

Update on CSLF-recognized Lacq Integrated CCS Project

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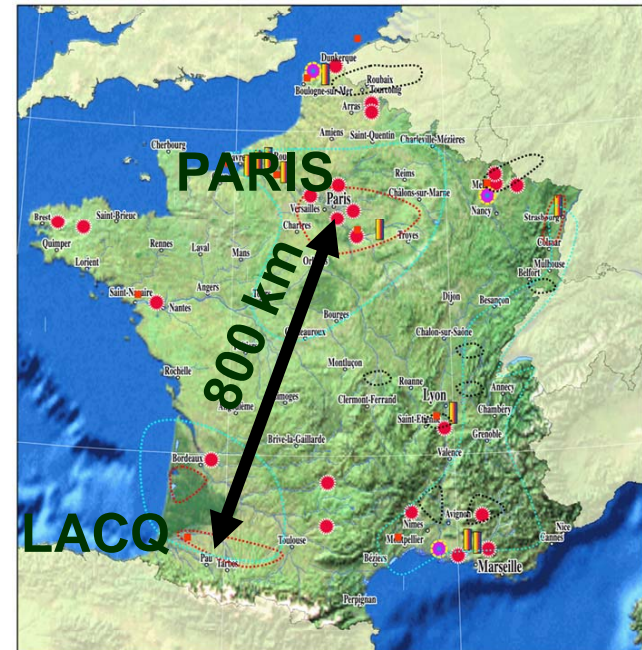
Total S.A.

CSLF Meeting of Technical Group - Pau, March 16th, 2010

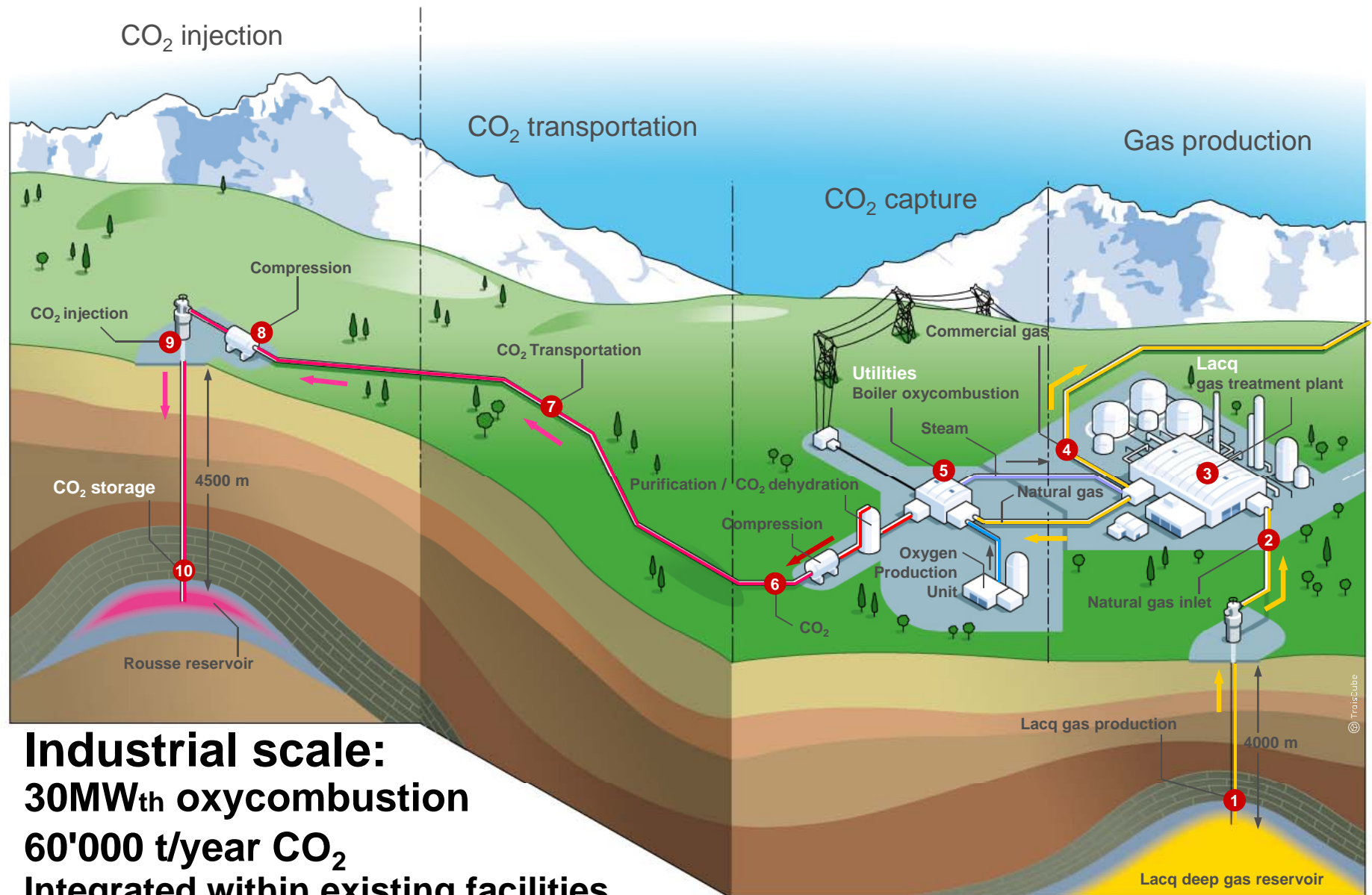


Potential storage areas in France:

The first CCS project started in 2007 in the South West area



An integrated carbon capture, transportation and geological storage in a depleted gas field project

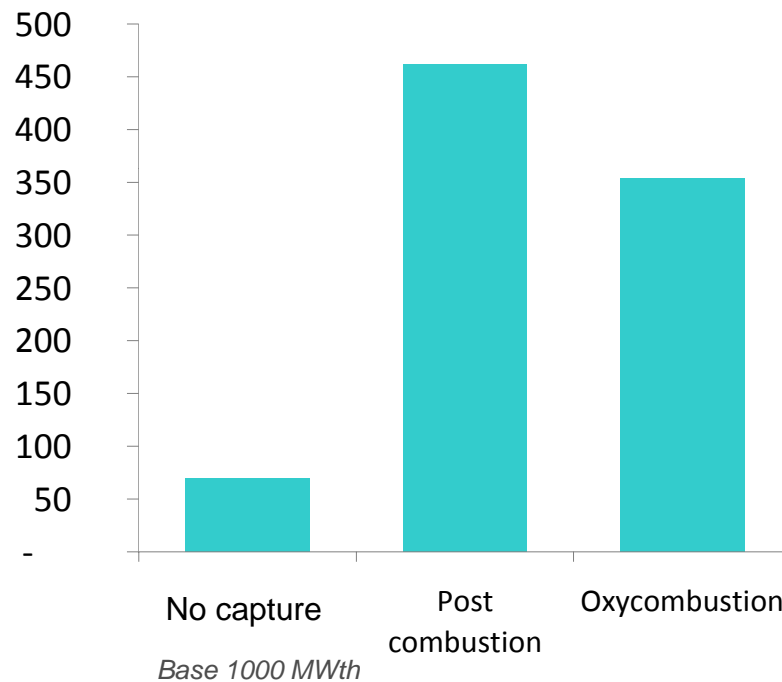


Industrial scale:
30MW_{th} oxycombustion
60'000 t/year CO₂
Integrated within existing facilities

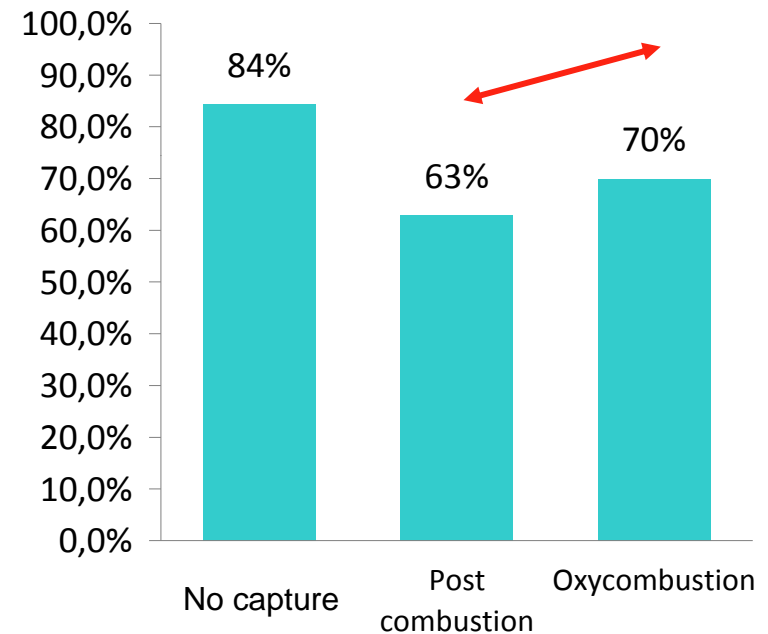
Oxy combustion allows to capture CO2 with a reduced energy cost

