

Recent geothermal projects within the Paris Basin



Survey,

Exploration,

Operation,

Maintenance...



cfg services

Geothermal energy,

quite simply!

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CFG Services company profile

CFG Services : BRGM's subsidiary, established in 1985, 36 employees in 2012

Engineering and services company specialised in geothermal energy

Turn over : 4,9 M€ for 2011 (without maintenance activity in Guadeloupe)

Organisation :

- International Department
- Electricity and Corrosion Department
- Direct Use of Heat Department

Competencies : drilling engineering, reservoir engineering, hydraulics, geochemistry, corrosion,...

Fields of activities :

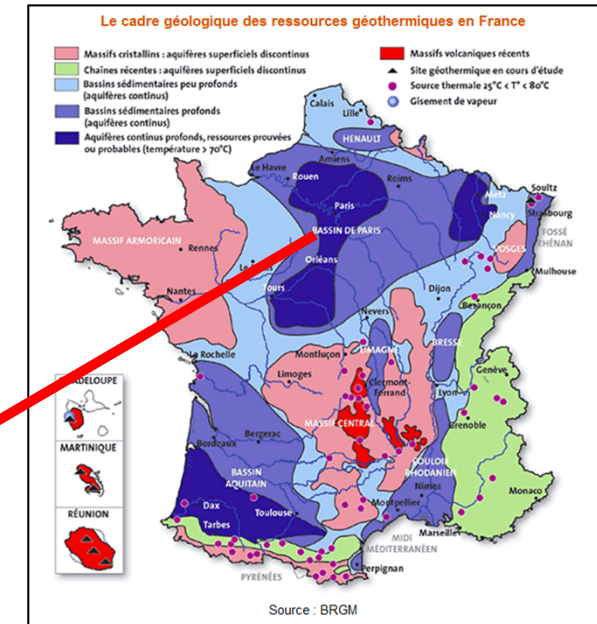
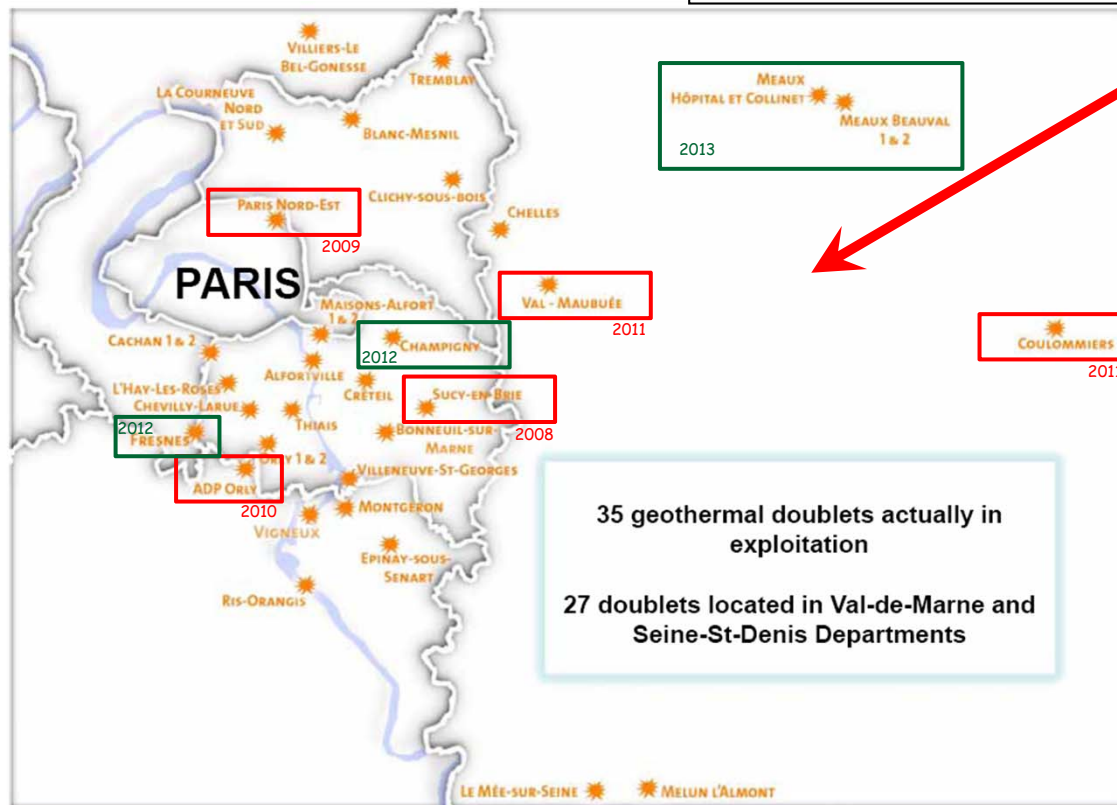
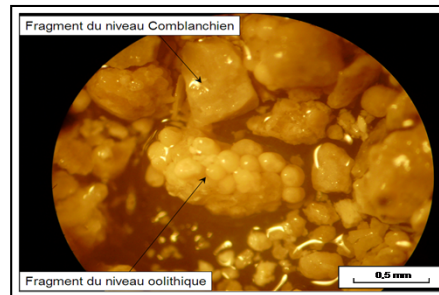
- Maintenance and exploitation of geothermal power plants
- Studies and projects in geothermal energy (low, medium and high enthalpy)
- Expertise, studies and audit in the field of corrosion, hydrogeochemistry, detection of fluids leakage by Helium injection.

