



# Workshop on considering CCS as a CDM project activity | [unfccc.int](http://unfccc.int)

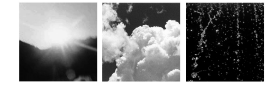
Summary of SBSTA workshop on CCS  
Overview of IPCC material relevant to CDM

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United Nations Framework Convention on Climate Change





# IPCC products useful for CDM?

## IPCC Special Report on CCS:

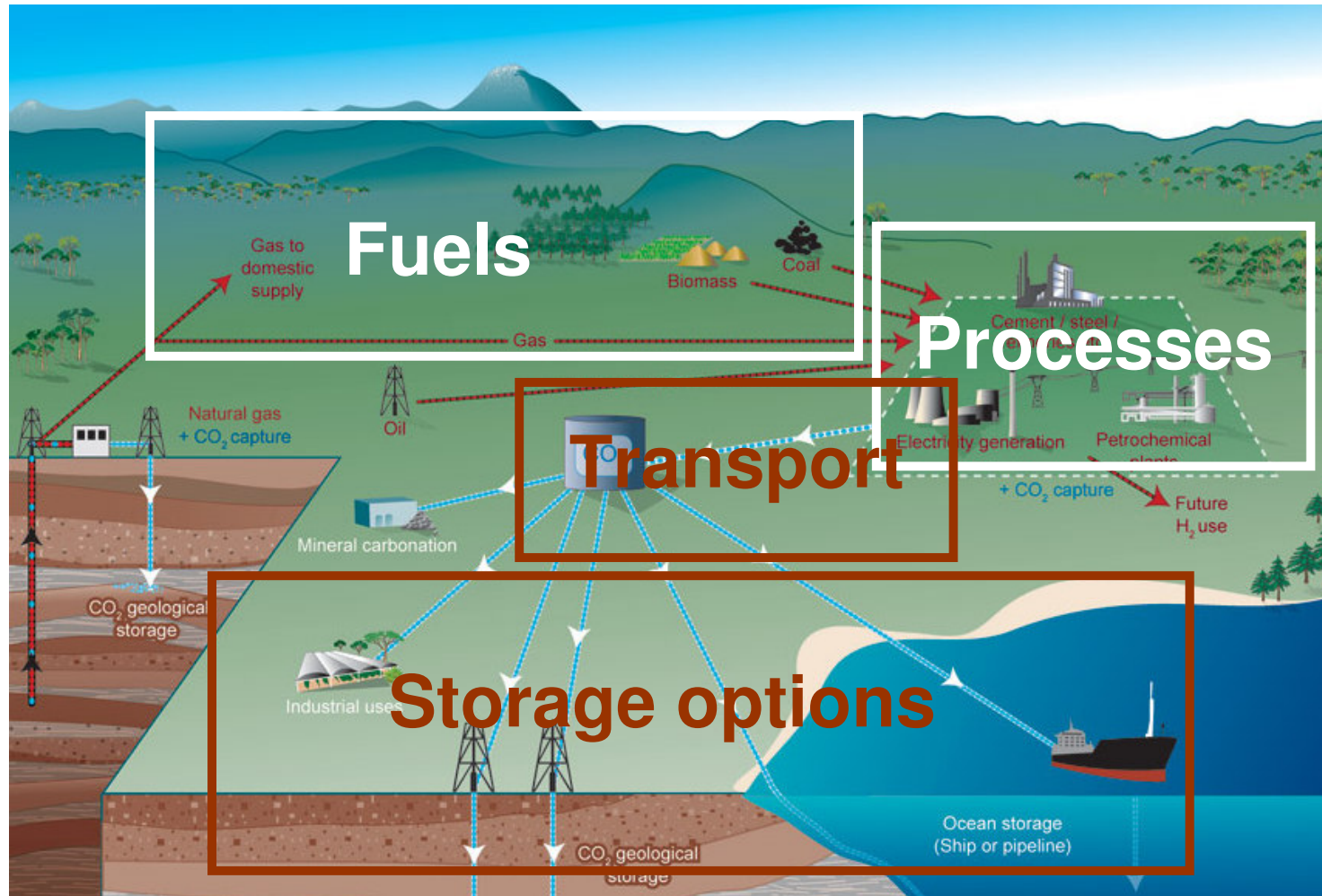
- Information base in the field of energy requirements, permanence of storage, monitoring techniques

