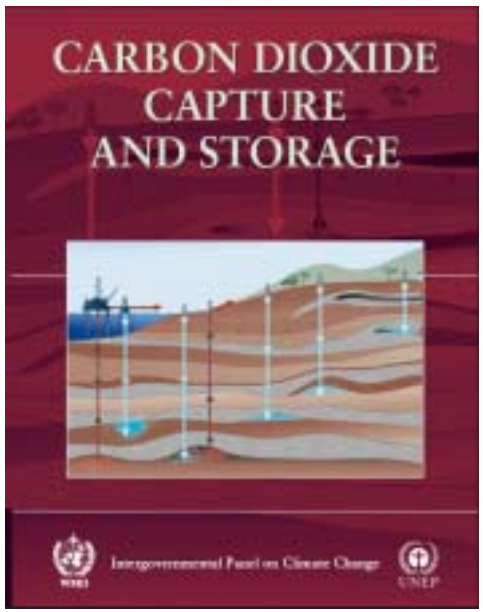
The IPCC Special Report on Carbon dioxide Capture and Storage

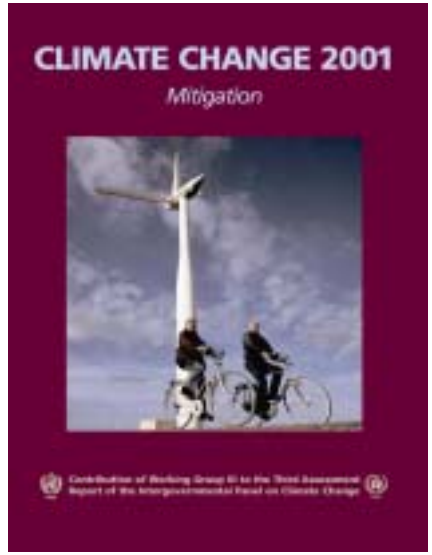


Heleen de Coninck

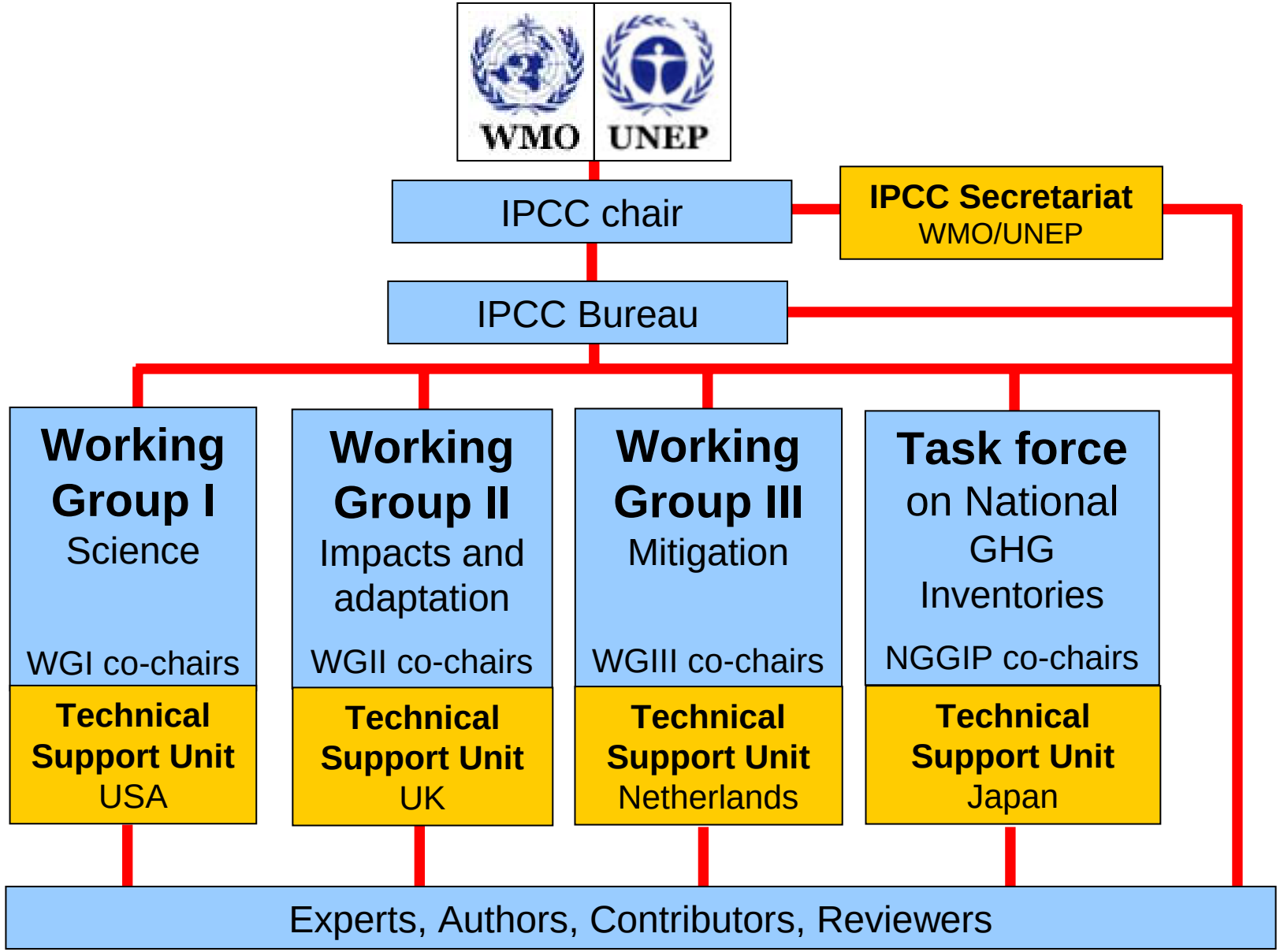
IPCC WG III on Mitigation

Workshop on CDM and CCS, Government of Japan, April 20th, 2006

About IPCC



- Founded 1988 by UNEP and WMO
- Publishes assessment reports; no research, no monitoring, no recommendations
- Quality checks:
  - Only assessment of peer-reviewed literature
