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CO2 storage potential of deep saline aquifers: the case of Italy

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Together with the improvement of energy efficiency and a wider use of renewable sources, the CO2 Capture and Storage techniques (CCS) represent a key instrument for the reduction of CO2 emissions in the atmosphere. Deep saline aquifers offer the largest storage potential of all the geological CO2 storage options and are widely distributed throughout the Earth.
In order to verify the location of geological formations having the characteristics suitable for CCS in the Italian subsurface, a comprehensive analysis of about 55000 km of 2-D multichannel seismic profiles and about 1650 well data has been performed. This dataset has been acquired since 1957 by several oil companies for hydrocarbon exploration and has been made available by the Ministry of the Economic Development in the framework of the project "Visibility of Petroleum Exploration Data in Italy (VI.D.E.P.I.; www.videpi.com)".
Most of the selected sites lie in the major Italian sedimentary basins, i.e the Apennine foredeep and the Adriatic foreland, characterized by thick accumulations of sediments. The potential reservoirs are mostly represented by permeable, terrigenous deep saline formations, whose capacity ranges from 30 to more than 1300 Mt. In the evaluation of the CO2 storage potential in the Italian deep saline aquifers, we have adopted the method used in the EU GeoCapacity project (Vangkilde et al., 2008). The same procedure has been also utilized for estimating the CO2 storage potential of saline formations in the United States and Canada (U.S. Department of Energy, 2008). This method provides a regional estimate based on bulk volume of the aquifers referred to as the "effective storage capacity" (i.e. the reservoir capacity evaluated considering technical cutoff limits and technically viable estimate) (Bachu et al., 2007).
CO2 emissions from the major stationary point sources (i.e. power plants) amount to about 220 Mt, placing Italy in the fifth position among the major emitting European countries (www.geocapacity.eu). The 14 saline reservoirs we have identified could potentially store Italy's annual CO2 emissions for the next 50 years. This value represents a very conservative estimate of the Italian potential for the CO2 geological storage in deep saline aquifers because other potential promising reservoirs could lie in areas where data are not available at present. Moreover, carbonate formations have not been included in the overall estimate.
In our capacity estimation some uncertainties arise from the unavailability of specific data, such as the occurrence of local heterogeneities, that can affect CO2 distribution and migration within the reservoir, although, at this stage, no evidence of relevant leakage features are detected. However, additional, site-specific investigations accompanied by further data are needed to a more detailed evaluation of the potential CO2 storage sites.
Despite these uncertainties, this study highlights that CO2 geological storage is a viable option in Italy and provides the first systematic evaluation of the storage capacity of the potential reservoirs identified in the country.

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