



RÉPUBLIQUE FRANÇAISE

Liberté
Égalité
Fraternité

ENERG.SYSTEM AGRI/AGRO



MANUFACT.



CONSTRUC.



CHEMISTRY



ENVIRON.



TERRITORY



ASSOCIATED MATERIALS



Our SOLUTIONS

Storage of industrial CO₂ emissions coupled with renewable heat production

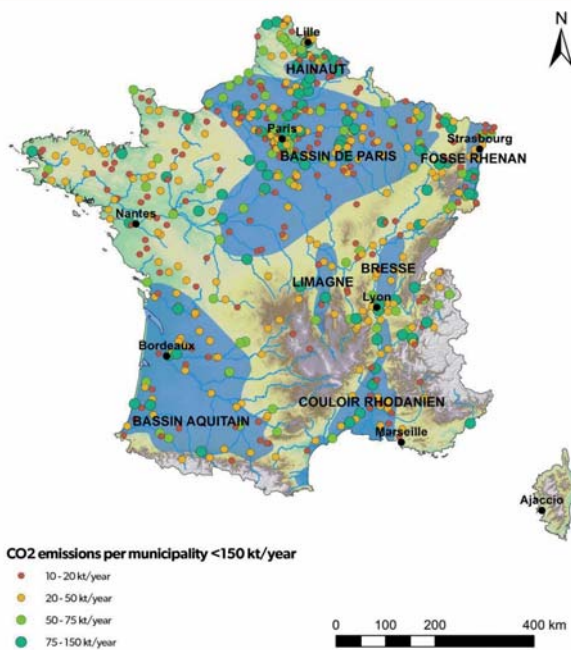
Does your industrial activity emit less than 100,000 tonnes of CO₂ per year and do you want to decarbonise your activities? It may be possible to capture and store your CO₂ emissions in the subsurface beneath your site while producing heat, thanks to an innovative technology developed at BRGM.



Geoscience for a sustainable Earth

brgm

View of an industrial facility emitting CO₂ into the atmosphere (2005). The capture and geological storage of industrial emissions is a key technology against global warming. © BRGM - Dominique Quiniou



Location of sites potentially compatible with CO₂-DISSOLVED technology in France: 437 sites in all according to 2017 data, represented by coloured dots (based on the quantity of CO₂ emissions) and located in blue areas with probable geothermal potential. © BRGM

YOUR ISSUES AND NEEDS

In the context of the fight against climate change, reducing industrial greenhouse gas (GHG) emissions is a major challenge. Geological carbon capture and storage (CSC) appears to be an essential solution for achieving the objectives of carbon neutrality.

The classic approach to geological storage of CO₂ in dense gaseous form (supercritical), adapted to industrial plants that emit large volumes, makes it possible to store several million tonnes of CO₂ per year and site. Nevertheless, this approach is complex to implement in terms of technical and economic feasibility (choice of reservoir, leak-tightness, safety, durability of storage, transport of the CO₂ to the injection site, etc.) and is not necessarily suitable for facilities that emit only a small volume and are potentially far from large industrial centres.

This is why BRGM has developed an innovative technology, called CO₂-DISSOLVED, which combines CO₂ capture in dissolved form in deep saline aquifers and production of geothermal heat. This solution is of particular interest for small industrial emitters at the territorial scale. Consequently in France, up to 12% of the country's industrial emissions could be avoided with this alternative storage technology. More than 400 potential industrial sites could be compatible!

