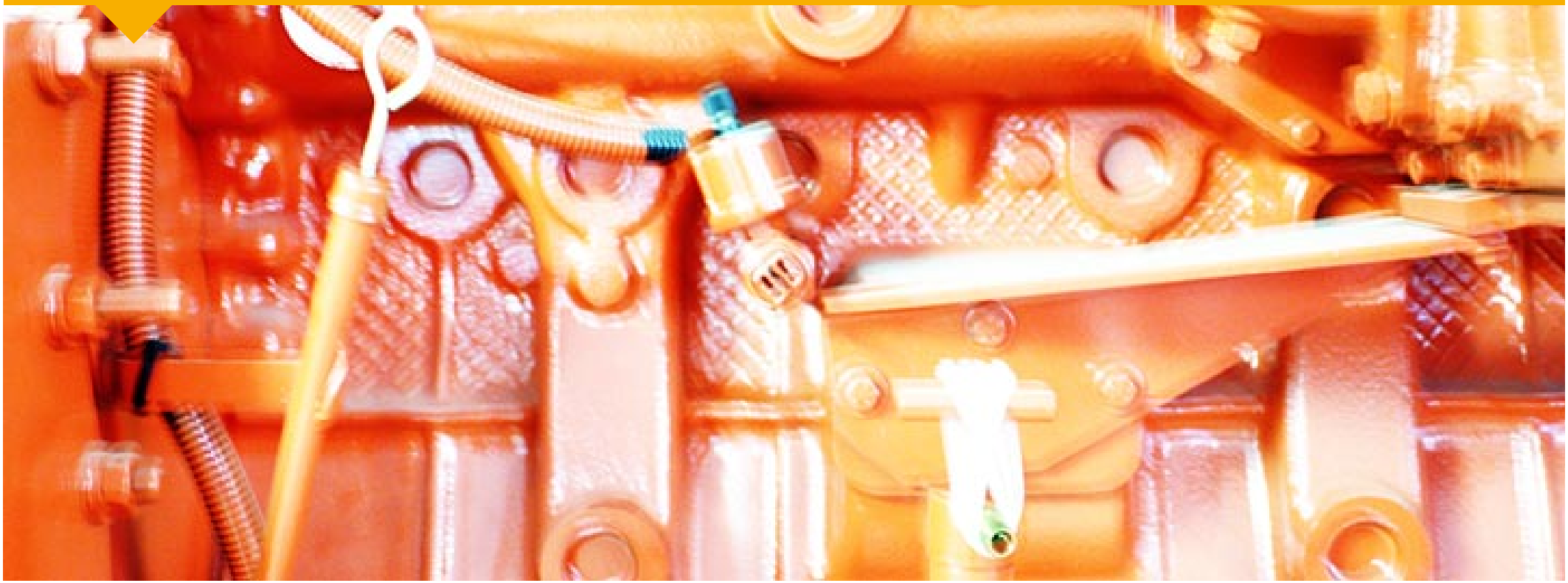
The "CASTOR" – Project and the CO_2 Sequestration Activities of RAG

Torsten Clemens



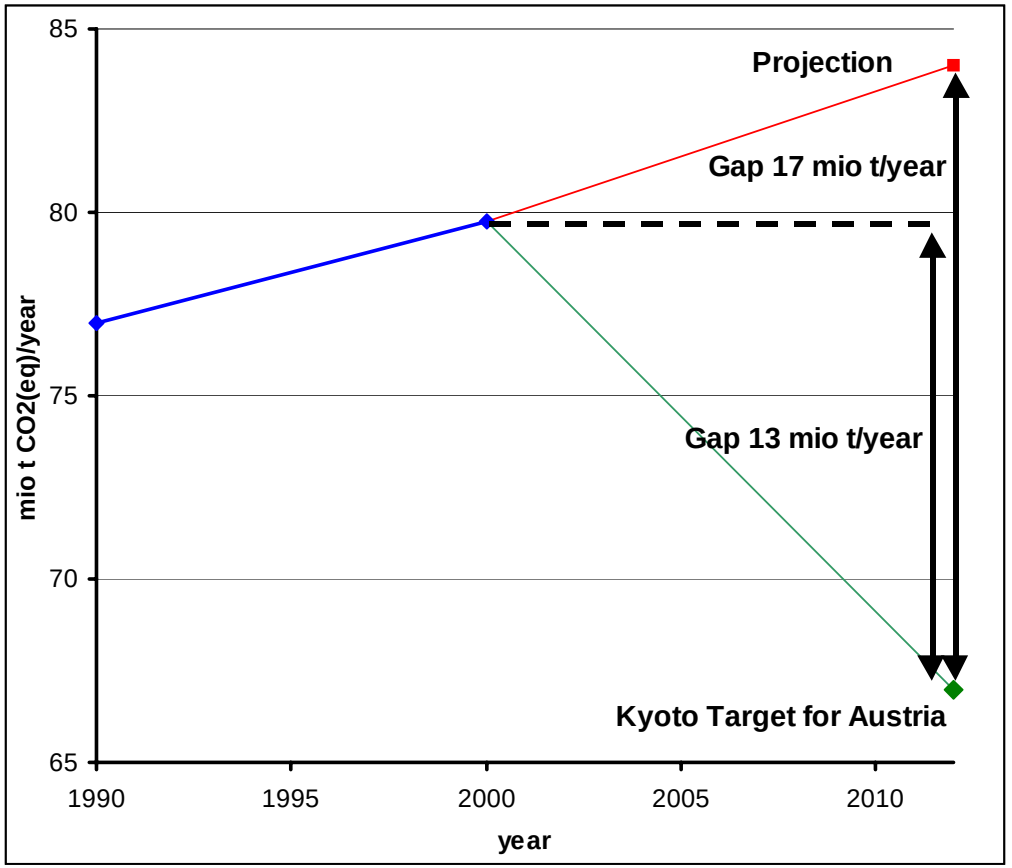
RAG Rohöl-Aufsuchungs AG
Schwarzenbergplatz 16 · A-1015 Wien · www.rohoel.at

Outline

- Introduction
- RAG's activities in Upper Austria
- EU Project: CO_2, from Capture to Storage (CASTOR)
- RAG's participation in CASTOR
- Conclusions

Introduction

- **Austrian target for CO_2 emission reduction: 13 % compared with CO_2 emissions in 1990**
- **However, until 2000 CO_2 emissions increased by 3.5 %**



