Demonstrating CCS in an onshore site in Europe. The current status of the Lacq integrated CCS project

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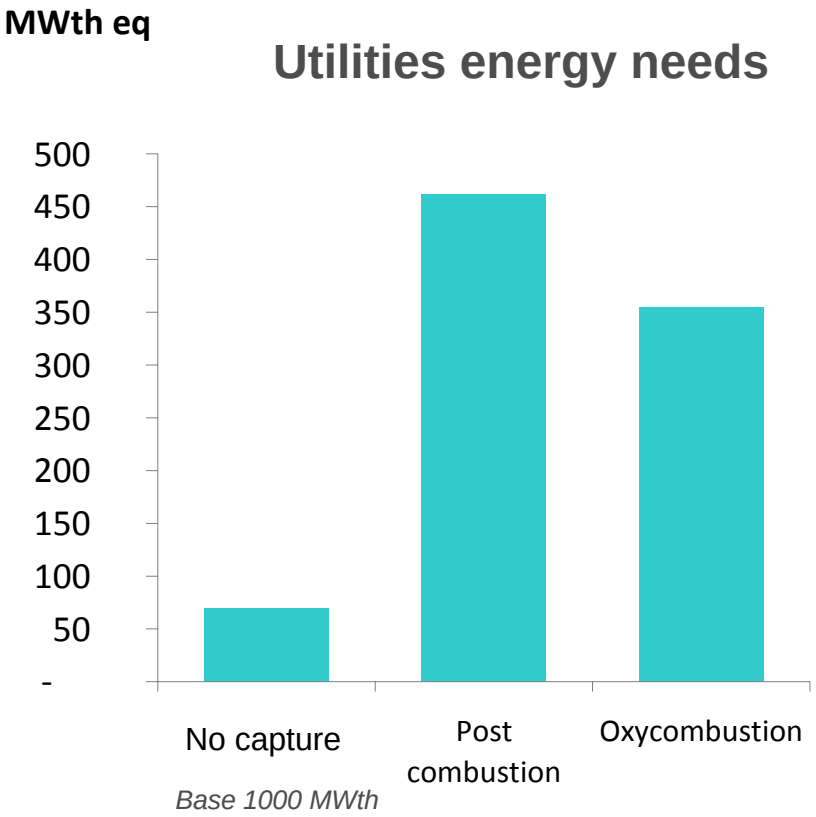
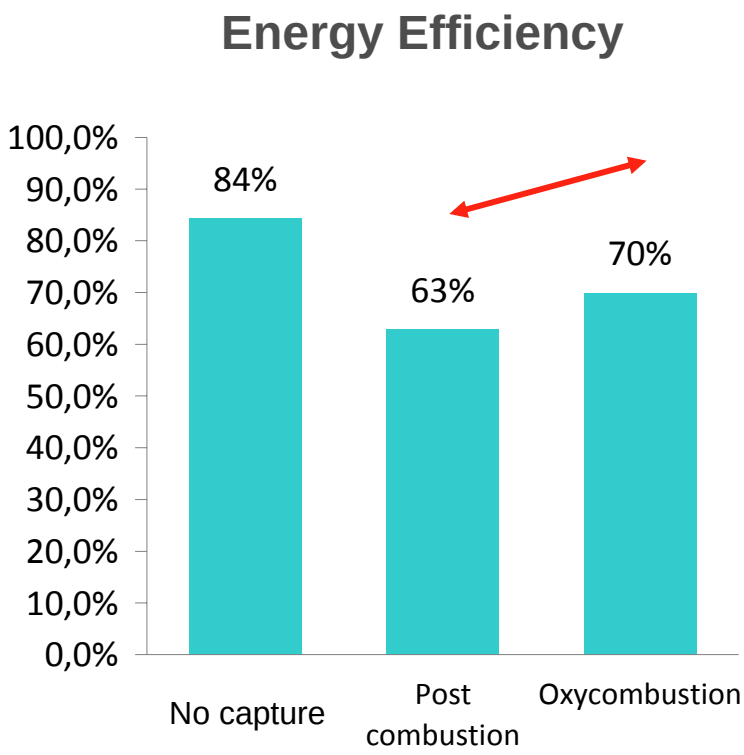
Oxy combustion allows to capture CO2 with a reduced energy cost

