

Entrepreneurial Ideas & an EU Perspective on CCS

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Opportunity?

- Worked on the design and construction of high pressure gas (H2S) injection wells in Tengiz, Kazakhstan.
- Heard more and more about CO2 in the news and in various publications.
- Thought that here lies an unique opportunity for a small company. A power company will not have the expertise to drill wells nor manage reservoirs and oil companies wouldn't be interested for lack of core business.
- Thought of two basic business models.
 - Offer the engineering services to have the wells designed and drilled, and manage the reservoir on a time based scale.
 - Own the wells outright. Raise the capital to drill the wells myself (secure geologic injection rights) and charge per unit of CO2 sequestered in the wells (basically a pass through for the credits).




Pursuit of idea

- Met with Big Sky Carbon Sequestration Partnership.
- 1st step was to secure injection rights.
- Dialog with Montana BLM (no clear rights established at that time).
- Understood the technology of gas injection so I felt this was not a technical issue so much as a commercial issue.
- Established Google Alerts aimed at Sequestration (like drinking from a fire hose).
- Read Bjorn Lomborgs book "Cool It".
- Attended SPE (Society of Petroleum Engineers) CCS workshop in Dubrovnik, Croatia.


2nd Thoughts

- Failure of Lieberman-Warner bill.
- No clear financial assurance that this would be viable in the near future for self employment.
- Must answer the question “Why would a company sequester CO2?”
- Reevaluate short term (< 5 years) opportunities for CCS.




SPE Workshop – The Big Picture

- The role anthropogenic CO2 emissions play in the ecological, societal and political implications for the world at large.
- Looked at Sources of CO2 and the methods with which they can be curbed, one of which is CCS.
- CCS has the potential to solve a quarter of the global Green House Gas problem.
- Initiatives underway to encourage widespread deployment.
- CCS industry would equal today's oil & gas industry.



SPE Workshop - Rationale for CCS

- World dependency upon fossil fuels will continue for decades with increasing emissions.
- Efficiency gains and non fossil energy do not guaranty that fossil fuels will not be burnt.
- Social/behavioral changes are slow.




SPE Workshop – Technical Challenges

- Tools and Methodologies to ensure safe and cost effective storage.
- CO2 Stream Characteristics
- Characterization and Modeling
- Integrity – Storage and Well
- Monitoring
- Well Integrity Risk Assessment
- Storage Risk Management



SPE Workshop – Case Studies of Geological Storage of CO2

Oil Fields – Croatia (INA – Naftapljin EOR)
Gas Fields – France (Totals’ Lacq)
Coal – Holland (Shell’s ECBM)
Aquifers – Algeria (BP’s In Salah)




SPE Workshop – Roadmap to Successful CO2 Storage

- Legal and Regulatory Framework
- Economics
- NGO view (Bellona Foundation)



SPE Workshop Conclusions


- Global warming is under way and will be difficult to mitigate. **Cost of inaction would be the highest.**
- CCS is one of many mitigating factors and must be used
- Need for economic (and/or political) incentives.
- Regulatory framework almost ready in EU
- Need to Develop monitoring technology
- Human resources problem
- Public "Communication" to achieve buy-in from all stakeholders
- CCS to be included in Al Gores' Climate solutions



Current Status of some CCS (non EOR) Projects


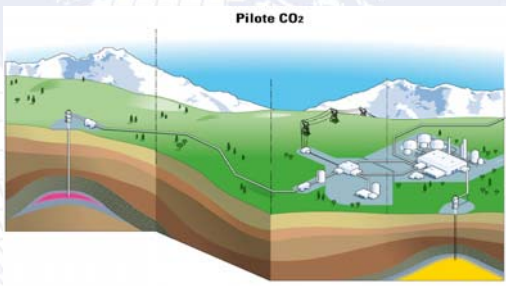
- Lacq (France)
 - Will sequester 150,000 tons of CO₂/year
 - CO₂ from an oxyfuel combustion process.
 - Injection into the depleted Rousee gas reservoir.
- CO₂Sink (Germany)
 - Has injected 2,000 tons of CO₂ (4 months).
 - Injection into a saline aquifer.
- In Salah (Algeria)
 - Has injected 2.46 million tons of CO₂
 - Relative Cost differential of \$6/ton to sequester (CO₂ stripped from Natural Gas).
 - Injection into a saline aquifer with a gas cap.
- Sleipner (Norway)
 - Since 1996 Statoil has injected over 12 million tons of CO₂.
 - Avoids levying of Norway's \$50/ton tax on offshore CO₂ emissions (CO₂ stripped from Natural Gas).
 - Injection into a saline aquifer ABOVE the oil zone.

