

CO₂Dissolved

Towards a demonstration pilot coupling CO₂ storage & geothermal heat production

Venice 9 May 2016



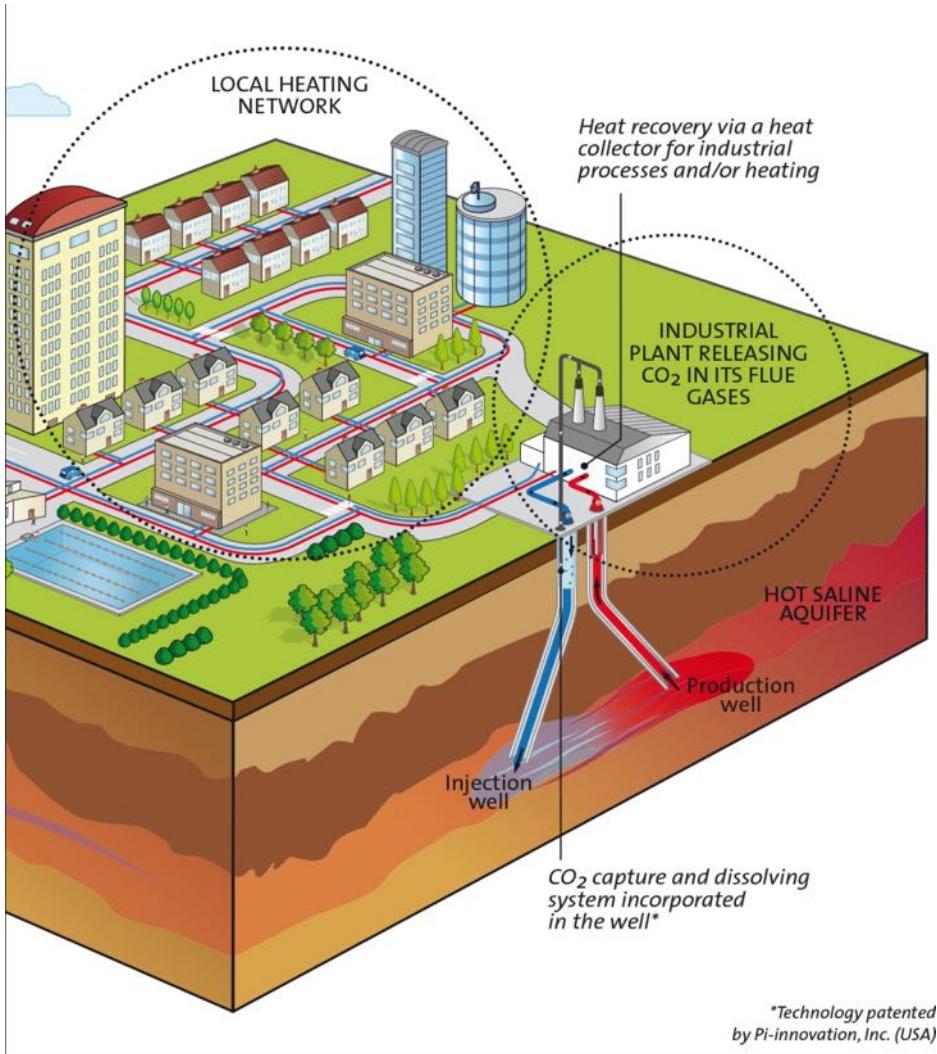
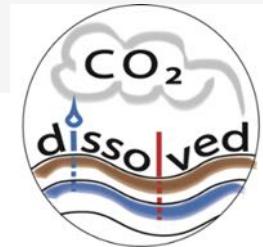
Partnering In Innovation, Inc.



The CO₂-DISSOLVED concept



Key features

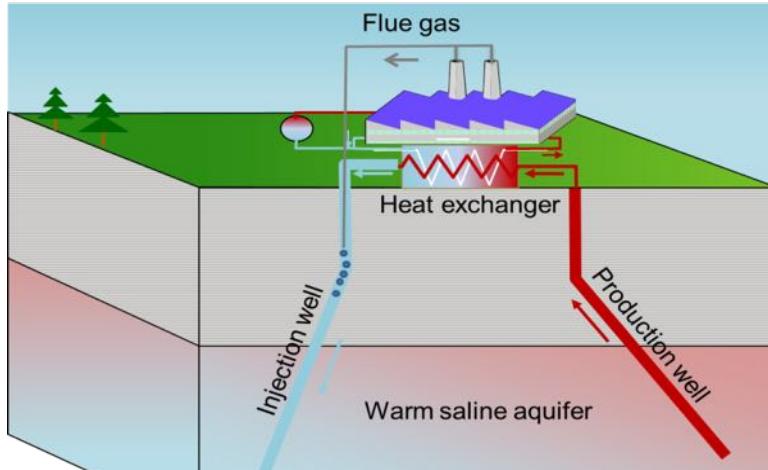


- A safer CO₂ storage approach, at the immediate vicinity of the emitter
- Economic and environmental benefits from the local use of the extracted geothermal heat
- Industrial target: small to medium emitters (< 150 kt/a)
- Applicable only to areas with geothermal potential