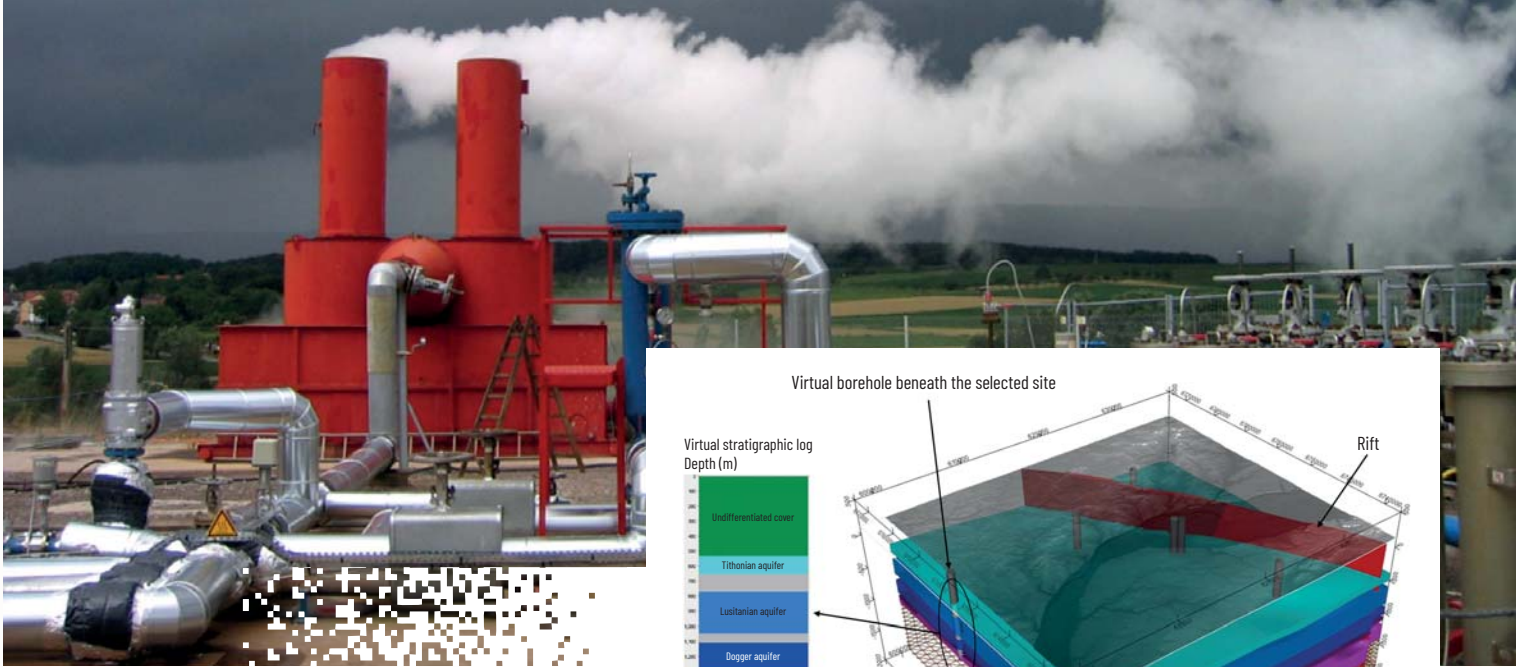
OUR VALUE PROPOSITION

BRGM has been doing research on the geological storage of CO₂, particularly in deep saline aquifers, for almost 30 years. Since 2012, it has acquired solid experience in studying the technical-economic feasibility of a CSC solution associated with geothermal energy recovery (CO₂-DISSOLVED process) which:

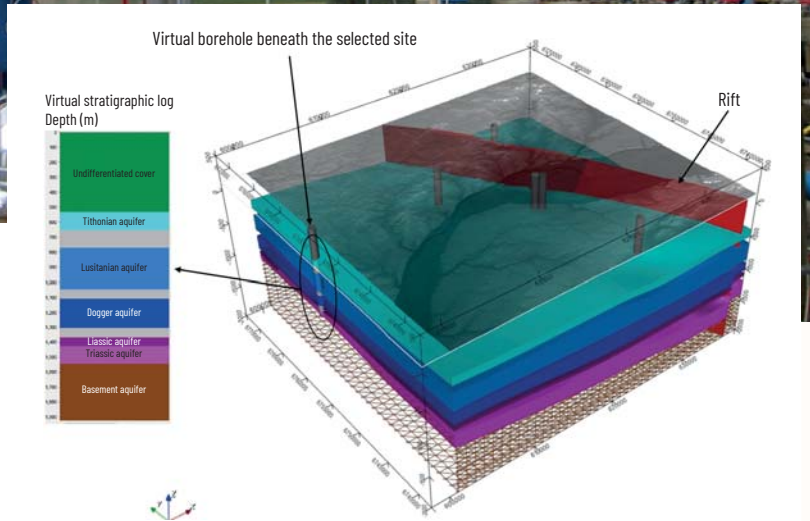
- **Integrates the system into an existing industrial site, for a double environmental and economic benefit**, thanks to the reduction of CO₂ emissions linked to the industrial activity being coupled with the production of a renewable energy that is largely decarbonised;
- **Meets local heat needs** of the industrial emitter or of its immediate neighbourhood by integrating the heat produced directly into the production chain or by supplying a district heat network;
- **Meets the needs of small industrial CO₂ emitters** (less than 150,000 tons of CO₂/year), scattered around the country and for which "classic" CSC is not suitable.

This work is based in particular on:

- **Identifying and characterising a continuous and suitable aquifer:** accessibility (between 1,000 and 2,000 m in depth), permeability, water flow rate, temperature (between 50°C and 80°C), nature of the rocks;
- **The numerical simulation of injection and storage scenarios** to assess the impact of dissolved CO₂ on the geothermal reservoir and the environment according to the operational parameters of the planned installation;
- **The establishment of a methodology for risk assessment and monitoring of injection operations;**
- **The possibility of integrating an innovative aqueous CO₂ capture solution** to maximise the efficiency of CO₂ recovery from the flue gas and its re-injection into the geothermal doublet.



The geothermal heat, produced in conjunction with CO₂ storage in dissolved form, can be recovered for local usage by the industrial facility and/or supply a heat network. © BRGM



TECHNICAL AND DIGITAL FACILITIES

- **COFRAC laboratories** for characterisation and analysis of water, rocks, and minerals.
- **GENIE:** digital geochemical platforms.
- **TER'GEOPHY:** ground geophysics platform.
- **Software for numerical simulation** of water-rock interactions and migration of dissolved CO₂ in the reservoir.