MWth eq

Utilities energy needs

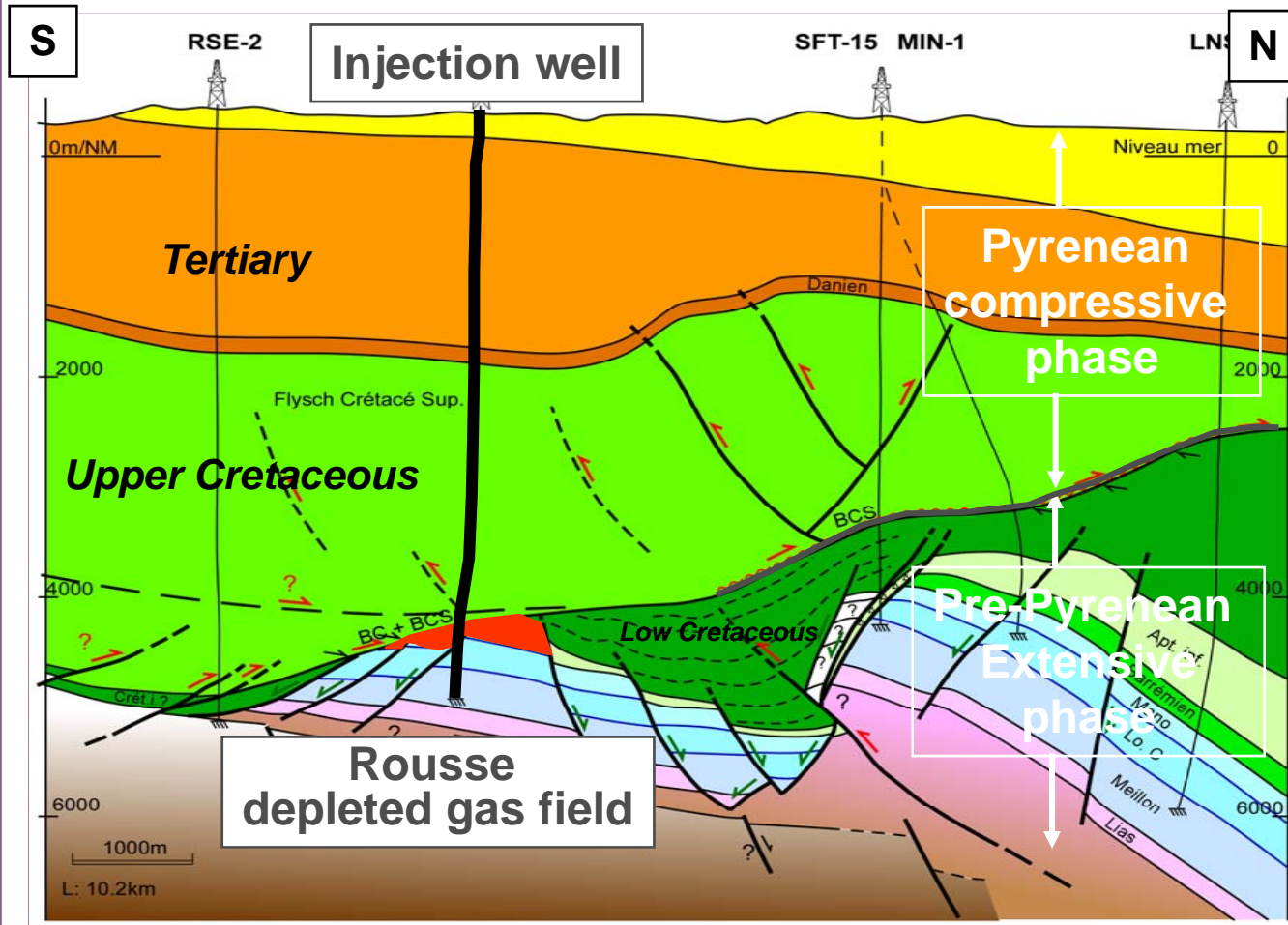


Energy Efficiency



Source: internal studies and Fluor Econamine published data

CO₂ injection into Rousse depleted gas reservoir



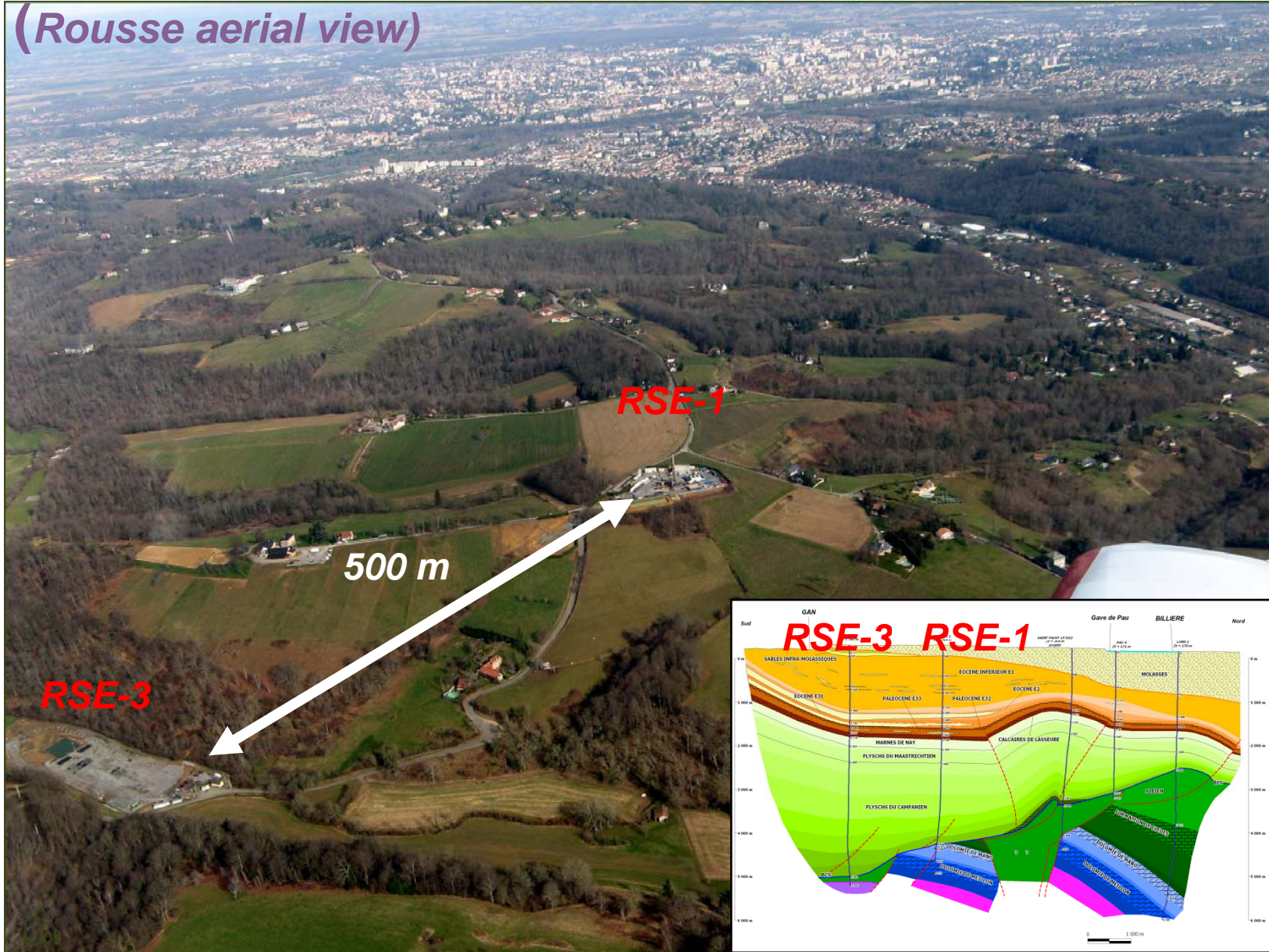
- Jurassic fractured dolomitic reservoir (in red)
- Thick cap rock (in green and orange)
- Depth # 4500m/MSL
- Temp. # 150°C
