

# Criteria and Methodology to select suitable areas and structures for storing CO<sub>2</sub>

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## ABSTRACT

CCS technology is a promising way to reduce drastically CO<sub>2</sub> emissions from static and great emitters, as power plants. Sedimentary basins are the most suitable areas for storing CO<sub>2</sub> and depleted oil and gas reservoir, deep saline formation and deep coal seams are the main geological formations that are under consideration. One of the issue is selecting suitable areas and structures in the pre-injection phase.

Depleted oil or gas reservoirs are well known, but its capacity is limited and they are not widespread along Europe. On the other hand, deep saline formation offers the highest theoretical capacity, they are widespread, but there are a lack of knowledge due never has been interesting for any application. At present, these formations are the best candidates for storing huge volume of CO<sub>2</sub> in a safe manner.

The most critical issue to develop CO<sub>2</sub> storage in deep saline aquifer is applying suitable criteria based on technical and socio-economical points of view. Those criteria should be measurable and easy to assess. Additionally, it is necessary to develop a methodology in order to consider all of the criteria: it is defined as a multicriteria decision.

In this work we show a complex methodology to select suitable areas for storing CO<sub>2</sub> based on criteria definition and mathematical methodology for evaluating which are the most suitable areas for storing CO<sub>2</sub>.

There are several technical and industrial applications which stores fluids into geological formations: Underground Injection Control in USA, Acid gas injection in Canada, Enhanced Oil Recovery and Enhanced Coal Bed Methane and underground natural gas injection and withdraw are techniques use worldwide. They are the most common and similar applications, but there are also several projects which inject CO<sub>2</sub>: Weyburn, In Salah and Sleipner are examples of CO<sub>2</sub> storage underground. Studying the way to select suitable areas for applying those techniques will be one way to define some criteria which will have to be considered in CO<sub>2</sub> selection areas. Oil and Gas exploration and production will complement those criteria.

Thanks to those studies we have formulated global criteria: geology (stratigraphy and structural), hydrogeology, capacity, CO<sub>2</sub> conditions underground and other or potential resources are the technical criteria defined in this work; available information, emitters points, population distribution, environmental and cultural points of interest, and economical

issues (regional and local aspects) are the social and economical criteria under consideration. There are some mathematical methods to select the best solution in a problem based on multiple criteria (scoring, etc.). One of the most useful techniques is the Analytical Hierarchy Process (AHP). The three main functions of this methodology are:

- Complex problems, with lot of criteria (quantify or qualify parameters).
- Mathematical scale which helps to “translate” scientific considerations or assessment.
- Easy method to summarize the evaluation.

In order to define properly those criteria, it's necessary to break down global criteria into simple and measurable criteria. This method helps to build a model, considering an objective, define main criteria and sub-criteria and finally alternatives. In this application we consider an absolute measure, so we have developed scientific scales in every criteria under consideration instead of develop alternatives.

Every criteria will have a weight considering its hierarchy and importance. To improve this methodology a database software has been developed (Microsoft ACCESS™), so it is easier to evaluate different areas considering different scenarios (i.e. environmental, technical or economical scenarios). This is a powerful tool to select suitable areas, with few data as deep saline aquifers.

**Keywords:** CCS, CO2 storage, multicriteria methodology, selection suitable areas.

**Proposed Topic:** CO2 storage