## 2006 IPCC Revised Guidelines for Inventories

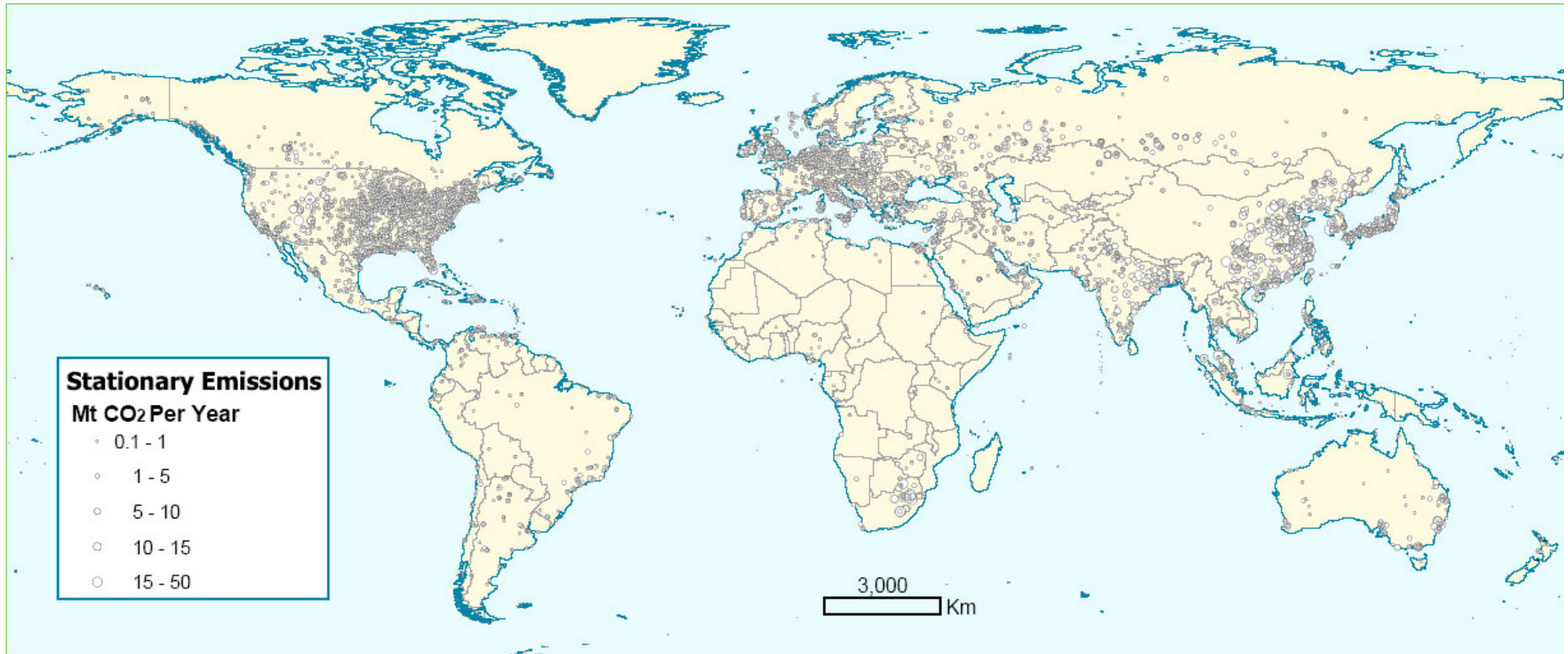
- Good practices on reporting capture of CO<sub>2</sub>
- Tier 1 estimates of transport leakage
- Good practices for site characterisation, leakage estimates, monitoring, reporting
- No site selection criteria