- Initial P = 485 barg
- Current P # 30 barg
- Initial CO₂ = 4,6%
- Initial H₂S < 1%
- No active aquifer

Existing unique well RSE-1 producing since 1972

Work over in Feb. 2009 (tubing/packer changed, cement logging, monitoring instal)

A major stake in the project: demonstrate safe and permanent CO2 storage into Rousse

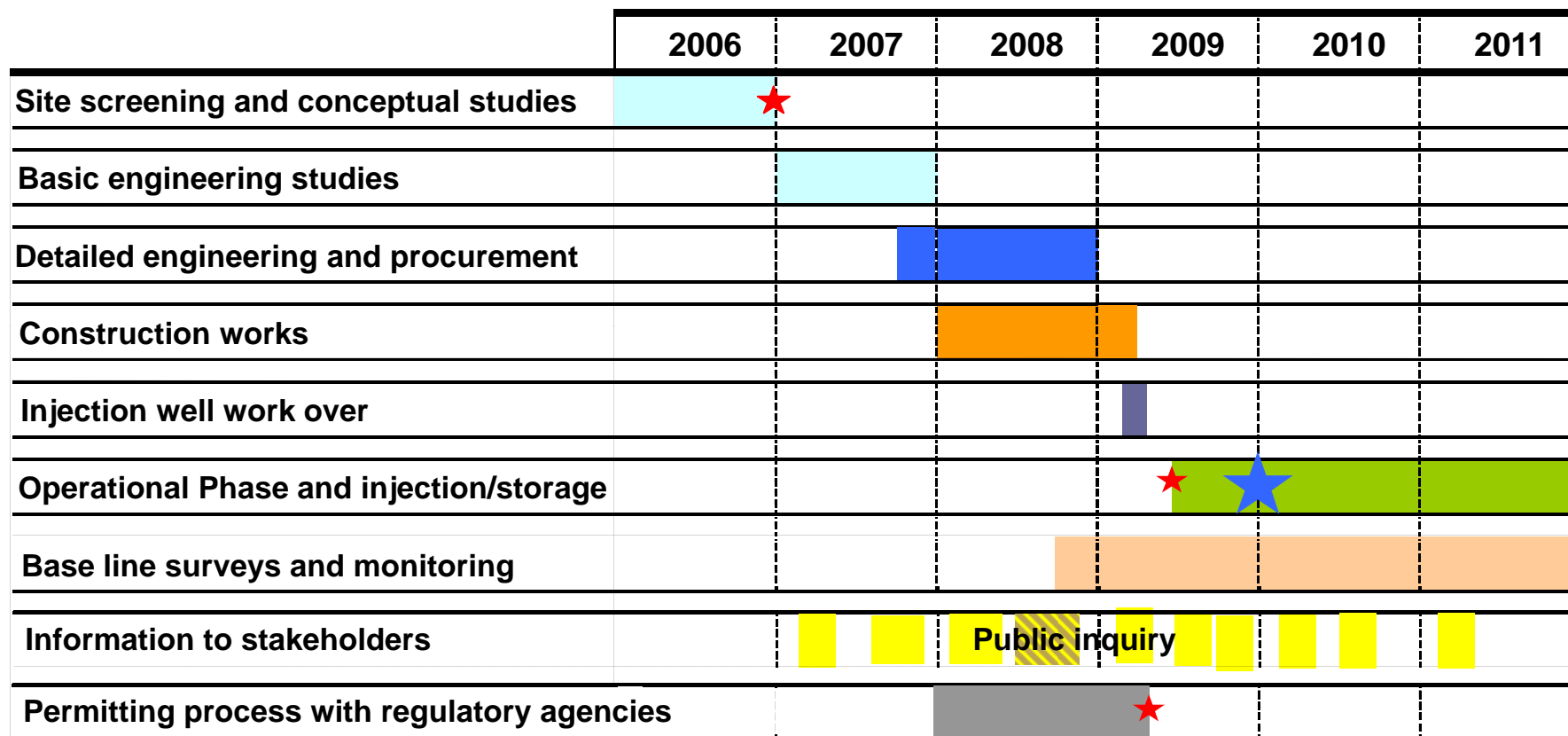
(Rousse aerial view)