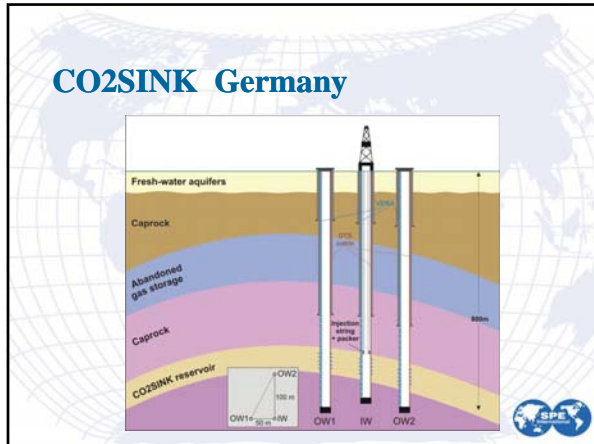
TOTAL Approx. 1.6 million tons of CO₂/year injected

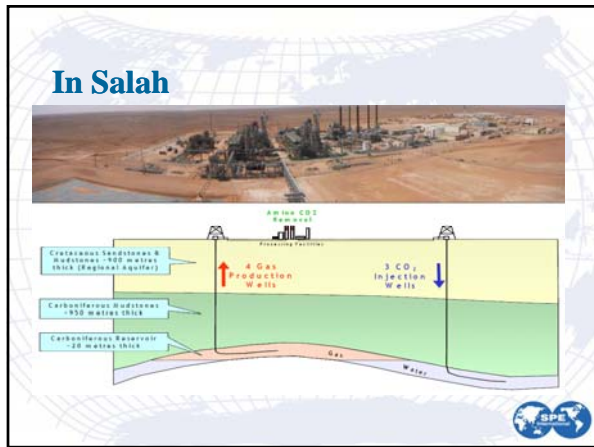


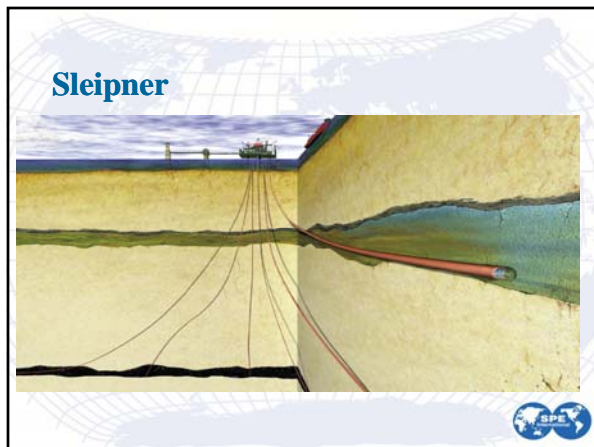
Lacq, France

Pilote CO₂



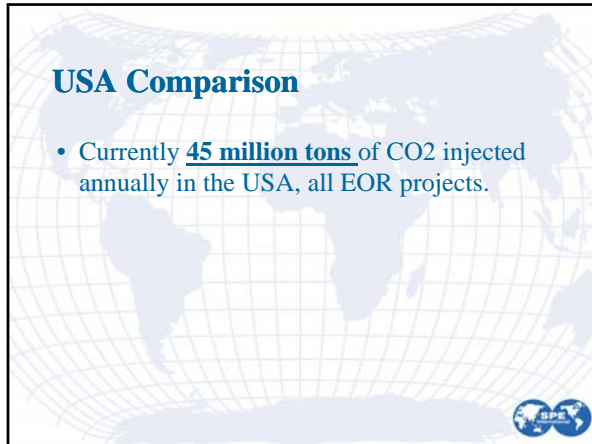






USA Comparison

- Currently **45 million tons** of CO2 injected annually in the USA, all EOR projects.



