance policies do not offer any specific solutions for this type of risk in view of its very specific nature and because the fairly small number of operations involved does not provide a sufficient statistical basis ;
- Moreover, financial organizations refuse to invest unless the public or private operator gives a formal guarantee ;
- In the absence of coverage against geological and mining risks, any failure of a drilling operation would require to charge back the taxpayers of the city or the tenants of subsidized housing concerned. Officials considered this as an unacceptable constraint. This was the main barrier preventing the development of geothermal energy.

So, the French government decided to create a system of risk guarantees to facilitate the development of geothermal energy and the risk guarantee system has been created in the 80's.
Before 1987, it spurred the growth of geothermal energy : more than 100 wells have been drilled in the Paris Basin.
It was based on one principle : successes pay for failures and thanks to the very low rate of failure in well-resourced regions (like the Paris basin), wells entailing higher risks can be drilled in regions where little exploration has been conducted.

Illustration 2 : Succes/failures repartition in Paris Basin and in France

During this first period of development, a lot of operations have been made, mainly in deep resources, with doublet of wells with re-injection in the origin aquifer in Paris basin and with fresh water single well without re-injection in Aquitain basin.

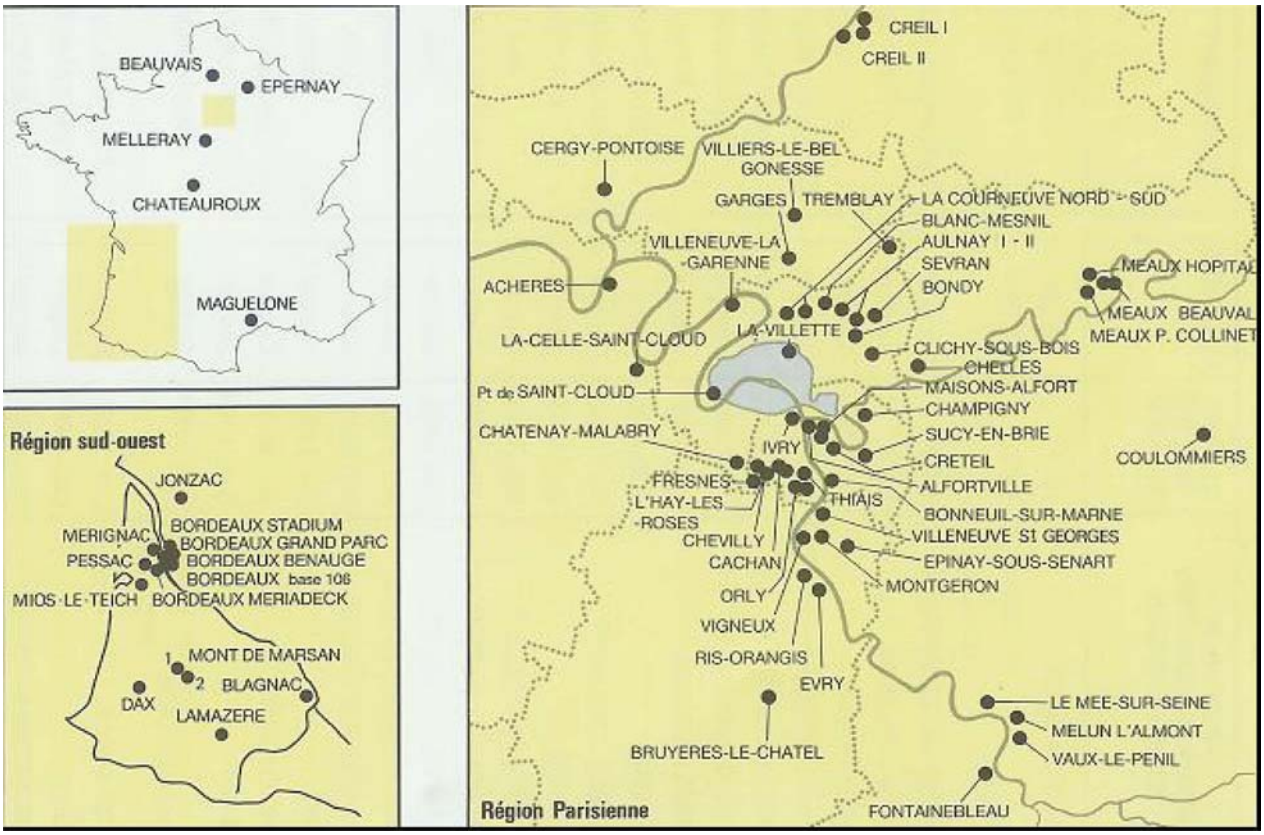

Illustration 3 : Operations realised during the first period of development for geothermal energy in France

1.3. Second stage of development

In the 90's, geothermal energy knew a period of decreasing, but, since a few years, and because of a new background (uncertainties on important increase of oil prices, growing concerns about climate changes), political decisions are taken to develop renewable energy, and a second stage of development for geothermal energy appear.

