

CCS: Fact and Fiction
A.K. Booer, CUEN CCT Symposium
June 24, 2008

Carbon Services

Schlumberger

Joint Science Academies' Statement: Climate Change Adaptation and the Transition to a Low Carbon Society



June 10, 2008

- Academia Brasileira de Ciências, Brazil
- Royal Society of Canada, Canada
- Chinese Academy of Sciences, China
- Académie des Sciences, France
- Deutsche Akademie der Naturforscher Leopoldina, Germany
- Indian National Science Academy, India
- Accademia Nazionale dei Lincei, Italy
- Science Council of Japan, Japan
- Academia Mexicana de Ciencias, Mexico
- Russian Academy of Sciences, Russia
- Academy of Science of South Africa, South Africa
- Royal Society, United Kingdom
- National Academy of Sciences, United States of America

Conclusions:

“We urge all nations, but particularly those participating in the 2008 G8 Summit in Hokkaido, Japan, to take the following actions:

- Call on G8+5 governments to agree, by 2009, a timetable, funding, and a coordinated plan for the construction of a significant number of CCS demonstration plants.
- Prepare for the challenges and risks...
- Take appropriate economic and policy measures...
- Promote science and technology co-operation...
- Urge governments to support research...

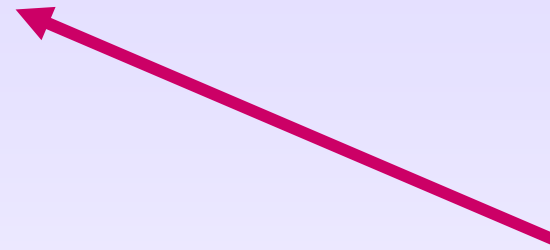
As national science academies, we commit to working with our governments to help implement these actions.”

A National newspaper reports on CCS...

June 10, 2008

“Carbon capture technology is still unproven at industrial scale, but the government believes it could remove 90% of the CO₂ released by Britain's fossil fuel power stations, and alone achieve almost one third of the country's emission-cut targets.”

“Carbon capturing facilities have to be built next to power stations so they can extract carbon dioxide from power station fumes. Advocates of the technique believe it will be safe to pump the captured gas into deep underground cavities or into the ocean.”



