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State of the art of French 'public-private' collaboration strategies in favor of renewable energy sector: the case of geothermal energy

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INTRODUCTION

Geothermal energy, particularly for heat production, plays a central role in achieving France's climate and energy goals, especially for thermal uses, which account for nearly half of the country's total energy consumption. The importance of geothermal energy in the French energy mix has been confirmed by a unpublished government's Action plan, officially launched at the end of 2023 by Ms Agnès Pannier-Runacher as Minister of Energy and Ecological Transition. Built on the collective intelligence of both public and private key players from the geothermal sector, the national action plan aims at achieving carbon neutrality by 2050. The follow up of its implementation has been assigned to ADEME, the French Agency for Ecological Transition.

Based on this geothermal roadmap, French energy policies, notably through the Multiannual Energy Programming (PPE) and the National Low-Carbon Strategy (SNBC) have acknowledged the importance of shallow and deep geothermal energies in decarbonizing buildings, supplying district heating and cooling networks and meeting industrial heat demands.

Despite this very structured ecosystem, the market shares of geothermal energy in France is still not living up to its potential. This is why this paper, based on an update of emblematic actions of the national Action plan for geothermal energy three years after its launch, will also provide an analyze on remaining obstacles and possible key drivers to make geothermal projects economically viable and attractive to both local authorities and private actors thanks to partnerships between both private and public sectors.

1 THE DEVELOPMENT OF THE GEOTHERMAL INDUSTRY HAS BENEFITED FROM A LONG TERM SUPPORT OF THE FRENCH STATE

1.1 THE CENTRAL ROLE OF ADEME IN THE STRUCTURATION OF THE GEOTHERMAL INDUSTRY

ADEME is the French Agency for Ecological Transition. It is a public institution under the supervision of the Ministry for Ecological Transition and the Ministry for Higher Education and Research. Its main objective is to support and accelerate the energy and ecological transition in France, within the framework of the National Low-Carbon Strategy (SNBC) and the Multi-Year Energy Programming (PPE). ADEME plays a central role in the practical implementation of French energy policy by financing, advising, informing and coordinating stakeholders to promote the transition to a more energy-efficient, effective and renewable energy model.

ADEME's action aims to help France – reduce greenhouse gas emissions – move away from fossil fuels in heat production and mobilise the still largely untapped geothermal potential. For example, in the Île-de-France region, ADEME has committed nearly €89 million of a total investment of €335 million over the recent period to renewable heat production, including deep geothermal projects.

A very symbolic example of the support of French State towards geothermal energy industry is the creation in 2010 of the French Association of Geothermal Professionals (AFPG). The establishment of the AFPG, at the request of the public authorities and ADEME, has enabled the professional sector to be structured by becoming their spokesperson to represent their interests and exert greater influence on the public authorities.

Another example is the implementation of the RGE (Reconnu Garant de l'Environnement) scheme for which ADEME also played a key role. Both RGE Études (for studies) and RGE Travaux (for installations), have played a major role in structuring, consolidating and professionalising the renewable energy (EnR) and energy renovation sectors in France. Before the RGE qualification scheme, introduced between 2011 and 2014, the renewable energy sector was very heterogeneous, with varying levels of expertise among companies and little official recognition. The RGE scheme has encouraged tradespeople and design offices to improve their skills through certified training courses (OPQIBI for design offices, etc.). This has helped to create a core group of qualified professionals capable of guaranteeing the quality of renewable energy installations and energy performance and combat counter-references.

1.2 GEOTHERMAL PROJECT: ADMITTEDLY A PRIVATE SECTOR DYNAMIC, BUT ONE THAT CANNOT YET DO WITHOUT STATE TOOLS

At the same time, geothermal projects tend to be initiated by private entities, but require public support policies in order to get off the ground.

ADEME also plays a central role in operating the ‘Fonds Chaleur’ (Heat Fund), a public scheme to support the production of renewable and recovered heat, which includes shallow and deep geothermal energy for both heating and cooling applications. It finances feasibility studies, geothermal drilling, geothermal heat pump installations, and even heating and cooling networks. This significantly reduces initial costs, which are a major obstacle to the development of this energy source and enables geothermal energy to be as competitive as its fossil fuel competitors, particularly gas-based solutions. For example, it has granted €27.7 million in aid for a deep geothermal energy project in Île-de-France (Grigny/Viry-Châtillon) through this fund.

In the context of deep geothermal energy development, one other main obstacle for project developers is the geological risk: drilling a well is very expensive (several million euros), and there is uncertainty about the quality of the resource at depth (temperature, flow rate, water mineralisation, etc.). If the resource does not meet expectations, the investment is largely lost. To mitigate this risk, the government has set up a public guarantee scheme, managed by ADEME: the Geothermal Guarantee Fund.