In France the renewed development of low geothermal energy => **9 new deep wells (2000 m, Dogger) in the Paris Basin since 2008 (CFG Services as master builder)**

Main geothermal projects in the Paris basin

Dogger aquifer features :

- Oolitic limestone
- Depth : 1600 to 1800 m
- Transmissivity : 10 to 110 D.m
- Temperature : 60 to 80°C
- Salinity \approx 20 g/l (average)

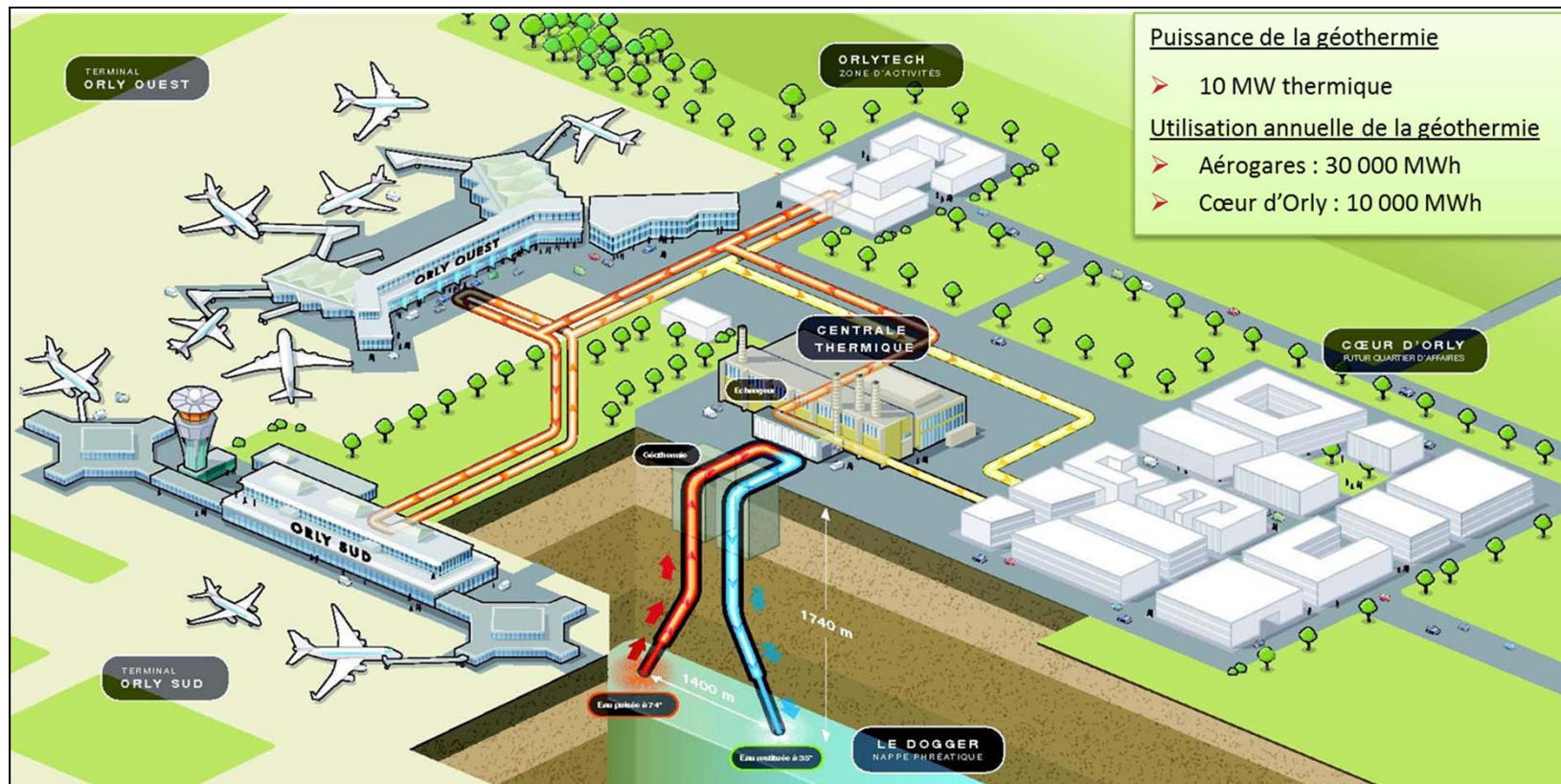


<http://www.geothermie-perspectives.fr>

Exploitation features :

- Max. prod./ inject. pumping : 300 m³/h
- Casing external diameter : 9"5/8
- Open hole diameter : 8"1/2
- Deviated wells (30° / 40°)
- Distance bet. injection / production well impacts at the reservoir \approx 1500 m
- H₂S corrosion and treatment