  - Authors academic, industrial and NGO experts
  - Reviews by independent Experts *and* Governments
- Policy relevant, but NOT policy prescriptive
- Full report and technical summary: accepted by governments without change
- Summary for policymakers: government approval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Japan
Experts, Authors, Contributors, Reviewers

Approval of the SPM

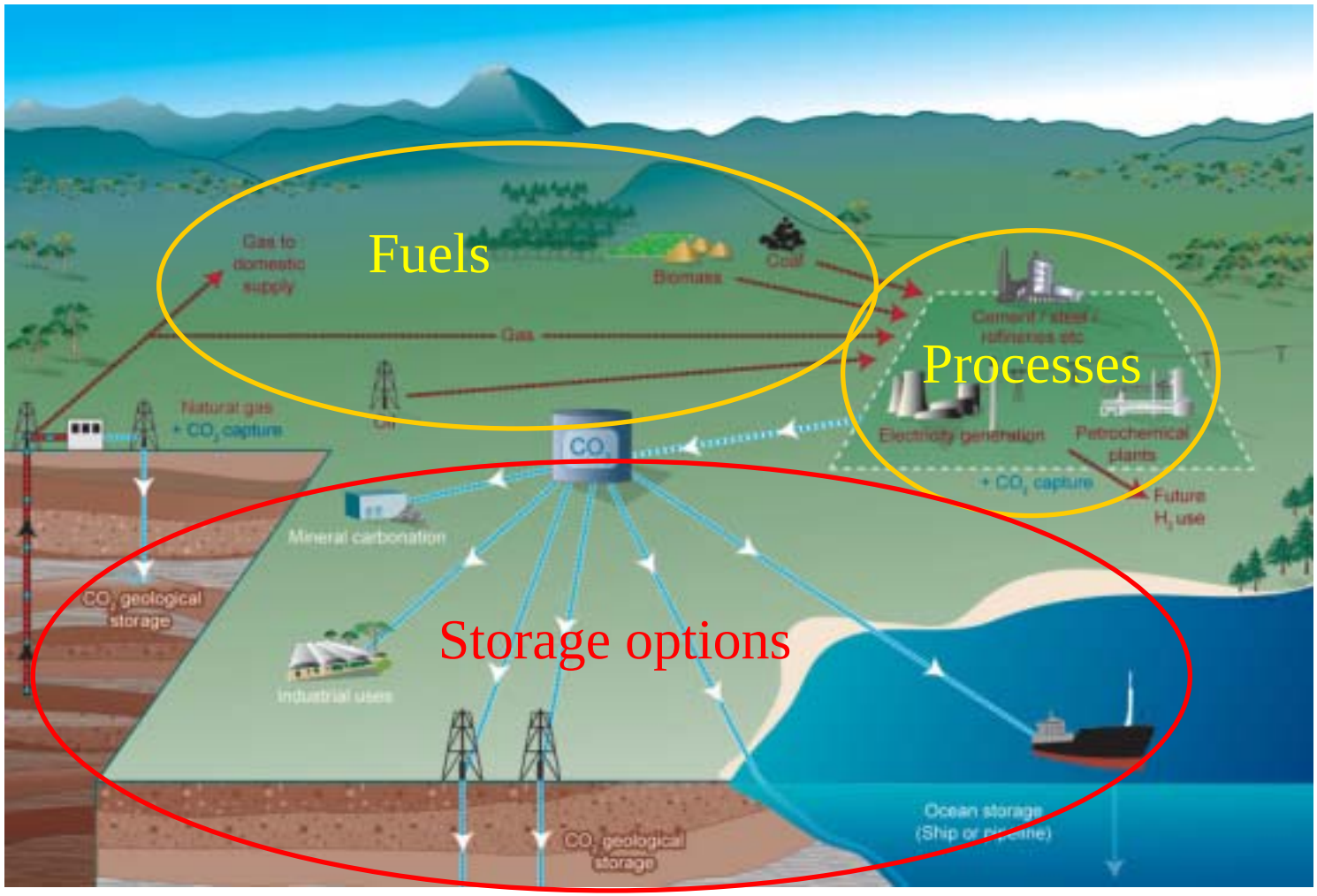
IPCC report useful for CDM?