# CO<sub>2</sub> capture and storage system

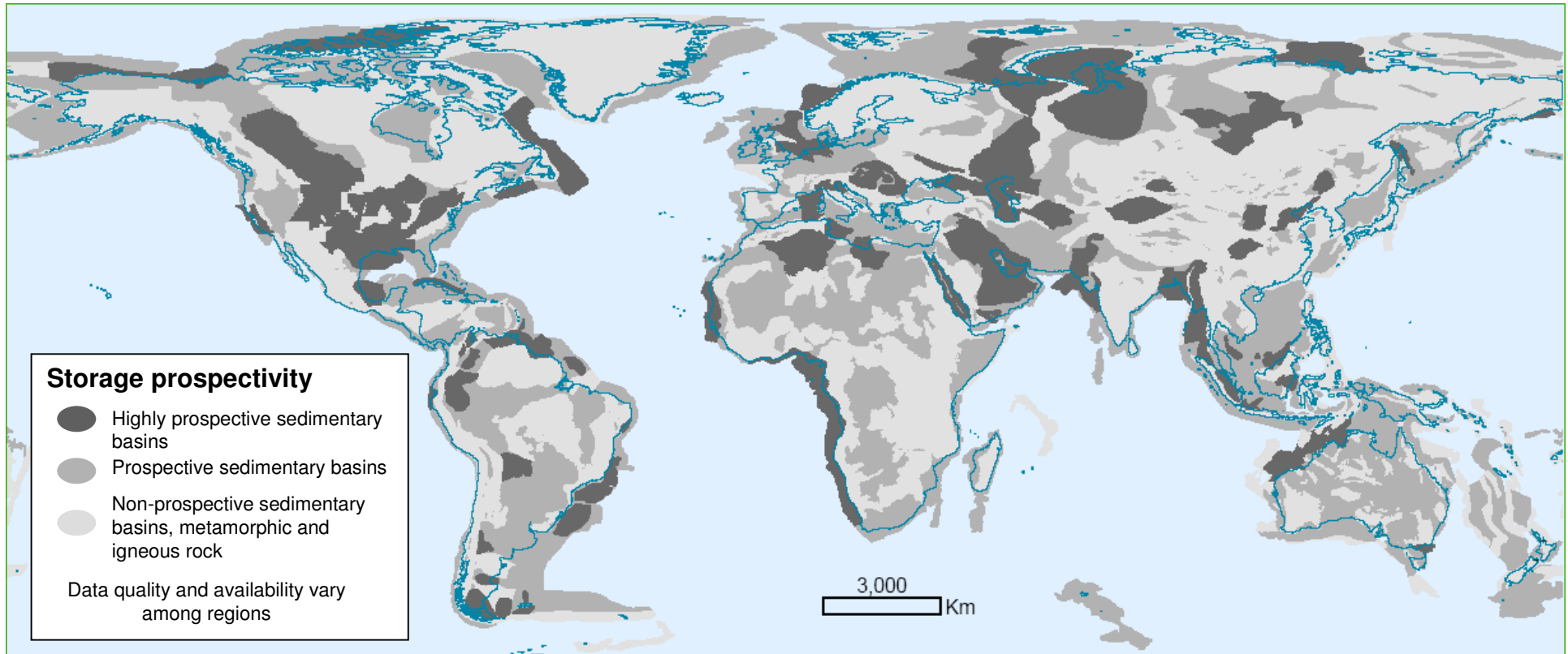


# Sources and storage opportunities both in Annex I and non-Annex-I countries



Global distribution of large stationary sources of CO<sub>2</sub> (Based on a compilation of publicly available information on global emission sources, IEA GHG 2002)