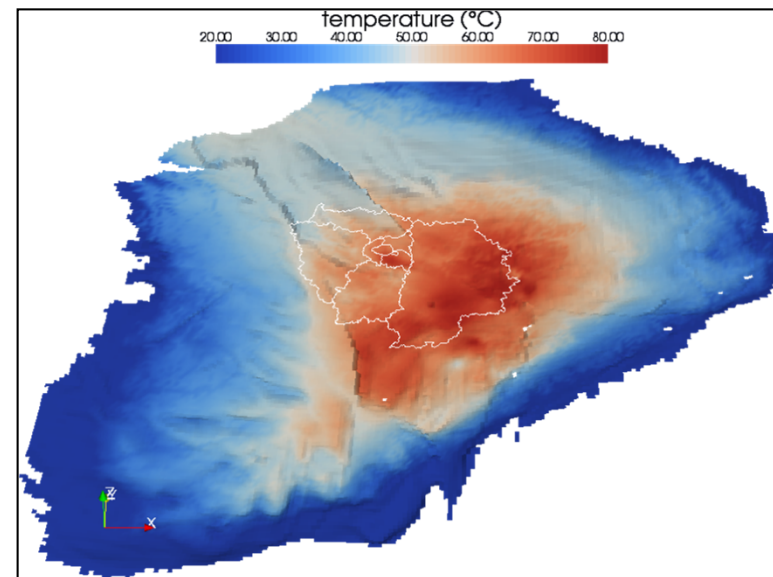
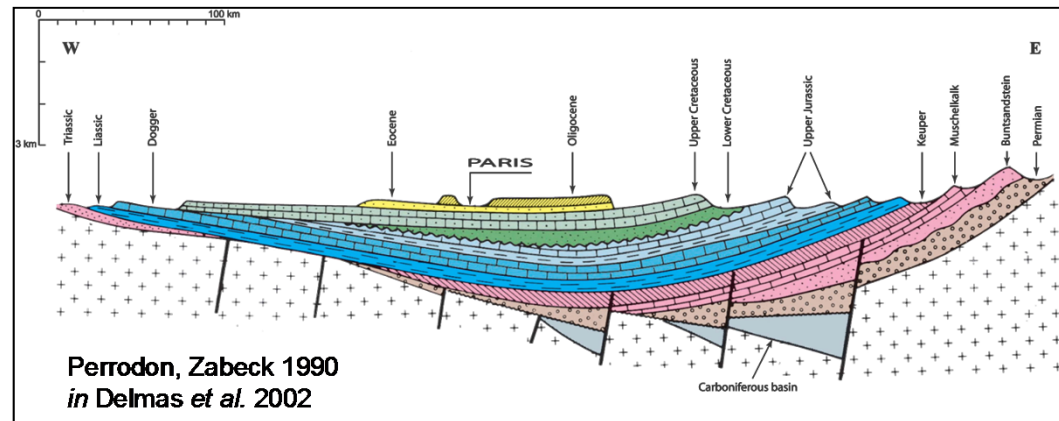
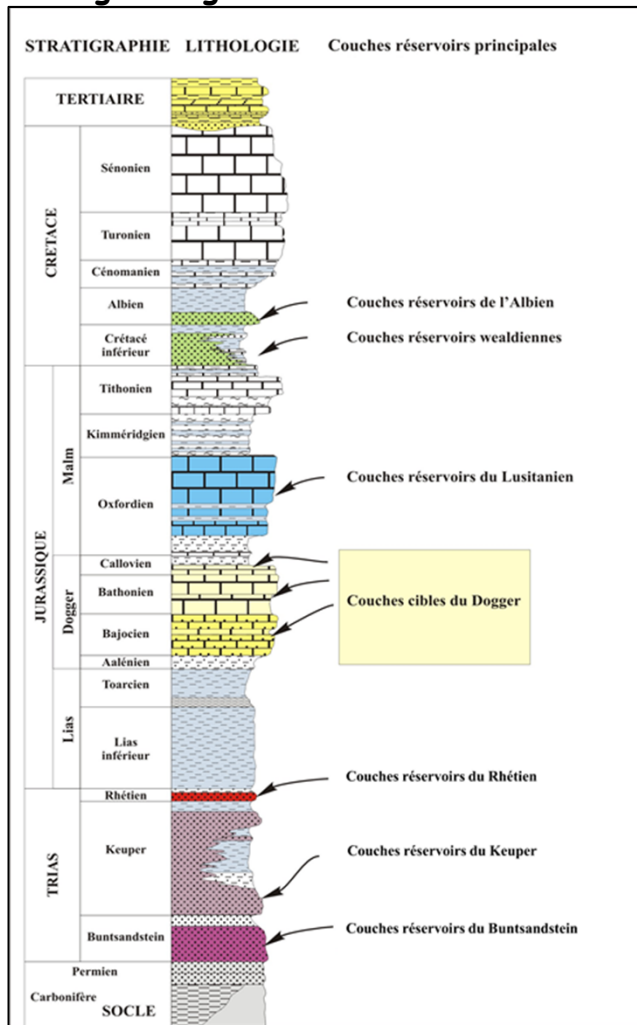
ADP Orly project



- ✈ Exploitation features : Temperature = 74°C, Flowrate = 250 to 300 m³/h, Thermal power = 10 MW
- ✈ Project duration : ≈ 3 years from feasibility study (dec 2007) to commissioning at the end of 2010
44 + 35 days for the 2 wells
- ✈ Operation costs : 12,7 M€ without subsidies ≈ 27% (3,4 M€ from ADEME & Ile-de-France region),
≈ 9 M€ for the two-well system
- ✈ Environmental impact : this project avoids the discharge in the atmosphere of ≈ 9000 t. CO₂ / year

Project engineering : resource knowledge (geology)

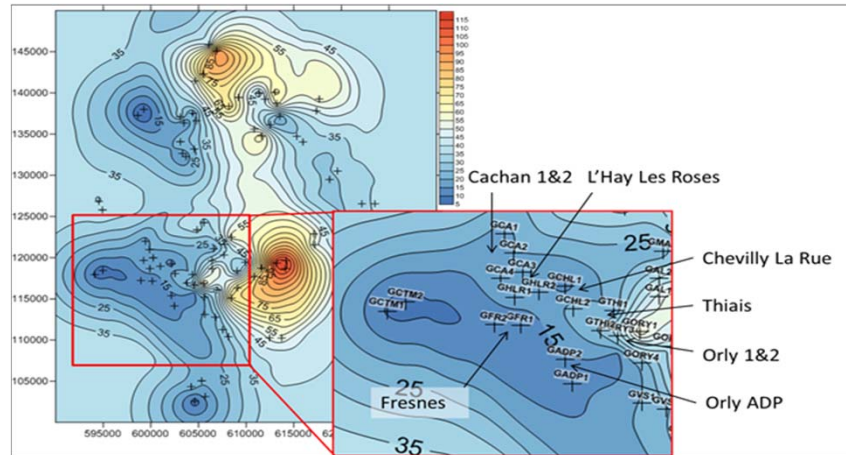
Geological log in the BP



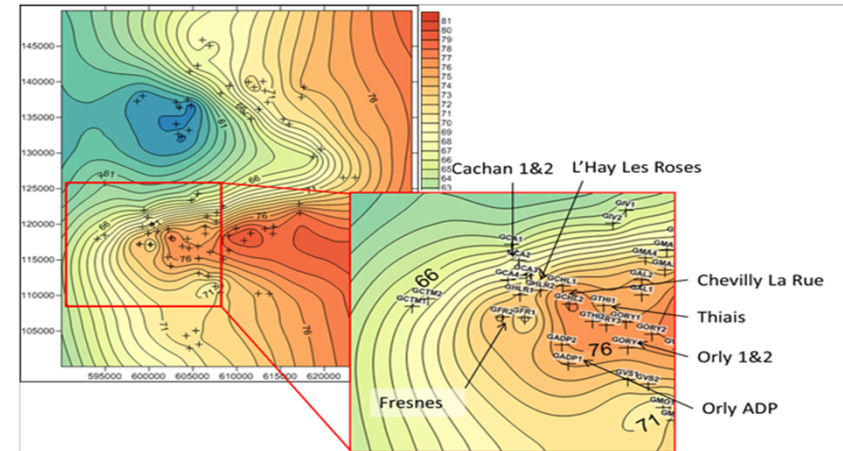
Temperature map of the Dogger aquifer

Project engineering : resource knowledge (hydrogeology)