- Not the answer on eligibility of CCS for CDM
- No methodologies or guidelines for accounting
- Information base in the field of:
  - Energy penalty
  - Current state of knowledge on permanence of storage
  - Monitoring techniques
  - Costs and benefits
- Legitimacy as a mitigation option

Key issues addressed in this presentation

- What is CO_2 capture and storage?
- How could CCS play a role in mitigating climate change?
- Maturity of the technology
- Sources of CO_2 and storage locations
- Cost and potential
- Health safety and environment risks
- CCS and the CDM

CO_2 capture and storage system

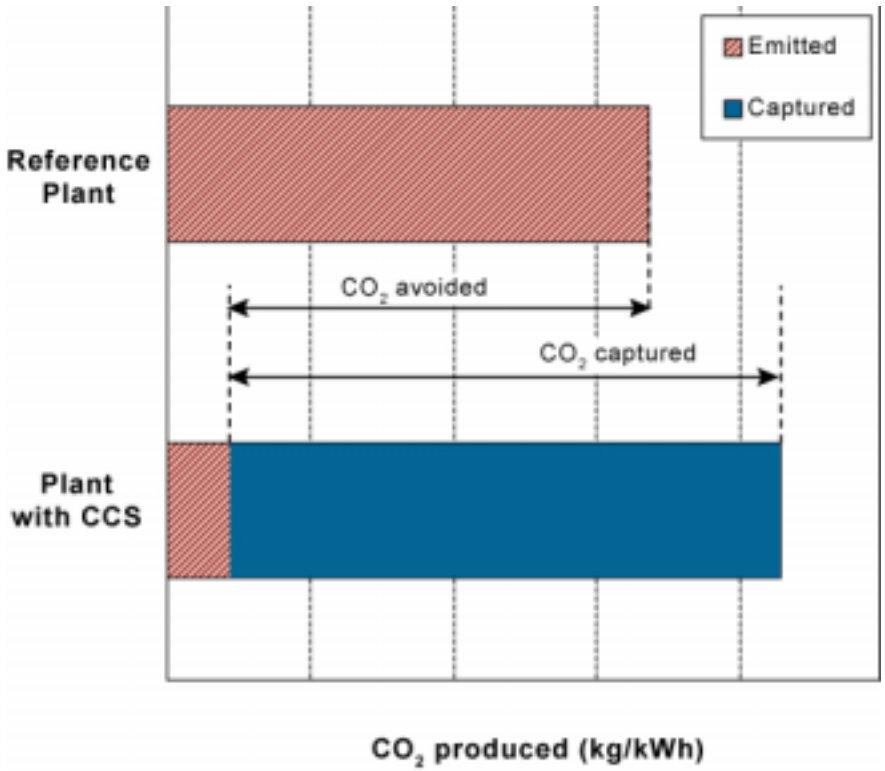


How could CCS play a role in mitigating climate change?

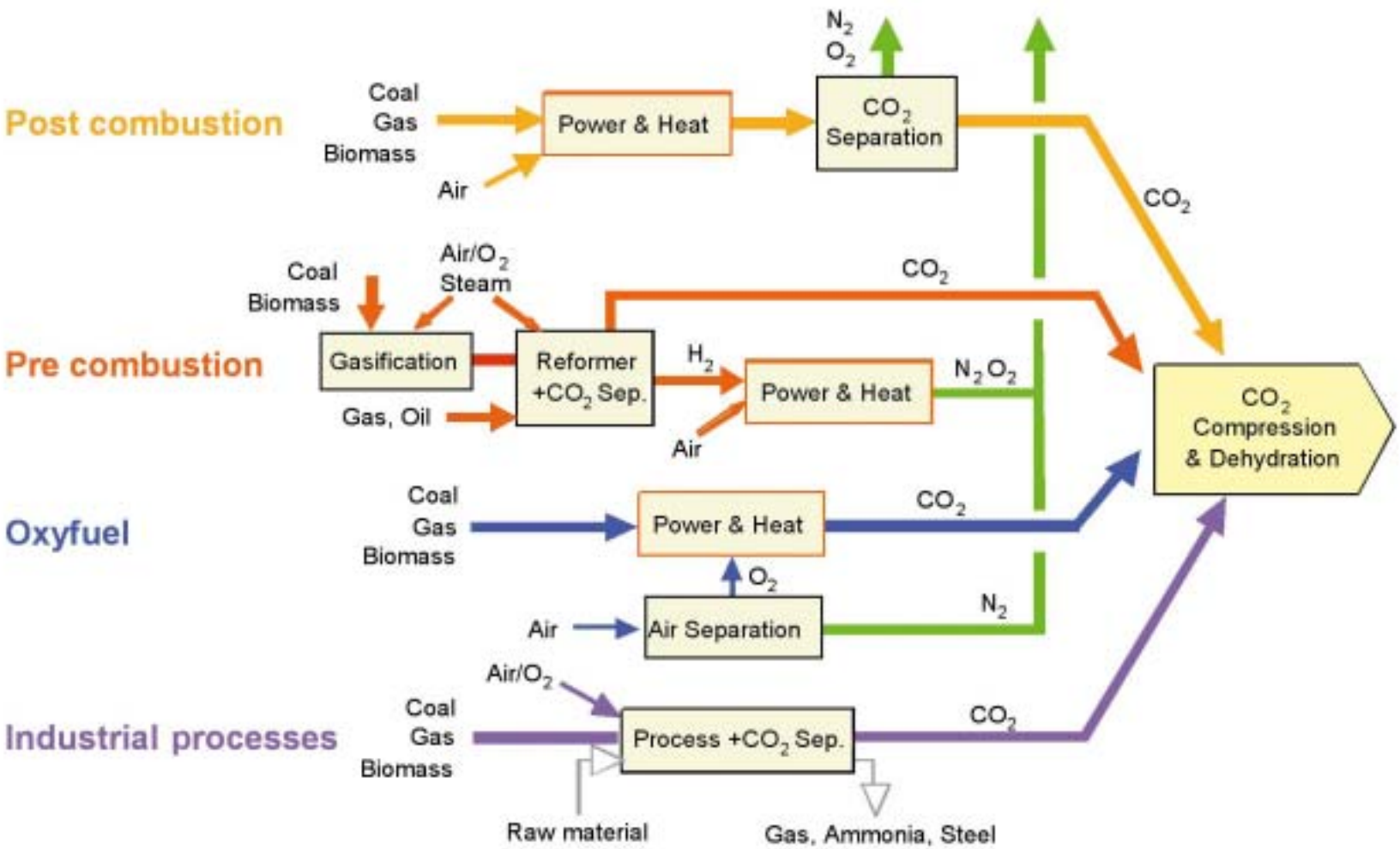
- Part of a portfolio of mitigation options
- Reduce overall mitigation costs
- Increase flexibility in achieving greenhouse gas emission reductions
- Application in developing countries important
- Energy requirements point of attention