WRONG

Carbon Capture & Storage

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Partly TRUE



Capture



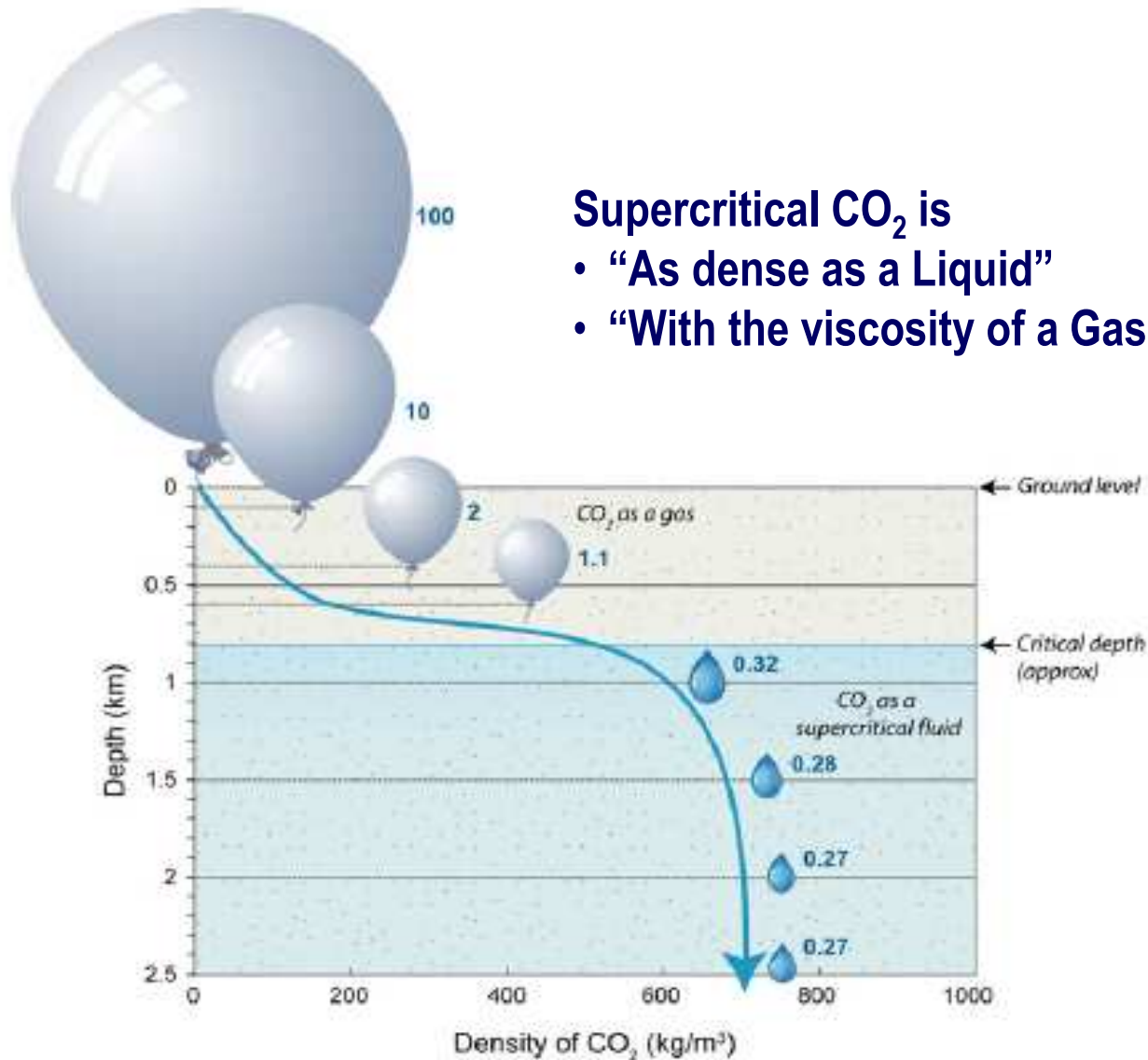
Transport



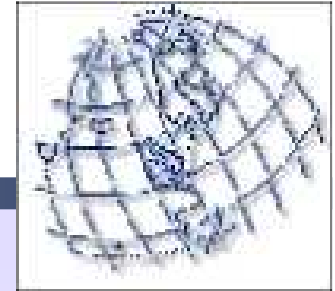
Storage

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Not just a gas : CO₂ – density and volume as a function of depth



“Cavities” and “Oceans” ...



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Totally FALSE

OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic

June 28, 2007:

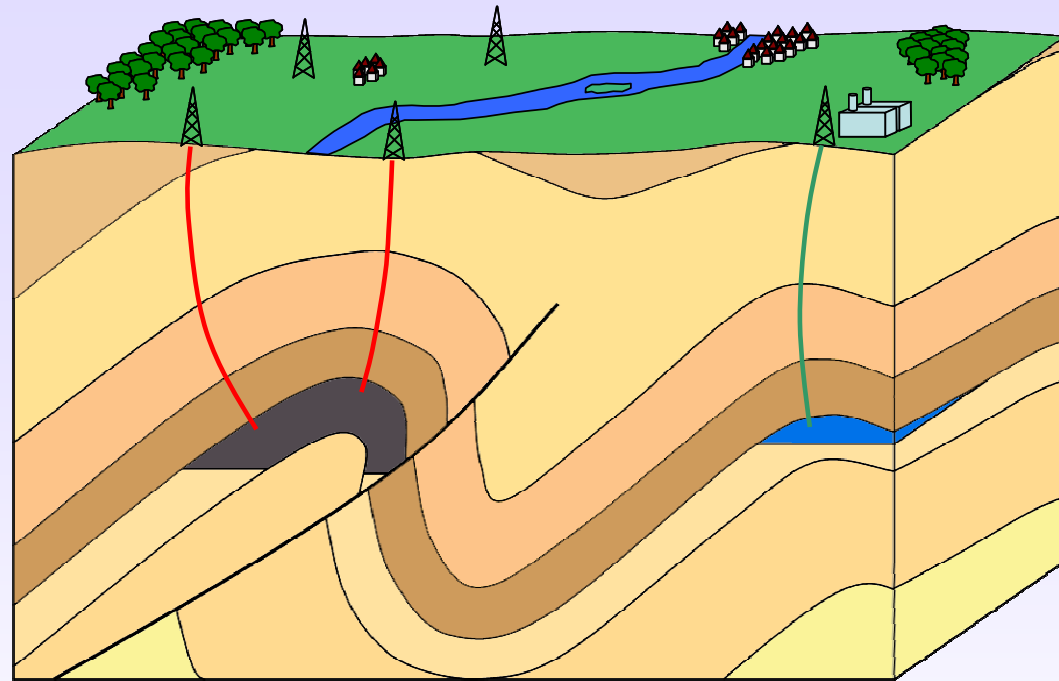
- OSPAR has adopted a Decision to ensure environmentally safe storage of carbon dioxide streams in geological formations ...”
- “The Commission has also adopted a Decision to legally rule out placement of CO₂ into the water-column of the sea and on the seabed, because of the potential negative effects.”