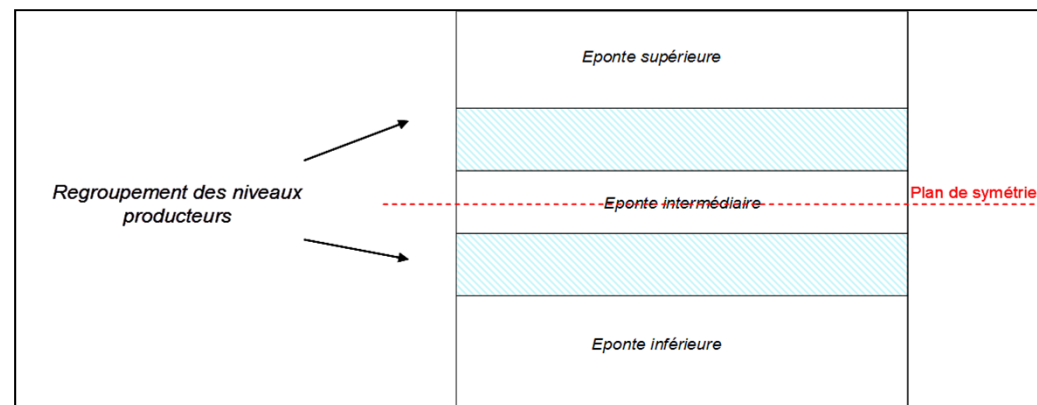
Transmissivity



Temperature

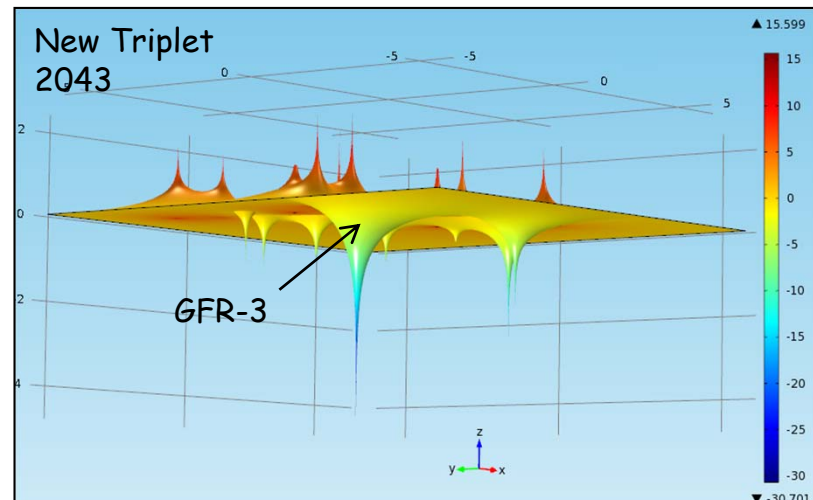
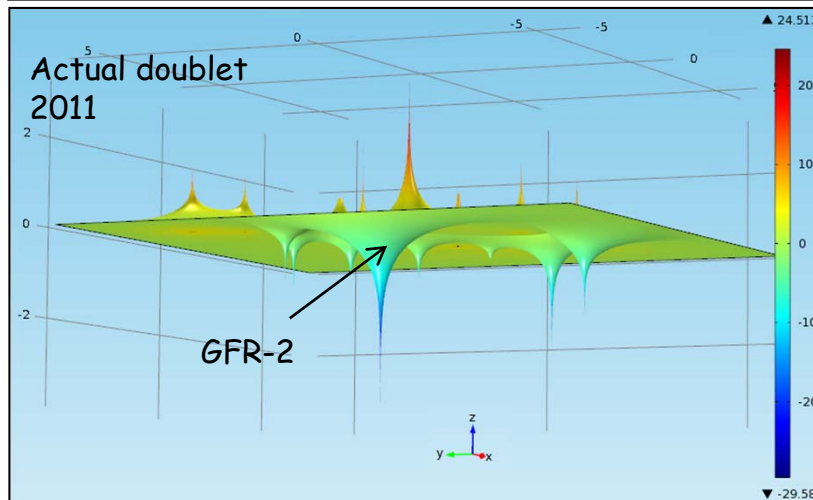
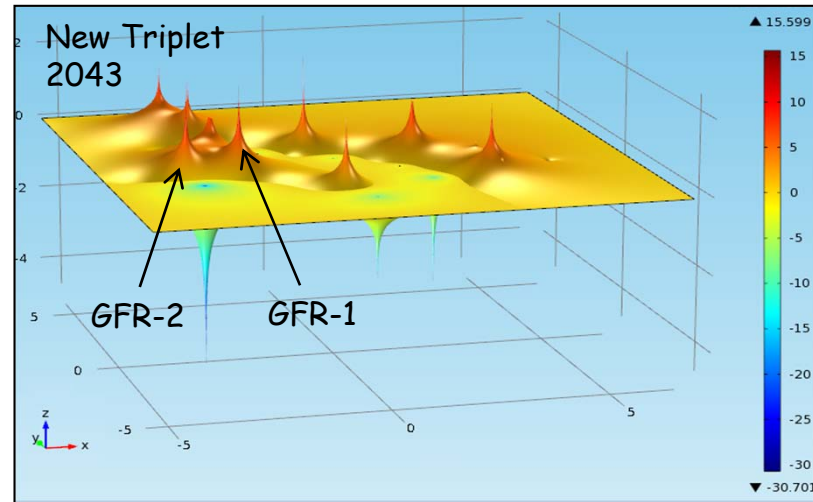
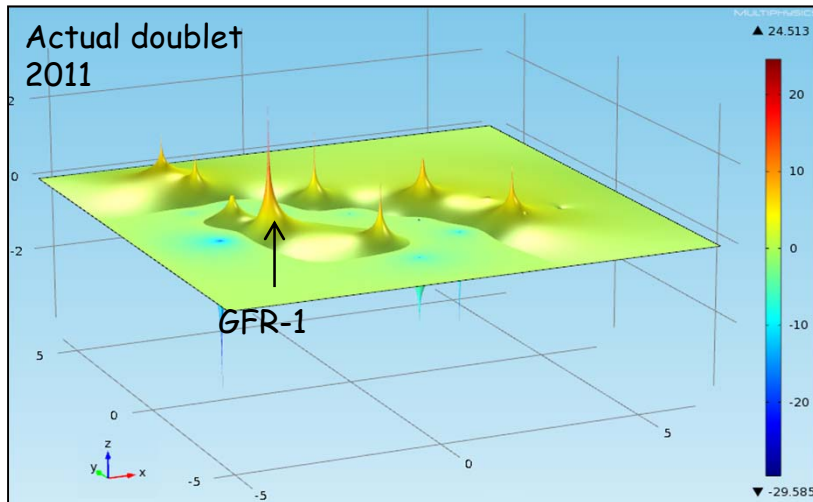