Energy requirements

- Additional energy use of 10 - 40%
- Capture efficiency: 85 - 95%
- Net CO_2 reduction: 80 - 90%

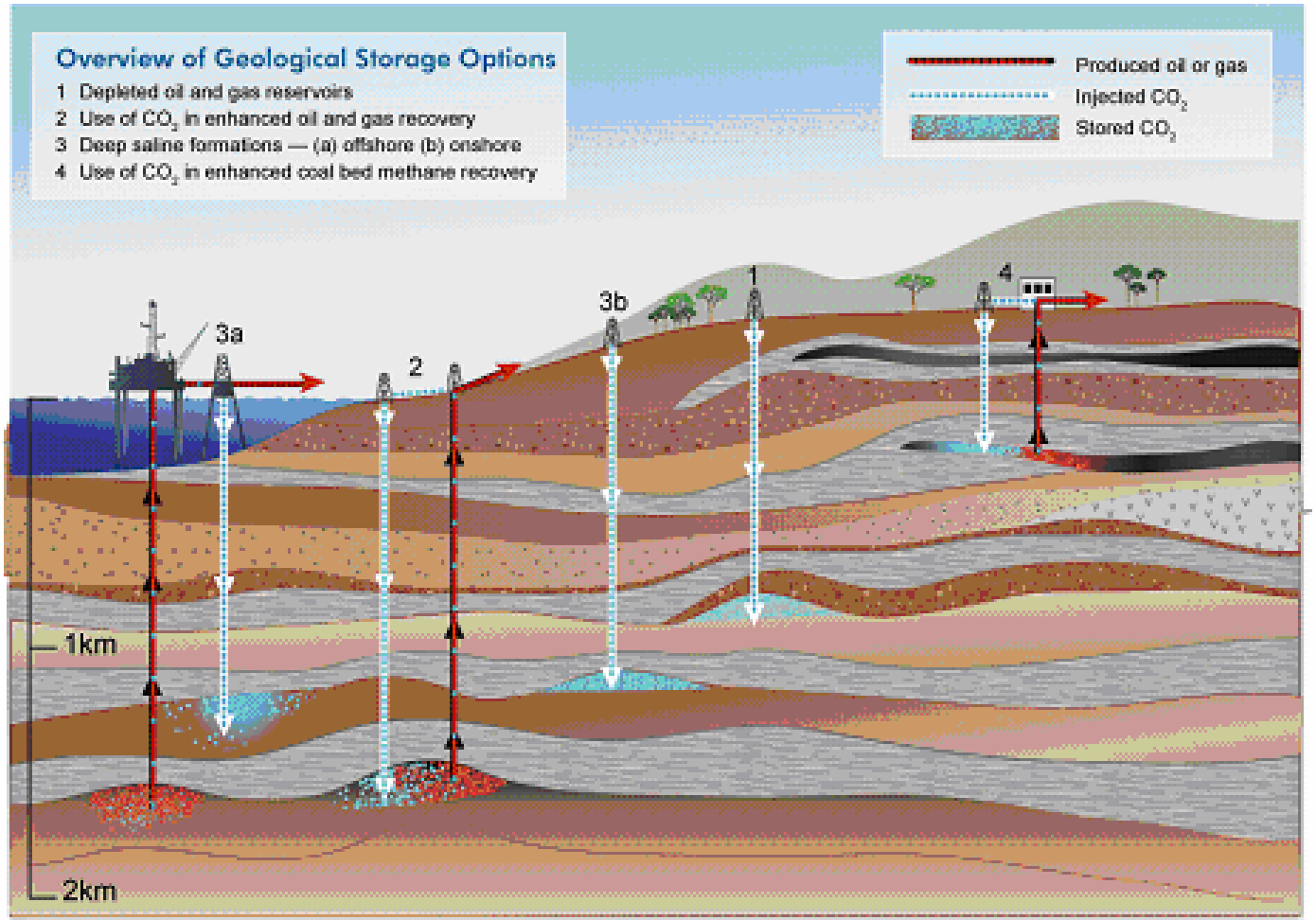


Capture of CO_2



Source: IPCC SRCCS

