Aquifer Thermal Energy Storage (G519)

Tutor(s)

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Overview

This course covers all subsurface aspects of Aquifer Thermal Energy Storage (ATES) and includes a brief overview of surface engineering and infrastructure requirements. The course includes an introduction to ATES, aquifer characterization for ATES, including geological and petrophysical considerations, ATES performance prediction, including modelling and simulation, and engineering considerations, including ATES system management and optimization.

Duration and Logistics

Classroom version: A 3-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: Five 3.5-hour interactive online sessions presented over 5 days. A digital manual exercise will be distributed to participants before the course. Some reading and exercises are to be completed by participants off-line.

Level and Audience

Advanced. The course is relevant to geoscientists and engineers and is intended for recent graduates and professionals with experience of, or a background in, a related subsurface geoscience or engineering area.

Objectives

You will learn to:

1. Describe the underlying principles of ATES and the context of its deployment worldwide.
2. Evaluate the properties of an aquifer for ATES deployment.
3. Perform aquifer characterization for ATES.
4. Appreciate the engineering considerations for efficient and sustainable ATES operation.
5. Understand modelling and simulation of ATES.
6. Optimize single and multiple ATES projects.
7. Evaluate surface infrastructure requirements and operation.
8. Review the regulatory considerations for deployment and operation.

Course Content

Course Details

This course will focus on the subsurface geoscience and engineering considerations for ATES.

Session 1: Introduction to ATES – definitions and international context

- Basic requirements for ATES
- Types of ATES systems and global projects
- Basic principles of operation
- Characterizing ATES efficiency and operation
- Case study
- Exercise

Session 2: Aquifer characterization for ATES

- Aquifer characterization for ATES
- Mass and heat transfer
- Scales of characterization
- Porosity
- Concept of representative pore volume
- Permeability
- Thermal conductivity and specific heat capacity
- Exercise

Session 3: Modelling and simulation of ATES

- Mass and heat transfer in aquifers
- Rock properties and data acquisition
- Modelling the reservoir
- Geological modelling of ATES
- Numerical simulation

Session 4: Engineering ATES deployment and operation

- Pumping tests
- Thermal response tests
- System design
- Sustainable operation
- Impacts on groundwater
- Exercise

Session 5: Surface facilities, regulatory issues and economic considerations

- Positive attributes and barriers to ATES
- Strategies to overcome barriers
- Surface facilities
- Economic considerations
- Decarbonization value
- Exercise