Conceptual model



Project engineering : reservoir modelling

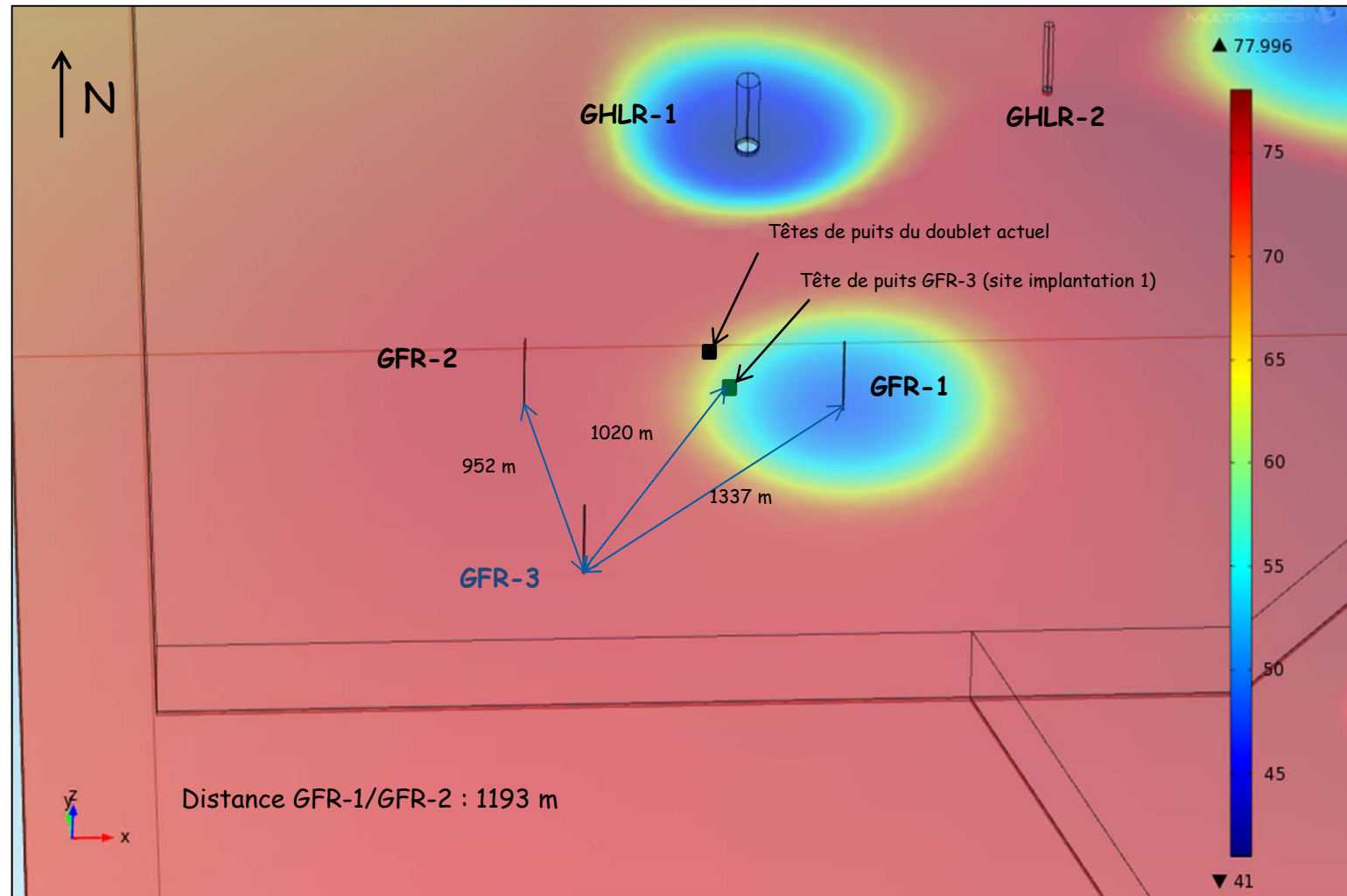
Hydraulic impact (reference state)



