
EP001: The Geoscience of CO₂ Storage

Format and Duration
Self-Paced - 20 Hours

Summary

This package of Carbon Capture and Storage (CCS) self-paced e-learning courses will provide geoscientists and engineers with an awareness and understanding of subsurface CO₂ storage, CO₂ flow in the subsurface, and monitoring of the CO₂ storage site. It addresses the key issues of reservoir depth, well design, reservoir lithology, and quality.

EC003 - Fundamentals of Carbon Capture and Storage (CCS) provides participants with awareness and understanding of the subsurface needs of CCS projects. It will establish basics such as how much CCS is needed to make a difference to global warming and explore what types of CO₂ injection have already happened including dedicated long-term CCS projects, pilot projects and CO₂-enhanced oil recovery projects.

EC004 - Geological Storage of CO₂ provides participants with understanding of geological subsurface CO₂ storage volumetrics, CO₂ flow in the subsurface away from injector wells, the objective of permanent and safe storage of CO₂. It also covers the key issues of reservoir depth, well design, reservoir lithology, reservoir quality, and reservoir architecture. Issues of mineral dissolution under different reservoir conditions are considered.

EC005 - Behaviour of CO₂ in Reservoirs addresses CO₂ as a fluid phase and the key question of CO₂ storage efficiency, the equivalent of oil recovery factor. The course will address the rate of CO₂ injection and the role reservoir permeability. The all-important issue of the geomechanical effects of CO₂ injection and feedbacks between induced mineral dissolution and rock strength and other rock properties will be addressed. The range of possible interaction between CO₂ and both aquifer and top-seal will be covered.

EC006 - Monitoring CO₂ Storage considers the range of potential leakage mechanisms that need to be assessed. It will include a detailed consideration of the monitoring strategies available to assure the safety and integrity of the CO₂ storage site.

Learning Outcomes

EC003 - Fundamentals of Carbon Capture and Storage (CCS)

1. Understand the role of CCS in CO₂ emissions-reductions.
2. Develop awareness of the role of geoscience and reservoir engineering in CCS.
3. Understand CO₂ as a fluid in the subsurface and how it differs from oil, gas and water.

EC004 - Geological Storage of CO₂

1. Build awareness of the clastic and carbonate reservoir rocks that can be used to store CO₂
2. Consider the volumetrics of CO₂ storage and storage efficiency
3. Consider the effects of mineral dissolution by CO₂ under different reservoir conditions

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4. Be aware of issues encountered in the development of CCS projects

EC005 - Behaviour of CO₂ in Reservoirs

1. Gain an appreciation of the question of the injectivity of CO₂ and the roles of permeability and aquifer architecture on CO₂
2. Appreciate the types of CO₂ injections projects have occurred so far, and the ones that are planned
3. Be aware of issues related to reactions between CO₂ and saline formation waters
4. Consider the geomechanical effects of CO₂ injection and the implications for top-seal integrity

EC006 - Monitoring CO₂ Storage

1. Understand the key issues relating to the monitoring of CO₂ storage sites
2. Appreciate the causes of leakage and how they may be monitored
3. Understand the principles of risk assessment in CCS projects

Training Method

This is a bundle of self-paced e-learning courses. Learning materials are structured into short sections, each including interactive text and image content, animations, video, and audio. End of course quizzes are scored to provide the learner with their learning progress.

Who Should Attend

This course is designed for scientists and engineers working in the energy industry and provides a foundation in key aspects of carbon capture and storage.

Course Content

EC003 - Fundamentals of Carbon Capture and Storage (CCS)

- CO₂ in the atmosphere and options to cut CO₂ emissions
- Geological CCS, CCS as mitigation strategy
- CO₂-EOR and CCS: fate of CO₂ in the subsurface
- CO₂ phase behaviour and properties, CO₂ trapping

EC004 - Geological Storage of CO₂

- CO₂ storage volumes and controls on porosity in sandstone reservoirs
- CO₂ storage volumes and controls on porosity in carbonate reservoirs
- The risk and rate of mineral dissolution due to CCS, with a focus on calcite in sandstones and limestones
- CO₂ storage efficiency

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EC005 - Behaviour of CO2 in Reservoirs

- Injectivity at CCS sites and controls on permeability in potential CCS reservoirs
- Relative permeability, formation damage, and history matching for CO2 flow patterns
- The geomechanical responses to elevated CO2 pressure
- The risk and rate of mineral precipitation in halite and water salinity, plus CCS in basalt
- Top-seal properties and stability at CCS sites

EC006 - Monitoring CO2 Storage

- CO2 risk of leakage from CCS sites and borehole issues
- CO2 leakage associated with geomechanical issues
- Monitoring and risk assessment of CCS projects