ESREL SRA-E 2025

Special session proposal

Title: Underground hydrogen storage: Understanding risks and ensuring safe and sustainable operations

Organizers:

Nadezhda Gotcheva, VTT Technical Research Centre of Finland, nadezhda.gotcheva@vtt.fi

Hanna Koskinen, VTT Technical Research Centre of Finland, hanna.koskinen@vtt.fi

Motivation

The attractiveness of the hydrogen economy is growing, driven by many factors. The EU's hydrogen strategy recognizes clean hydrogen as a key energy carrier in a European integrated energy system, which supports the EU's carbon neutrality ambitions. Since the production and demand of hydrogen needs to be balanced, underground hydrogen storages (UHS) are seen as critical to enable the stable supply and flexible use of hydrogen. In the future, a variety of storage solutions might be needed to meet diverse needs and ensure energy security.

Although progress has been made for advancing different UHS solutions for example in Sweden, USA, Australia, ensuring the safe and effective storage of hydrogen is far from trivial. A number of challenges remain, related to understanding emerging risks and opportunities from technical, economic, environmental, organizational, societal, safety and security perspectives, and interactions between these different aspects. Ensuring responsible operations, management and organizing for safety and sustainability are yet other challenges.

This session is supported by research project Hydrogen UnderGround (HUG), focused on underground storage of hydrogen in Finland. This two-year project brings together many industrial partners, with VTT Technical Research Centre of Finland and Geological Survey of Finland GTK assuming the central roles in project coordination and research activities.

Objective

This Special session invites participants to discuss emerging risks and safety aspects related to lifecycle and operations of UHS from a holistic perspective: how to understand and analyse the systemic nature of risks and safety, how to ensure safe and sustainable design and operations, how to establish a socially acceptable and responsible UHS business throughout the UHS lifecycle? These are some of the questions to address during this session, oriented towards ensuring safe and future-proof UHS solutions.