Geological storage



WMO

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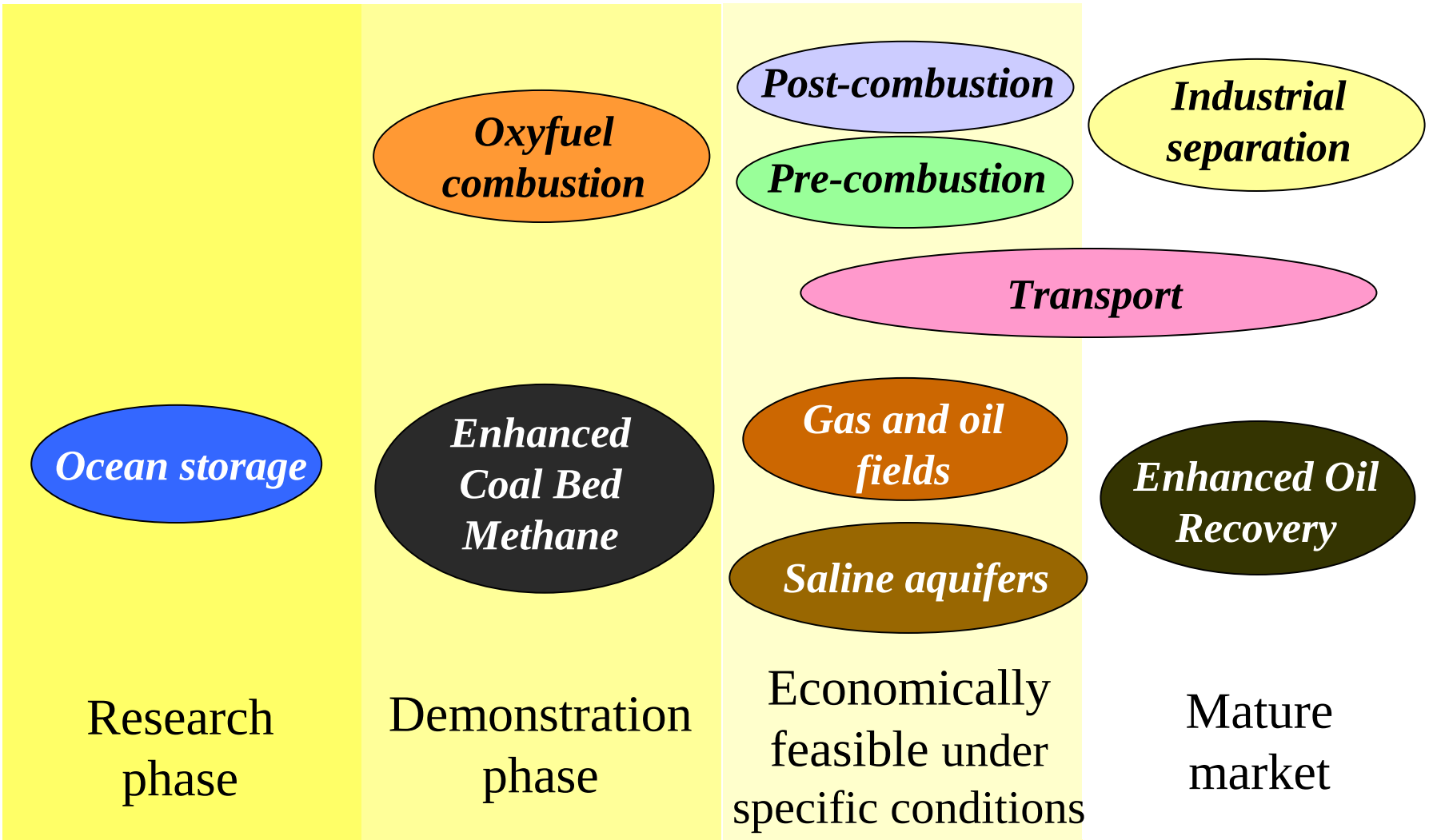
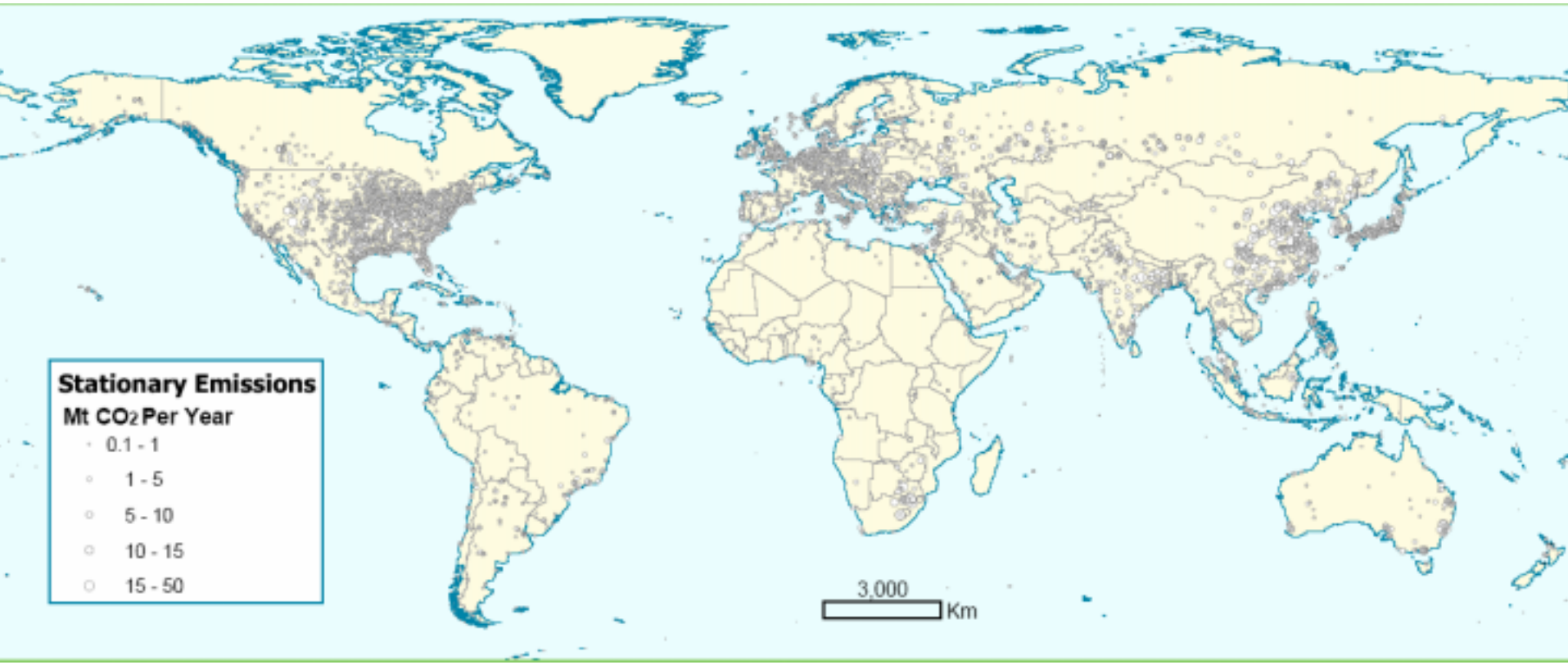
Maturity of CCS technology