Introduction

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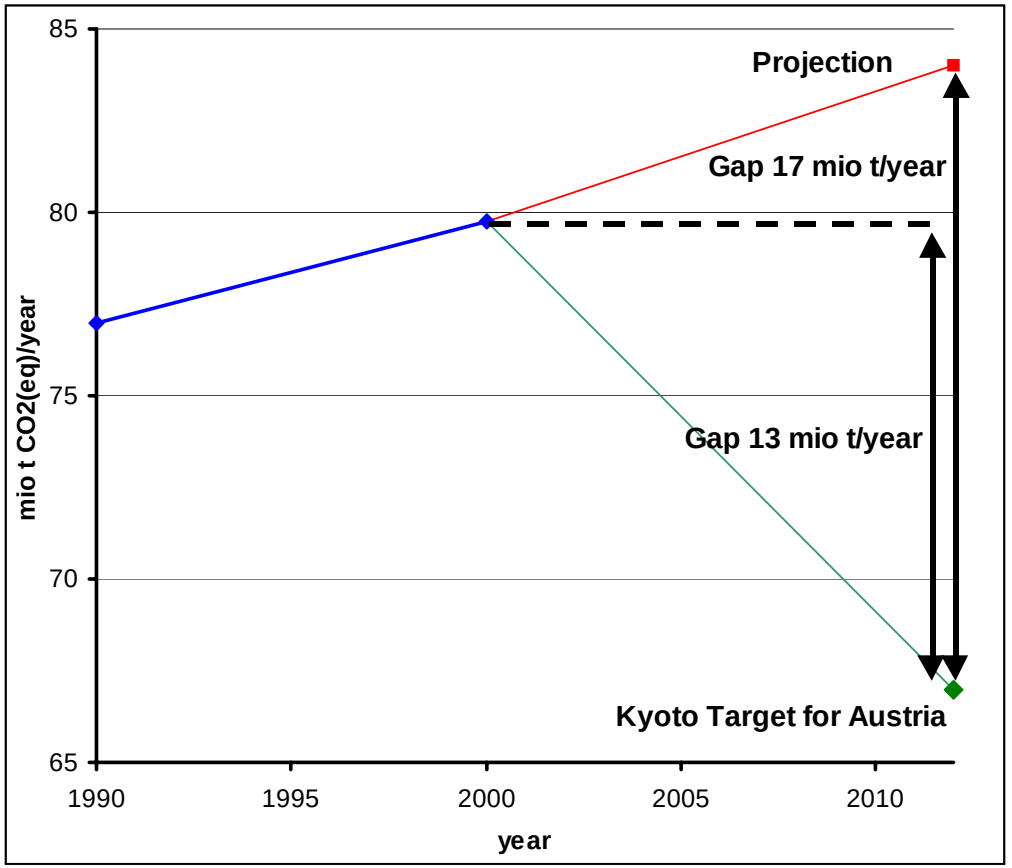
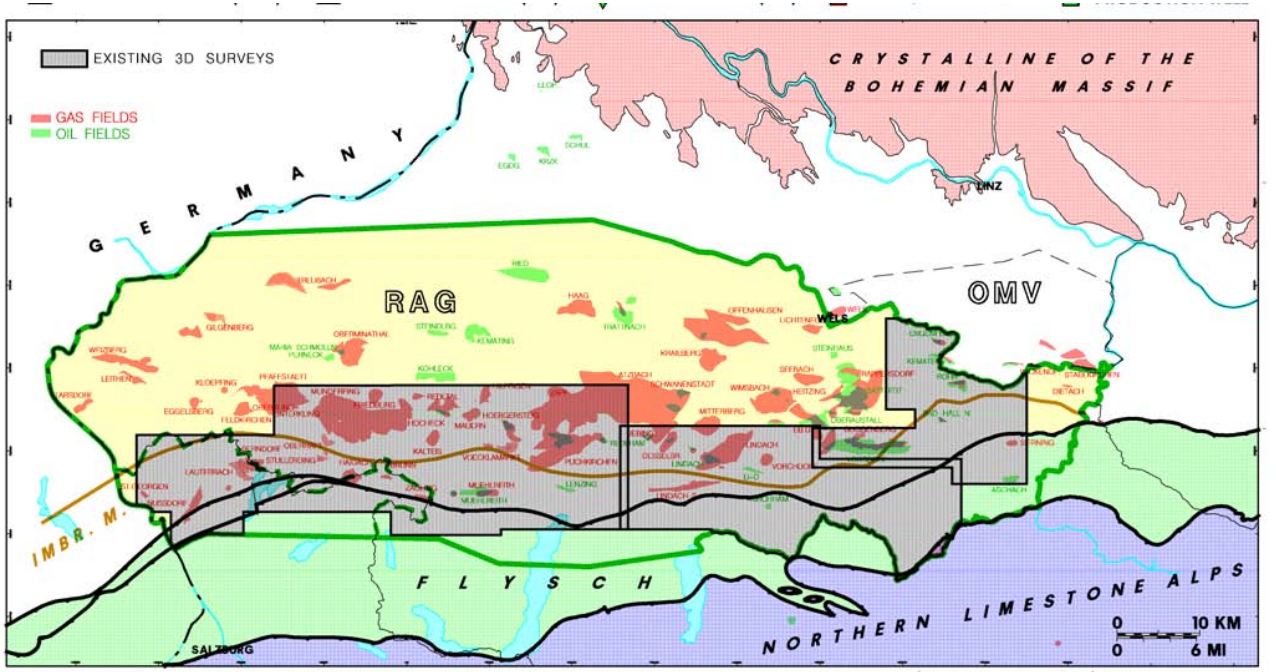
- However, until 2000 CO_2 emissions increased by 3.5 %
- **Greenhouse gas emission reduction can be achieved by:**
  (1) Increasing energy efficiency
  (2) Switching to fuels emitting less CO_2
  (3) Increasing use of renewable energy
  (4) CO_2 capture and storage