Example of a 3D geological model, established from a real dataset at scale, of a potentially interesting site for CO₂-DISSOLVED. A virtual borehole can be drilled, thus enabling the display of the deep geological structure beneath the site (stratigraphic log on the left).
(c) BRGM - Severine Caritg

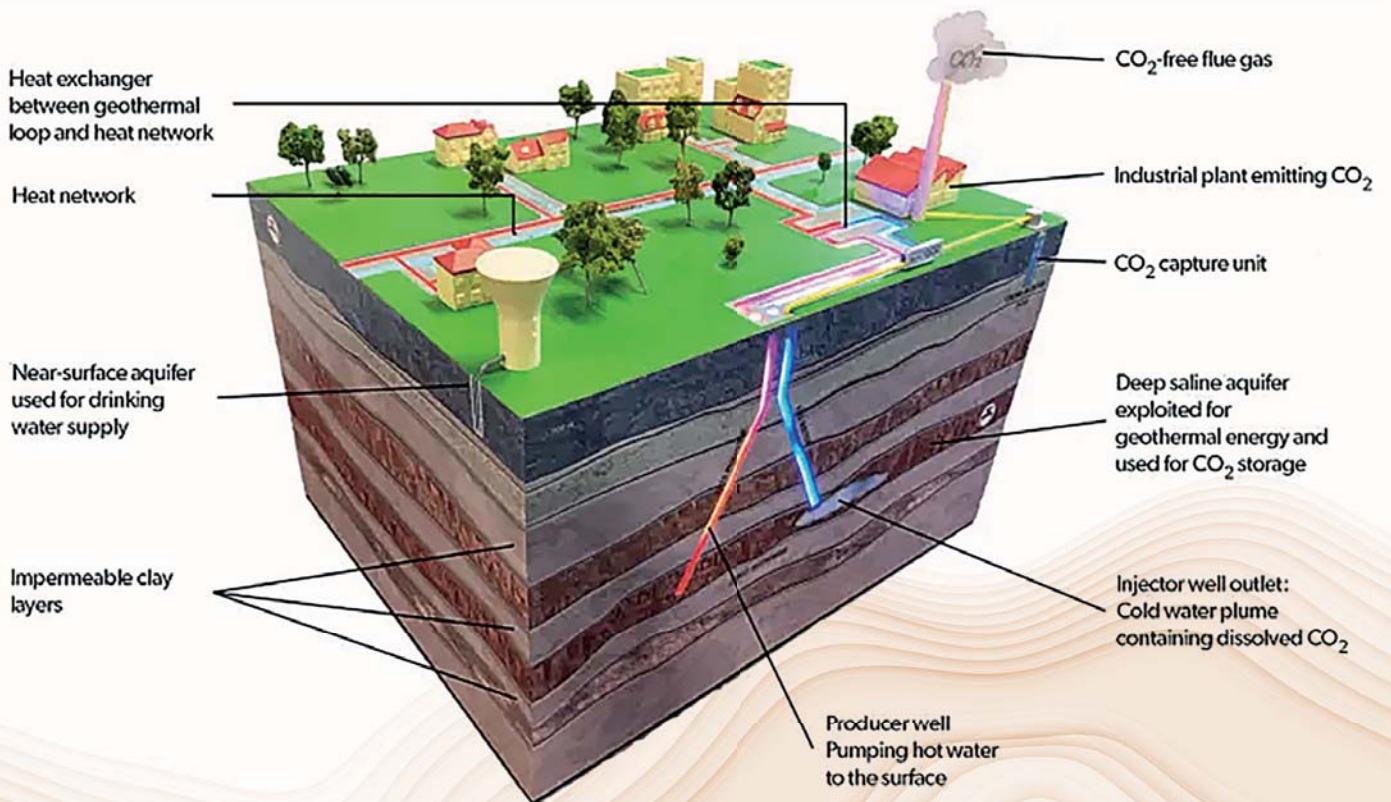


Diagram of the CO₂-DISSOLVED technology coupling dissolved CO₂ storage in deep saline aquifers and production of geothermal heat. © BRGM

SOME REFERENCES

- Four subsequent research projects (2013-2022) co-funded by the ANR, the Géodénergies scientific interest group (for two) and the Centre-Val de Loire Region.
- Preliminary studies of potential or pre-feasibility applied to various industrial sectors (household waste incineration, sugar factories, cement plants, glass production, thermal power plants).
- Feasibility studies for one site in Ile-de-France and two sites in the Centre-Val de Loire Region.
- Preparation of the first dissolved CO₂ injection tests in a geothermal doublet in Ile-de-France.

View the CO₂-DISSOLVED video



EDUCATION & TRAINING,
one of BRGM's missions

BRGM helps to develop scientific and technical skills through both "off-the-shelf" and "tailor-made" training courses, provided by its specific professional training branch: BRGM Formation.

Training course themes :

Geology | Sustainable management of groundwater resources | Mineral resources and circular economy | Environment, land-use projects | Energy transition and underground space | Natural risks, impacts of climate change.



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