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Options for Storage

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- Depleted oil or gas fields
- Deep saline formations
- Unmineable coal seams
- “Deep” means 1 – 4 km
- Additionally, can sometimes inject into oilfields to provide ‘enhanced oil recovery’



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TWO KEY POINTS:

Reservoirs are NOT huge “cavities”...
...but ‘solid rocks’ acting like a sponge.

CO₂ is NOT a gas, at these temperatures and pressures, but
like a dense liquid.

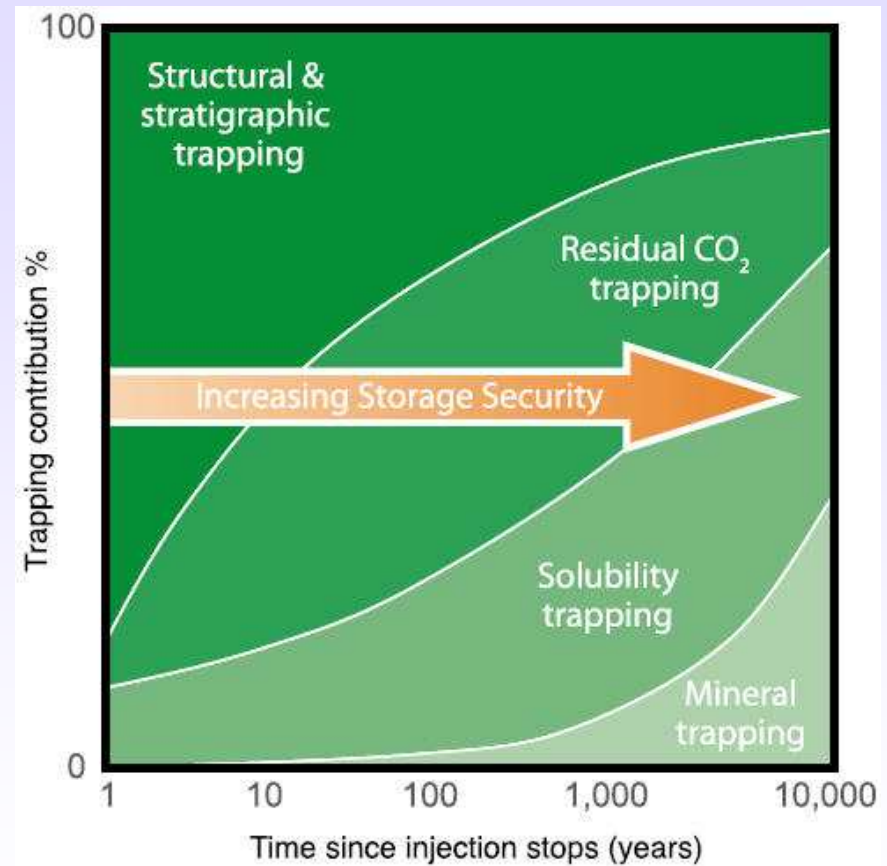
Storage mechanisms & containment

Storage sites evolve over time...

- Structural & stratigraphic trapping
- Residual – in pore space
- Solubility – in water
- Mineralisation – “cast in stone”

- Oil/gas fields and natural analogues demonstrate storage time of millions of years.

