Carbon Sequestration leadership forum

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CSLF TG Action Plan Update
Action 8
Competition of CCS with Other Resources

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Origin of the Work

During the last CSLF meeting in Washington, D.C., USA, November 5, 2013, France was asked to report on the state of knowledge concerning "Competition of CCS with Other Resources" in order to recommend (or not) the creation of a specific Task Force to address this topic.

The analysis is based on the review of existing publications, and assessment if all aspects of the issue have been addressed

Background of the Action

- IEAGHG Report 2013-08: interaction of CO2 storage with subsurface resources
- IEAGHG Report 2011-10: Global storage resources gap analysis for policy makers
- IEAGHG Report 2011-11: Potential impacts on groundwater resources of geological storage

All information provided is based on the IEAGHG report 2013-08

Subsurface Resources in Sedimentary Basins

- Conventional oil and gas
- Shale gas and oil
- Coal (incl. CBM and UCG)
- Gas hydrates
- Gas storage (CH_4)
- Saline aquifer minerals and sediment hosted minerals
- Geothermal energy
- Groundwater
- Nuclear waste repositories
- Sediment-hosted metallic mineral deposits (Pb-Zn, etc.)

Subsurface resources

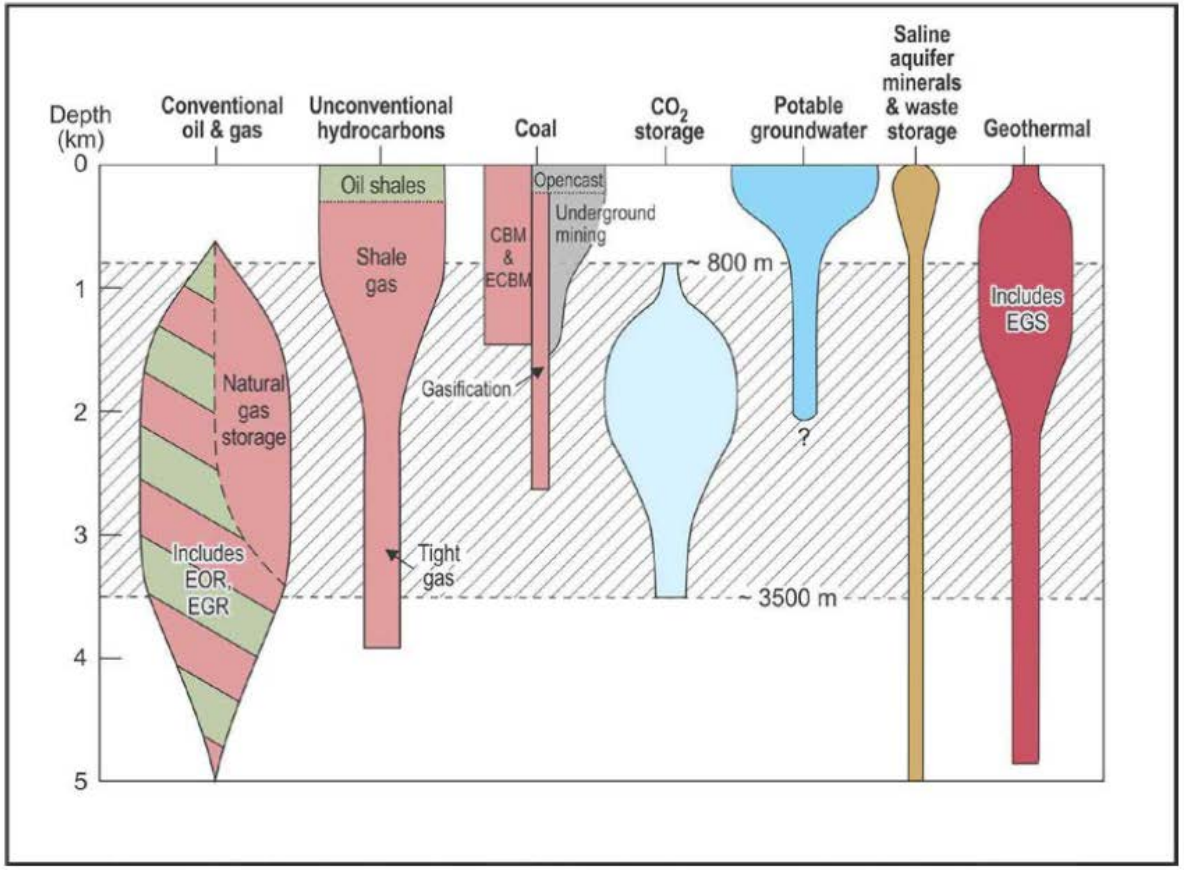

Figure i: Schematic diagram of the typical depth ranges over which sub-surface resources occur, including the use of pore space for CO_2 storage. Variations in the widths of the polygons are conceptually in proportion to the most common depths for the activities.

