Short CV

Eleonora Parente has recently graduated in the Erasmus Mundus Joint Master of Science on Hydrogen Systems and Enabling Technologies (HySET). Through the MoS, she had the opportunity of studying in Politecnico di Milano and Universitat Politècnica de Catalunya and carrying out an internship at Shell Energy Transition Campus Amsterdam as part of her Master thesis. Her studies mainly focused on the field of green hydrogen production and storage, energy conversion technologies and renewable energy sources.

During her internship, she worked on proposing and applying a novel protocol for relative permeability computations from μCT images of imbibition experiments. This research could be beneficial for the technological development of underground hydrogen storage, potentially leveraging on the knowledge that has been acquired for other gases in subsurface storage.

Paper ID: 216

Paper title: *"Addressing fundamental knowledge gaps in Underground Hydrogen Storage"*

Abstract: Global energy scenarios have been progressively shifting toward renewable sources, driven by climate goals and policy mandates. However, the intermittent nature of renewables, such as solar and wind, necessitates scalable and flexible energy storage solutions. Green hydrogen has emerged as a promising carbon-neutral energy carrier, that can be used as a substitute vector in those sectors where electrification cannot yet succeed, such as hard-to-abate sectors and long-term large-scale energy storage applications. Underground Hydrogen Storage, UHS, in saline aquifers is considered a viable pathway to storing large volumes of hydrogen, enabling seasonal and backup energy supply, and creating necessary buffer for wider utilization of renewables worldwide. Reservoir simulation is used to assess the feasibility and optimization of such geological storage systems. Key input data includes petrophysical properties such as porosity and permeability but as relative permeability saturation functions. Due to the scarcity and inconsistency of hydrogen-specific data in the literature, this study proposed a new consistent and repeatable procedure for obtaining relative permeability. The key question addressed is whether hydrogen relative permeability is similar as other gases like nitrogen and methane where more data is readily available for relevant rock types. The novel protocol is tested across these gases, combining μCT imaging and pore-scale flow simulations to derive relative permeability curves over a broader saturation range, providing a final comparison between the obtained results. The comparative findings support the hypothesis of similar behavior between the different gases, justifying the use of model gases for early-stage UHS design, ultimately facilitating the development of such technology and the integration of hydrogen into renewable energy systems.