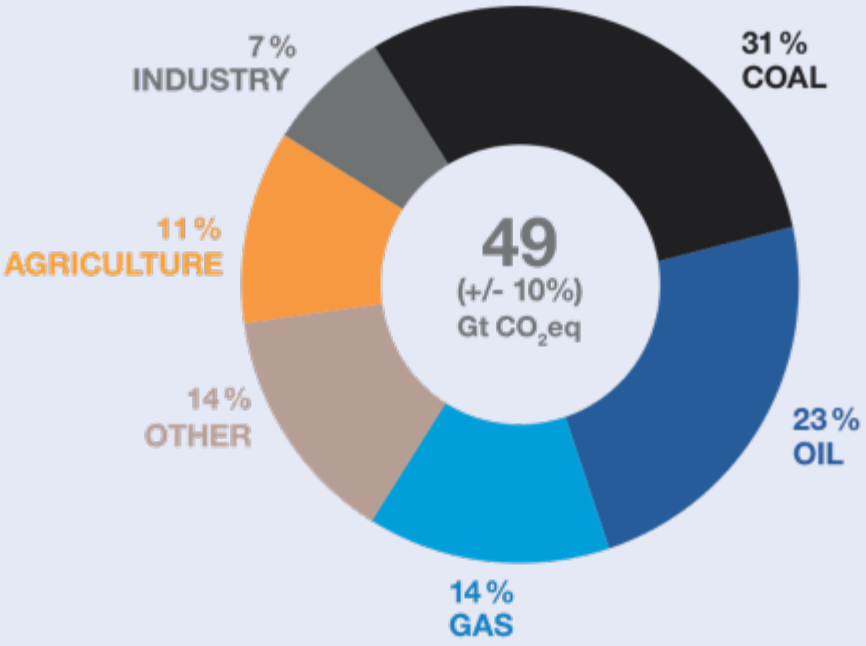
TOTAL
COMMITTED TO BETTER ENERGY

Integrating Climate Into Our Strategy

2016

The Challenges of the 2°C Target

GLOBAL GHG EMISSIONS IN 2010



Source: IEA, CO2 Emissions from Fuel Combustion, 2014 Edition

OIL AND GAS

37%

GHG emissions
related to human activity

OIL AND GAS EMISSIONS

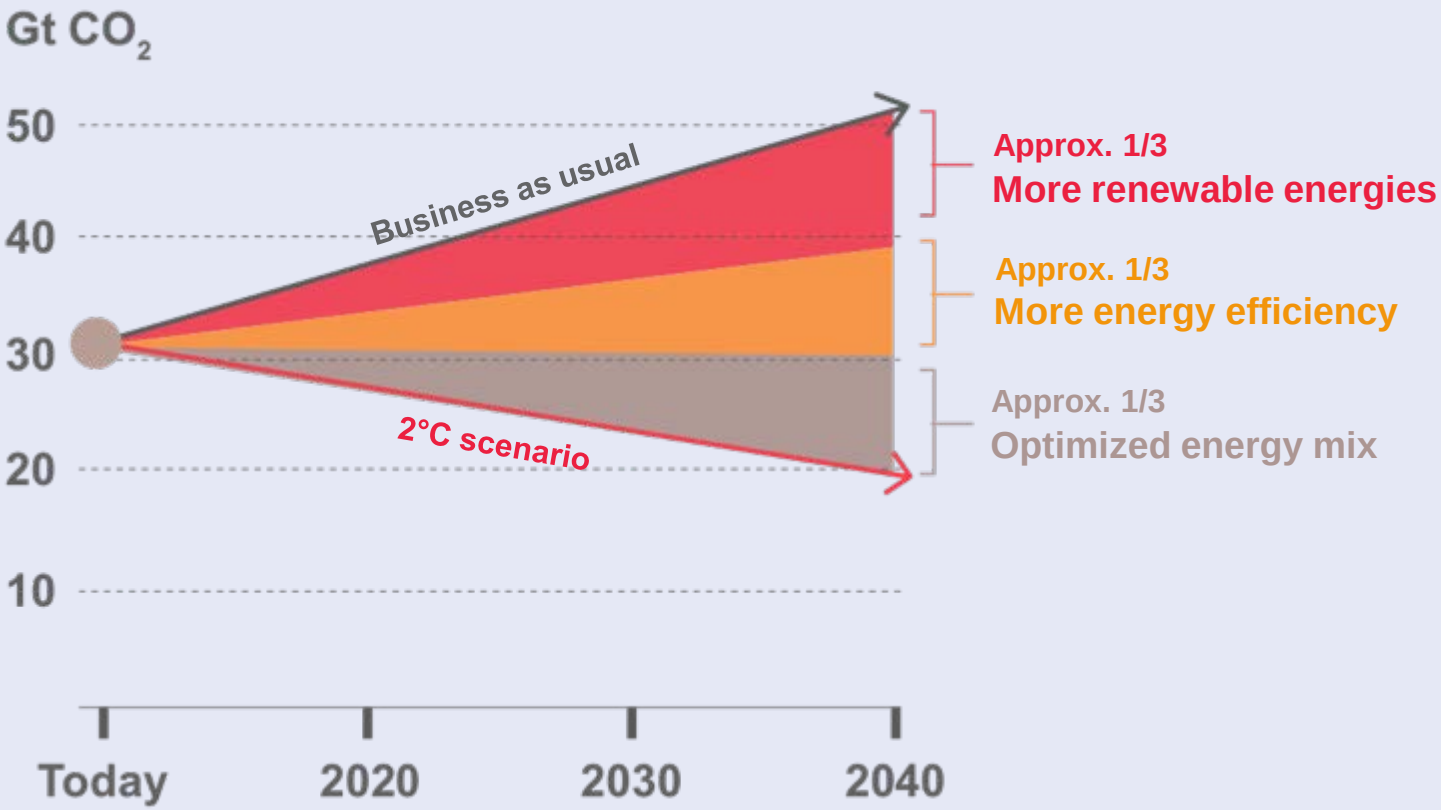
~85%

associated with product end-use

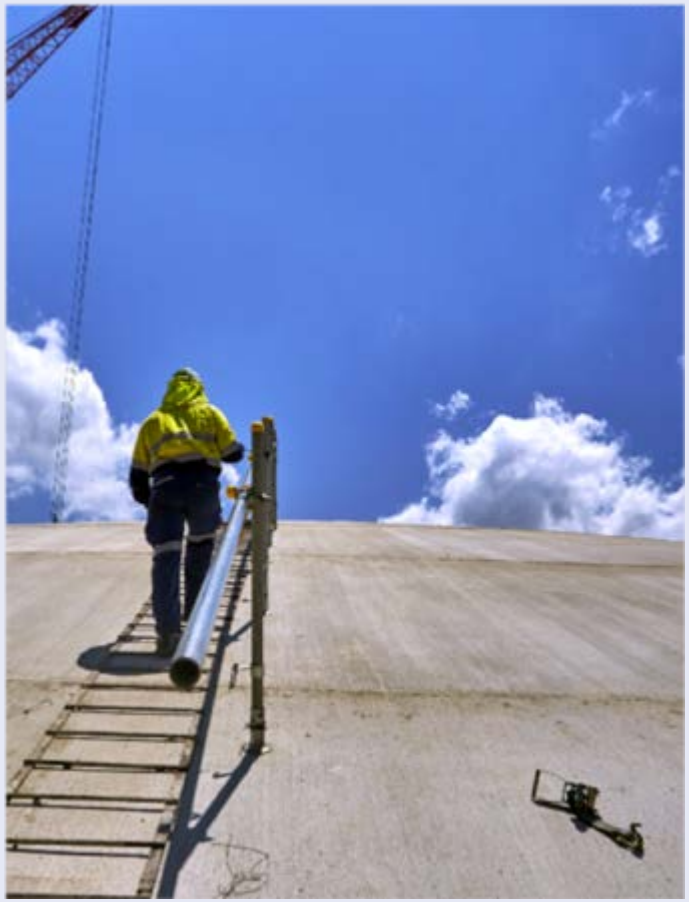
~15%

during production and refining

Three Areas of Focus to Meet the 2°C Target



Total's Ambition: to be Consistent with the IEA's 2°C Scenario



Working with governments and industry

Advocating for a price on carbon

Focusing on oil projects with low breakevens

Prioritizing gas projects

Exiting coal business

Growing in renewables and biofuels

Integrating Climate into Our Strategy

Improving the Carbon Intensity of Our Production Mix

Become the
responsible energy major