Modelling software : COMSOL Multiphysics, Earthscience module

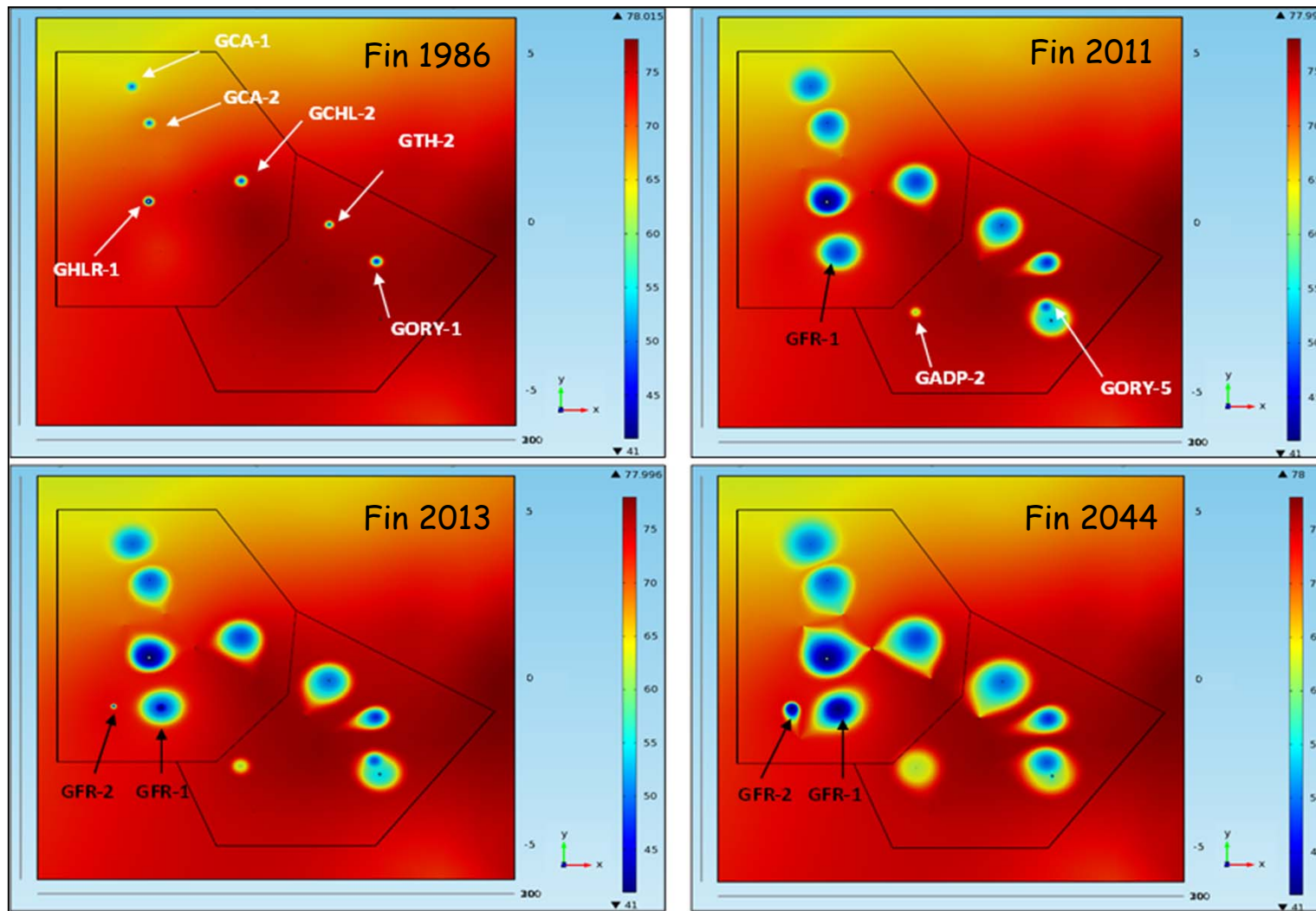
Project engineering : reservoir modelling

Thermal impact (optimization) : thermal breakthrough, aquifer history (locations disturbed by cold reinjection)