RAG's activities in Upper Austria

- In 2004, RAG is producing 700 mio m³ gas and 50,000 t oil from Upper Austria



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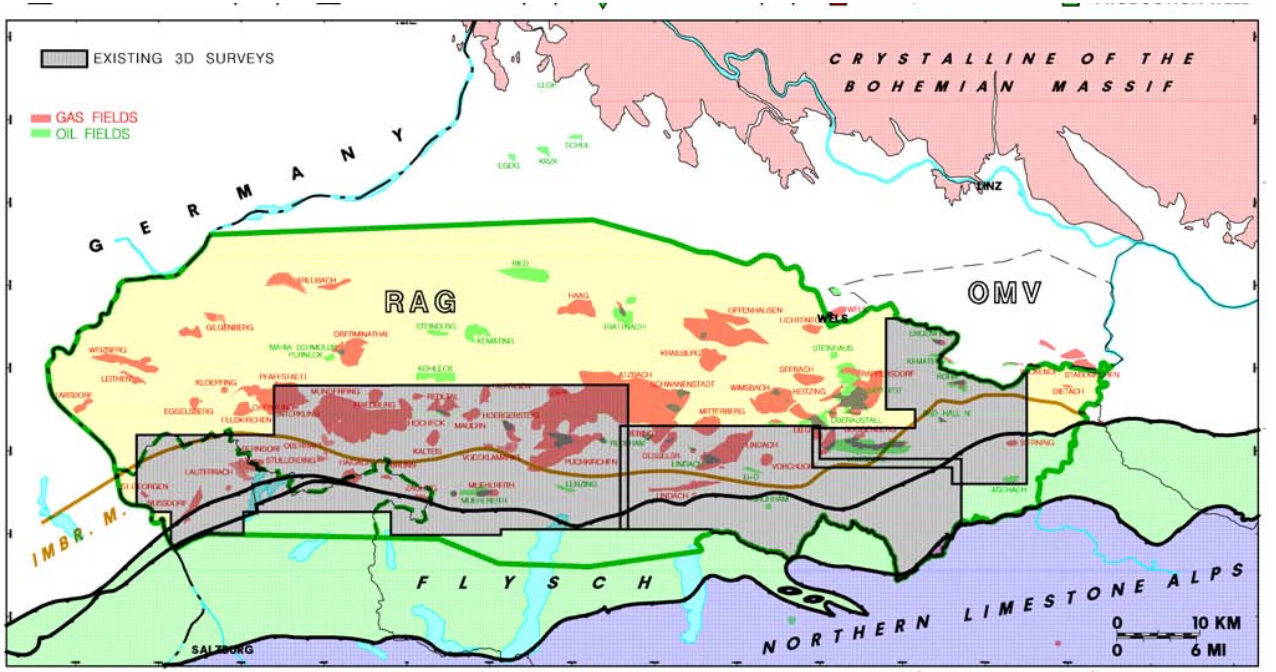

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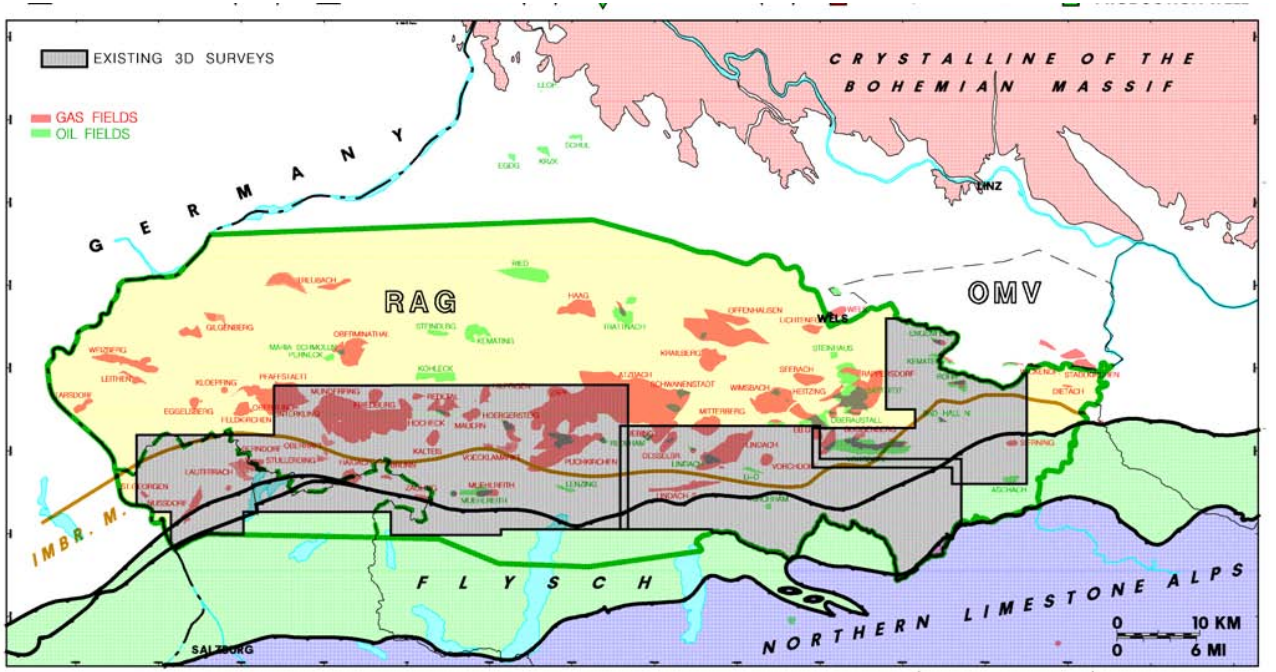

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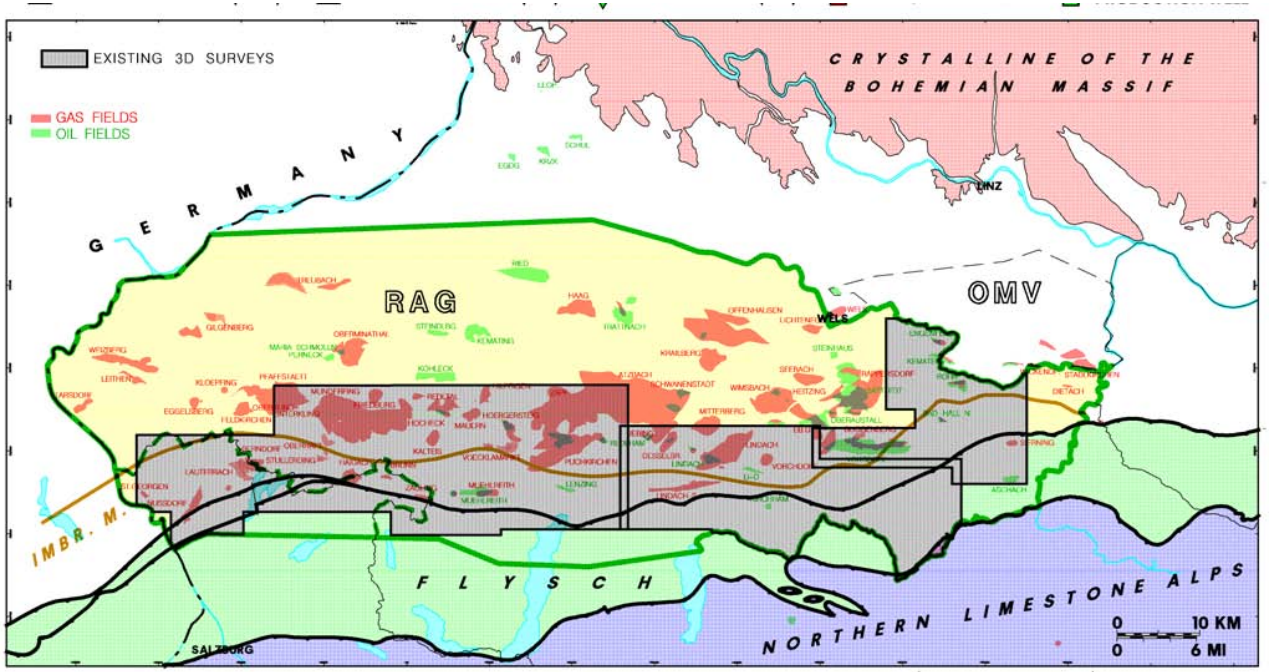

