

Sixth Annual Conference on Carbon Capture & Sequestration

CCS outside the U.S.

The French CO₂ R&D program Overview, Achievements, Perspectives

Andreas Ehinger, CEA-ANR/NTE
Sylvie Gentier, ANR

May 7-10, 2007 • Sheraton Station Square • Pittsburgh, Pennsylvania



- Why a French CCS program ?
- What are the foundations we can build on ?
- What do we want to build ?
- How do we try to do it ?
- How far have we got ?
- How do we envisage to go beyond ?

- Global Climate Change high on political agenda
 - Willingness to contribute to the international R&D effort, including in CCS
 - ambitious national GHG reduction goal (80% by 2050)



MINISTÈRE DE L'ÉCONOMIE
DES FINANCES ET DE L'INDUSTRIE



Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE



Ministère de l'Écologie
et du Développement Durable

**The Factor 4 Objective: addressing the Climate Challenge
in France**

**Report from the Working Group on
“Achieving a fourfold reduction in greenhouse gas
emissions in France by 2050”**

Chaired by Christian de Boissieu



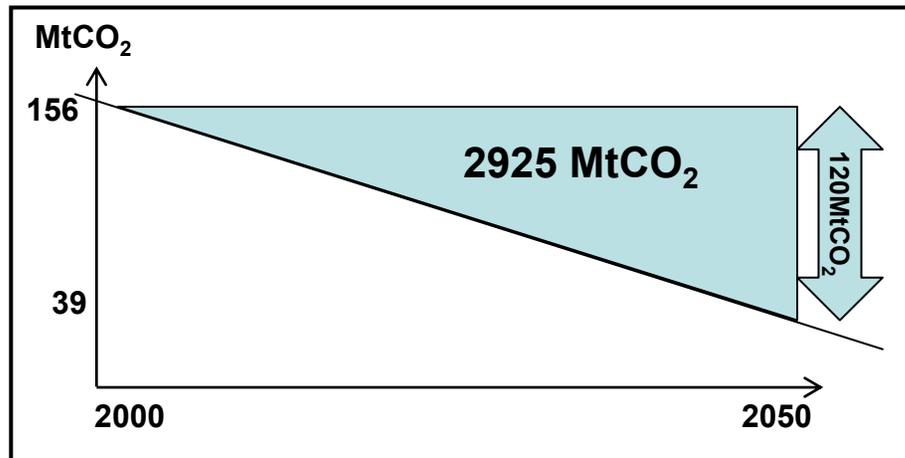
August 2006

<http://www.industrie.gouv.fr/energie/facteur4.htm>

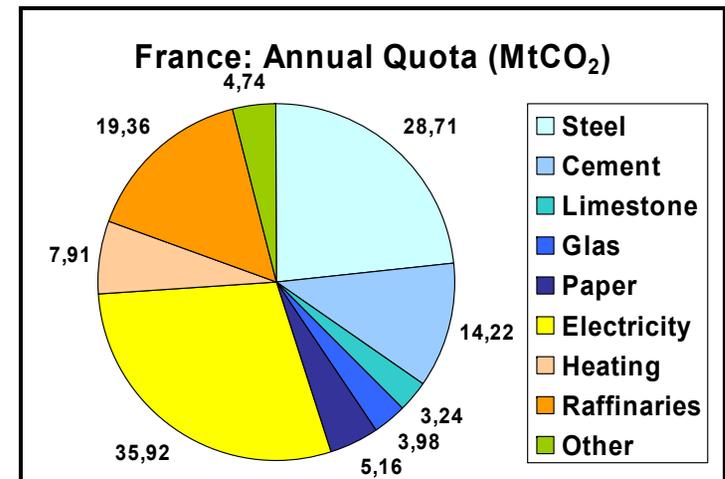


- Total CO₂ emissions 2004: around 535 Mt
- EU-ETS NAP (quotas for units with > 20MW/10ktCO₂) : around 156 MtCO₂/year

- 80% for those units:



- eliminate 120 MtCO₂ in 2050
- partly by CCS
- Sleipner: 1 Mt CO₂/an



French electricity production largely based on nuclear



- Strong earth sciences
 - oil and gas background
 - water and mining background
 - universities and research organizations
- Strong technology providers
 - oil and gas
 - coal technologies
 - industrial gases



- Participation in EU projects (FP3-6)
 - public research organizations (BRGM, IFP, IPGP, ...)
 - private companies (AirLiquide, Alstom, Arcelor, Gaz de France, ...)
- Moderate national funding by
 - hydrocarbon research fund (CO₂ storage, EOR)
 - ADEME (energy efficiency, CO₂ capture)