CO_2 sources

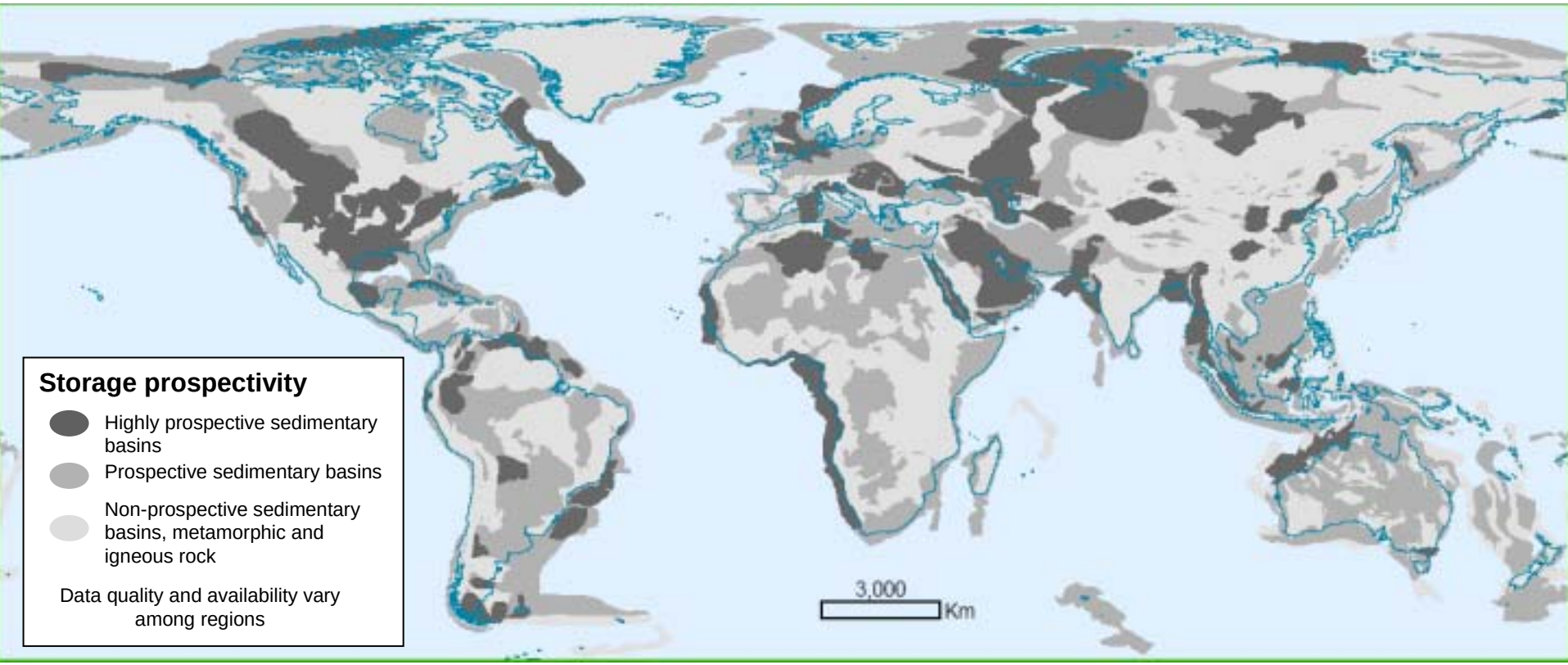
- Large stationary point sources
- High CO_2 concentration in the waste, flue gas or by-product stream (purity)
- Pressure of CO_2 stream
- Distance from suitable storage sites