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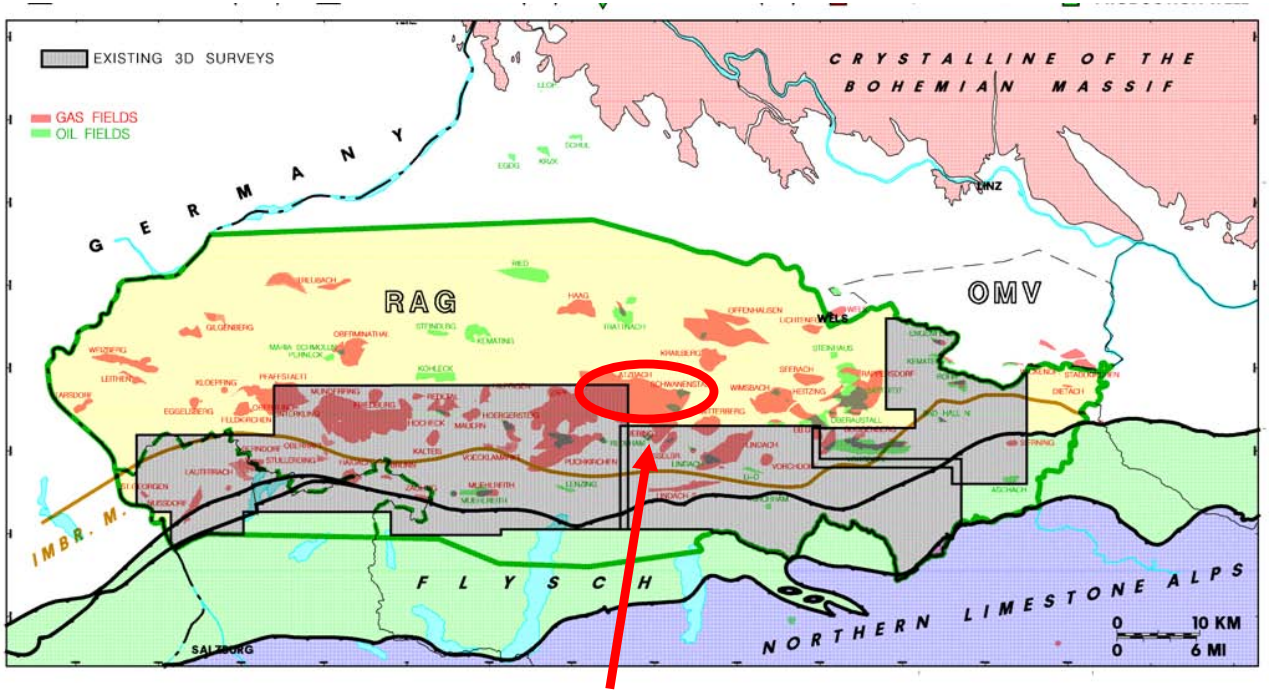

Atzbach-Schwanenstadt field

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CASTOR

CO_2, from Capture to Storage
an European Initiative

CASTOR Objectives / targets

- Reduce the cost of CO_2 post-combustion capture
- Contribute to the feasibility & acceptance of the geological storage concept

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- Reduce the cost of CO_2 post-combustion capture
- Contribute to the feasibility & acceptance of the geological storage concept
- Validate the concept on real site(s)
  - Pilot testing for capture (25 t CO_2 / day)
  - Detailed studies of future storage projects

Consortium participants

R&D
IFP (FR)
TNO (NL)
SINTEF (NO)
NTNU (NO)
BGS (UK)
BGR (DE)
BRGM (FR)
GEUS (DK)
IMPERIAL (UK)
OGS (IT)
TWENTE U. (NL)
STUTTGARTT U. (DE)

Oil & Gas
STATOIL (NO)
GDF (FR)
REPSOL (SP)
ENITecnologie (IT)
ROHOEL (AT)

Power Companies
VATTENFALL (SE)
ELSAM (DK)
ENERGI E2 (DK)
RWE (DE)
PPC (GR)
POWERGEN (UK)

Manufacturers
ALSTOM POWER (FR)
MITSUI BABCOCK (UK)
SIEMENS (DE)
BASF (DE)
GVS (IT)

Co-ordinator: IFP

Chair of the Executive Board: Statoil

Participant outside Europe: Petrobras (Brazil)

CASTOR main components

Strategy for CO_2 Reduction

Budget: 0,9 M€

CO_2 Post-Combustion Capture

Budget: 10,3 M€

CO_2 storage performance & risk assessment studies

Budget: 3,8 M€

Management Dissemination

Budget: 0,75 M€

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WP1.1 Development of CO_2 reduction strategies

WP1.2 Geological storage options for CO_2 reduction strategy

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WP2.1 Evaluation, optimisation & integration of post-combustion capture processes

WP2.2 Identification of most promising liquids

WP3.3 Designed of membrane based processes

WP3.4 Advanced processes

WP3.5 Process validation in pilot plant

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CO_2 storage performance & risk assessment studies

WP3.1 Field case "Casablanca"

WP3.2 Field case “Atz-Sch"

WP3.3 Field case "K13b"

WP3.4 Field case "Snohvit"

WP3.5 Preventive & corrective actions

WP3.6 Criteria for site selection and site management

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Management Dissemination

WP0.1 Project Management

WP0.2 Dissemination & Training

Budget: 0,75 M€

SP1. Strategy for CO_2 reduction

Objectives

- Define the overall strategies required to effect a 10% reduction of EU CO_2 emissions and to monitoring the effectiveness of the strategies (from capture to storage) from a techno-economical point of view.
  - input from other sub-projects and on ongoing research in this field
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- Obtaining data on capture and geological storage capacities from Southern and Eastern Europe (extension of GESTCO European project). The impact of the overall strategies on EU countries, including Candidate Countries, will be taken into account.

SP2. CO_2 post-combustion

Overall Objectives

- Development of absorption liquids, with a thermal energy consumption of 2.0 GJ/tonne CO_2 at 90% recovery rates
- Resulting costs per tonne CO_2 avoided not higher than 20 to 30 €/tonne CO_2, depending on the type of fuel
- Pilot plant tests showing the reliability and efficiency of the post-combustion capture process

Elsam Esbjerg Power unit

SP3. CO_2 Storage Performance & Risk Assessment Studies.