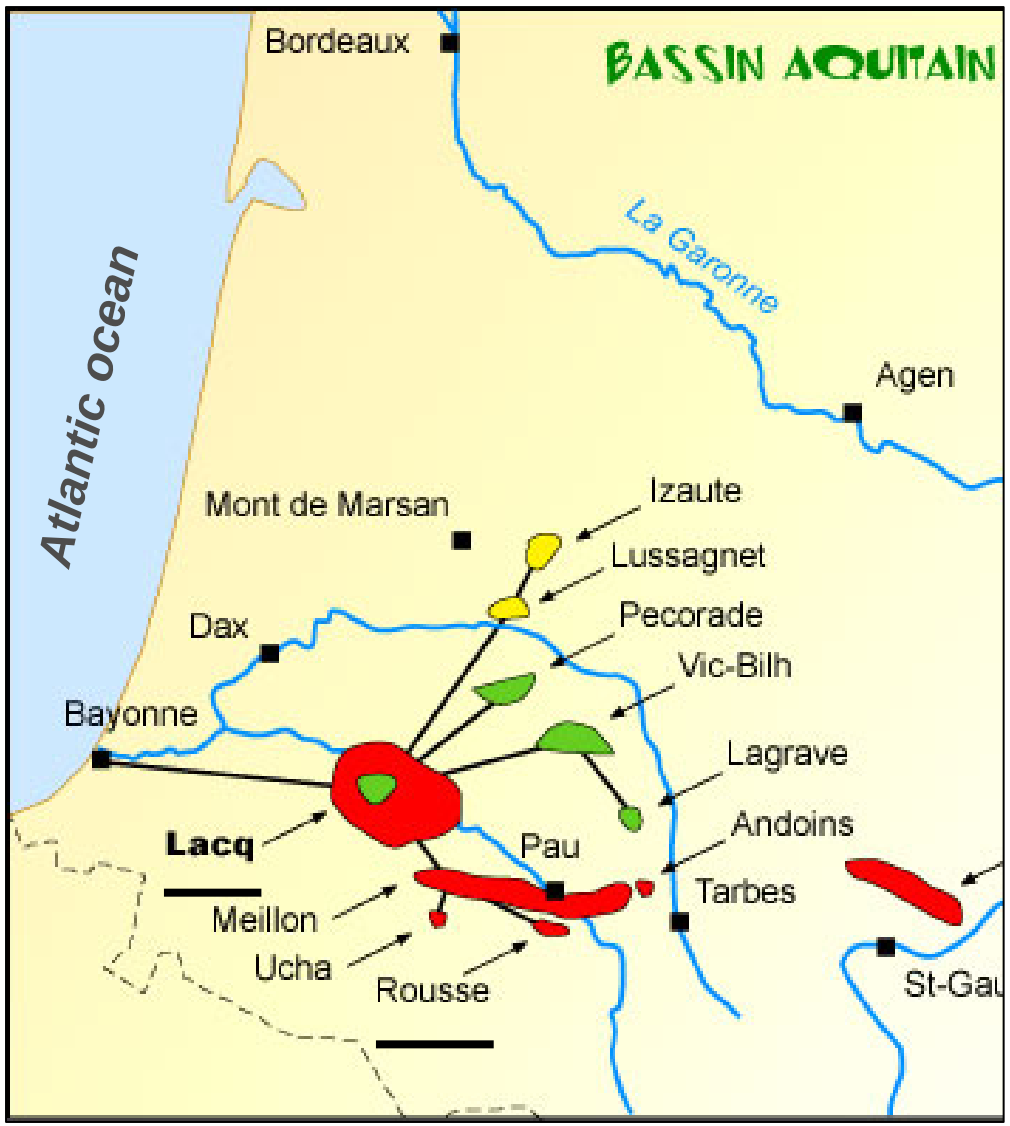


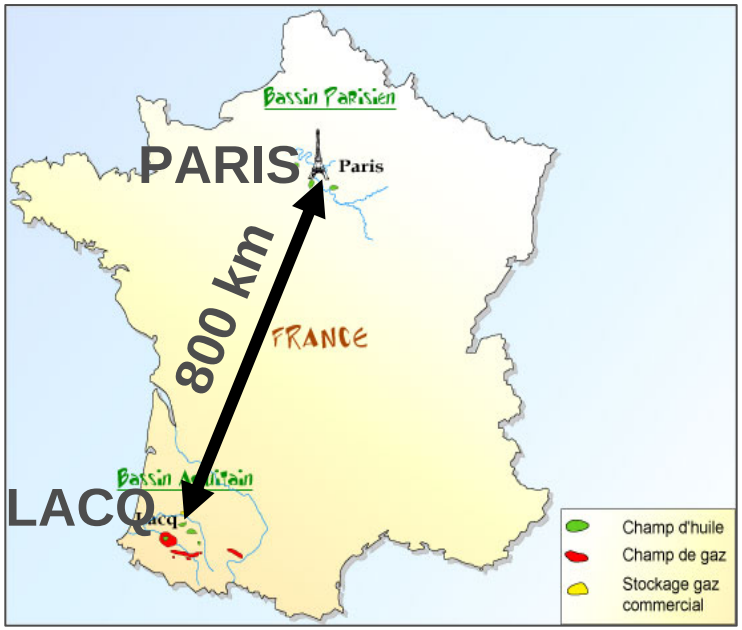
Base 1000 MWth



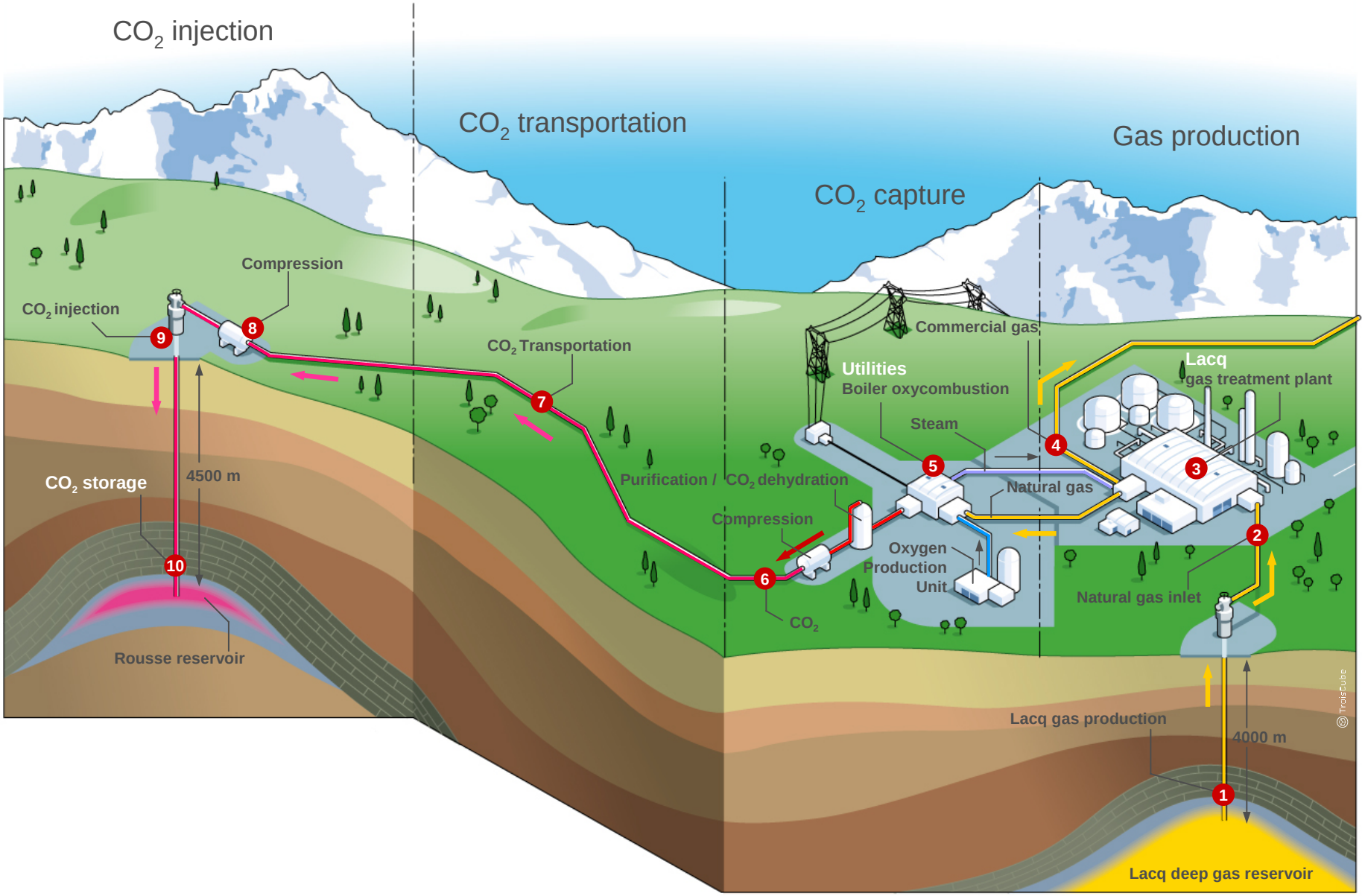
Source: internal studies and Fluor Econamine published data

Project location
Total Exploration & Production in France





Experimenting the complete CCS chain at Lacq France



Oxygen Unit

30 MW Oxyboiler

CO2 drying

CO2 compression in Lacq

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Transportation and injection into a depleted gas reservoir

Typical CO_2 composition

CO_2: 92.0 %

O_2: 4.0%

Ar: 3.7%

N_2: 0.3%

Pilot phase: 120,000 T CO2 injected for 2 years
85,000 Sm^3/d

A major stake for the project: demonstrate that CO2 can be stored safely and permanently into the Rousse reservoir