For Total : several interconnected relationship management tracks to follow

- ▶ The technical & scientific developments and dialog with the scientific community**
- ▶ The public awareness and dialog, environmental NGO's, associations, elected representatives**
- ▶ The administrative instruction process, regulatory framework, formal submission documents, third party expertise, etc...**

Project schedule milestones



What do we know on public awareness and position?

SOCECO2 -Assessing CSC technology support in France on economical and public acceptance stand point.

Social Awareness& Acceptance evaluation

- ▶ CCS awareness low in France (from poll) (6% aware)
- ▶ From the 6% knowing the technology 50% in favor/50% against
- ▶ After explaining the risks (38% in favor..)
- ▶ CCS has strong supports from businesses and public institutions, but acceptability is not given yet.
- ▶ Some organized opposition at national and local level. Some position papers from NGO's

Different levels for public dialog : main issues discussed during the process

- ▶ **Local impacts : Safety issues, housing prices, local image (indirect impact on other activities..) site visual impact, etc..**
- ▶ **Regional impacts : regional attractiveness, industrial development, employment, taxes..**
- ▶ **Global CCS issues : Cost, scale, additional energy requirements, policy& regulatory issues, public incentives, long term liabilities, risk management, etc..**

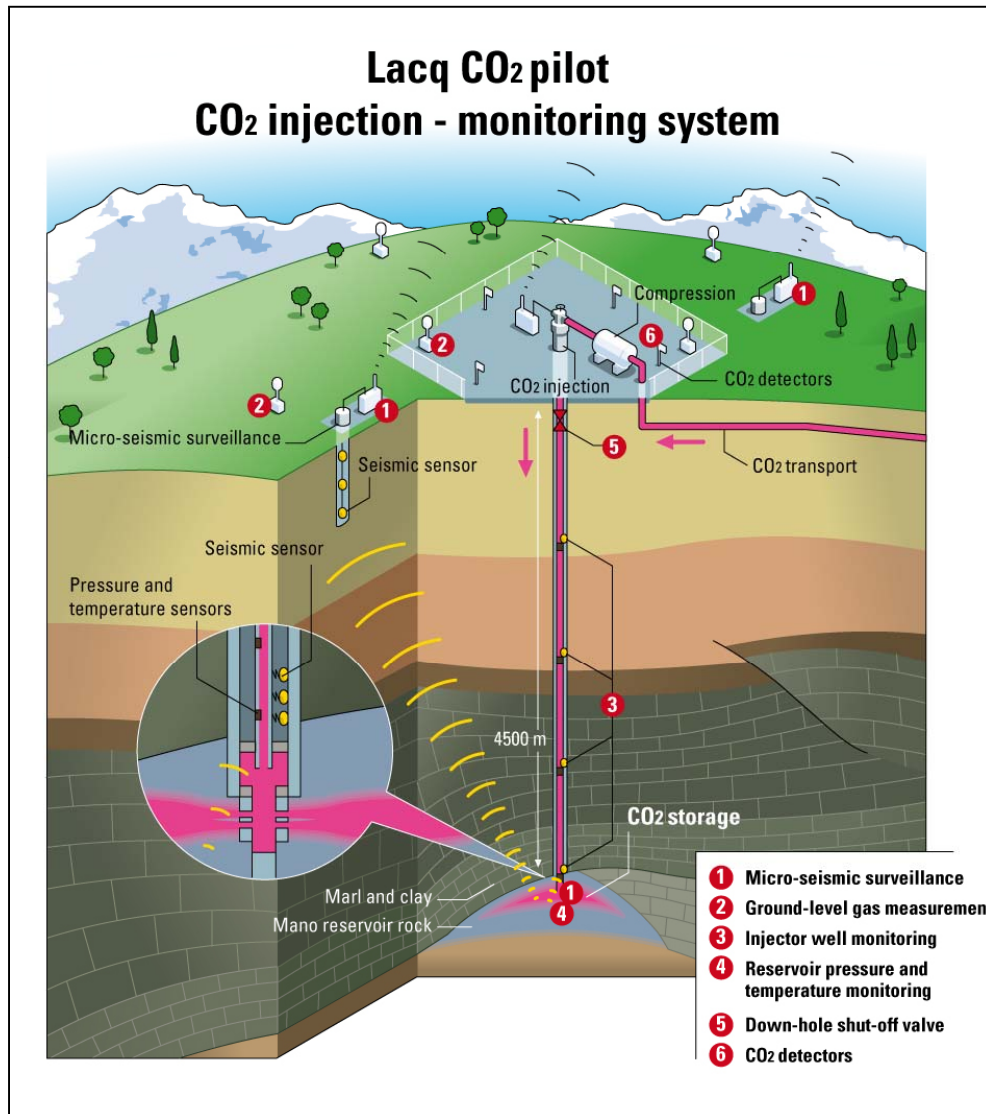
Creation of a scientific advisory committee: objectives

