

Geology for Non-geologists (G088)



Tutor(s)

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Overview

The aim of this course is to provide an overview of the fundamental geological topics relevant to the modern energy industry. Focus will be placed on petroleum geoscience and the basics of petroleum exploration, but the course will also cover geothermal systems, carbon capture and storage, and hydrogen energy.

Duration and Logistics

Classroom: A 2-day course comprising a mix of lectures, case studies and exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Four 3.5-hour interactive online sessions presented over 4 days. Digital course notes and exercises will be distributed to participants before the course.

Level and Audience

Fundamental. The course is largely aimed at non-geologists who are interested in knowing more about the fundamentals of geology and how these relate to the modern energy industry.

Objectives

You will learn to:

1. Describe the fundamental principles of geology, including different rock types, geological time and stratigraphy.
2. Understand the basics of petroleum geoscience, including the formation of oil and gas.
3. Review the different types of reservoir rocks and their properties, including porosity and permeability.
4. Recognize how we search for oil and gas, including using seismic and other data.
5. Understand how we drill for oil and gas and how we acquire information from wells, such as log and core data.
6. Recognize what technical staff in companies do and how they work together.
7. Describe the basic principles of carbon capture and storage and how it is being adopted worldwide as a climate change mitigation tool.
8. Understand the basics of geothermal energy, what it is and how it can be used.
9. Appreciate how hydrogen energy can be used and stored underground.

Course Content

Section 1: The principles of geology and the subsurface

Geological principles:

- Structure of the Earth
- Plate tectonics
- Rock types
- Geological time
- Stratigraphy

Energy industry structure:

- Global distribution of reserves and production (oil and gas)
- Industry players and stakeholders (States, NOCs, IOCs, Independents etc.)
- Oil and gas value chains (define upstream, downstream, trading etc.)
- How companies create value for resource owners (states) and investors
- Energy statistics, trends and future challenges
- Climate change and potential mitigations

Section 2: Oil and gas basics

The value chain:

- Exploration
- Appraisal
- Development
- Production
- Abandonment

Petroleum systems:

- Source rocks – formation, maturation and migration
- Reservoirs
- Seals
- Traps

Imaging the subsurface:

- Satellite and airborne data
- Seismic – 2-D and 3-D
- Well logs and core
- Analogues – outcrop studies, other oil/gas fields

Section 3: Drilling holes and getting hydrocarbons out

Overview of the drilling process:

- Drill bits, drill pipe, running casing and cementing

Types of wells:

- Vertical, horizontal and multilateral
- Exploration, appraisal, production and injection

Rig types:

- Land, barge, jack-up, semi-sub and drillship

Section 4: The future energy mix

Geothermal energy:

- How is this different to oil and gas?
- How do we extract heat from the subsurface?

Carbon capture and storage:

- Capturing carbon dioxide
- Storing carbon dioxide
- Monitoring the subsurface reservoir

Hydrogen energy:

- Producing hydrogen
- Uses
- Storing it underground

Other geological roles in energy:

- Geonuclear – waste disposal
- Critical minerals for the energy transition