Aerial Rousse site view

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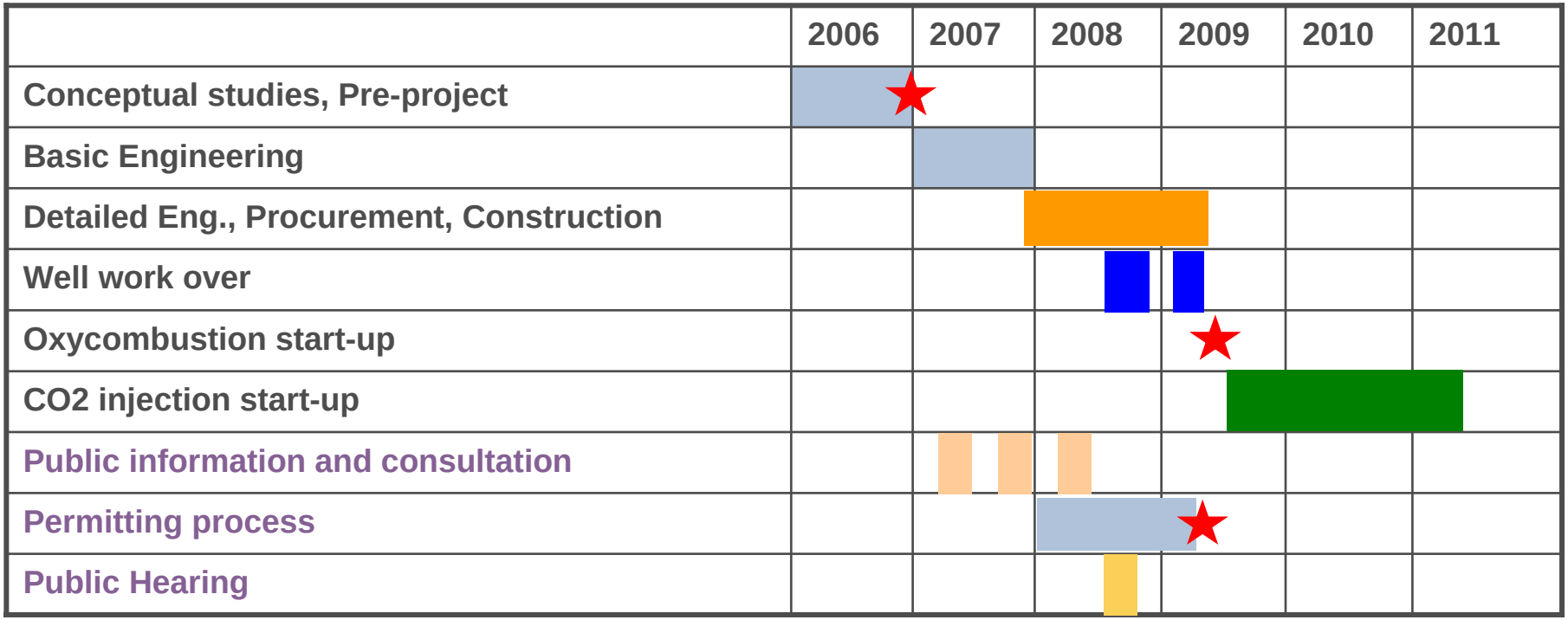
Project schedule – main milestones



Project information also available on

www.total.com/corporate-social-responsibility

In parallel with the public dialog…
….one year of administrative process before formal authorization can be given…