# Sources and storage opportunities both in Annex I and non-Annex-I countries

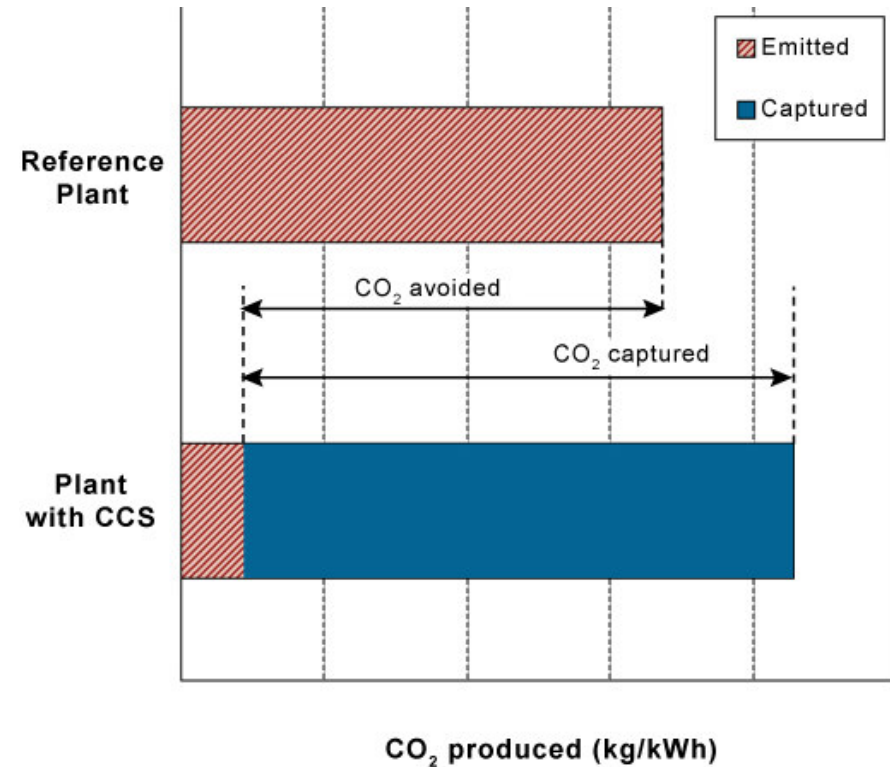


Prospective areas in sedimentary basins where suitable saline formations, oil or gas fields, or coal beds may be found. Locations for storage in coal beds are only partly included. Prospectivity is a qualitative assessment of the likelihood that a suitable storage location is present in a given area 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).