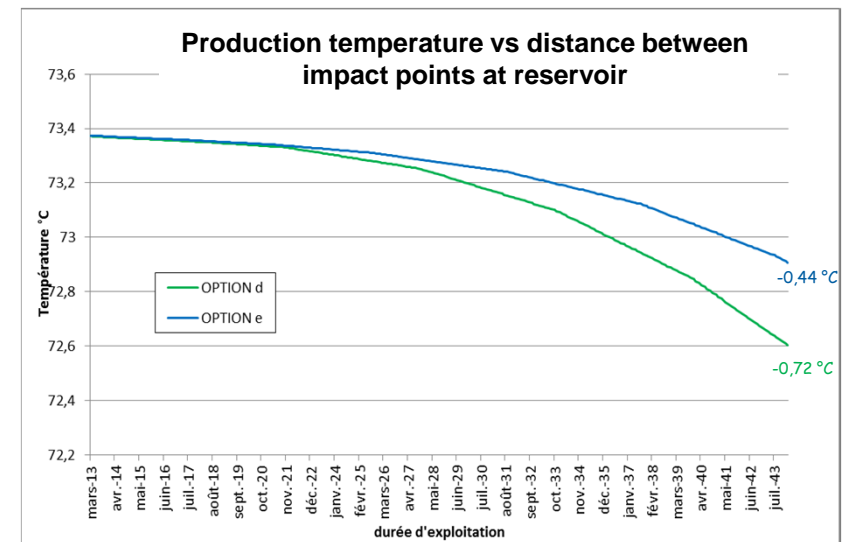
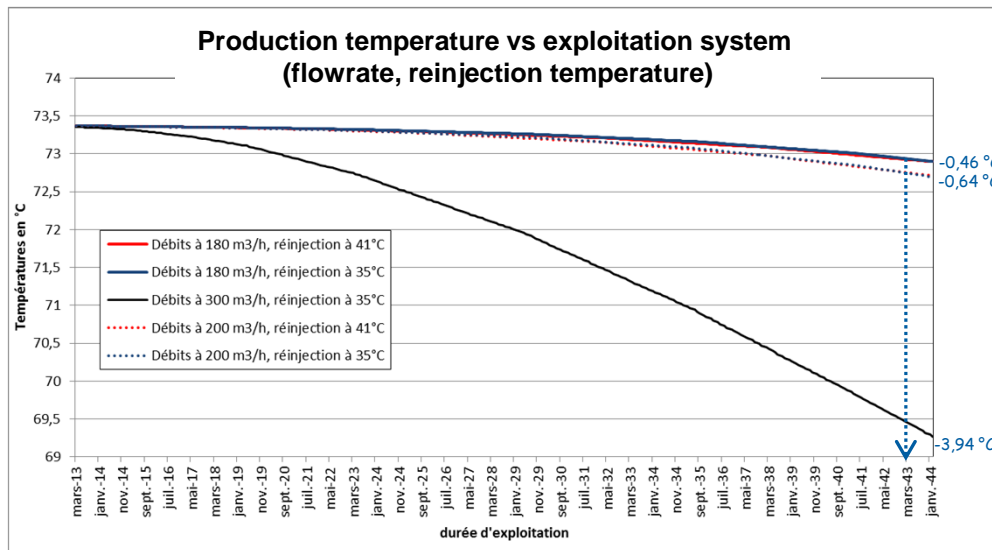
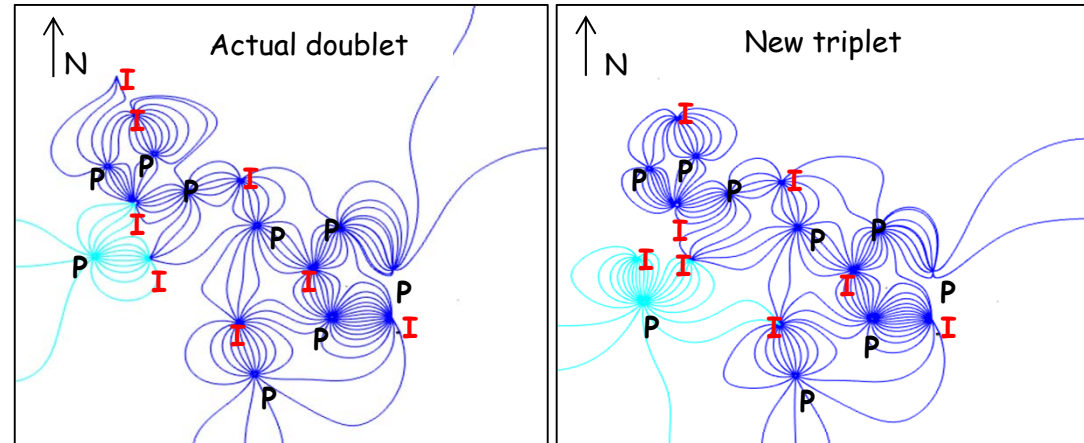
Project engineering : reservoir modelling

Thermal impact : Long term management of the Dogger aquifer



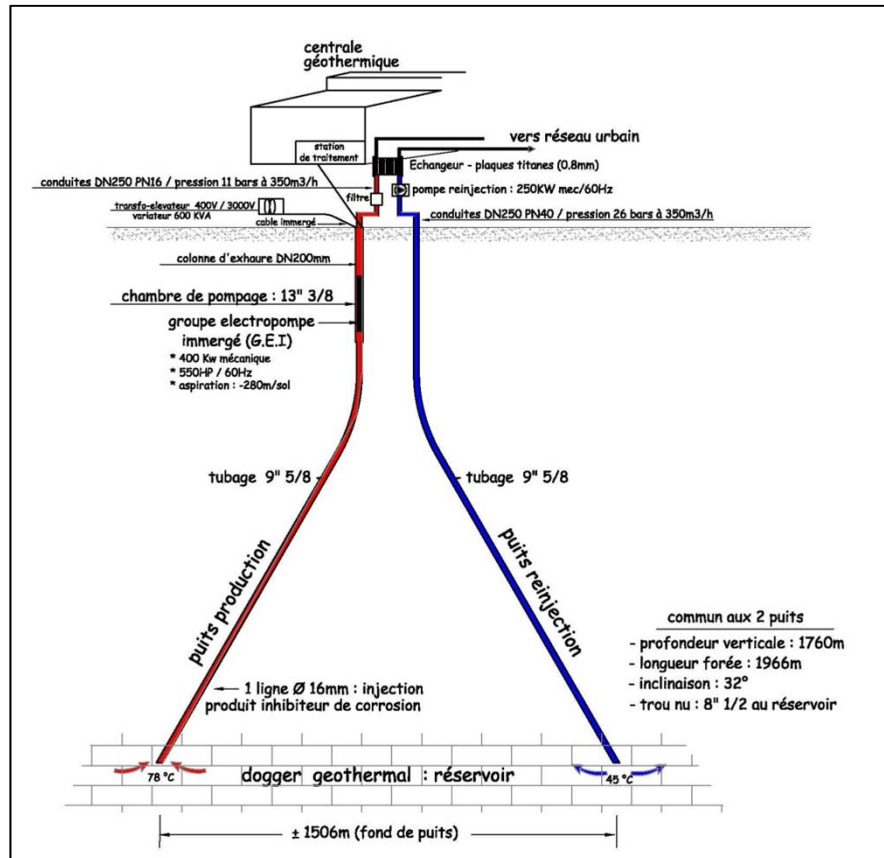
Project engineering : reservoir modelling