May 2008 : File for project

June - July 2008 : BRGM Expertise

21 July 2008 to 22 Sept. 2008 : Public Inquiry

23 Sept 2008 : Work starts on storage site

October 2008 : Inquiry commission report

Oct - Nov 2008 : Municipalities advice

December 2008 : Complementary file from TOTAL following external expertise

January 2009 : Second expertise review by BRGM

March 2009 : Pyrénées atlantique prefectoral committee meeting

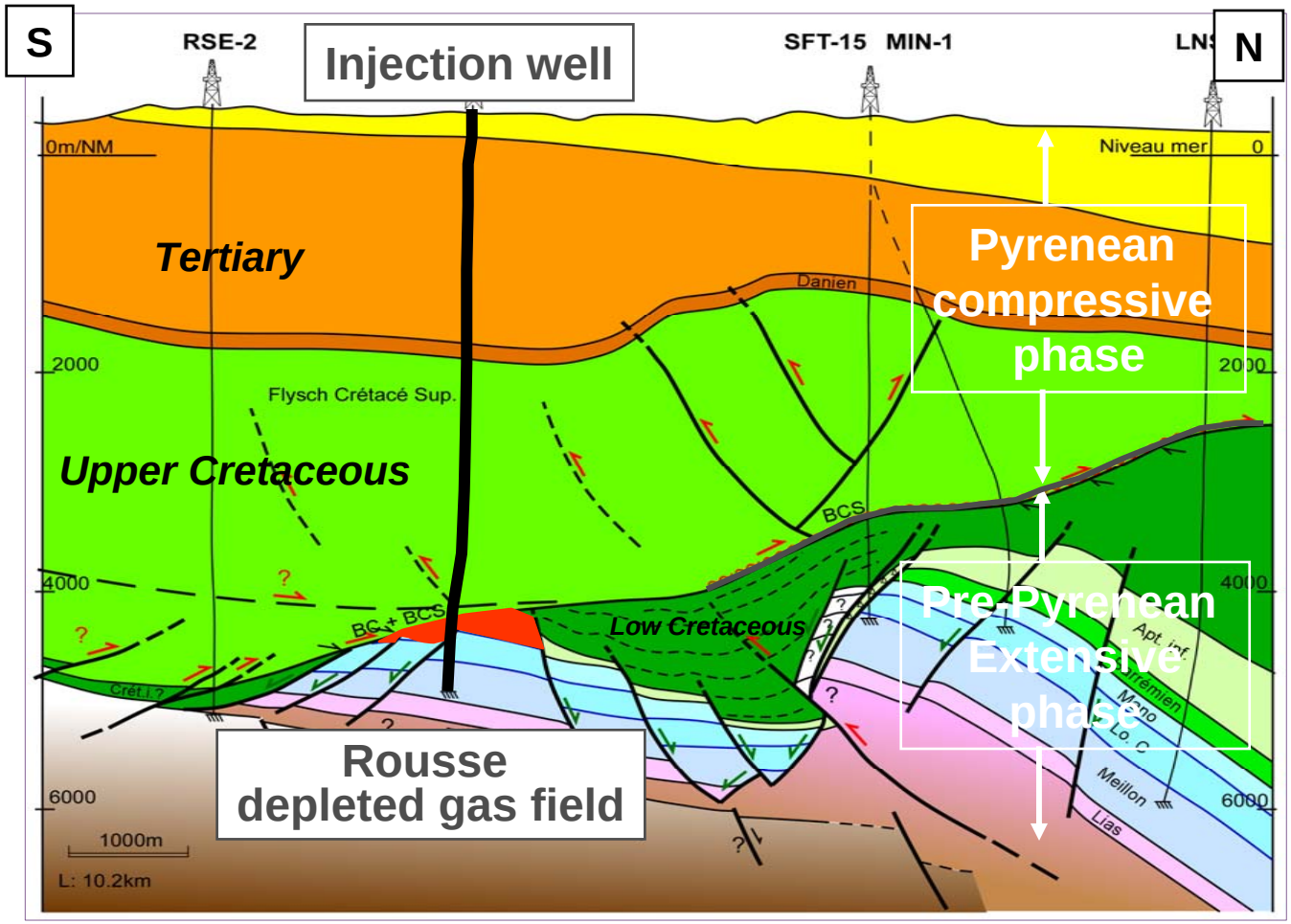
May 2009 : **Prefectoral formal authorization**

The main fundamental questions :

What makes the Rousse field a good candidate for storage?

What type of technical information can you provide to demonstrate safe and permanent storage ?