Relies on the Pi-CO₂ technology

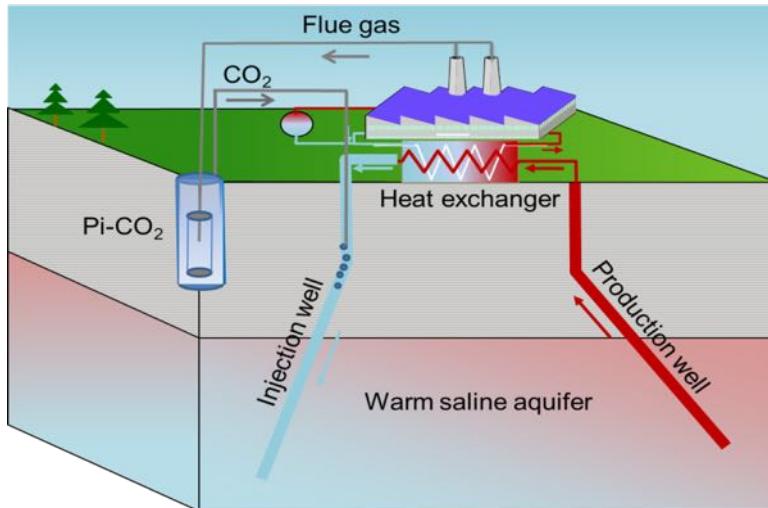
%CO₂ > 80%



'Pi-CO₂ Simplified'

- Uses a single absorber version of Pi-CO₂
- Low Cost of Capture

%CO₂ 10 to 80%



Pi-CO₂ Full Capture

- Full Capture version uses multiple, cascading absorbers + compression in a large diameter 600 m-deep well
- Wider Range of Industry Sources
- Possibly, markets for the sale of exceeding captured CO₂ that could not be stored in the aquifer (solubility limit)



CO₂-DISSOLVED concept strong points

- > **Safer storage, more potential sites**
 - No gas phase in the aquifer → favorable buoyancy effects
 - No pressure increase in the aquifer
 - Limited impacted area
 - no or very low-distance transport
- > **Local benefit around storage: heat recovery (mature technology)**
- > **A solution for small industrial emitters : 10-150 kt/yr**

→ **A solution complementary to conventional CCS**



The ANR “CO₂-DISSOLVED” project (2013-2016)





Key points

- A techno-economic feasibility study
 - 2013-2016,
 - Budget €1.4M
- Identification of potentially compatible sites
- First modelling and laboratory work
- Business case on a bioethanol refinery test-case



Positive technical results

> Water rock interactions

High reactivity expected in the carbonate reservoir (Dogger in the Paris basin). Coherent results between:

- Lab experiments (with and without CO₂)
- Numerical simulations (with and without CO₂)
- In situ measurements of the open-hole geometry on a former geothermal injection well (without CO₂)