Geographical relationship between sources and storage opportunities



Global distribution of large stationary sources of CO_2 (Based on a compilation of publicly available information on global emission sources, IEA GHG 2002)

Geographical relationship between sources and storage opportunities



Prospective areas in sedimentary basins where suitable saline formations, oil or gas fields, or coal beds may be found. Locations for storage in coal beds are only partly included. Prospectivity is a qualitative assessment of the likelihood that a suitable storage location is present in a given area based on the available information. This figure should be taken as a guide only, because it is based on partial data, the quality of which may vary from region to region, and which may change over time and with new information (Courtesy of Geoscience Australia).

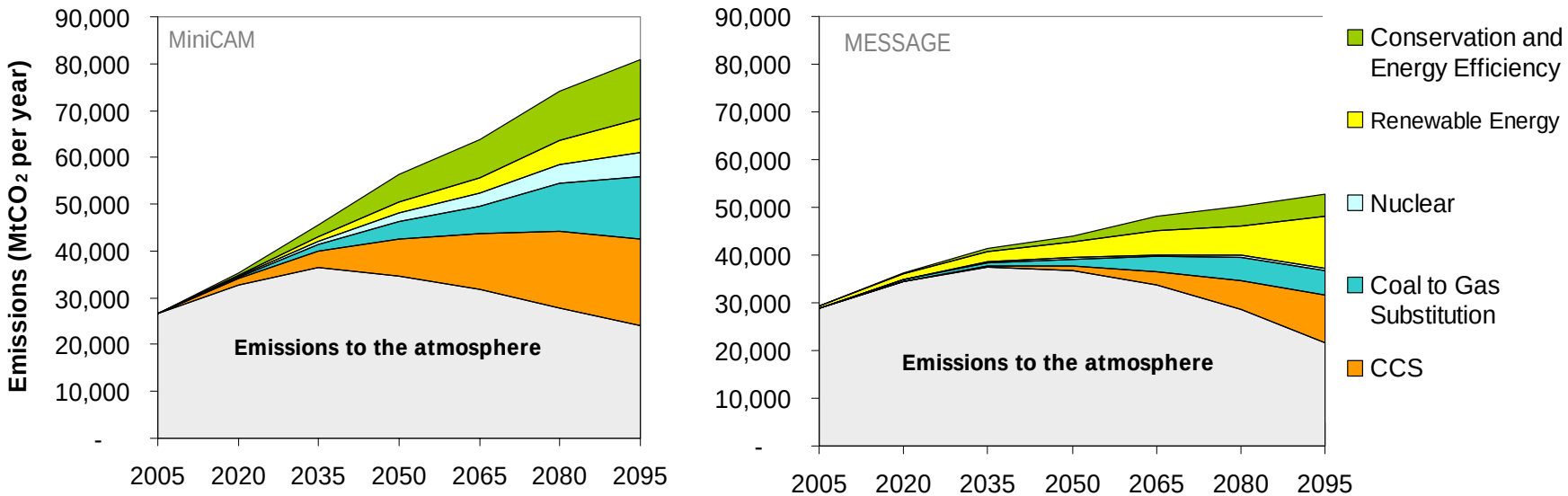
Costs

- Additional electricity costs: 0.01 - 005 US$/kWh
- CO_2 avoidance costs: 20 - 270 US$/t$CO_2$ avoided (EOR: 20 - 30 US$/t$CO_2$ avoided less)