CO2 injection into Rousse depleted gas reservoir



Jurassic fractured dolomitic reservoir *(in red)*

Thick cap rock *(in green and orange)*

Depth # 4500m/MSL

Temp. # 150°C

Initial P = 485 barg

Current P # 30 barg

Initial CO_2 = 4,6%

Initial H2S < 1%

No aquifer

Existing unique well RSE-1 producing since 1972

Well work over planned winter 2009

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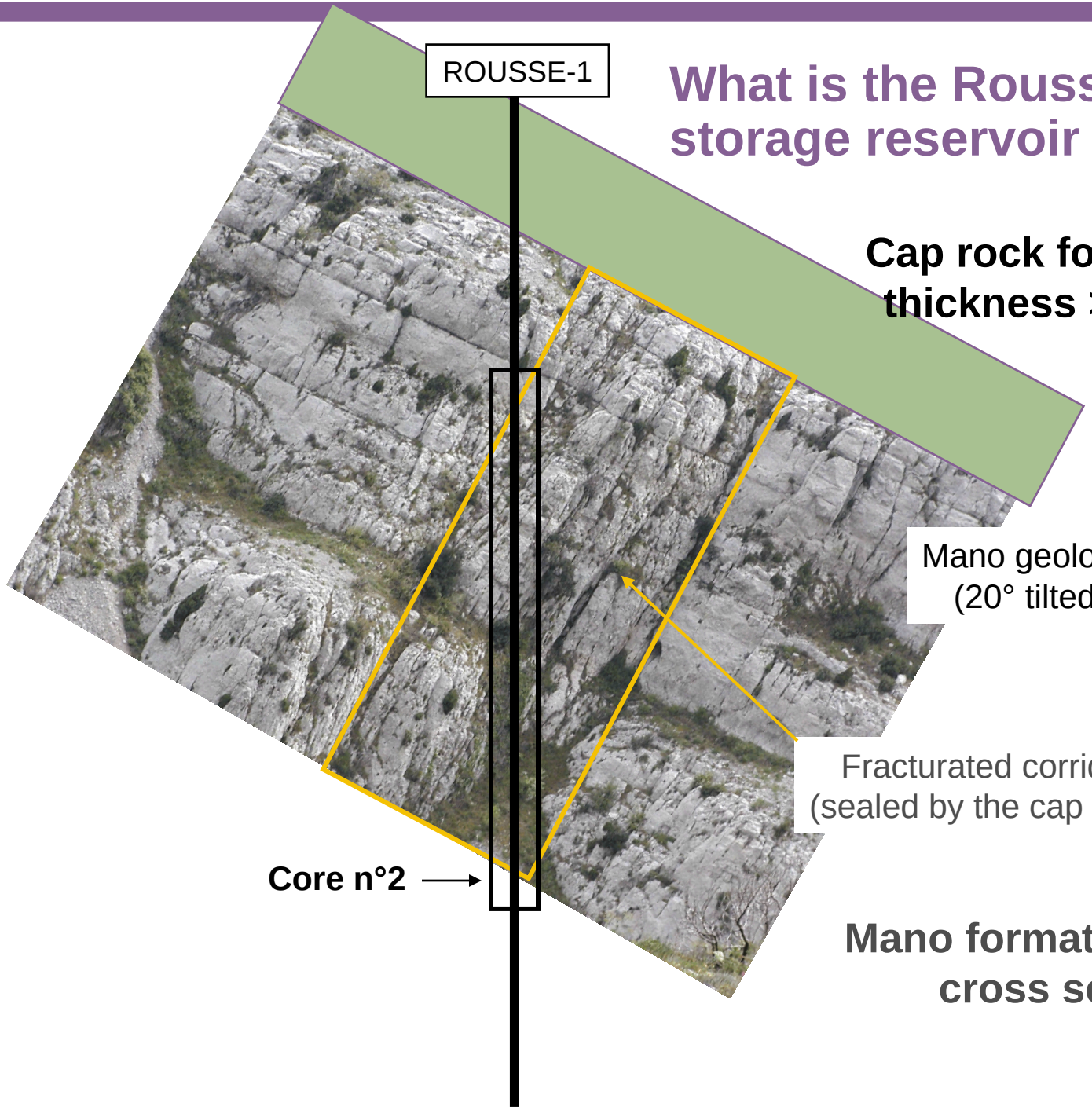
What is the Rousse « CO2 storage reservoir ?»



Mano formation schematic cross section N-S

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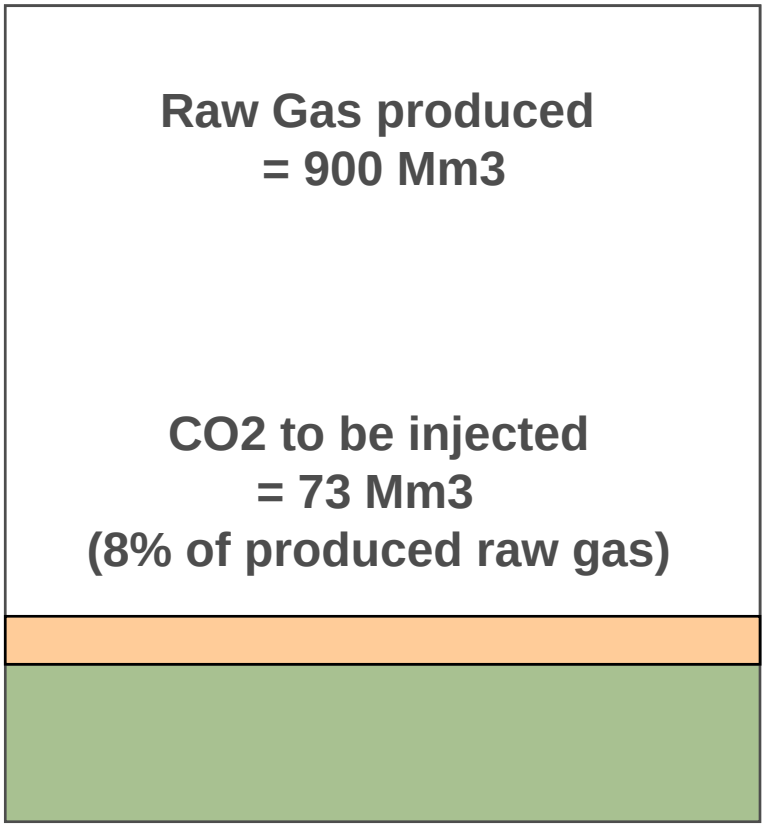
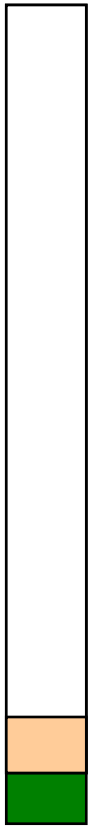
Injected CO2 quantities are low compared to initial natural gas quantities…