Overall Objectives

- Develop and apply a methodology for the selection and the secure management of storage sites by improving assessment methods, defining acceptance criteria, and developing a strategy for safety-focussed, cost-effective site monitoring
- Improve the "Best Practice Manual" by adding 4 more real-site cases

Four field cases

- Casablanca case (oilfield, Repsol, Spain)
- Atzbach-Schwanenstadt case (gasfield, Rohöl-Aufsuchung AG, Austria)
- K12B case (gasfield, Gaz de France, Netherlands)
- Snøhvit case (aquifer, Statoil, Norway)

Two cross-disciplinary work packages

- Preventive and corrective actions
- Criteria for site selection & site mgmt

Casablanca oilfield (Repsol, Spain)

- **Carbonate oil-field, offshore**
- **Depth: 2500 m**
- **Injection of 0.5 Mt CO_2 / year from the Tarragona Refinery**

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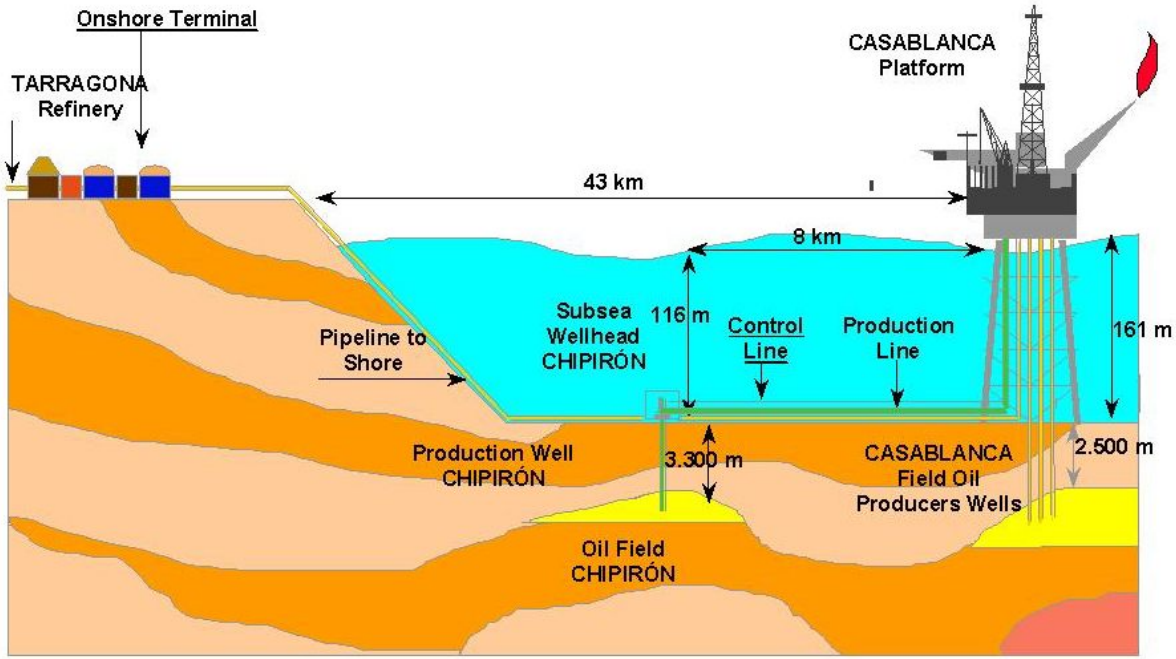
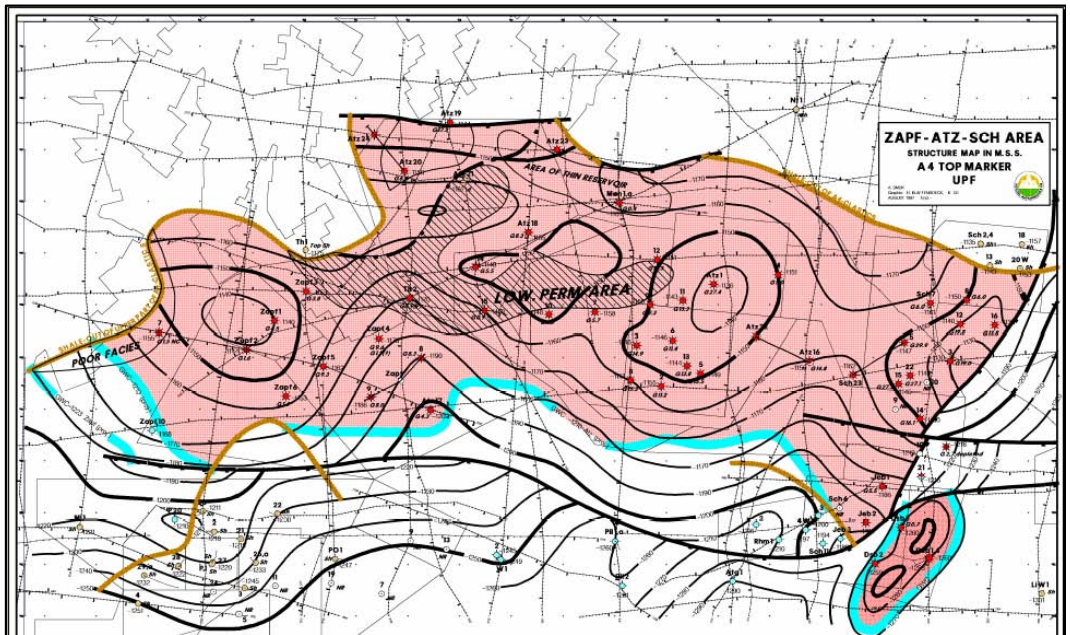
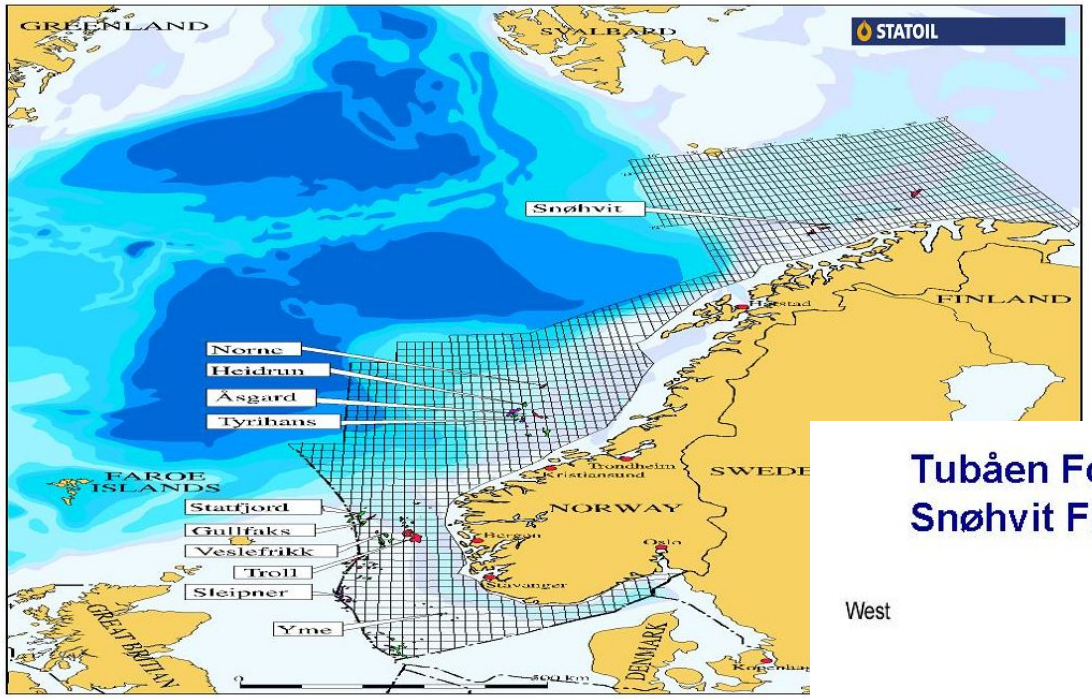