Political decisions are taken at several levels (Kyoto, Europe, France) :

- Europe : Triple target for 2020 :
  - 20 % share of renewable energies in overall EU energy consumption
  - 20 % reduction of greenhouse gas emissions
  - 20% saving of the EU's energy consumption

- France :
  - « Grenelle de l'environnement » : strong increase of renewable energy are planed

So, as shown on this graphic (illustration 4), a jump of the geothermal energy development is expected and is already observed with :

- 31 geothermal doublets in Paris basin and 18 in Aquitain basin which are still operating;
- new wells which have been done : Orly's doublet (2007) and Sucy's well (2008)
- new projects planed near Paris in 2009.

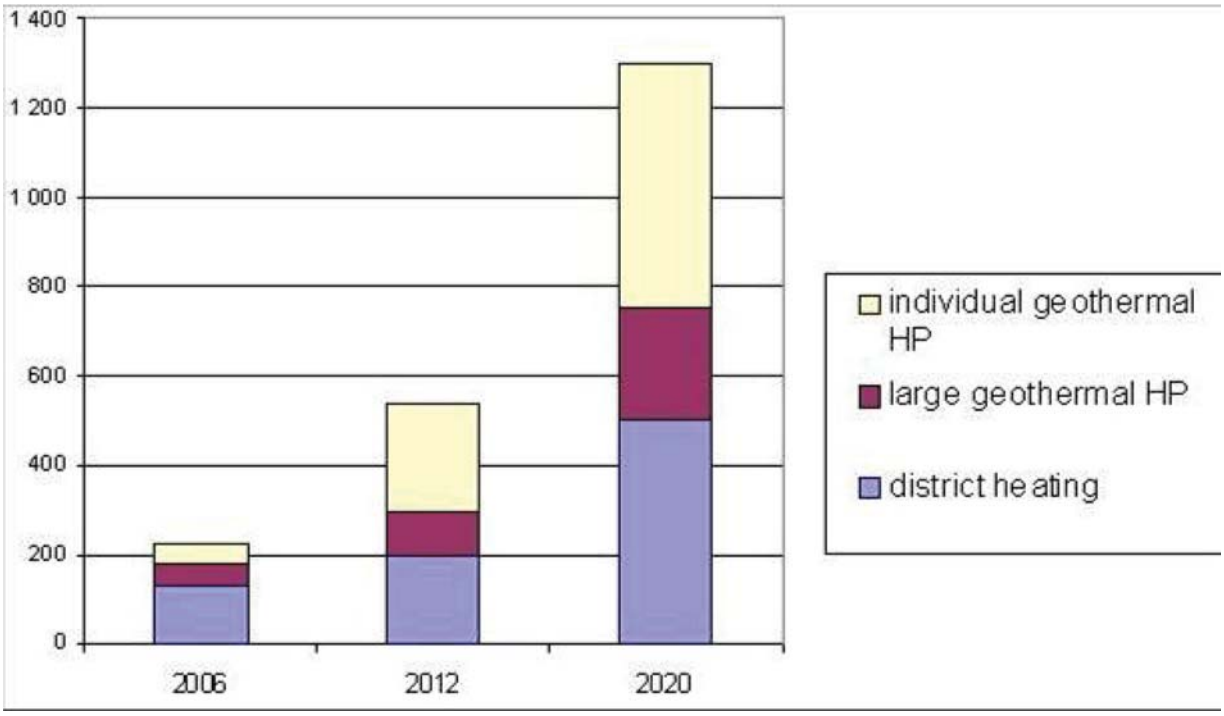

Illustration 4 : Expected development for geothermal energy in France

So, the risk guarantee system had to be reactivated and this has been done in 2006 by the government.

2. The French guarantee system mechanism for Deep geothermal energy

The French guarantee system is a financing system used to cover geological risks. It is based on two complementary mechanisms :

- A short-term procedure based on the socialisation of risks which guarantees the result of the first well drilled
- A long-term procedure which begin at the starting-up of the facilities and guarantees the sustainability of the resource and the risk of total or partial depletion during 15 years of operation.