Initial reservoir pressure
= 480 Bar

Post injection pressure
= 70 Bars

Current Pressure
= 30 Bars

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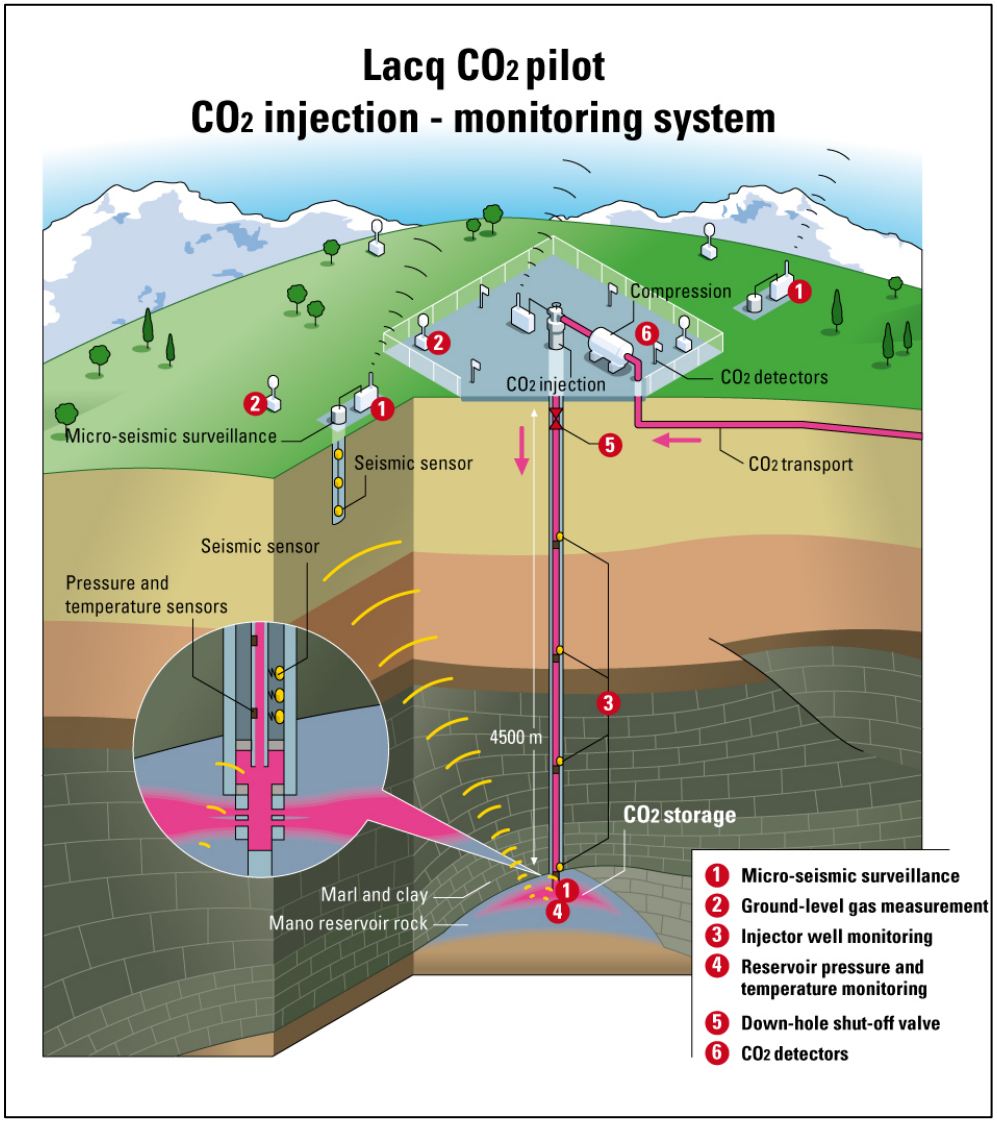
Demonstrating CO2 storage integrity : Monitoring plan



Injection phase

- Flow rate & composition of injected gas
- P and T borehole and reservoir pressure (optical fiber)
- Micro seismic monitoring of reservoir and cap rock
  - baseline before injection
- Gas migration at the surface :
  - soil gas survey (baseline before injection)
  - surface detectors on well pad
- Aquifer sampling