Historically, Risk Mitigation Schele (RMS) was used in the Ile-de-France region, but a new scheme has been officially approved in Brussels July 2023 to develop projects all over France except overseas territories. The fund intervenes to partially cover financial losses if the geothermal resource is proved as insufficient after drilling (non-compliant flow rate or temperature, absence of an exploitable reservoir, etc.). The mechanism is only applicable to deep geothermal energy project producing heat often intended to supply district heating networks. Power generation is no more supported in France Mainland.

This guarantee reassures public and private investors, facilitates bank financing, and makes it possible to launch projects that would otherwise be too risky. The fund is financed by public contributions (from the government via the ecological transition budget) and contributions paid by project leaders (mutualist principle).

These two schemes managed both by ADEME are really linked although they intervene at different stages of a geothermal project's development. The Geothermal Fund secures upstream risk (uncertain resources) whereas Heat Fund supports downstream investment (installation and heat production), and together, they make geothermal energy more attractive, safer and economically viable. The subscription of the RMS guarantee is compulsory to get an access to the Heat Fund.

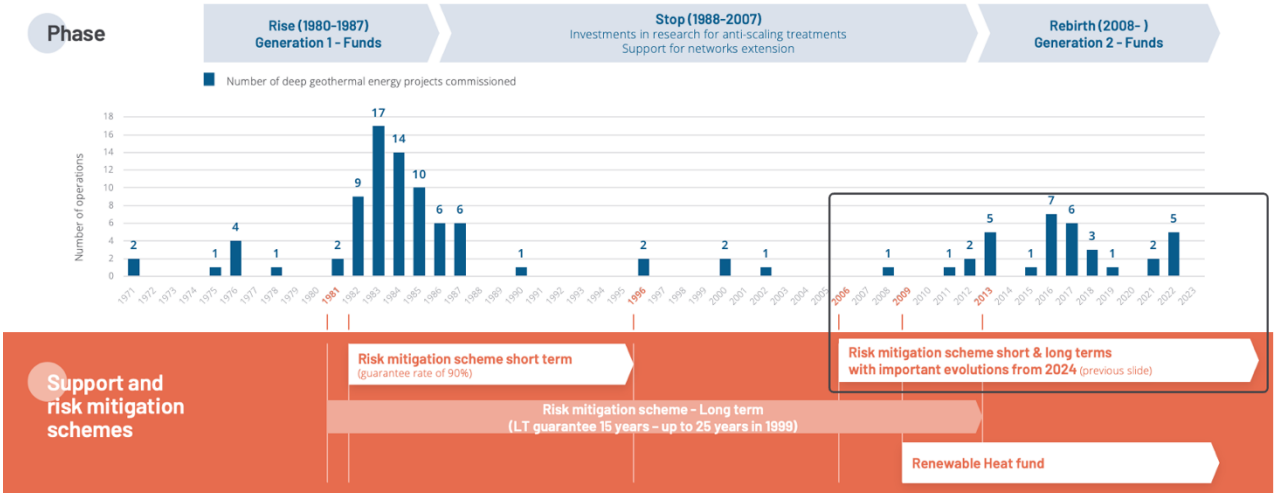


Figure 1: Heat Fund and Geothermal RMS, two key schemes in favor of the development of deep geothermal energy

1.3 THE FRENCH NATIONAL GEOTHERMAL ACTION PLAN (PANG): AN INPUBLISHED ROADMAP MANAGED BY ADEME

The national action plan, officially launched in December 2023 by the French government, is the result of work conducted by ADEME in 2022 to draw up a national roadmap dedicated to geothermal energy. The implementation of the PANG has requested the presence of the private sector to define the actions and to oversee some of them.

On the basis of these efforts, the roadmap evolved into a national action plan comprising 27 actions identified as priorities by all stakeholders, and 23 additional courses of action. ADEME is responsible for monitoring and steering the action plan, with the backing of a committee of public and private stakeholders (ministries, trade associations, public scientific and technical establishments), convened to meet twice a year.

The Government's plan is divided into eight main thematic areas.

1. Strengthen surface geothermal drilling capacity to meet demand from the residential and tertiary sectors

2. Refine the regulatory framework to encourage the development of shallow geothermal projects

3. Encourage the installation of geothermal heat pumps in the residential and tertiary sectors

4. Identify and develop under-exploited deep aquifers suitable for the construction of geothermal doublets for heating networks

5. Raise awareness and build the skills of local stakeholders, support project developers in the deployment of geothermal solutions

6. Generate new projects and encourage new financial arrangements in geothermal energy

7. Developing geothermal energy overseas

8. Developing the French geothermal energy market for export

It is by now the most successful example of powerful collaboration between the private and public sectors.