>60%gas

in our hydrocarbon production mix in 20 years' time

Developing Renewable Energies

20%
low-carbon
businesses in
20 years' time

Improving Energy Efficiency

Promote
responsible energy use
in our operations
and by our customers

Improving the Carbon Intensity of Our Production Mix

More than 60% gas in our hydrocarbon production mix in 20 years' time

- Exiting the coal business
- Deploying an assertive strategy in gas, while limiting methane emissions
- Selecting and developing safe, environmentally responsible, competitive oil and gas projects
- Encouraging sector initiatives and collectively engaging to address climate issues
- Publicly supporting the implementation of carbon pricing mechanisms
- Expanding carbon capture, use and storage technologies

Encouraging Sector Initiatives and Engaging to Address Climate Change

Committed to working with OGCI member companies to deliver practical solutions to climate risks

BP, CNPC, ENI, Pemex, Reliance Industries, Repsol, Saudi Aramco, Shell, Statoil, Total

An active member of the Climate and Clean Air Coalition

Working to effectively measure, manage and mitigate methane emissions

Pursuing a viable solution to eliminate routine flaring by 2030

Working with Global Compact

Total supports the call for companies to factor an internal carbon price into their investment decisions

Carbon Capture Usage and Storage (CCUS): Significant Potential to Mitigate Climate Change

$100M euros in CCUS R&D
> $60M euros invested in Lacq

A tool to help **combat climate change**

A real **business opportunity**

Critical to **invest and develop** an industry around CCUS to make an **impact on climate change mitigation**

TOTAL'S LACQ PROJECT

1st European onshore capture-transport-storage chain

3-year pilot

Over **51,000 metric tons of CO_2** successfully injected into the Rousse reservoir (France)