Atzbach-Schwanenstadt Gas Field (Rohöl-Aufsuchungs AG, Austria)

- **Sandstone gasfield, onshore**
- **Depth: 1600 m**
- **Possible injection of 200,000 t CO_2/year**



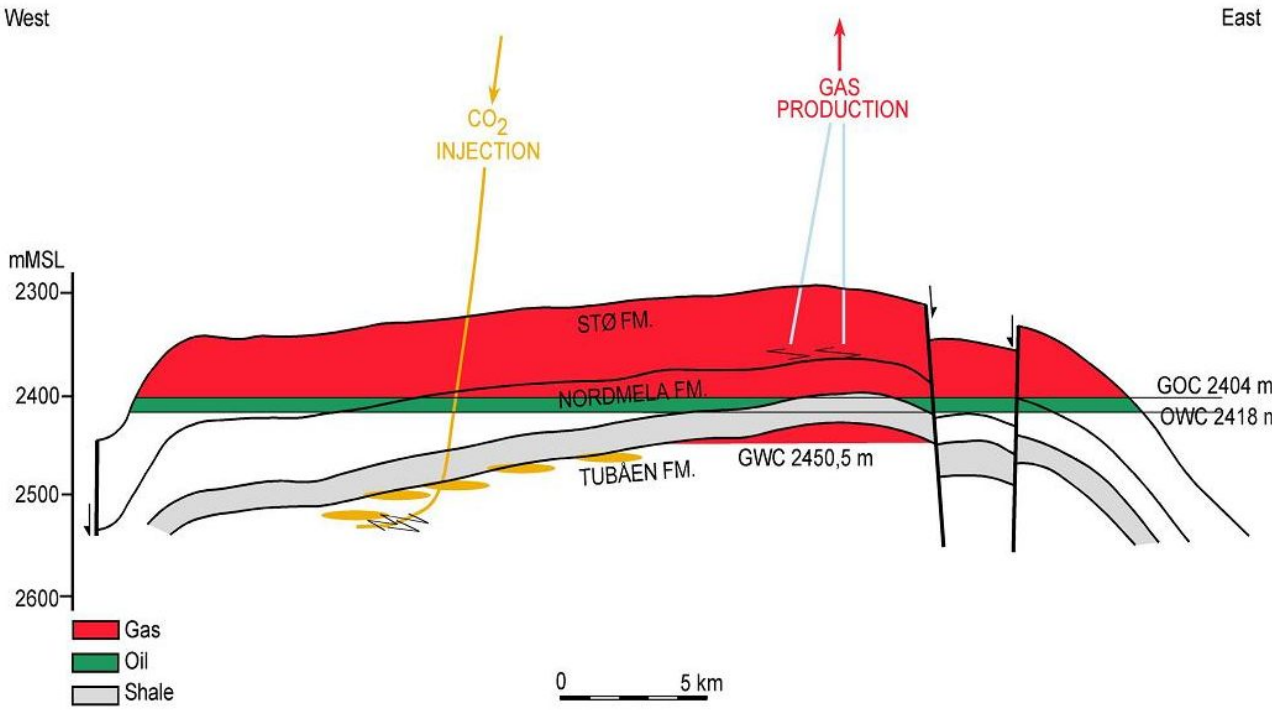
Snohvit Aquifer (Statoil, Norway)



- **Sandstone aquifer, offshore**
- **Depth: 2500 m**
- **0.75 Mt CO_2 per year; Start in Oct 2006 and last for 20 + years**
- **CO_2 source is removal from natural gas before cooling to LNG; limit 50 ppmvol.**