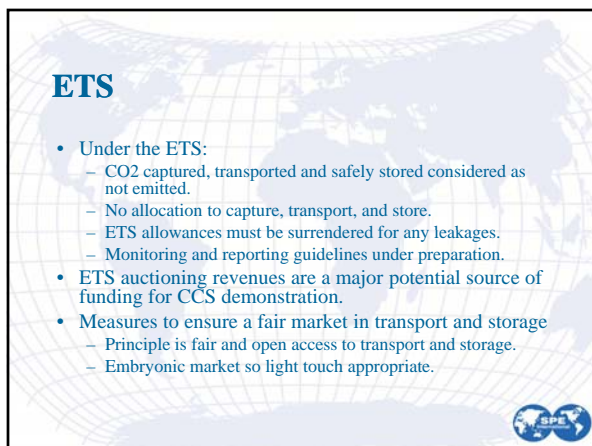
European Initiatives Quick Overview

- Kyoto Protocol signed in 1997 and ratified in Feb 2005.
- All A-1 countries committed to reduce the GHG emissions by 5.2% during 2008 – 2012 compared to 1990.
- The benefits of limiting climate change outweigh the costs of action (Stern Report).
- EU commitments are to Reduce emissions by 20% by 2020 (or 30% if jointly agreed with other developed countries) by:
 - Improving EU's energy efficiency by 20% by 2020.
 - Increasing renewables to 20% by 2020.
 - **Promote CCS (12 large scale demo plants by 2015)**
 - **Strengthen the EU ETS (Emission Trading Scheme)**



ETS


- Under the ETS:
 - CO2 captured, transported and safely stored considered as not emitted.
 - No allocation to capture, transport, and store.
 - ETS allowances must be surrendered for any leakages.
 - Monitoring and reporting guidelines under preparation.
- ETS auctioning revenues are a major potential source of funding for CCS demonstration.
- Measures to ensure a fair market in transport and storage
 - Principle is fair and open access to transport and storage.
 - Embryonic market so light touch appropriate.



CCS Legislation


Three Parts of the Process

- Capture – Regulated by IPPC Directive
- Transport – Regulated as for natural gas transport.
- Storage – no existing regulation




Environmental Security of Storage Sites

- Site Location
 - Member States have sole right to decide which areas in their territory are to be made available.
 - Where exploration is allowed, standard non-discrimination provisions apply.
- Site Selection
 - Integrity of project depends crucially on the initial choice.
 - Criteria are established for prior assessment of the site.
 - Condition of use is that the assessment shows that under the proposed conditions of use, there is no significant risk of leakage or impacts on human health or the environment.
- Monitoring plan to confirm expected behavior of CO2 in site and detect leakage.
- Commission may review permits.




Liability and long-term stewardship

- Liability measures in case sites do leak
 - Competent authority immediately notified and corrective measures taken.
 - Environmental Liability Directive applies for any local damage.
 - ETS allowance must be surrendered for any leakage.
 - Financial provision for future liabilities.
- Transfer of responsibility to the state under clear conditions to avoid distortion of competition.
 - The site must be safely closed and sealed.
 - While site represents a significant risk it remains the operators' responsibility.
 - Transfers to the state when all available evidence indicates complete containment of CO2 for the indefinite future.




Removal of barriers to CCS deployment

- Water Framework Directive amended to allow CO2 storage in saline aquifers.
 - Same environmental condition as for natural gas.
- Waste legislation adapted to remove from scope CO2 transported and stored in accordance with this framework.




Enabling vs. Mandating CCS

- Enabling
 - Member States determine whether and where CCS will happen.
 - Companies decide whether to use CCS on the basis of conditions in the carbon market.
- No mandatory CCS at this stage
 - Let the market work: The revised ETS will ensure a robust carbon price and action on demonstration will bring CCS costs down.




Contribution of CCS to Climate Goals

- Some impact already in 2020 but major contribution comes after that.
- In 2030:
 - A 32% reduction in emissions in 2030 would be €60bn (40%) more expensive than without CCS.
 - Carbon Price in 2030 would be 46% higher than would otherwise be the case.



EU CCS Summary


- Clear enabling legal framework that can serve as an international model on risk management, liability, long-term stewardship and other management issues.
- Market-driven deployment.
- Impact assessment evidence shows that CCS can make a substantial contribution towards reducing the cost of major CO2 reductions.
- Substantial finance available from ETS auctioning revenues, including for CCS demonstration.



Public Awareness

As of 2002 there are 407 underground natural gas storage facilities in operation in the United States.

- 340, or 84%, were depleted reservoir facilities;
- 38, or 9%, were aquifer facilities and
- 29, or 7%, were salt cavern facilities.



Storing CO2 is similar to storing natural gas – a common practice. The Olympic stadium in Berlin sits on a large gas store.

"What if CCS leaks" must be balanced against "What happens if we do not urgently deploy CCS"?