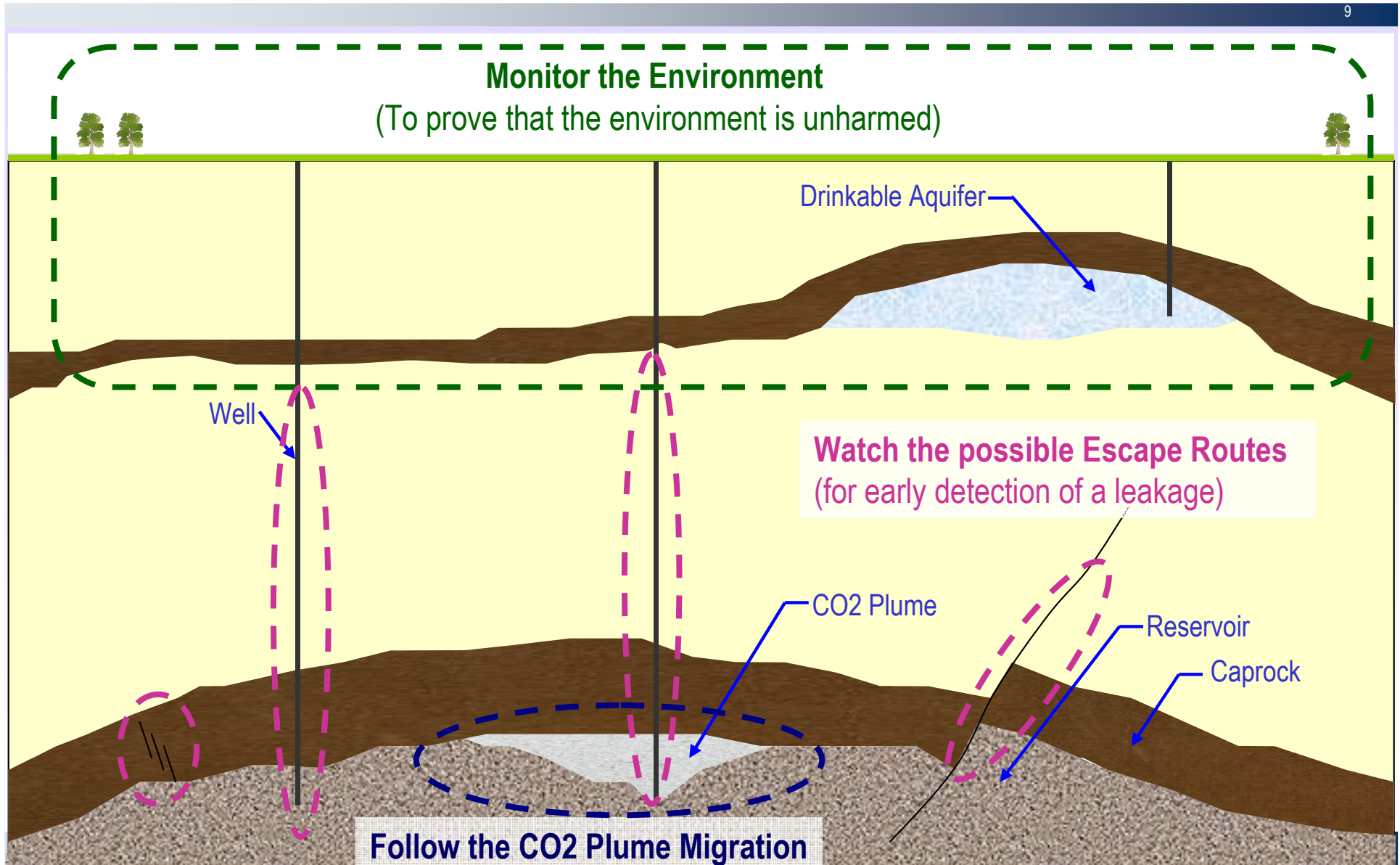
- Most injected CO₂ dissolved or fixed to minerals after ~10,000 years.



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from IPCC, 2005

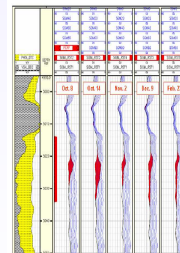
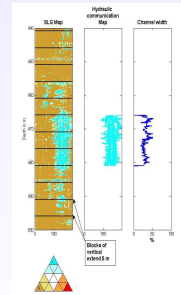
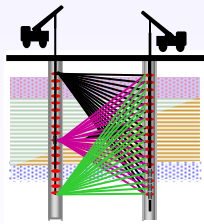
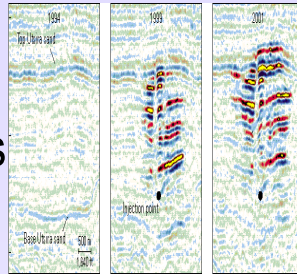
Monitoring – 3 Objectives



Monitoring methods

- Geophysical Techniques

- Timelapse Seismic
- Electromagnetic
- Gravimetry
- Microseismics



- Well Logging Techniques

- Formation measurements – CO₂ saturation, temperature, pressure
- Fluid Sampling
- Wellbore Integrity - cement, casing

- Environmental Monitoring

- Aquifers
- Surface
- Atmospheric

Industrial scale ?