Tubåen Formation storing CO2 under the Snøhvit Field

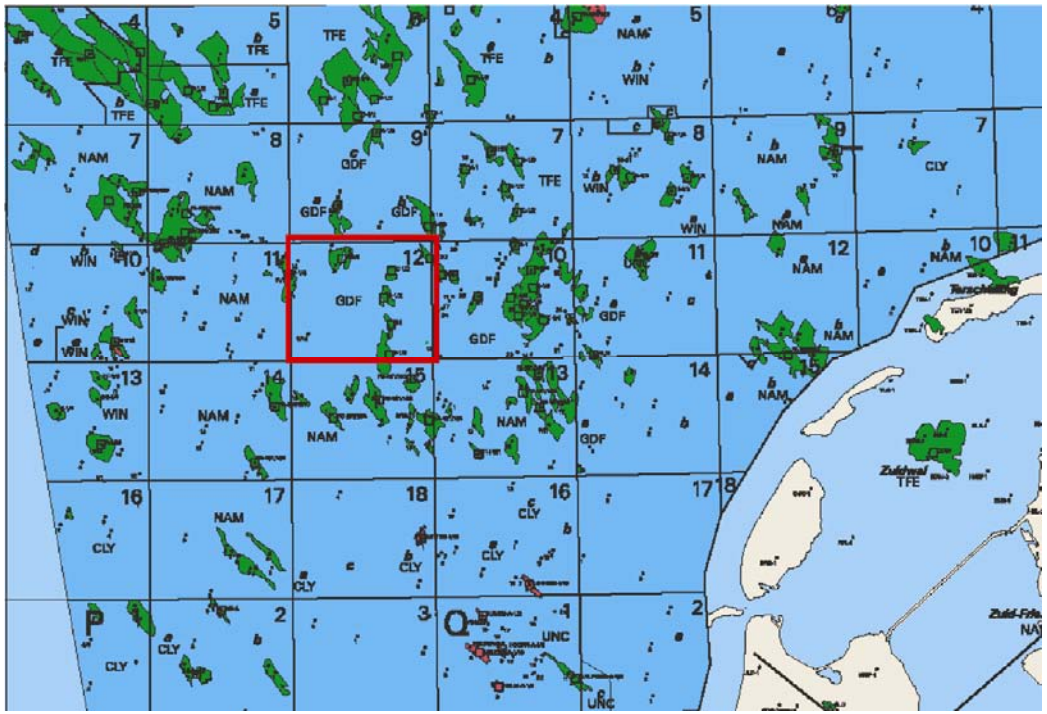
STATOIL

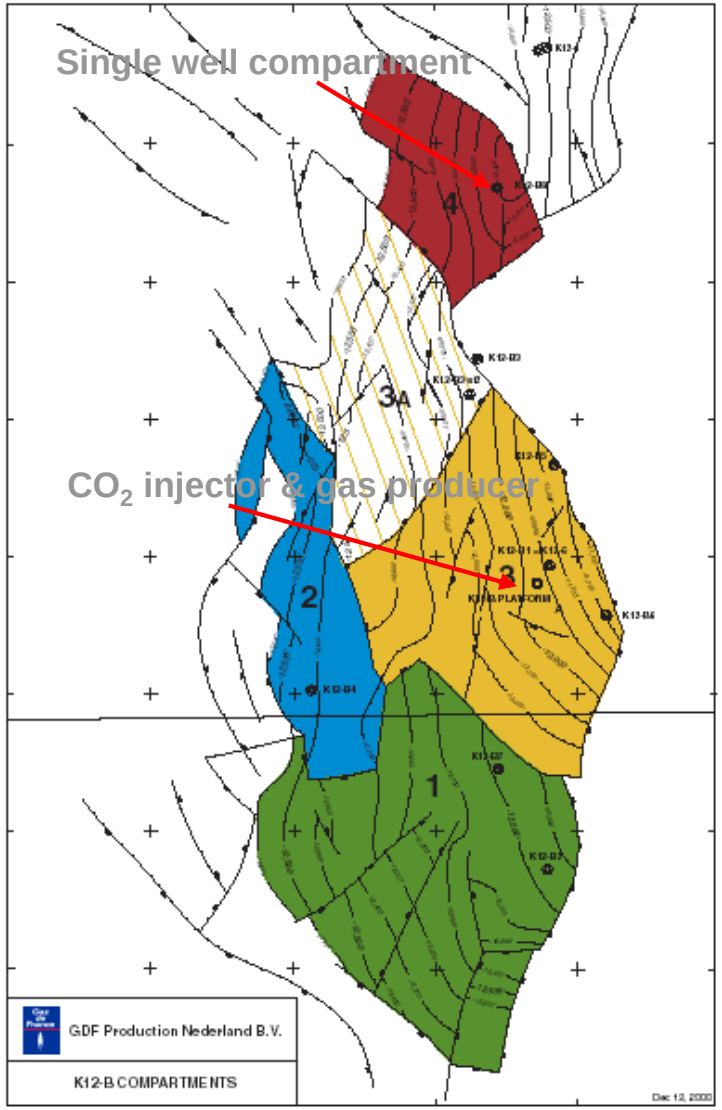


K12b Gas Field (Gaz de France, The Netherlands)

- **Gasfield in Rotliengen clastics, offshore**
- **Depth: 3500-4000 m**
- **Small-scale injection test: 30 000 t/year in mid-2004**
- **400 000 t/year in 2006**

