CIVIL AND ENVIRONMENTAL ENGINEERING

DIATI - Experimental characterization of underground fluid storage systems

Funded By	Dipartimento DIATI
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Context of the research activity	Several aspects of the energy transition require underground storage, whether it is decarbonization by shifting to natural gas, CO2 sequestration in deep geological formations to compensate for CO2 emissions, or storage of chemical energy in the form of H2, obtained from electrical power. The research is concerned with the scientific and technological challenges related to system characterization, including fluids, rocks, and their mutual interactions, for efficient, economically and environmentally viable storage processes of natural gas, CO2, and hydrogen.
Objectives	The research topic concerns the laboratory investigations to characterize the properties of a storage and the validation of the adopted experimental methods. The underground system properties are related to the capacity, injectivity, and integrity of a storage, whatever the considered fluid. Capacity depends on the storage porous volume at reservoir conditions and the fluid thermodynamic behavior. Injectivity requires the characterization of the rock's effective permeability to the injected fluid at reservoir conditions. Integrity comprises the hydraulic sealing efficiency of the cap rock, typically a low-permeability clayey formation, which must guarantee the long-term confinement of gases in the underlying reservoir. The focus of the PhD project is the laboratory determination of the key fluid, petrophysical, and fluid-rock interaction parameters (PVT, porosity, absolute and effective permeability, capillary pressures, and threshold pressure) of underground fluid storage systems under reservoir conditions. These parameters will serve as the input to 3D numerical simulators to predict the system response to fluid injection (and withdrawal when applicable) for a range of operational conditions.
Skills and competencies for the development of the activity	Knowledge of deep geological formations, rock characteristics and fluid properties. Knowledge of laboratory testing equipment and methodologies for fluid and rock petrophysical characterization. Knowledge of 3D reservoir numerical simulation. MSc degree in Petroleum Engineering/Petroleum and Mining Engineering/Georesources and Geoenergy Engineering will be preferentially considered.