2.1. Short term risk (STR) insurance principles

The STR covers geological risk in the event of total or partial failure of the first drilling operation.
Success parameters are the flow rate (Q) and the temperature (T), as representatives parameters of the project's profitability.
They can be extrapolated from general geological models before the beginning of the operation.
So, the STR insurance is used to secure the project's profitability in spite of the geological model's uncertainties.

The conditions for subscript to the STR insurance are :

- The acceptance of the project by a technical committee : based on a complete economic, financial and juridical analysis ;
- The payment of 1,5 % of the covered coast.

The level of compensation can reached 90% of the eligible coast (total cost of the first well – subsidies + over costs due to unforeseen or accidental events during drilling works). But different sums are granted according to the degree of success of the project which is estimated with success-failure curves (illustration 5) :

- In case of total success, no compensation is paid ;
- In case of partial success, a partial compensation is paid to reach profitability ;
- In case of total failure, the full compensation is paid.

The success-failure economical curves are calculated on the basis of the project's economic sensitivity study.

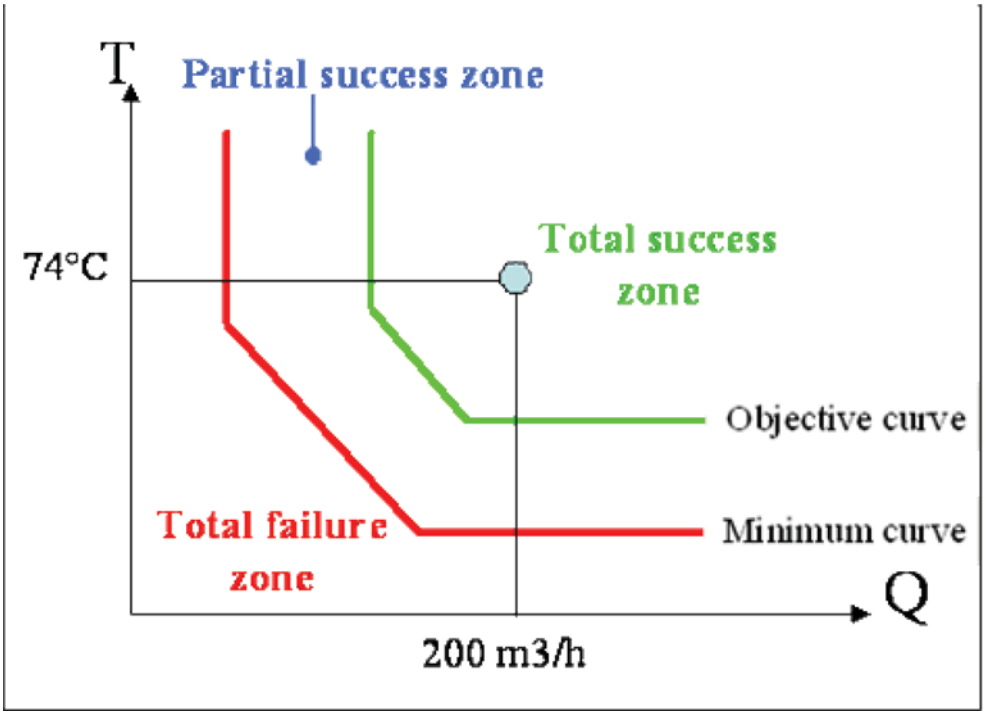

Illustration 5 : Success/failure curves

2.2. Long term risk (LTR) insurance principles

After the doublet setting, the geothermal characteristics are known, but their long term behaviour are unknown, as well as long term chemistry effects on wells and reservoir. The mains risks are :

- Temperature and/or flow rate decrease ;
- Severe corrosion and/or scaling in wells.

The LTR insurance is used for securing long term profitable exploitation, covering the risks of drilling exploitability's degradation.

The LTR covers :

- the wells, materials and specifics equipments (included inhibitor injection operations which prevent well corrosion and avoid expensive cleaning) ;
- the geothermal loop ;
- the quality of the geothermal resource (defined clearly at the origin).

The duration of the insurance contracts is 15 years.
The conditions for subscript to the LTR insurance are :

- The acceptance of rule of good technical management and respect of regulations ;
- An initial payment of 3.2 % of insured costs ;
- The payment of an annual contribution.

The level of compensation depend on the drilling exploitability's degradation :

- In case of partial damage (the exploitation is still economically viable after repairing), the compensation is calculated according to the plant's lifetime and its power loss according to the contract reference ;
- In case of total damage (non repairable damages or accidents - the exploitation is no more economically viable), the compensation is calculated according to a contractual ceiling and the plant's residual value.
- Details are contractual: reference situation, franchises, depreciation policy on the value of equipments.