Hydraulic impact : Interference between wells
=> thermal breakthrough

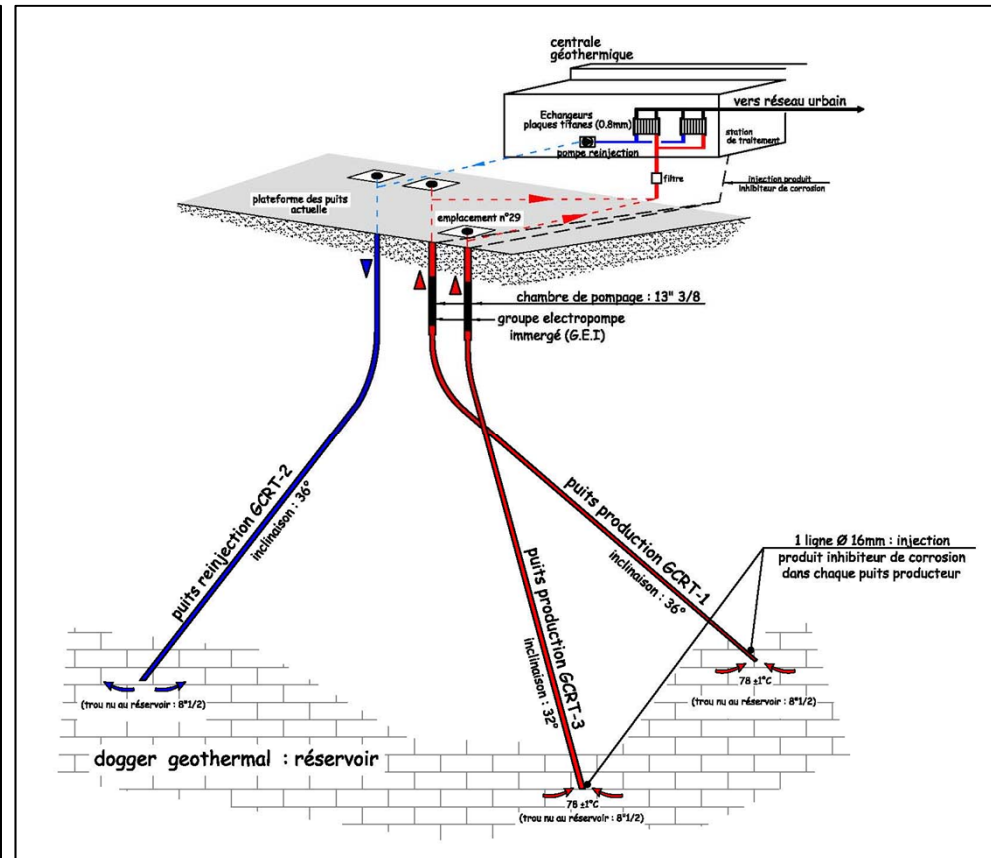


Project engineering : geothermal system design

Principle scheme for a two-wells system (doublet)



Principle scheme for a three-wells system (triplet)



Project engineering : site constraints

Drilling rig location & Environmental impacts



CPCU (PNE)



Sucy-en-Brie

Project engineering : site constraints

Servicing area - Well heads



Meaux Beauval 1



Fresnes

Sucy-en-Brie



Maisons-Alfort

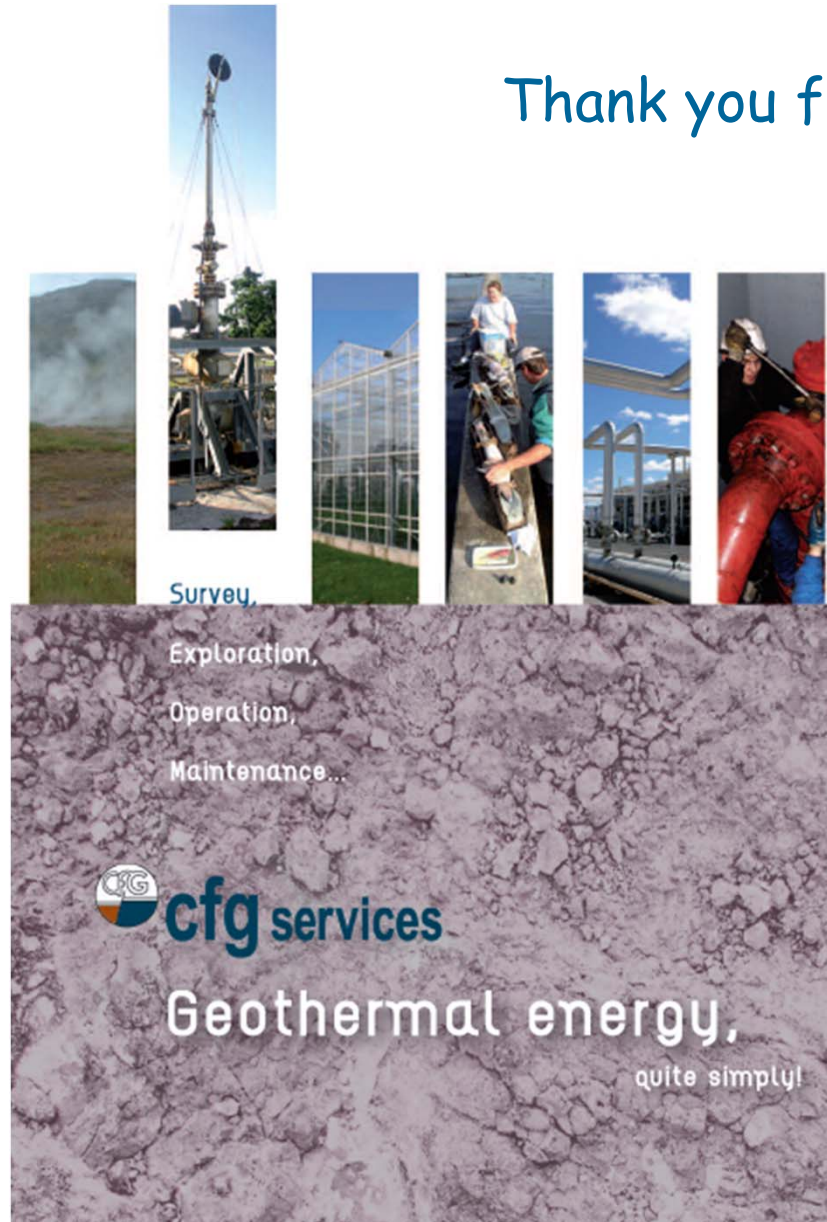
Work-over operation

Fresnes




Maisons-Alfort

Thank you for your attention



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