2 KEY ACTIONS PRESENTATION AND ANALYSES 3 YEARS AFTER THE IMPLEMENTATION OF THE GEOTHERMAL ROADMAP

Based on a selection of three flagship actions with moderate, good and very good levels of achievement, an analyse will be conducted to assess the extent to which public and private actions are partnerships.

2.1 Increase the number of drillers trained in shallow geothermal energy by developing vocational training and creating initial training courses.

In the sector of shallow geothermal energy, future drillers are trained in the trade by working on sites for two years as an assistant driller in a team involving a qualified driller. To gradually increase drilling capacity, the State decided to support initial and continuing training. Announced in a report on Shallow geothermal energy launched by the "Haut Commissaire au Plan*", "This training initiative, estimated at €60 million over approximately seven years, aims to increase the number of drillers in the country. From just a few hundred across the whole country today, their numbers will need to reach several thousands in order to carry out a vast plan to replace gas and oil boilers with geothermal heat pumps. France once had this expertise in the drilling sector, but lost it over the years and now needs to regain it."*

Although considered essential, the first feedback concerning the creation and implementation of training programmes are mixed.

The attractiveness of drilling jobs, which are considered to be physically demanding, is a major obstacle, even though the pay is good to very good. The need to be away from home for several days each time to work on sites does not help to attract young recruits neither people with family. Candidates' attendance throughout the training programme also proved to be an issue. According to initial reports from the French Drilling School (EFF), only 21 out of 36 trainees completed the course.

Selecting a training organization is also not an easy task, as it requires not only the acquisition of theoretical modules, but also the availability of technical sites capable of accommodating drilling platforms and all the necessary technical equipment, including a drill. This initiative also faces a challenge purely related to training engineering. The diversity of the target audience for these training courses, whether they are former unemployed people, employees undergoing retraining or students in initial training, currently prevents the standardisation of the economic model. Support mechanisms vary greatly depending on the trainees' situations and locations.

Although the public authorities and the industry have jointly acknowledged a shortage of qualified personnel in minor geothermal drilling, implementing solutions that precisely meet market needs is not an easy task. Setting up training programmes is a skill that requires the involvement of third parties who are specialists in this type of engineering and who are familiar with standards, financing and promotional channels to attract the target audience.

2.2 Accelerating the development of a network of regional facilitators specialized in geothermal energy throughout the country.

Regional coordination is an essential tool for developing the geothermal energy sector. Its aim is to boost the sector within each region by connecting the various stakeholders and promoting geothermal energy. Regions that have a specialist coordinator show stronger geothermal energy development momentum than the rest of the country. To this end, the appointment of at least one coordinator in each region has been included in the Multi-Year Energy Programming but it must be noticed that the network of facilitators is still not covering all French regions at the end of 2025. The Bourgogne-Franche-Comté, Occitanie, Auvergne-Rhône-Alpes, Nouvelle-Aquitaine, Ile-de-France, Grand-Est, Hauts-de-France, Centre-Val de Loire regions have been certainly endorsed by a regional coordination but 6 regions (Bretagne, Normandie, Pays de la Loire, PACA, Overseas departments) have still not started this structuration.

Since the end of 2019, the Regional Geothermal Energy Initiative (RAG) has been coordinated by AFPG and has proven its effectiveness. Quarterly meetings, technical visits and an annual plenary session enable the network to come together to share their experiences and discuss their needs in terms of developing skills in technical areas, as well as in areas such as promotion (promoting the sector, events, developing the sector in the region, etc.). Nevertheless, this flagship initiative for structuring the geothermal energy sector is struggling to achieve its objective. Regional particularities prevent the standardisation of job creation. The funding, part of which comes from ADEME, must be supplemented by contributions from regional partners, which are not easy to find.

Finally, the employment contract poses a final difficulty; geothermal energy is a relatively uncommon topic and rarely features in the roadmaps of potentially eligible regional organisations.

This initiative suffers from a lack of ownership on the part of the French regions, which could be the missing link in the system by contributing both to the financing round table and by hosting regional coordination offices.

Unlike other renewable energy sectors, there are no easily identifiable regional structures to support these positions, as it was the case for biomass equivalents hosted by organisations such as chambers of agriculture.

2.3 Increasing the visibility of shallow geothermal energy professionals: the GEOARTISAN interactive map managed by AFPG

The AFPG has created a map listing geothermal heat pump installers nationwide, followed by drillers and earthworks companies. It is currently difficult for project developers to identify these professionals. In exchange for this listing, which gives them visibility, professionals must sign a charter in which they undertake to promote geothermal solutions to their prospects without discriminating against other heat pump solutions. The charter also requires them to report on their geothermal heat pump projects to the AFPG in order to provide quantified feedback on their experience from year to year. Of course, this map will be filled in over time. Other maps exist showing drilling and earthmoving companies, which are not yet significant in number, but this should also change as more companies sign the charter.