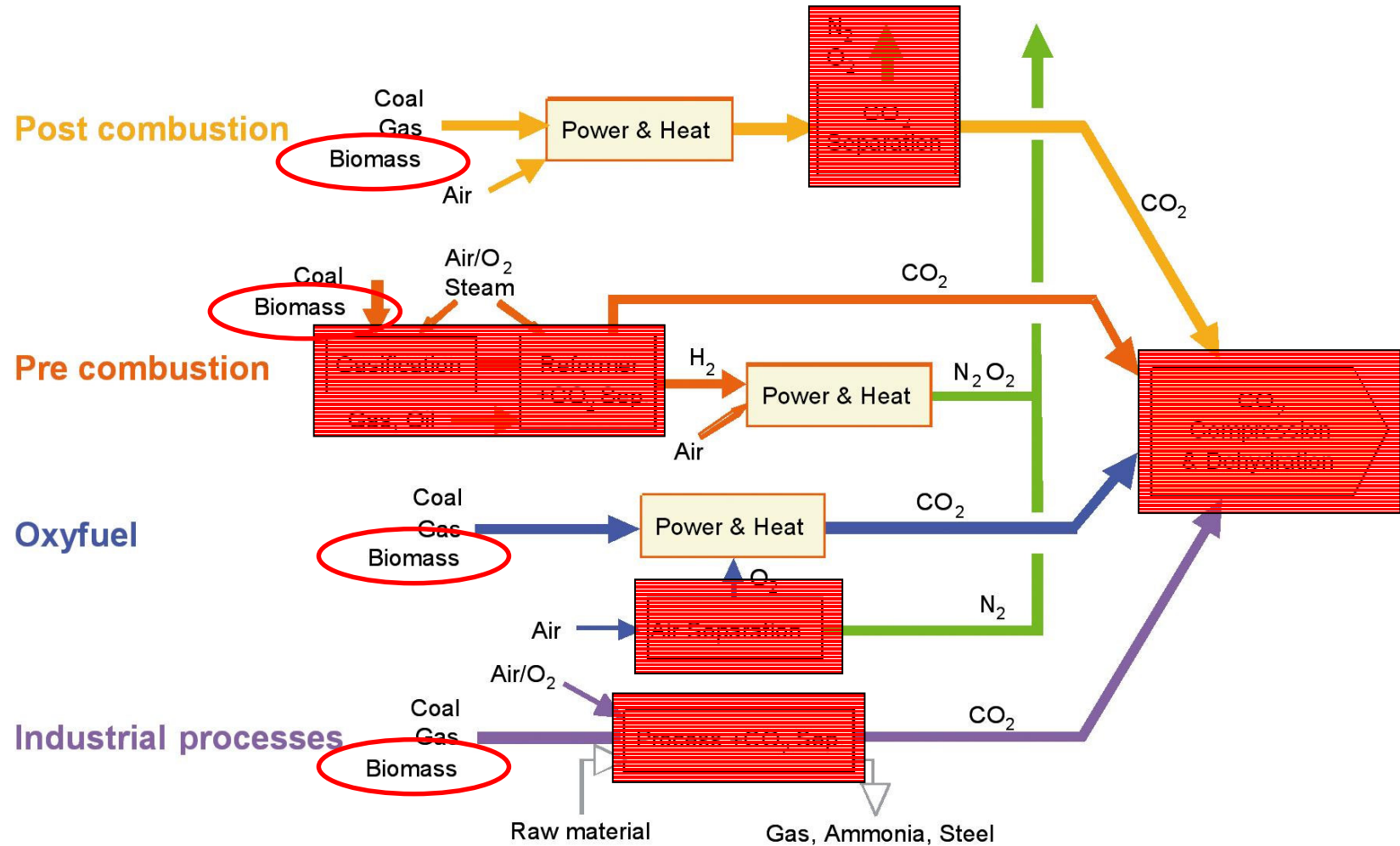
# Energy requirements

- Additional energy use of 10 - 40%
- Capture efficiency: 85 - 95%
- Net CO<sub>2</sub> reduction: 80 - 90%
- Assuming the CO<sub>2</sub> from the energy supplier is also captured and stored





# Capture of CO<sub>2</sub>



Biomass would lead to negative emissions



# Transport and injection of CO<sub>2</sub>

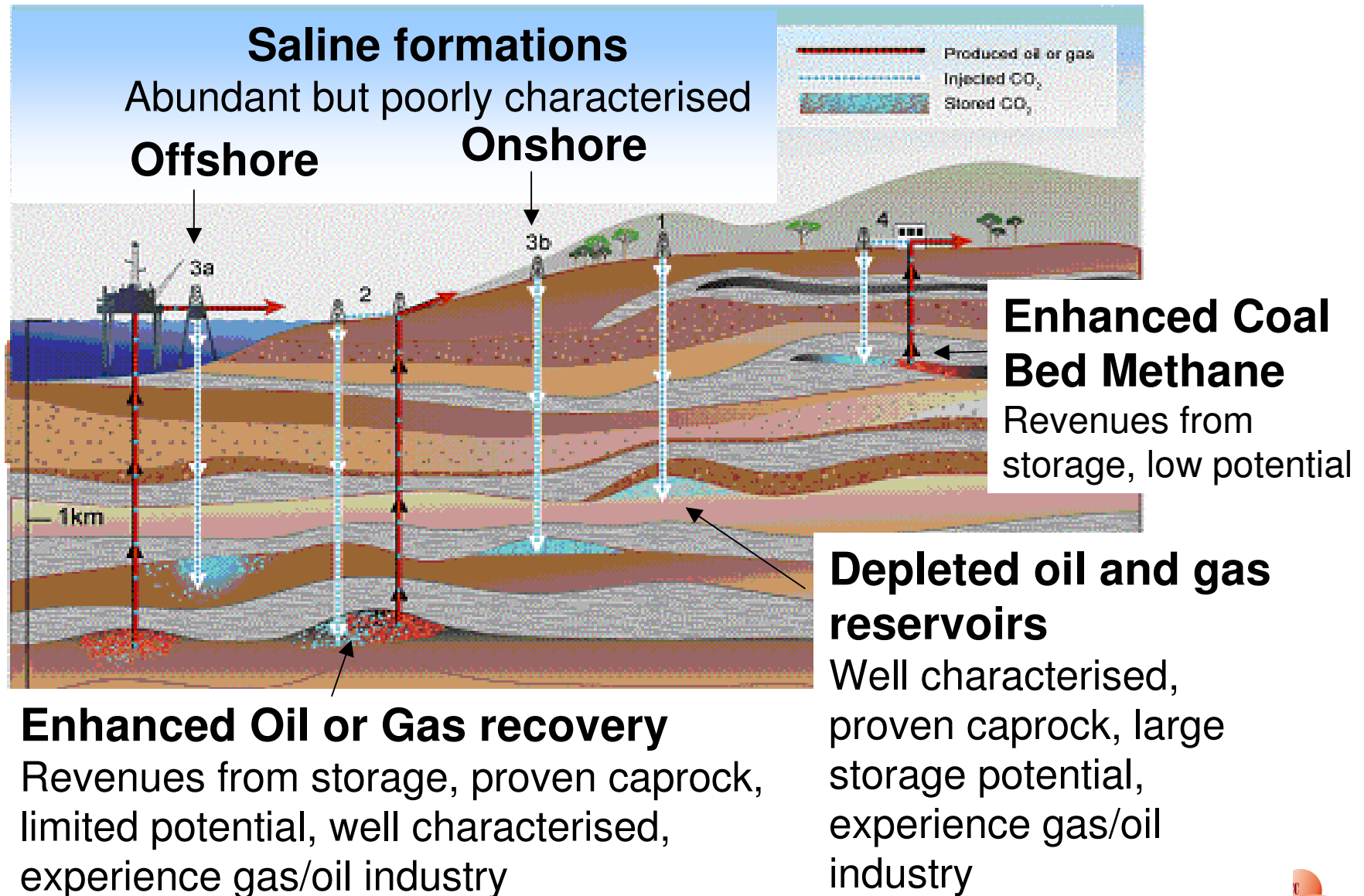
## IPCC Revised Guidelines for Inventories:

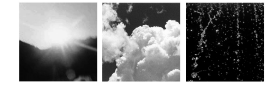
- Tier 1 emission factor for transport:
  - 0.00014 - 0.014 GgCO<sub>2</sub>/km/yr (median: 0.0014)
- Good practice for injection: no Tier 1 or 2 available, so direct measurement at the injection well





# Geological storage: types of storage





# Geological storage: seepage

IPCC Special Report on CO<sub>2</sub> capture and storage:

- 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%

- appropriate **site selection**, a **monitoring** program to detect problems, a **regulatory system**, **remediation methods** [..], risks are comparable to risks of current activities (natural gas storage, EOR, disposal of acid gas)



# Geological storage: seepage

## IPCC Revised Guidelines on Inventories:

*Site characterisation:* Identify geology of storage site, local and regional hydrogeology and seepage pathways



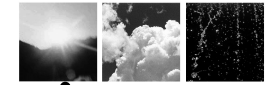
*Risk of seepage:* Evaluate potential for seepage based on site characterisation and realistic models that predict CO<sub>2</sub> movement



*Monitoring plan:* Adequate measurement based on seepage pathways identified. Validate update models if necessary



Report CO<sub>2</sub> injected and emissions from storage site



# Geological storage: site characterisation

Site-specific characterisation essential

Reservoir: Thick, impermeable caprock, lateral continuity, not many faults

IPCC Special Report on CCS:

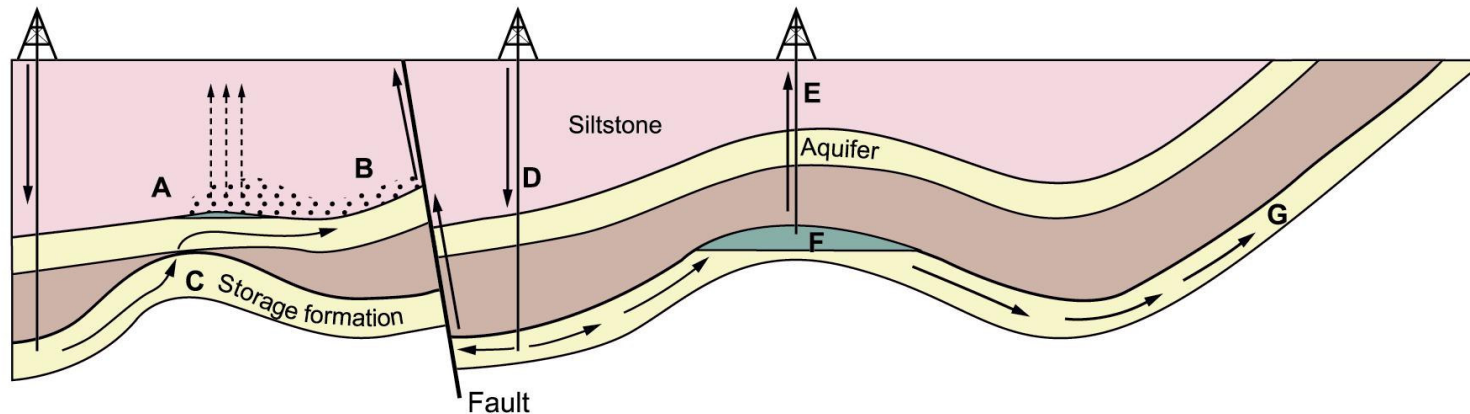
- Focus on reservoir and sealing, but also strata above and caprock
- Direct and indirect data

IPCC Revised Guidelines for Inventories:

- Potential seepage pathways (faults, old wells, etc)
- Quantify CO<sub>2</sub> migration
- Sufficient data to represent in geological model of the site and surrounding area and numerical model