Key R&D Priorities

Carbon Capture Utilization and Storage

Developing partnerships
With universities, startups and industrial collaboration

Expanding energy efficiency

Photovoltaic research, energy storage
Reliability, affordability

Digital energy systems

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Lacq project

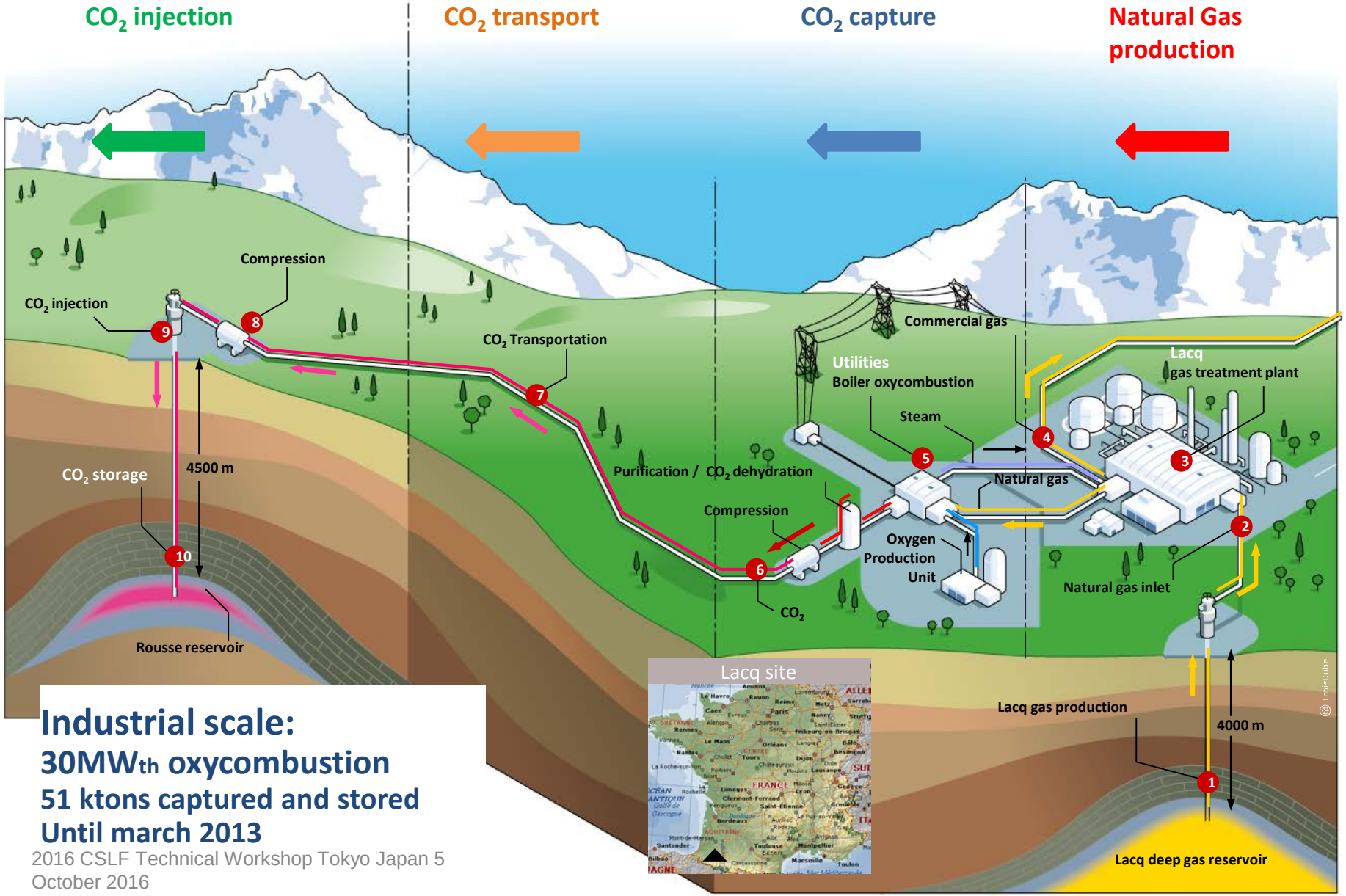
Key results of an integrated CCS chain based on oxycombustion

Dominique Copin

2016

Lacq and Rousse

A complete industrial chain based on gas-fired combustion



Industrial scale:

30MW$_{th}$ oxycombustion

51 ktons captured and stored

Until march 2013

Combining 4 characteristics

Integrated project from capture to storage

Based on gas-fired combustion

Uses oxycombustion technology

CO2 stored in a depleted natural reservoir

Project Objectives

Acquire expertise and reduce costs for future industrial deployment

To Demonstrate the technical feasibility and reliability of an integrated onshore Carbone Capture and Storage scheme for steam production

To acquire operational experience and data to up-scale with cost reduction the oxy-combustion technology from pilot (30MW) to industrial scale (200MW).

To develop geological storage qualification methodologies

To develop monitoring methodologies on site to prepare future larger scale long term onshore storage projects. (Micro seismic monitoring, Environmental monitoring.)