Post injection phase

- P and T bottom hole and reservoir pressure
- Micro seismic monitoring of reservoir and cap rock
- Gas migration at the surface
- Aquifer sampling

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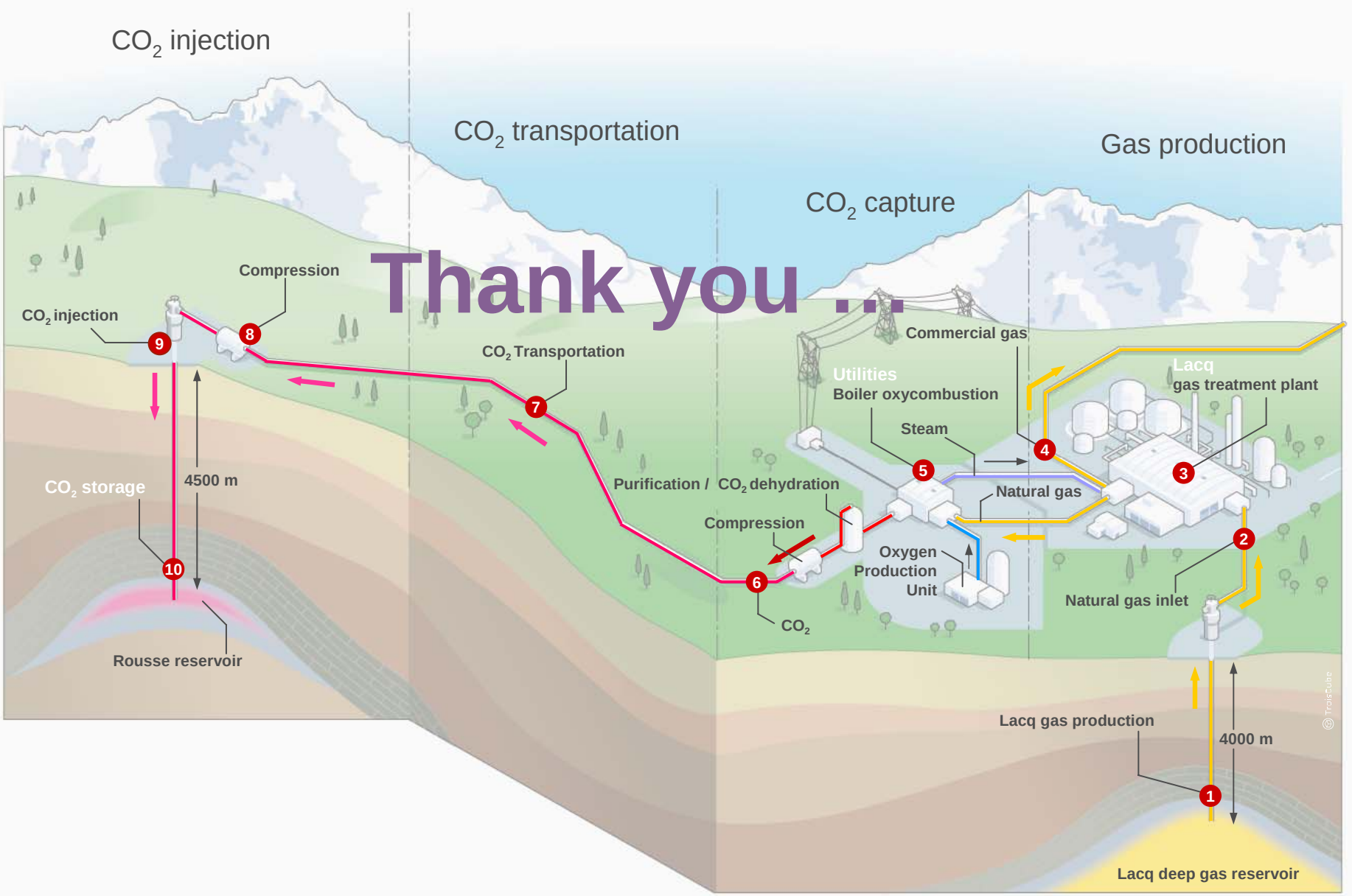
CO_2 injection
CO_2 transportation
Gas production
CO_2 capture
Thank you ...
Compression
CO_2 injection
CO_2 Transportation
Commercial gas
Utilities
Boiler oxycombustion
Steam
Lacq
gas treatment plant
Purification / CO_2 dehydration
Natural gas
Compression
Oxygen
Production
Unit
CO_2 storage
4500 m
Natural gas inlet
CO_2
Rousse reservoir
Lacq gas production
4000 m
Lacq deep gas reservoir
1
2
3
4
5
6
7
8
9
10