The local work of the geothermal energy network, combined with the AFPG's communication activities (press coverage, participation in trade fairs, presentations), has resulted in nearly sixty geothermal energy specialists being listed on the dedicated map. Officially launched in 2023, the GEOARTISAN initiative had 58 geothermal heat pump installers by the end of 2024.

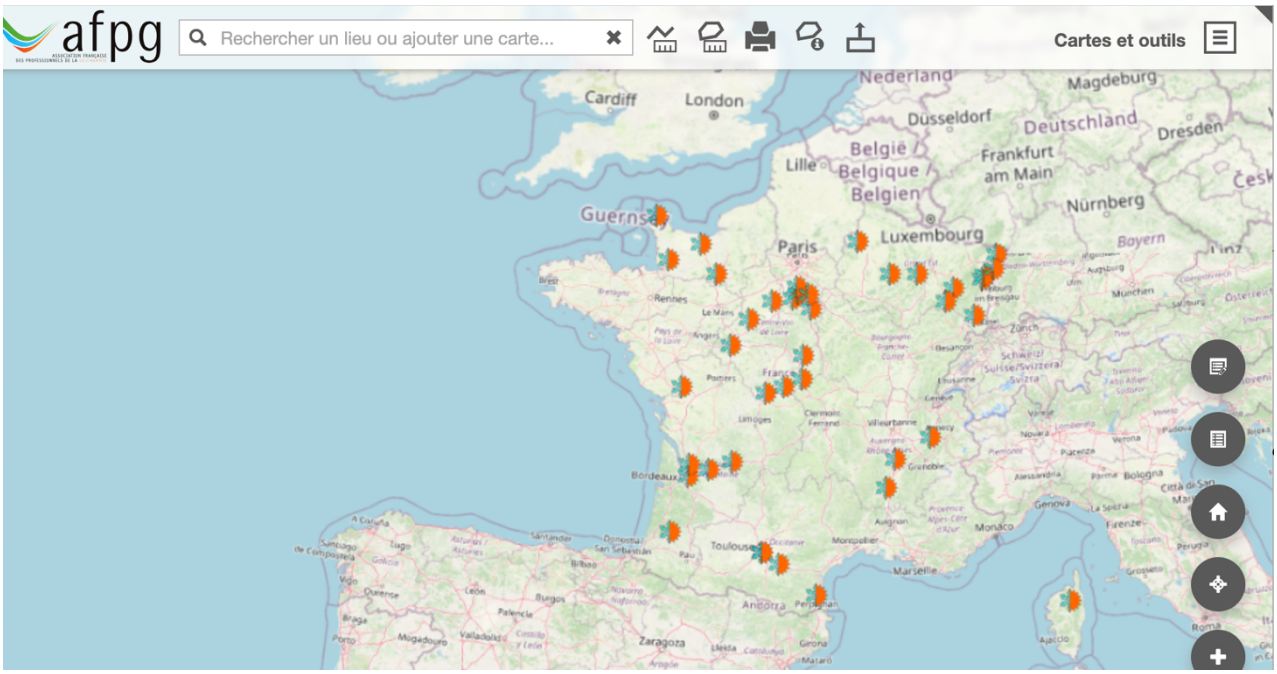


Figure 2: Interactive GEOARTISAN's map managed by AFPG

CONCLUSION

In 2024, geothermal heat production accounted for just 1% of final heat consumption (approximately 6.9 TWh) and 5% of incoming energy to district heating networks (approximately 2.3 TWh) in mainland France. The targets set for 2028 are between 5.2 TWh and 7 TWh per year. Two power plants are currently in operation. Located at Bouillante in Guadeloupe, this plant comprises three units with a total capacity of 25 MW and is expected to cover 13 to 14% of the Guadeloupe archipelago's electricity consumption by 2026. Although development opportunities exist in all these territories, the existing potential for development has yet to be assessed through exploratory drilling campaigns.

The share of geothermal energy is still very small, but there is now consensus on its potential and geothermal energy currently benefits from proven support from public authorities, in contrast to the general trend of opposition to renewable energies. At the very least, the existence of the PANG creates essential visibility and is a valuable structuring tool. In return, manufacturers in the sector are expected to commit to this approach, this undeniably involves representative organisations such as the AFPG. As the market matures, they must be able to gradually offer more financially competitive projects and turnkey solutions that users can more easily adopt.

At the same time, threats loom over state agencies, including ADEME which is now perceived by some on the political spectrum as the symbol of an environmental technocracy imposing its choices on regions and citizens. This climate of mistrust raises questions about the future of ecological transition policies in a context of increasing polarization of public debate. Aware that it has a window of opportunity for development, the geothermal energy sector must seize the PANG and prove to actively implement key actions.

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