Pilot Techical Description

Surface facilities

Air separation unit

Cryogenic unit
(Air Liquide)
O_2 : 240 t/d

Oxy-combustion Boiler

30 MW, 40 t/h steam @ 60b, 450°C

Direct Contact Cooler

Cooling of flue gases
From to 200°C to 30°C

Wet CO_2 Compressor

From 1barg to 27 barg

Dehydration Unit

Outlet: < 20 ppm of water

Transport and Storage

Key results of the Lacq capture phase

Test and Validation of Oxycombustion on a 30 MW boiler

Collection of data needed to design a 200 MW boiler

Transport and Storage

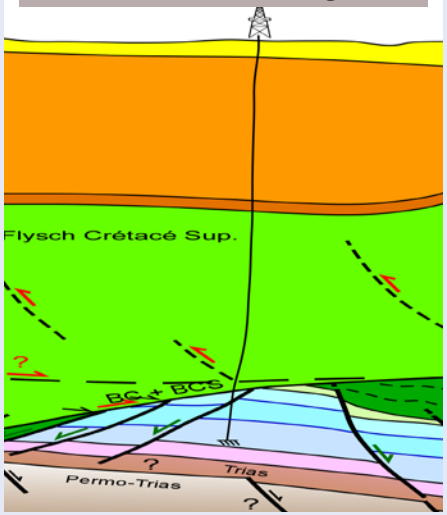
Capture

Rousse compressor

Pinlet: 27bar Poutlet: 51bar

RSE-1 injection well head

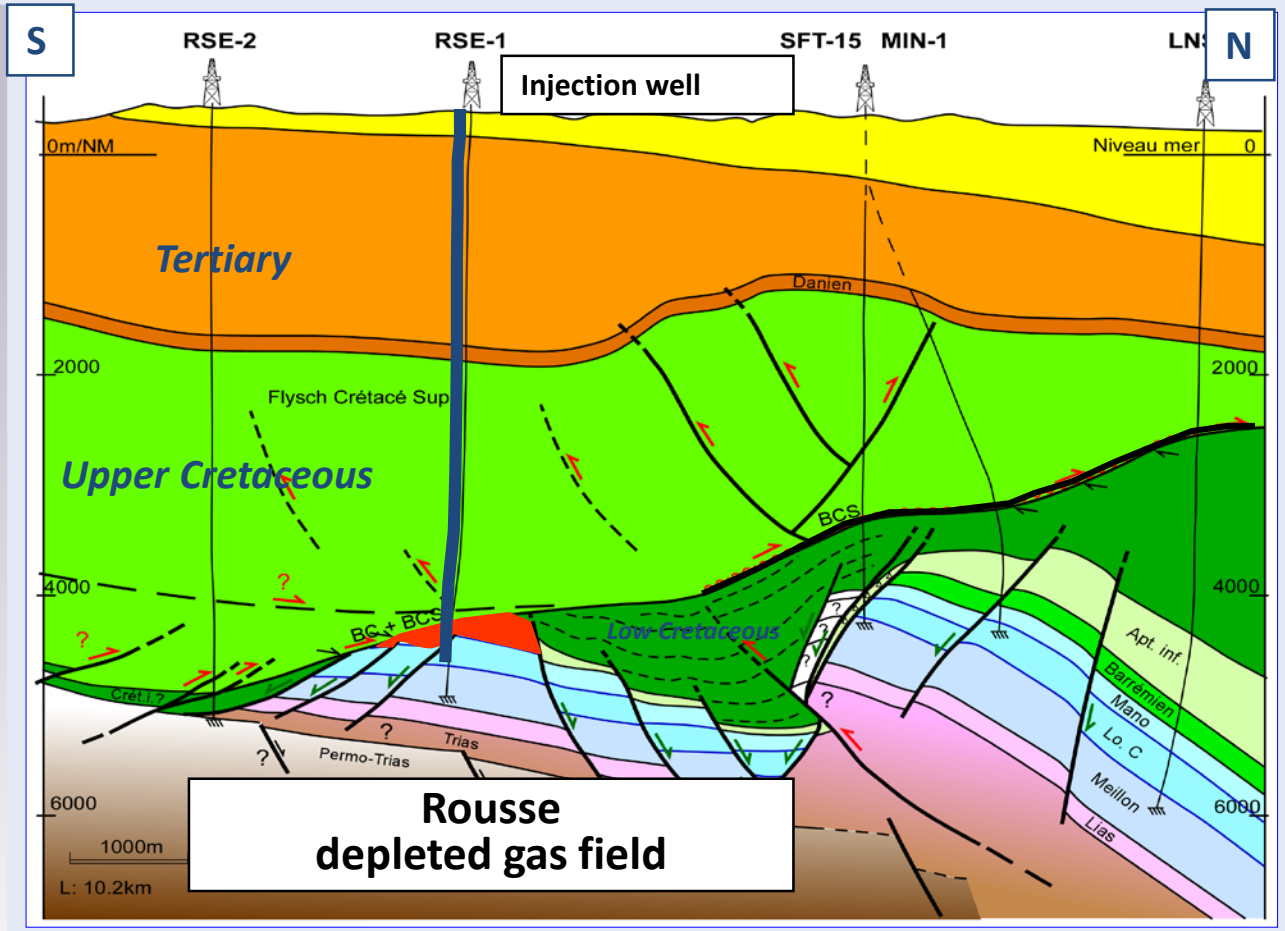
Rousse storage



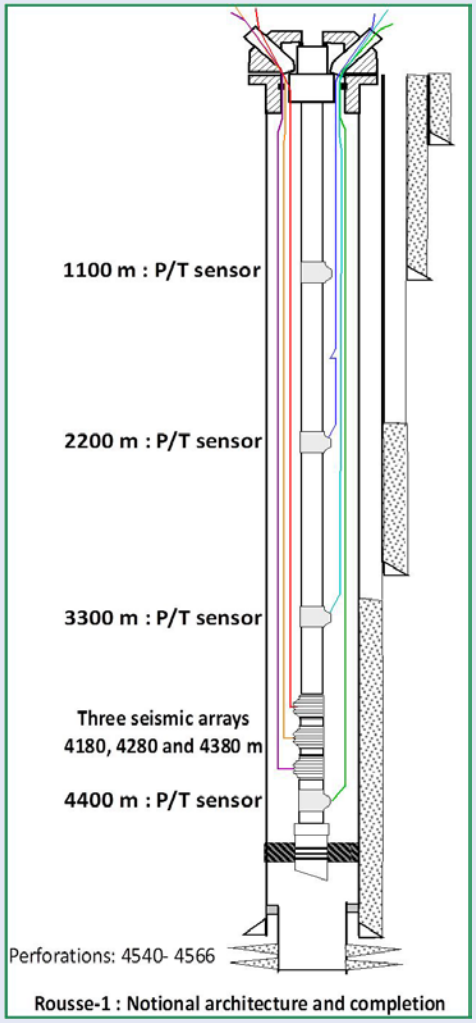
Depleted gas reservoir @ 4500m/GL

Reservoir Storage

- Jurassic fractured dolomitic reservoir
- Depth # 4500m/MSL
- Temp. # 150°C
- Initial P: 485 bars
- P before inj: # 40 bars