- A large, integrated research community
 - increase the number of labs / researchers involved
 - span fundamental to applied to industrial researchers
 - cover all pieces of the CCS chain
 - critical mass, cross-fertilization
- An internationally competitive research
 - competitive, project-based funding
 - severe project selection procedures
 - emergence of best-in-class projects
- An efficient research
 - European and international integration
 - leadership and complementarities

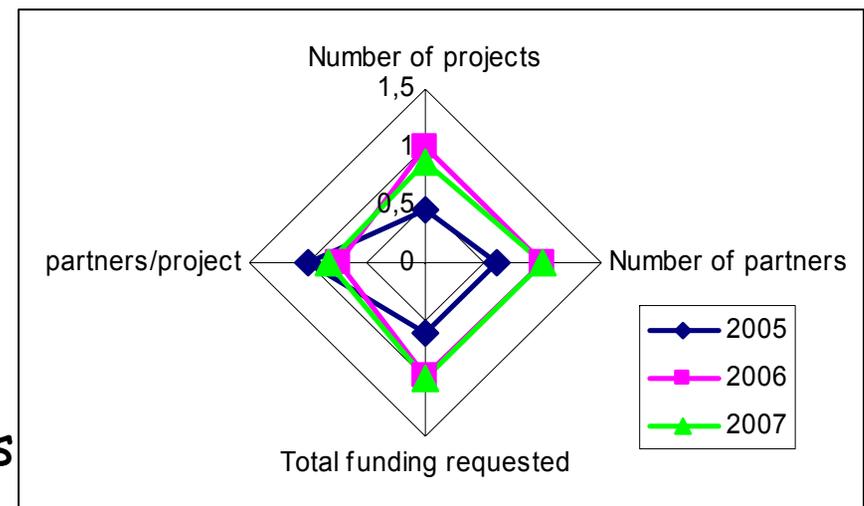
- A large, integrated research community
 - increase the number of labs / researchers involved
 - span fundamental to applied to industrial researchers
 - cover all pieces of the puzzle
 - **critical mass**
- An international research community
 - complementary
 - several research areas
 - **emergence**
- An efficient research system
 - European and international integration
 - **leadership and complementarities**

**the challenge we were
taking up in 2005**



- New (and only) CCS program - funded by ANR, the National French Research Agency
- Agency policy
 - program and project oriented funding
 - competitive research (call for projects)
 - yearly calls
 - multi-annual projects (2-4 years)
 - peer evaluation
 - public-private partnerships (depending on program)
 - funding
 - $\leq 50\%$ for private partners
 - specific project costs for public partners
 - foreign partners welcome, but no funding

- First call 2005
 - limited responses by (the few) established players
- Second call 2006
 - enlarged thematic scope
 - organization of a French CCS day (brokerage event) with 100 participants
 - number of proposals more than doubled, many newcomers
- Third call 2007
 - same thematic scope as 2006
 - brokerage event with 160 participants
 - constant high number of project proposals
 - more newcomers, including SMEs





- Capture and transport
- Storage and MM&V
- Risk, security, regulation
- Innovative / breakthrough concepts
- Socio- and technical-economic studies, social acceptability



- Major themes ...
 - postcombustion capture ...
 - ... with new amines
 - ... with sublimation technique
 - oxycombustion ...
 - ... flameless combustion
 - ... chemical looping
 - materials ...
 - ... membranes
 - ... ab- and adsorbents
- ... and some new topics
 - more materials
 - low-purity oxygen production
 - special processes



- Major themes ...
 - rock-fluid interaction ...
 - ... in storage rocks (reservoirs, aquifers, coal seams)
 - ... in cap rocks
 - site characterization
 - monitoring methodologies and risk assessment
 - well integrity
- ... and some new topics
 - monitoring equipment
 - basalt storage
 - fault dynamics



- Capture / storage
 - ex-situ carbonation
- Legal and regulatory aspects
- Acceptability



- Large and active research community, still growing
- Joint public and private research projects
- Projects on all aspects of CCS
- Good mixture of incremental and breakthrough research



- Maintain high level of involvement of a broad research community
 - foster the French CCS innovation community
- Promote the launch of pilot and demonstration projects
 - Total project in Southern France on track
 - pilot project in Paris basin area being instructed
- Increase international involvement
 - promote participation at international conferences
 - participation in ERAnet (EU instrument for coordinating national R&D programs)
 - French-German Symposium on CO₂ storage
 - other initiatives being envisaged

Sixth Annual Conference on Carbon Capture & Sequestration

CCS outside the U.S.

The French CO₂ R&D program Overview, Achievements, Perspectives

Andreas Ehinger, CEA-ANR/NTE
Sylvie Gentier, ANR

May 7-10, 2007 • Sheraton Station Square • Pittsburgh, Pennsylvania