2.3. Management of the fund

In 1980, public authorities & ADEME created a private society to manage the risks funds : SAF-ENVIRONNEMENT.

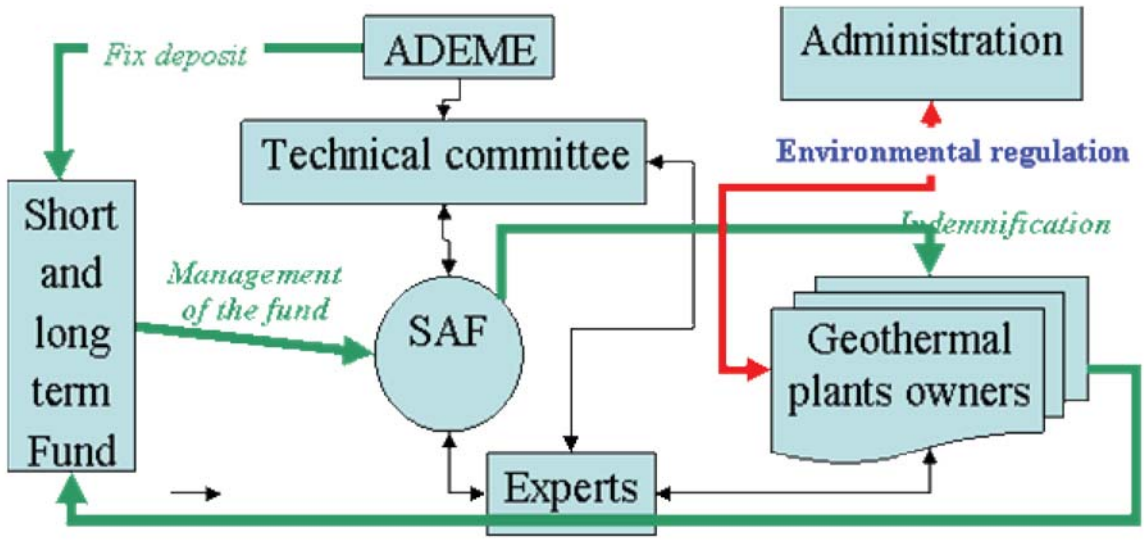

Illustration 6 : Short and long term risk insurance mechanisms and managment

As shown in illustration 6, the decision to grant the guarantee is taken by the technical committee composed with :

- ADEME ;
- SAF-Environnement (manager of the risk fund) ;
- Representatives of private and public owners ;
- Representatives of financial institutions specialised in Renewable Energy Projects ;
- BRGM ;
- Experts appointed to analyse files.

The balance of the fund is ensured by :

- Public funds : ADEME as a State Agency ;
- Owners of geothermal plants (public or private) : initial payment and annual contribution ;
- Financial products of investments.

3. The French guarantee system mechanism for shallow geothermal energy : AQUAPAC

The exploitation of shallow resource is also increasing (illustration 7), so, an other guarantee system, called AQUAPAC, has been created for geological risks due to uncertainties of the drilling's results for shallows groundwaters.

It concern plants using heat pumps of more than 30 kW (not for individual plants).
It's based on two complementary mechanisms:

- A research guarantee which covers the risk of insufficient resource with regard to the expected one and failure of injection
- A long term productivity guarantee which covers the risk of decrease or deterioration of the resource during the exploitation.

The maximum amount covered reach 115 000 •, the duration of the guarantee is 10 years and the fund is managed by SAF-Environnement (but this is a different fund than the deep resource fund).
The decision of allocation is taken by the AQUAPAC committee compound of : ADEME, EDF, BRGM and SAF-Environnement.

Illustration 7 : Increasing of shallow geothermal energy exploitation

Illustration 8 : Aquapac file

4. Conclusion

The insurance guarantee schemes proved to be successful, overcoming many obstacles for the deployment of geothermal energy :

- Psychological : geothermal energy is a basic choice for the long term and competitive
- Technical : improvement of the initial technology
- Financial : the guarantee system overcomes the hesitations of bankers to offer loans

The future for geothermal energy is to develop sectors such as :

- Deep geothermal
- High enthalpy electricity production in overseas departments (Guadeloupe, Martinique, Réunion)
- Development of shallow geothermal energy with heat pumps
- Hot dry rocks

4.1. Further informations

www.geothermie-perspectives.fr
www.brgm.fr/

4.2. Contacts

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