CCS component	Cost range
Capture from a power plant	15 - 75 US$/t$CO_2$ net captured
Transportation	1 - 8 US$/t$CO_2$ transported per 250km
Geological storage	0.5 - 8 US$/t$CO_2$ injected

- Capture-ready, low transport cost, revenues from storage: 360 MtCO_2/yr

Economic potential



Economic potential

- Cost reduction of climate change stabilisation: 30% or more
- Most scenario studies: role of CCS increases over the course of the century
- Substantial application above CO_2 price of 25-30 US$/t$CO_2$
- 15 to 55% of the cumulative mitigation effort worldwide until 2100, depending on the baseline scenario, stabilisation level (450 - 750 ppmv), cost assumptions
- 220 - 2,200 GtCO_2 cumulatively up to 2100

Storage potential

- Geological storage: likely at least about 2,000 $GtCO_2$ in geological formations

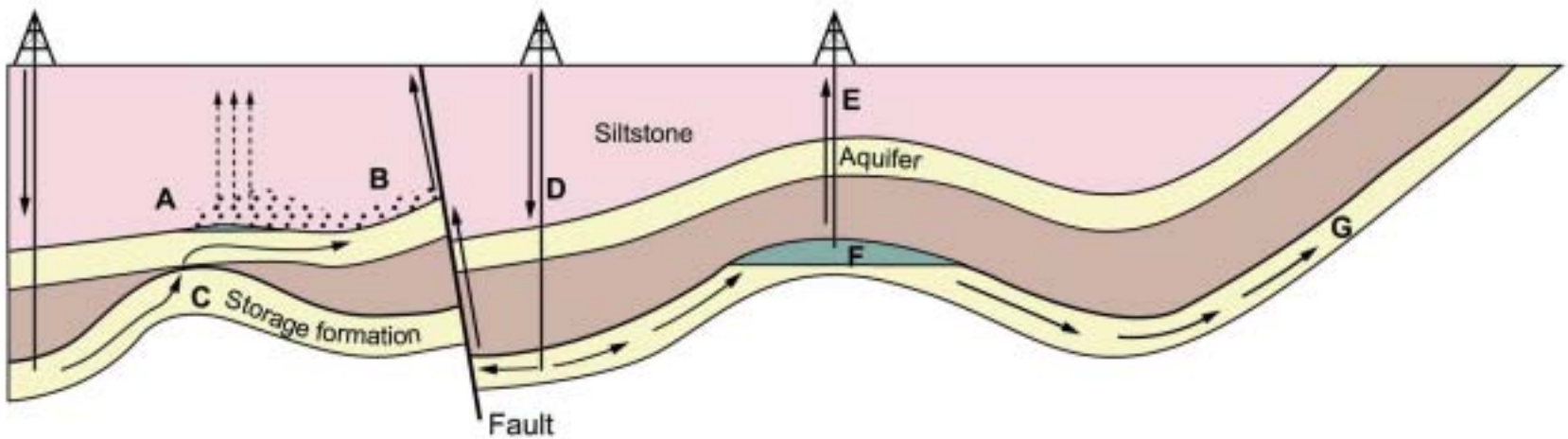
  "Likely" is a probability between 66 and 90%.

  - Oil/gas fields: 675 - 900 $GtCO_2$
  - Saline formations: 1000 - ~ 10^4 $GtCO_2$
  - Coal beds: 3 - 200 $GtCO_2$

Health, safety, environment risks

- In general: lack of real data, so comparison with current operations
- CO_2 pipelines: similar to or lower than those posed by hydrocarbon pipelines
- Geological storage:
  - appropriate site selection, a monitoring program to detect problems, a regulatory system, remediation methods to stop or control CO_2 releases if they arise:
  - comparable to risks of current activities
  - natural gas storage, EOR, disposal of acid gas

Health, safety, environment risks



Potential Escape Mechanisms

A. CO_2 gas pressure exceeds capillary pressure & passes through siltstone	**B.** Free CO_2 leaks from A into upper aquifer up fault	**C.** CO_2 escapes through 'gap' in cap rock into higher aquifer	**D.** Injected CO_2 migrates up dip, increases reservoir pressure & permeability of fault	**E.** CO_2 escapes via poorly plugged old abandoned well	**F.** Natural flow dissolves CO_2 at CO_2 / water interface & transports it out of closure	**G.** Dissolved CO_2 escapes to atmosphere or ocean

Will leakage compromise climate goals?

- Fraction retained in appropriately selected and managed geological reservoirs is
  - very likely to exceed 99% over 100 years, and
  - is likely to exceed 99% over 1,000 years.

    "Likely" is a probability between 66 and 90%, "very likely" of 90 to 99%
- Release of CO_2 from ocean storage would be gradual over hundreds of years

CCS and the CDM

- Specific methods may be required for the net capture and storage of CO_2, physical leakage, fugitive emissions and negative emissions associated with biomass applications of CCS systems
- CO_2 might be captured in one country and stored in another with different commitments.
- Rules and methods for accounting may have to be adjusted accordingly
- Possible physical leakage from a storage site in the future would have to be accounted for

Thank you

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