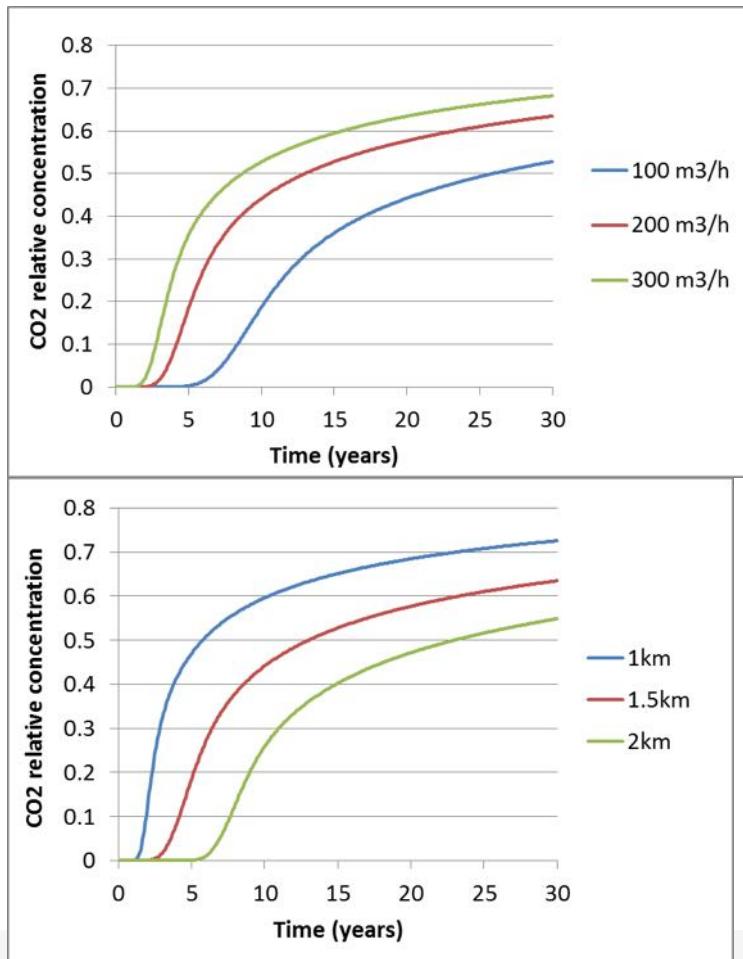
> Dissolved CO₂ migration modelling

- Breakthrough time
- Impact on CO₂ injection capacity over time.

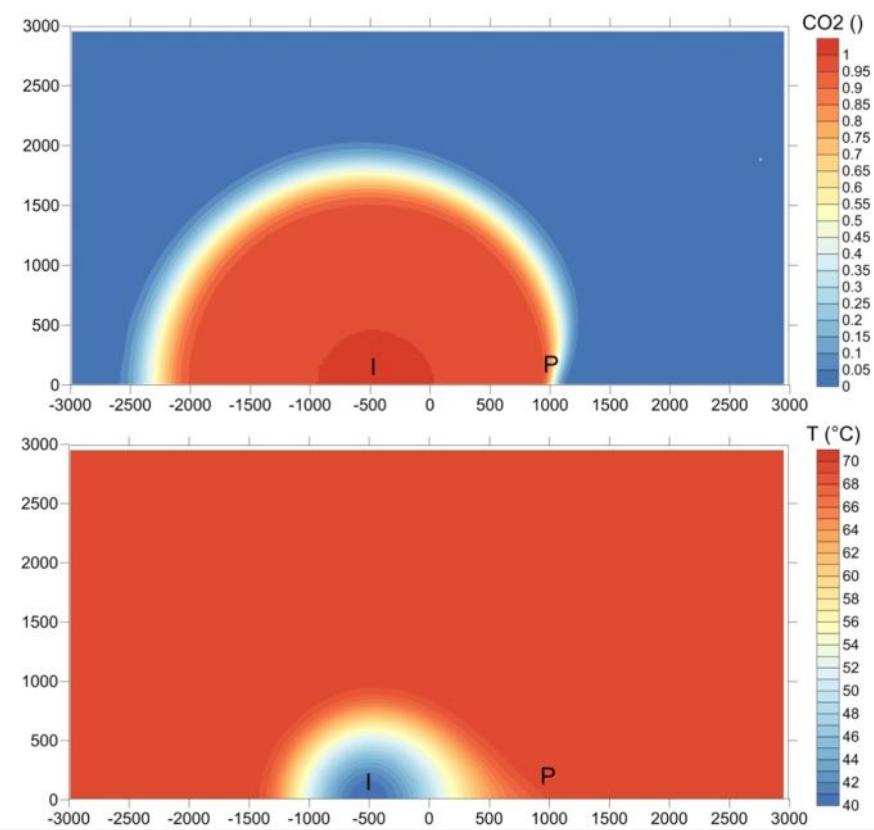
> CO₂ capture integration



Breakthrough time



CO₂ and thermal plumes after 30 years of continuous injection





Business case on Biorefinery site

CO₂ emissions : 145 kt/yr with 50 kt/yr from Biomass

Geological context: Paris basin.

- Boissy sandstone 65°C 1400m
- Dogger limestone 50°C 1000m

Very concentrated CO₂ fumes:

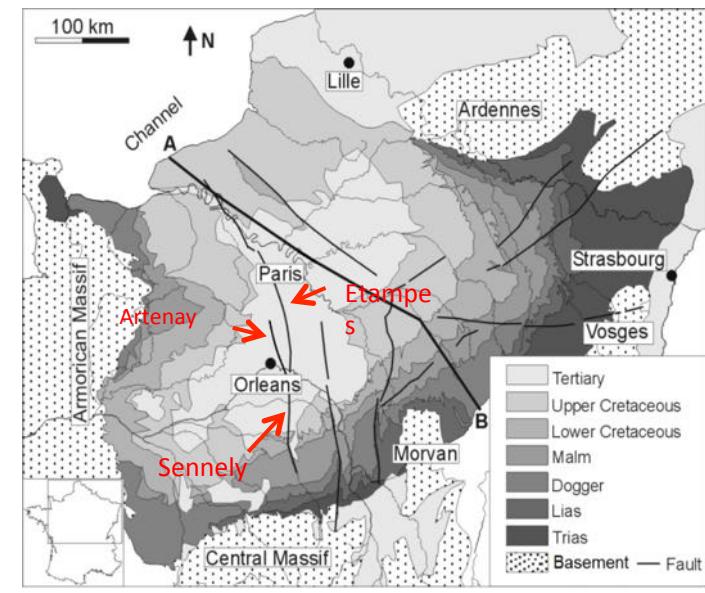
Full capture set up not necessary

Technico-economic study:

Cost for stored tonne between 39 and 72€

(different scenario considered)

→ Very favorable compared to conventional CCS



modified from Goncalvès et al. (2003)



The Geodenergies “PILOTE CO₂-DISSOLVED” project (2016-2018)





Key points

> **Objective:**

Select a site and an industrial emitter, and secure additional funding for designing and building a first CO₂-DISSOLVED demonstration pilot (to be launched around 2020)

> **Prototype of capture process**

> **Non-technical feasibility**

- Social acceptance
- Regulatory regime

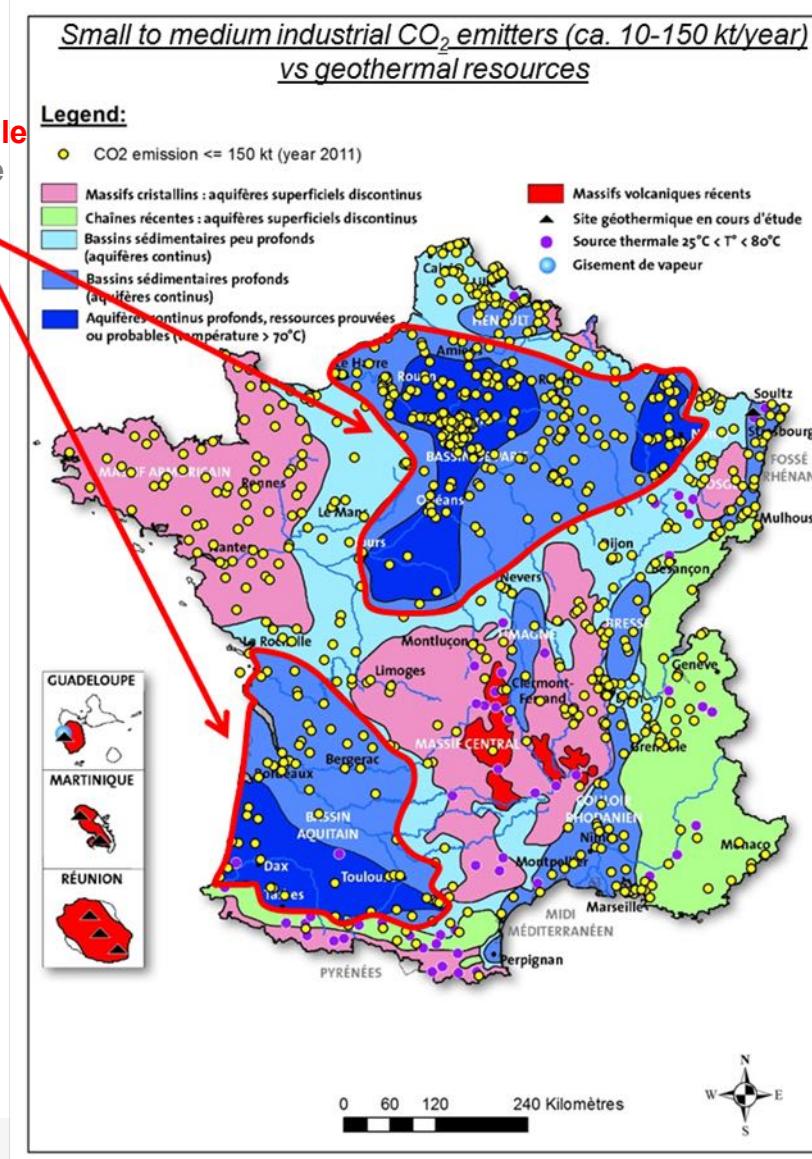
> **Key figures**

- Launching in May 2016
- Duration : 18 months
- 10 partners (4 industrialists - 1 from USA -, 1 Public institute, 5 university labs)
- Budget: €2.2M



Finding a pilot site

More than **350 compatible emitters** identified in the Paris basin and in the Aquitaine basin



Main industry sectors concerned :

- Cement
- Urban heating
- Bio ethanol refineries
- Wastes
- Etc.



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