Gaz de France

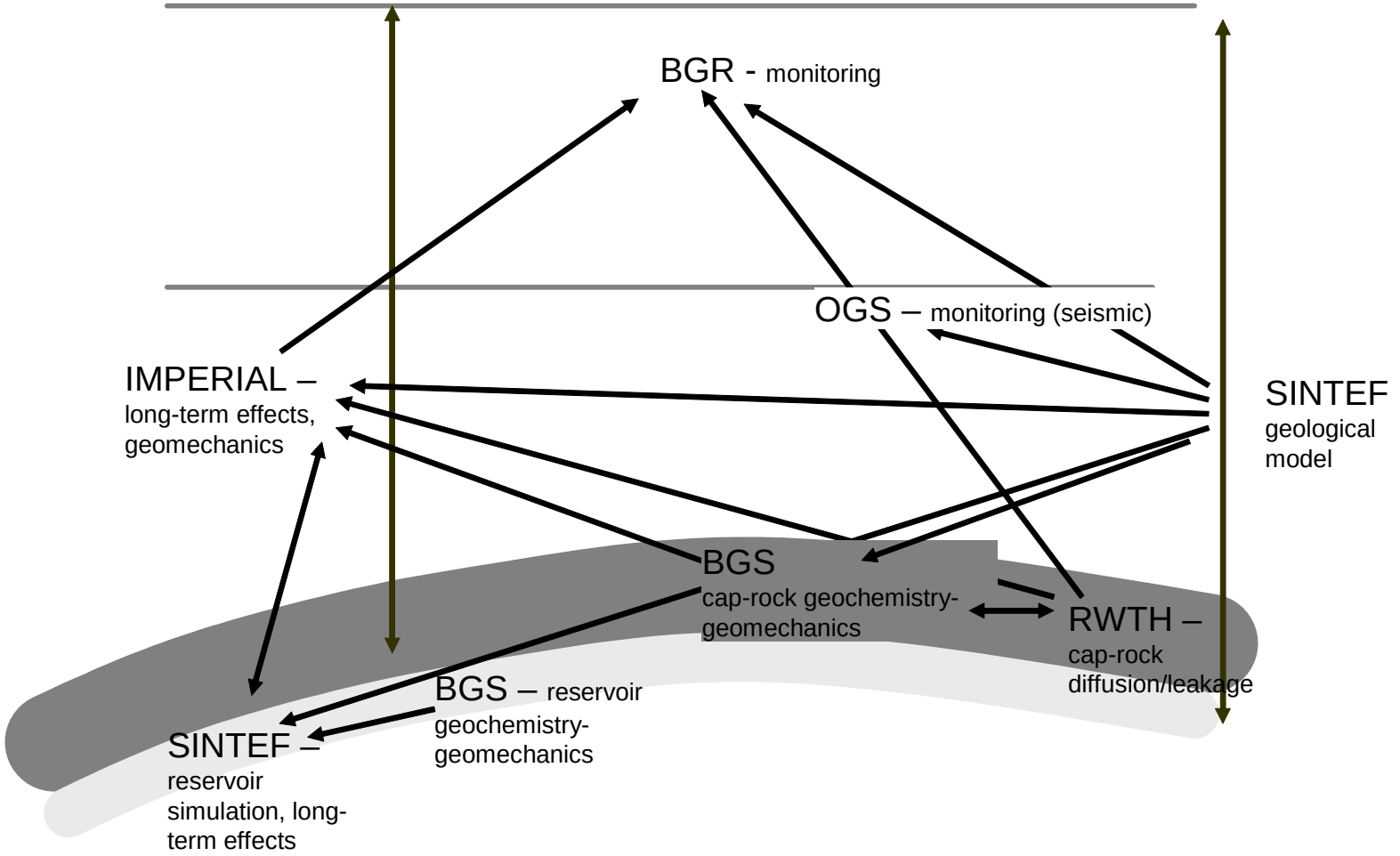




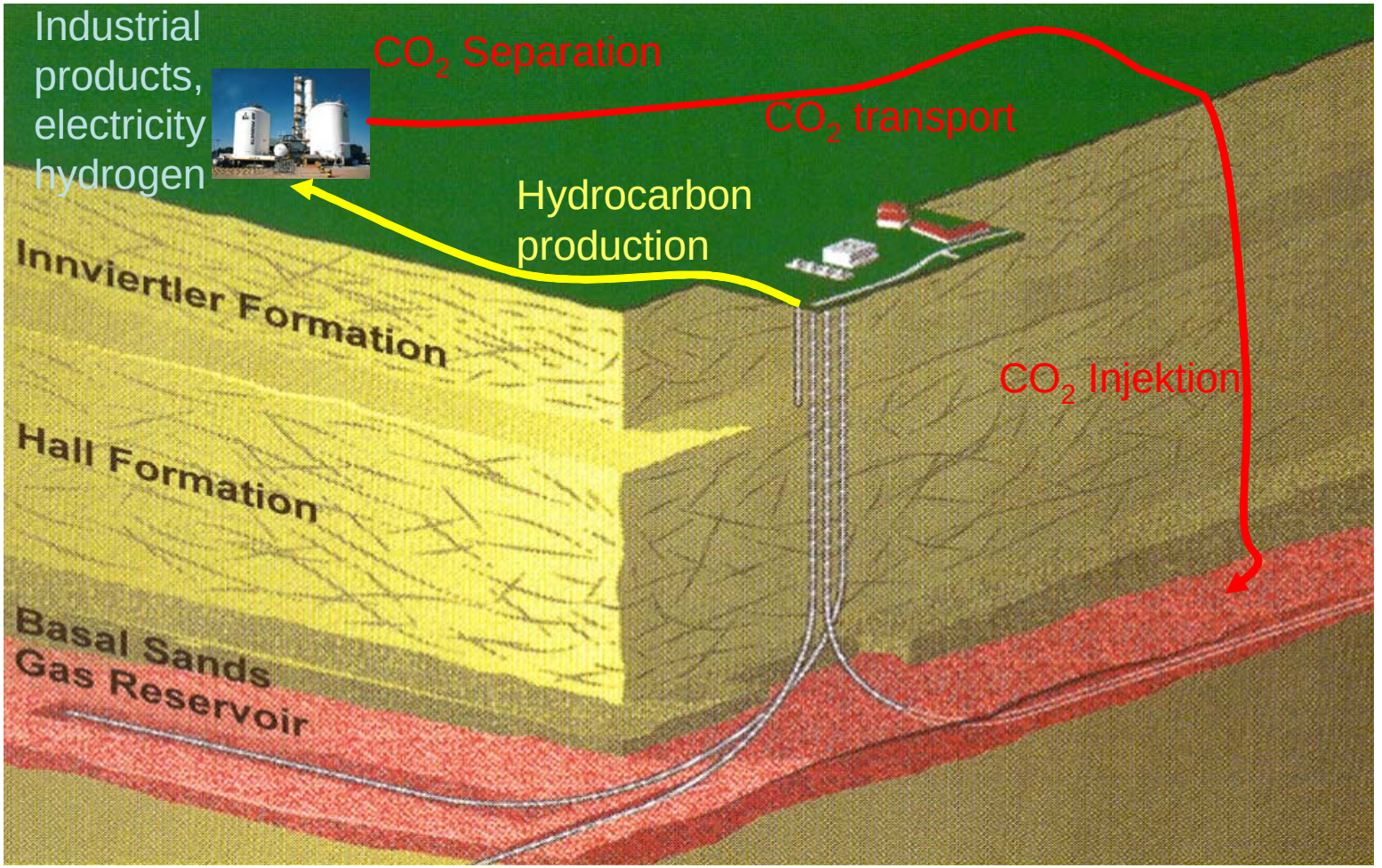
CASTOR Summary

- Budget: 15.8 M€
- EU funding: 8.5 M€
- Industrial funding: 2.2 M€
- Duration: 4 years
- 30 partners from 11 European countries

Austrian part of CASTOR project – RAG involvement



Potential implementation in Upper Austria



Conclusions

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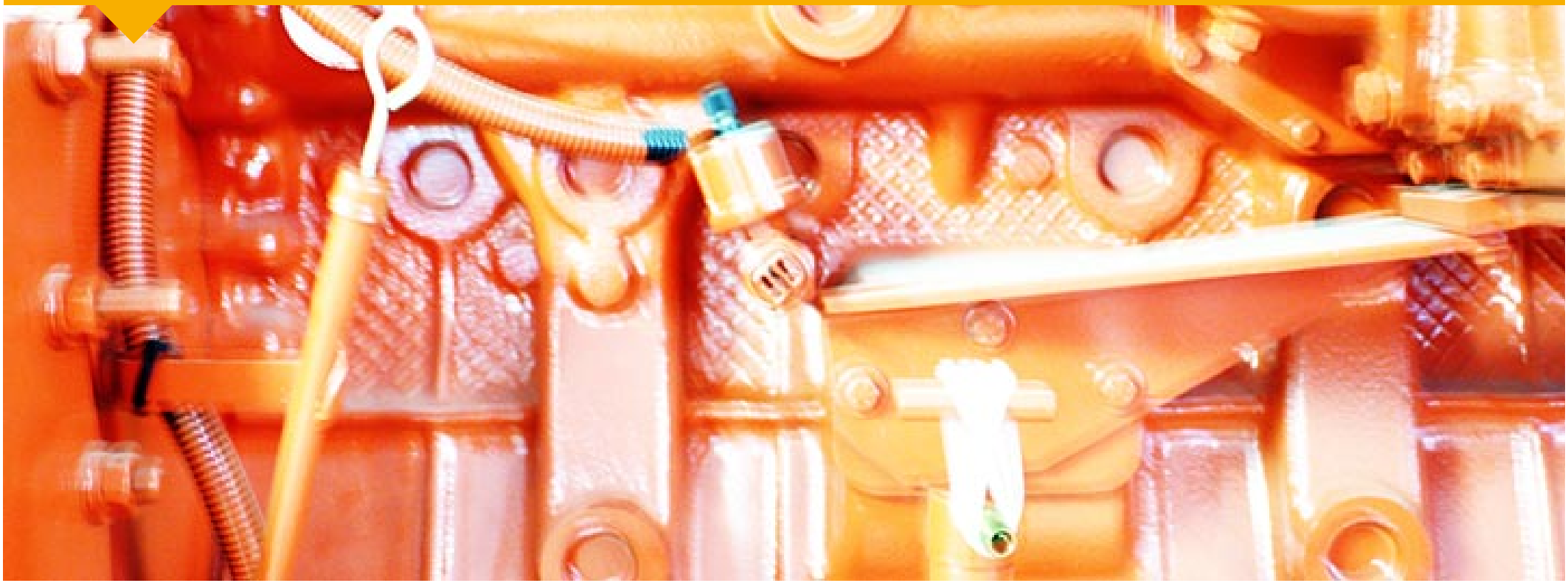

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