Geothermal Energy: Resources, Projects and Business Aspects (G529)

Tutor(s)

David Townsend: CEO, TownRock Energy.

Overview

This course explores the key themes of geothermal energy from the fundamentals of what a geothermal resource is and what it can offer, through to project examples and the business case. The course will explore a variety of geothermal resource types and current EU-based project examples, in addition to environmental considerations, legislation and future innovations and emerging technologies.

Duration and Logistics

Classroom version: 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. A paper by the course presenter will be distributed to participants before the course, and materials for an interactive cashflow modelling exercise will be distributed during the course.

Level and Audience

Fundamental. The course is aimed at those individuals looking to transition to geothermal projects and/or who are new to the geothermal industry

Objectives

You will learn to:

1. Understand the basics of geothermal resources and their use and applications.
2. Recall the fundamental characteristics of geothermal resources and reservoirs.
3. Appreciate the European potential for geothermal projects and case studies representative of the current state of active projects, as well as some case studies of unsuccessful projects.
4. Describe the fundamentals of a geothermal project business case, including identifying the relevant stakeholders, the project development timeline and the risks and mitigations.
5. Assess the financial framework of a geothermal project and how to create a business model and de-risk these projects.
6. Assess the potential environmental impacts of geothermal developments.
7. Understand how emerging technologies can be included as part of a geothermal project and how these could rewrite the way geothermal business models are developed in the future.

Course Content

Course Detials

The course will illustrate geothermal project development from the point of identified value through to a business case and model. The tutor will explore current projects in development and give attendees a sound understanding of their business context.

Introduction to geothermal energy

- What is geothermal energy?
- Where are geothermal energy systems utilized?
- High, medium and low enthalpy
    - installed capacity worldwide
- Classification of geothermal systems
    - volcanic, convective fracture, sedimentary aquifers and HDR, pressured systems (O&G)
- Uses of geothermal energy
    - power, industrial heat, greenhouses, district heating, leisure
- What makes geothermal energy a sustainable renewable energy?
    - geothermal system sustainability assessment
    - environmental sustainability
    - carbon footprint

European potential for geothermal and current low enthalpy projects

- History of geothermal in Europe (timeline)
- Geological structure and heat flow
- Heat vs electricity
- Different resources and EU project examples (shallow aquifers, mine water, deep geothermal)
- Re-purposing oil and gas infrastructure
- EU and select nation-state governmental policy (decarbonizing heat)

Fundamentals of a geothermal project business case

- Stakeholders
- Project development timeline to reduce risk and raise funding through stage-gate process
- Being demand led: start with the customers’ needs!
- Project risks
- Assessing revenue streams
- Assessing capex
- Assessing opex
- Joining the dots to make a project investable

Financing of geothermal projects

- Sliding scale of the capex of projects (deep geothermal at the top, shallow at the bottom)
- Reasons for this difference in capex and opex
- How to finance a project
    - grant funded
    - government / council backed
    - private
    - loans / equity / pensions
- Developing a cashflow forecast
- After-care – O&M and optimization

Mine water energy

- History of mining
- Mine locations in Europe
- General overview of mine water energy
- Creating a business case for a mine water heating project
- Active TownRock project case studies

Hot sedimentary aquifers (HAS)

- What is an HSA?
- European sedimentary basins
- Cross-sections through basins, showing depths and temperatures
- Creating a business case for a hot sedimentary aquifer heating project
- TownRock case studies with explanation of cost benefit of ‘going deeper’ to avoid the need for a heat pump
- Capex vs opex discussion

Deep geothermal

- Location of granites
- Fractures
- Explanation on the increased thermal gradient
- Creating a business case (major heat customer)
- Is there a place for Engineered Geothermal Systems (EGS)?
- Geohazards: induced seismicity

Thermal storage

- What is it?
- General technology overview and application of TES
- TES options (boreholes, aquifers, water tanks, salts)
- BodyHeat case study and creating a business case

Innovation and emerging technologies

- Technological innovations
    - hybrid systems
    - integrated systems
    - cascading systems
- Emerging technologies
    - EGS systems
    - closed-loop systems – Eavor
    - repurposing oil and gas wells / infrastructure
- Future energy market
    - development risks
    - lithium and other metals extraction
- Future innovation (community, legislation, industry)
- How do these de-risk / benefit the financing of geothermal projects