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FALSE



Injecting CO₂ – Current large scale Projects

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Not on an industrial scale ... ?



Weyburn



Sleipner



In Salah

Courtesy of IEA Weyburn CO2 Storage and Monitoring Project, BP, and StatoilHydro

Key Projects - worldwide



- R&D European Consortia**
- CO2ReMoVe
 - CO2GeoNet
 - MOVECBM
 - COSMOS
 - ANR Monitoring
 - SURENL
 - Ramore
 - COACH
 - CO2STORE
 - SACS
 - CO2 SINK
 - GRASP
 - Scotland CO2 Consortium
 - CASSEM
 - ...

Case study lessons (1)

- There IS currently no full-scale coal-fired power station with CCS
 - Full-scale “demonstration” projects are needed to show system integration
- There IS over 30 years of industry expertise in pumping CO₂ into geological formations
 - There is a lot of existing technology, the safety issues are manageable
 - EOR (Enhanced Oil Recovery using CO₂) is NOT the same as long-term storage
- Sleipner
 - Offshore storage is feasible
 - Importance of monitoring during injection to understand reservoir structure
 - Fiscal driver: Carbon taxes work!
- In Salah
 - Remote regions have fewer public acceptance issues
 - Policy driver: National & Corporate

Case study lessons (2)

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- Weyburn
 - CO₂ from industrial processes can be piped long distances
 - CO₂ injection in an area familiar with oilfield operations has public acceptance
 - Business driver: CO₂ has value
- Research projects / universities / consortia
 - There are still important questions to study
 - Technology will continue to develop
- Miller and Draugen
 - EOR revenues are not necessarily sufficient financial incentives
 - The window of opportunity for North Sea EOR is closing
- On-going commercial activities
 - The business has already started

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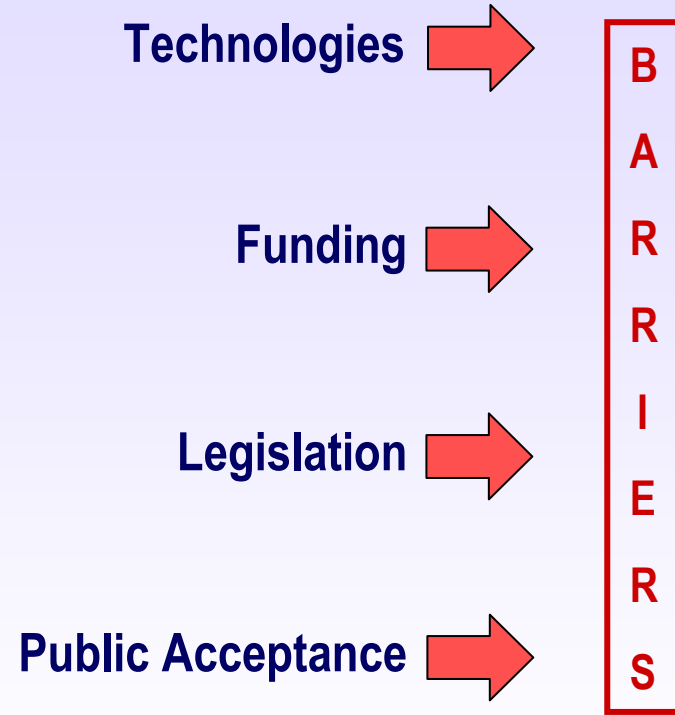
CCS contribution to emission cuts



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TRUE



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- “**Technologies should be developed and deployed** for carbon capture, storage and sequestration (CCS), particularly for emissions from coal which will continue to be a primary energy source for the next 50 years for power and other industrial processes.”
- “This will involve governments and industry working collaboratively to develop the **financial and regulatory conditions** needed to move CCS forward and international coordination in the development of demonstration plants.”

“**Given the time-lags inherent in the global energy system, actions need to be taken now to reach the desired target by 2050.**”



