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Storage potential evaluation of eastern Mediterranean area as final step of the full chain assessment

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Abstract

The last step of the CCUS full chain is represented by geological storage, when the CO2 is injected, via injection wells, into the deep sub-surface at a carefully selected site (such as a saline aquifer or a depleted oil/gas field). This work describes the methodology and the results adopted by the AURORA project (https://aurora-heu.eu/) to select suitable storage sites for the CO2 source plants of the project, located in the Mediterranean area. The selection will be based on a comprehensive set of criteria that has been extensively described in numerous publications, tested in various projects, and adopted by the CO2 storage atlas of several European countries (as Norway and UK) (Riis & Halland, 2014; Halland et al., 2014; https://www.co2stored.co.uk/home/index); results has been compared to the previous calculation and evaluation performed for the same areas.
The presented work had the aims to review the main strategies adopted for site selection and evaluation by previous projects, describes the geological areas suitable for storage for the Aurora project and their potential, and summarizes the methodology that will be used for evaluation (ranking criteria). Considering that storage wasn't included in the LCA provided by the project, further goals were to evaluate criteria for the commercial maturity of the sites. One of the main targets for suitable sites is represented by the Adriatic Sea province, where the Ravenna project, managed by Eni SpA, is ongoing, The Adriatic Sea geological province spans from the coast of Venice in the north to the Gulf of Taranto in the south. From a geological perspective it represents the foreland/foredeep domain of three distinct fold and thrust belts, the Southern Alps in the north, the Apennines to the west and the Dinarides in the east. The three orogens, associated with different subduction zones, formed in the broad and articulated framework of the N–S convergence between the European and the Adriatic plates. The Adriatic Sea geological province is one of the most important regions of natural gas and oil production in the entire Mediterranean area. Indeed, starting from the early 1950's about one hundred small gas fields have been discovered in the Italian part of the basin, mainly within Pliocene clastic sequences; a similar situation exists on the Croatia site. Recently, the Adriatic Sea has attracted much attention also for the geological storage of CO2, due to the occurrence of well-known physical traps (confirmed by the now mostly exploited hydrocarbon reserves) and deep saline aquifers within both the carbonate and siliciclastic sequences (Donda et al., 2013; Saftic et al., 2019; Proietti et al., 2023). These geological aspects, together with the presence of different industrial centers along the coasts (representing a relatively close source of CO2) and with the already existing infrastructure for the management and distribution of natural gas (gather center, pipelines), make the Adriatic Sea geological province a promising area for CO2 storage.
During the last fifteen years, several European projects have focused on the evaluation of the potential of CO2 storage and on the

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storage capacity calculation of the European territory. In the previous project appraisal of storage potential was focused on saline aquifers, both in the siliciclastic and in the carbonate portion of the stratigraphic succession; more recently, the potential of depleted gas reservoirs has also been evaluated (CO2Stop https://setis.ec.europa.eu/european-co2-storage-database_en). Southeastern Europe includes other areas of potential interest for the AURORA project: in particular, the onshore Balkan area, which includes the orogenic system of the Balkan chain (the so called "mobile Europe"), the onshore northern Greece, Croatia and Romania (Tasianas & Koukouzas, 2016; Kukouzas et al., 2009; Cormos, 2016). The total CO2 storage capacity of these countries was already evaluated in several EU projects (CASTOR, CCUSTRATEGY) and has been reviewed. Greece offers opportunities for CO2 geological storage such as deep saline aquifers in the Greek Mesohellenic basin and existing depleted hydrocarbon fields in the Tertiary sedimentary basins; previous estimation reaches the theoretical capacity of 700 gigaton. From the storage side evaluation, the method provides a double approach. On one side it evaluates the site from a geological point of view (considering some geological aspects as a function of data quality). On the other, it evaluates the state of development of the site from a technical-economic point of view, including the capacity estimation (introducing the concept of SPE SRMS). The adopted methodology (in common with the most recent EU project) has the aims to be comparable as much as possible with the already performed evaluation of the other provinces/sites of Europe, with the aims to homogenise the results. This choice will favour standardization of the adopted criteria for site selection in European countries that still does not have a comprehensive storage atlas; on the other side, as this methodology includes some economical/commercial aspects, it will provide a more complete full chain analysis.

Keywords: capacity evaluation, geological storage, southeastern Europe, Aurora project

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