- ▶ Assist Total in the science developments for the CCS project in Rouse
- ▶ Better incorporate technical and scientific stakes, particularly in the storage part
- ▶ Maximize information flux to the academic world and optimize the opportunity for R&D attached to the CCS demonstration project.
- ▶ Help to detect in advance the potential issues for the society at large in the project.
- ▶ Help to identify early opportunities for scientific collaborations within and beyond the project between actors involved in the CCS development.

Scientific collaboration program on Rousse

- ▶ **Scientific Advisory Committee set up since 2007**
- ▶ **IFP (French Institute of Petroleum) – Total**
 - Petrophysical properties of cap rocks (capillary entry pressure, permeability, diffusion coef., ...)
 - Geochemical monitoring techniques
 - Geochemical model of CO₂ injection
 - Thermodynamics properties of CO₂ mixtures
- ▶ **BRGM (French Geological Survey) – Total**
 - Geochemical model of CO₂ injection
 - Effect of natural seismicity on CO₂ storage
- ▶ **French National Research Agency (ANR) – CO₂ program**
 - Sentinelle (CO₂ storage monitoring techniques development)
 - Gaz Annexes (thermodynamics and thermochemical data of CO₂ mixtures)
- ▶ **PhD program with IPGP (French Earth Physics Institute) and Schlumberger (seismic monitoring, isotopic monitoring, geo biosphere, ...)**
- ▶ **Project endorsed by the Carbon Sequestration Leadership Forum in Oct. 2009**

CO₂ Monitoring plan



Injection phase

- Flowrate & composition of injected gas
- P and T borehole and reservoir pressure (optical fibre)
- Microseismic monitoring of reservoir and caprock
 - baseline before injection

Gas migration at the surface :