# Geological storage: seepage paths



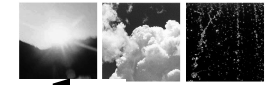
A: CO<sub>2</sub> pressure exceeds capillary pressure, through sandstone

B: CO<sub>2</sub> leaks from upper formation into fault

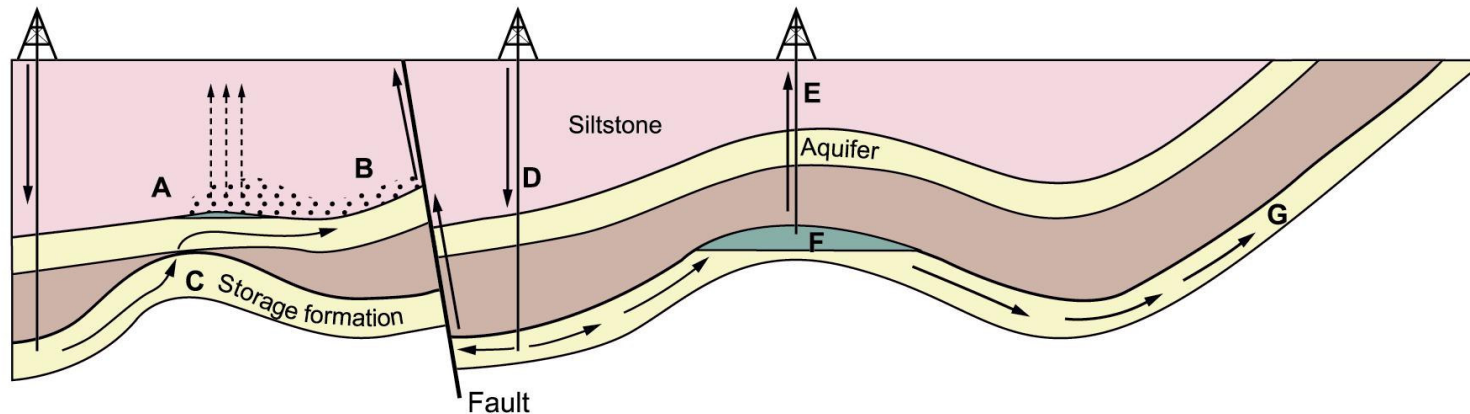
C: Gap in caprock allows migration into upper formation

D: CO<sub>2</sub> migration, increases reservoir pressure and fault permeability

IPCC SRCCS, 2005



# Geological storage: seepage paths



E: CO<sub>2</sub> escapes via poorly plugged abandoned well

F: CO<sub>2</sub> dissolves in formation water and diffuses out of closure

G: Dissolved CO<sub>2</sub> escapes to atmosphere or ocean

IPCC SRCCS, 2005



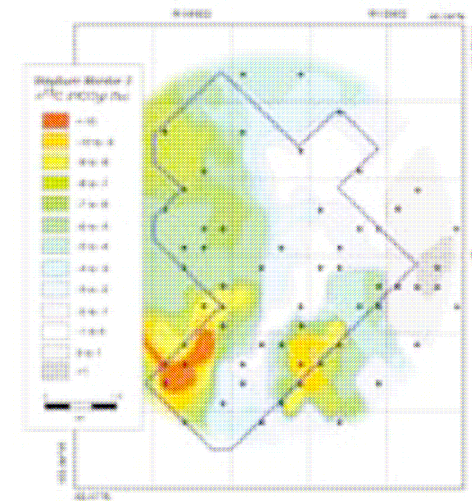


# Geological storage: monitoring

Monitoring low share in costs (0.1 - 0.3 US\$/tCO<sub>2</sub>)

IPCC Revised Guidelines for Inventories:

- Monitoring should consistent with outcome site characterisation and expected seepage pathways
- Annex 1 lists techniques for
  - Deep subsurface (200 - 5000 m)
  - Shallow subsurface (up to 200 m)
  - Near-surface (up to 10 m)





# Geological storage: monitoring

## Monitoring techniques:

- Should include provisions for:
  - Measurement of background CO<sub>2</sub> fluxes
  - Continuous measurement of CO<sub>2</sub> injected
  - Determination of emissions from injection system
  - Determination flux of CO<sub>2</sub> through seabed or ground surface
  - Surface measurements at storage site and potential CO<sub>2</sub> exit points
  - Technical improvements and periodic verification
- Post-injection: take into account forward modelling