- Final pressure: # 90 bars
- Initial CO_2 = 4,6%
- Initial H2S < 1%
- Av. Porosity: 3%
- Av. Perm. = 5mD
- Av. Water saturation: 30%- 40%
- Only one well: RSE-1, producing from 1972 to 2008, 0.9 GSM3 .



Rousse Well-Specific Completion



4 Pressure and Temperature sensors

Objectives:

-Calibrate pressure loss models

-Calibrate reservoir models

-Monitor well injectivity

3 Micro-seismic sensors

Objectives:

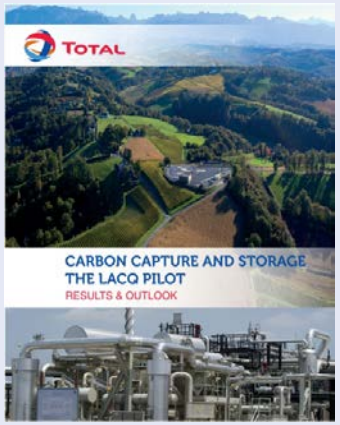
-Assess the impact of the injection near the wellbore

Results from the Rousse Storage Phase

Characterization of a depleted gas reservois as a CO_2 storage site

Monitor the integrity and the environmental impact of a CO_2 storage site

Public Support and Acceptance



Engaging the community, transparency

A brochure was published in 2014 outlining our stakeholder activities

Technical book on lessons learned at Lacq CCS pilot to be published

Available on the GCCSI website