- soil gas survey (baseline before injection)
- surface detectors on well pad

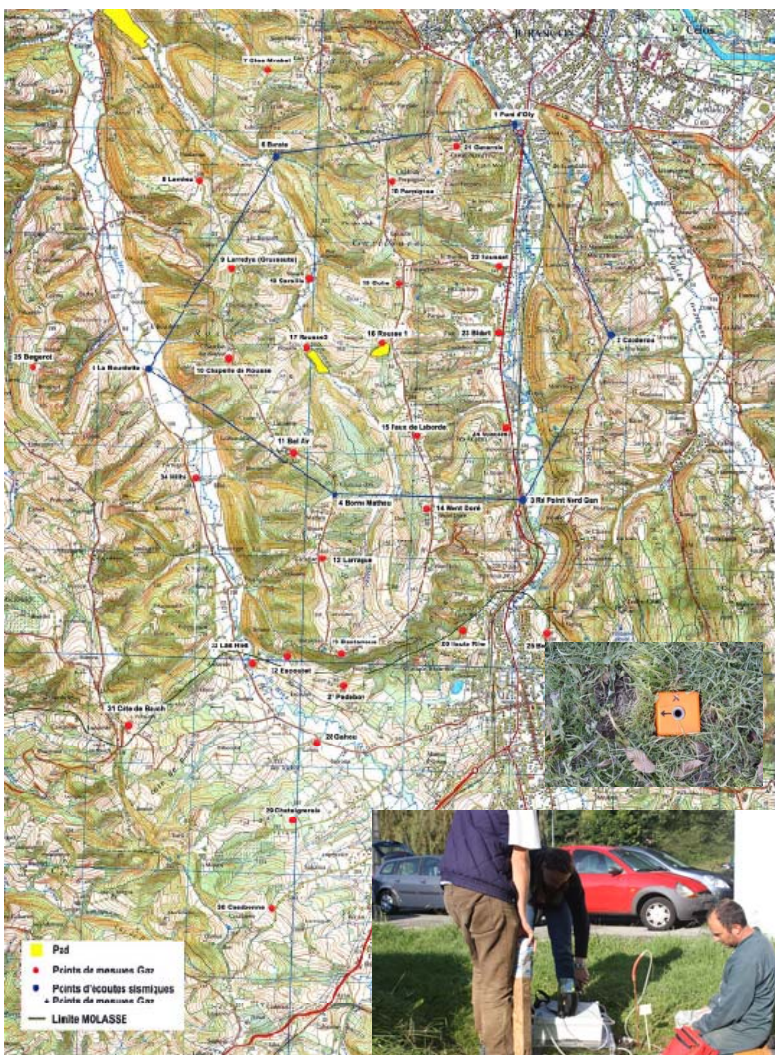
Environmental monitoring

- Underground aquifers and surface water
- Fauna and flora

Post injection phase

- P and T bottom hole and reservoir pressure
- Microseismic monitoring of reservoir and caprock
- Gas migration at the surface
- Environmental monitoring

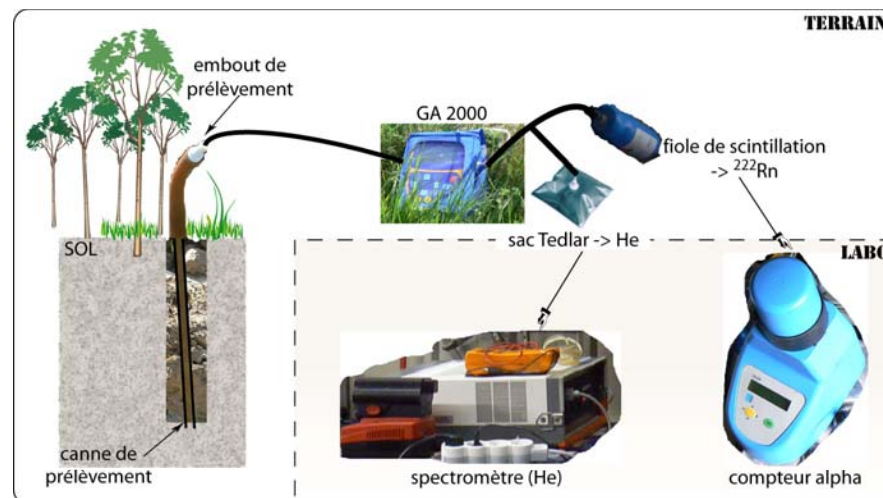
Soil gas surveys



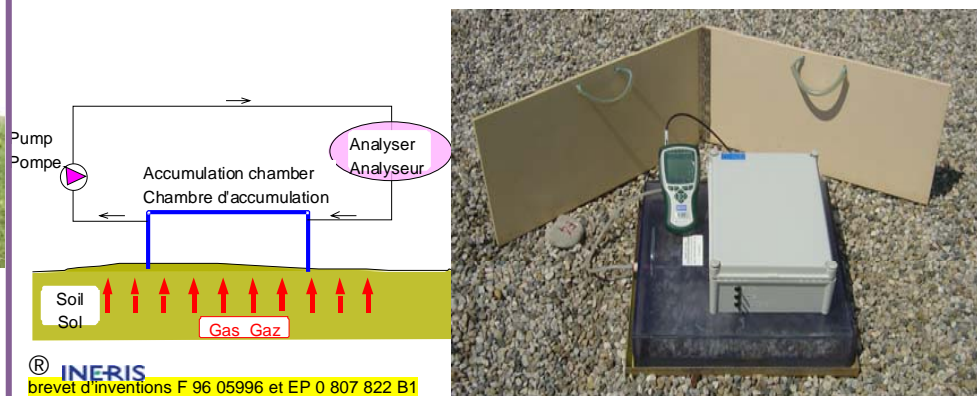
35 spots identified
4 campaigns (2008/09) sept, dec, march, june

• Soil gases concentration - BRGM

- CO₂, O₂, CH₄ at site
- He, ²²²Rn in lab



• CO₂ and CH₄ fluxes - INERIS



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A long process for a well known depleted gas field

2006 : Early presentations of the concept

Jan – Oct 2007 : Formal information to the french administration, mayors

March 2007: Public meeting Rouse

Nov 2007 : press conference and launch of the dialogue phase

Nov – dec 2007: **3 public meetings (Jurançon, Pau, Mourenx)**

Apr – June 2008 : several meetings with small groups

May 2008 : meeting with all mayors from Lacq to Rouse

June – July 2008 : CLIS n°1 et 2

July 2008 : working meetings with Jurançon

July – Sept 2008 : **official public hearings**

Sept 2008 : CLIS n°3

Dec 2008 : well pad open to the public – information letter to project neighbours

Feb – March 2009: CLIS n°4, CLIS n°5

May 2009 : **Official permit to capture, transport, inject and store 120'000 t of CO2**