Table 1 Positive and negative aspects of the interaction of CO_2 storage operations on other pore-space resources

Pore space resource	Positive	Negative
Oil	Might increase sweep efficiency hence more effective resource use; EOR can offset cost of storage, but not always usable; creates demand for CO_2 and hence improvement of capture technology; similar industries and service and supply needs; possible pressure enhancement	Pressure interference with existing operations; contamination of oil; infrastructure conflict; timing delays to CO_2 storage if EOR not feasible or wanted
Gas	EGR possible in some reservoirs (though rarely done); possible pressure enhancement	High cost of separating CO_2 from the produced gas if they mix; pressure interference with existing operations
Coal	CO_2 can flush out methane, creating valuable by-product	CO_2 would sterilize coal for mining or underground gasification

Table 1 Positive and negative aspects of the interaction of CO_2 storage operations on other pore-space resources

Pore space resource	Positive	Negative
Groundwater	Could re-pressure low-productivity aquifers; pressure-relief wells used to increase CO_2 injection rates might produce useable water	Could acidify or contaminate potable water, or change hydraulic heads through pressure interference
Dissolved minerals	CO_2 could flush or displace saline water, enhancing water, and hence mineral extraction	CO_2 might react with some dissolved mineral salts, plugging pores
Geothermal	Better heat transfer medium than water; possible pressure enhancement	High temperatures might increase risk of corrosion; possible pressure interference with existing operations
Natural gas storage	Nil	Pore space unavailable for CO_2 storage for life of gas storage facility; pressure interference with existing operations
Waste disposal	Nil	Pressure effects or the presence of CO_2 may affect waste storage

Interactions of CO2 Geological Storage with Subsurface Resources

- Timing of interactions
  - Pre-implementation:
    - Define the higher priority of use, or
    - Define the mix of successive uses that will produce the best return
  - During injection:
    - Monitor in order to alert on unexpected behavior of the injected CO_2 that might affect other resources
  - Post-injection
    - Determine what future uses might be feasible in and around a CO_2 storage site

Interactions of CO2 geological storage with subsurface resources

- Risk assessment
  - Improved recovery of resources
    - In what cases CO_2 storage can have a positive or negative impact on resource recovery
  - Resource sterilization
    - Determine conditions where CO_2 storage can preclude the use of other resources (e.g., ECBM and UGC)
  - Injectivity
    - Forecast and monitor the impact of unexpected conditions of injectivity on other resource uses

Interactions of CO2 geological storage with subsurface resources

- Risk assessment
  - Seal integrity
    - A key element for storage safety – a major element in the decision to allow the use of seals for hydrocarbon production or solid waste repository
  - Pressure front
    - In what case CO_2 storage can have a positive or negative impact on resource recovery
  - Ground surface deformation
    - Determine the impact on surface infrastructures

Interactions of CO2 geological storage with subsurface resources

- Risk assessment
  - Composition of injected gas
    - Assess the impact on groundwater quality
  - Mobilization of minerals and other substances
    - Assess potential contamination of groundwater by mobilized heavy metals
  - Infrastructure
    - Assess the impact on borehole casing integrity (corrosion and induced leakage)

Interactions of CO2 geological storage with subsurface resources

- Risk assessment
  - Monitoring and verification
    - Importance of baseline studies and monitoring of the CO_2 plume for identification of interactions with other resources
  - Regulation conflict and overlap
    - Management of overlap and conflict in case of multiple uses of resources (at different stratigraphic levels or for adjacent resources), ensuring that they are rarely clearly defined. A major risk for the development and costing of CO_2 storage projects.

Interactions of CO_2 Geological Storage with Subsurface Resources

- Three main types of interaction
  - CO_2 invasion
  - Pressure
  - Chemistry
- Two types of effects
  - Positive
  - Negative
- Possibility of sterilizing other resources

A risk assessement is necessary

Interactions of CO_2 Geological Storage with Subsurface Resources

- The same area can be suited for different uses
- A main consequence for regulators
  - To have access to an extensive **inventory on any resources in the underground in the area impacted by CO_2 storage**
  - To define an **order of priority for resource extraction and/or usage**
    - Dedicate one usage per area
    - Assign different usages to different stratigraphic levels per area
    - Plan the timing of potential usages per area

Conclusion
Interactions of CO_2 Geological Storage with Subsurface Resources

- Available documentation is complete and pertinent
- Adapted for a efficient management of underground resource competition
- No particular need for complementary work from the CSLF Technical Group

Questions and Comments?