Enhanced Geothermal Systems: Design Optimization and Project Examples (G581)

Tutor(s)

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Overview

In Enhanced Geothermal Systems (EGS), hydraulic stimulation is applied to improve the productivity of wells drilled in hot, low-permeability formations. This training course provides an introduction to EGS fundamentals including history, stimulation designs, and challenges and opportunities. We will present FORGE and Fervo case studies, briefly cover market trends and thermodynamics, and work through exercises calculating power output and thermal decline for an idealized EGS reservoir and understanding the stress field and implications on EGS design at FORGE from wellbore and test data obtained.

Duration and Logistics

Virtual version: Two 3.5 hour online sessions presented over two days comprising a mix of lectures and exercises. The course manual will be provided in digital format.

Level and Audience

Advanced. The course is largely aimed at geologists and engineers working EGS projects.

Objectives

You will learn to:

1. Outline key geothermal technical themes with a focus on EGS (history, current case studies, market trends, thermodynamics).
2. Evaluate modern stimulation designs for EGS as applied at FORGE and Fervo.
3. Assess EGS challenges (induced seismicity, poor connectivity, rapid thermal decline) and potential mitigation strategies.

Course Content

Course Details

Lectures

- Introduction to geothermal generally and historic background on EGS
- Current market pull for EGS
- Stimulation design for EGS
- Calculating flow and power output
- Thermal breakthrough
- Mechanisms of stimulation
- The Utah FORGE project
- EGS design optimization at Fervo’s Project Cape
- Induced seismicity

Exercises

1. For a certain EGS design, calculate power output (based on flow rate, temperature, power plant efficiency), and expected thermal decline (based on cluster spacing, fracture area, and flow per cluster (with Gringarten).
2. Using FORGE data (e.g., image logs, injection tests) – derive information on the stress field, (e.g. Shmin magnitude and orientation) and what the implications are for an EGS design.