June 2009 : CLIS n°6

July 2009 : **CO2 capture start up - first oxycombustion test**

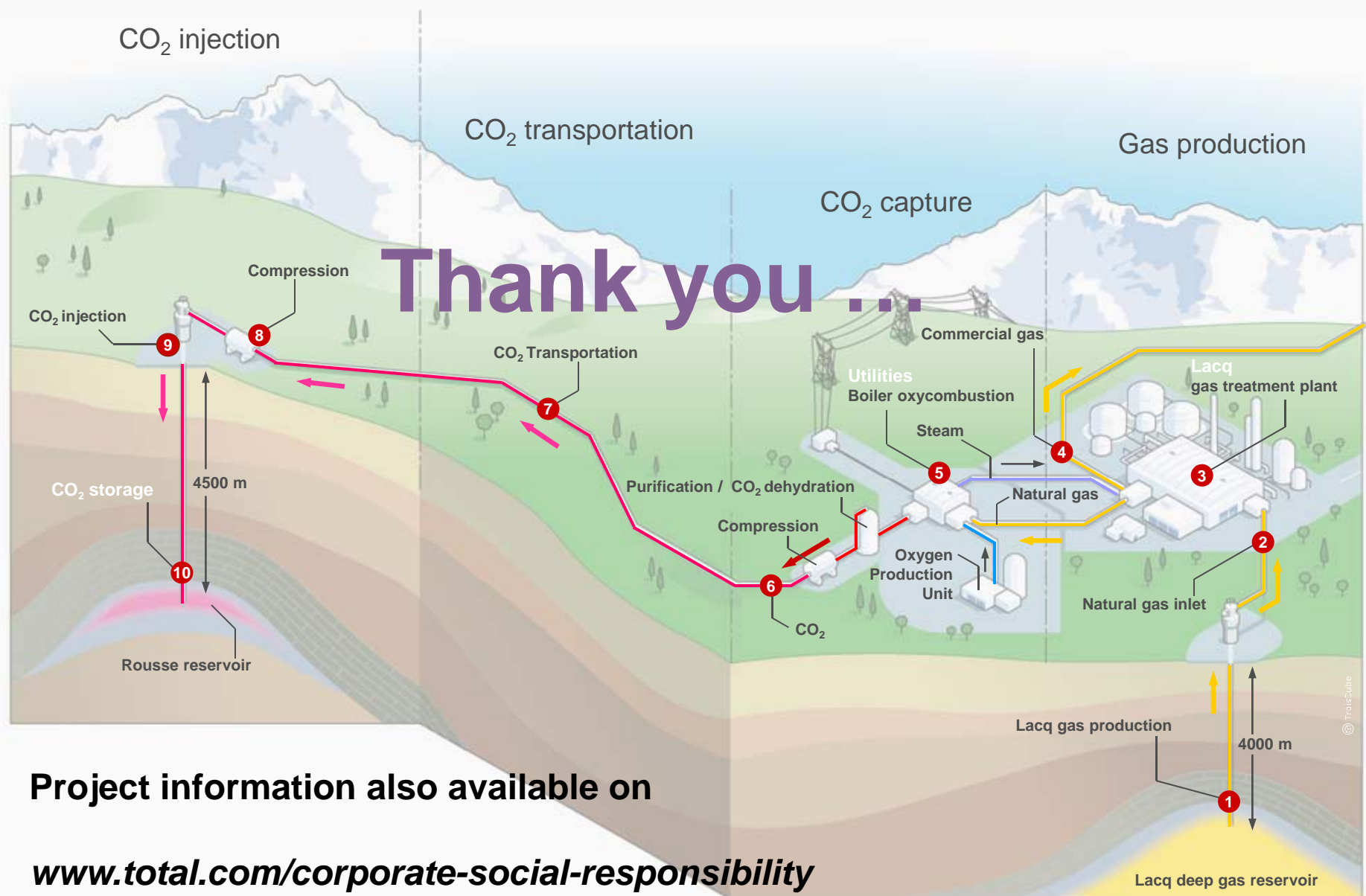
July 2009 : One local NGO taking administrative actions against official permit

Sept. – Oct. 2009 : pre-injection baseline data and detailed monitoring procedures set up

Jan. 8th 2010 : **Fully operationnal CCS project**

Some lessons learned...

- ▶ **Set the right level of resources early in the process and perform the full social relationship management analysis to map completely your stakeholders upfront.**
- ▶ **The basic rules: asymmetric decision making**
 - « All participants to public dialog do not take part in the final decision but all participants in the decision making take part in the public dialog »
- ▶ **Establish the right level and timing of stakeholder management process**
 - Local and regional vs national,
 - Importance of the proper timing of the public consultation
- ▶ **More efficient to have the technical project people answering the questions**
- ▶ **Public awareness on Geosciences in general to be improved . Highlight the difference between basic Geoscience know how and analysis of knowledge gaps for R&D purposes**



Project information also available on

www.total.com/corporate-social-responsibility