

CIVIL-470

Geothermal resource development

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Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Opt.
Civil engineering minor	H	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Oral
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course provides an overview of the geothermal energy sector, spanning core topics of geology, thermodynamics, hydrogeology, and geochemistry and tackles questions of geothermal resource exploration, assessment, exploitation, economics, and environmental, and societal considerations.

Content

The objective of this course is to provide students with an overview of the geothermal energy sector, from fundamental basics to resource exploration, assessment, exploitation, and economic/environmental/societal consequences.

The course is divided into three main parts:

In the first part, we review key concepts in geology, thermodynamics, hydrogeology, and geochemistry, contextualised to geothermal systems.

In the second part of the course, we address resource exploration, assessment, and exploitation. Students will apply the general knowledge gained in the first part of the course to understand how we search for and identify geothermal resources. Students will learn how heat and energy availability are assessed. The course will also offer an overview of exploitation techniques.

In the third part of the course, we will focus on specific methods and challenges particular to a selection of geothermal type systems, including enhanced geothermal systems. The course ends by considering the economic, environmental, and societal implications and challenges associated with geothermal energy implementation.

Keywords

Geothermal energy
Renewable energy

Learning Prerequisites**Required courses**

PHYS-106 General physics: thermodynamics
CH-160 General chemistry

Recommended courses

CIVIL-308 Rock mechanics
CIVIL-209 Urban thermodynamics

ENV-221 Hydrology for engineers
CIVIL-211 Geology

Important concepts to start the course

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Heat transfer mechanisms: radiation, conduction, convection

- First Law of Thermodynamics
- Second Law of Thermodynamics
- Gibbs function / Gibbs energy
- Introductory inorganic chemistry

Learning Outcomes

By the end of the course, the student must be able to:

- Explain key scientific and practical aspects associated with the geothermal energy sector
- Choose appropriate techniques for geothermal resource assessment
- Perform resource assessment
- Propose resource exploitation plans
- Anticipate environmental and societal consequence of geothermal projects

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Take feedback (critique) and respond in an appropriate manner.

Teaching methods

Lectures and bi-weekly assignments

Expected student activities

Bi-weekly assignments, oral exam

Assessment methods

Bi-weekly assignments (50%), oral exam (50%)

Supervision

Office hours	Yes
Assistants	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Notes/Handbook

Geothermal Energy Second Edition: Renewable Energy and the Environment, by William E. Glassley

Moodle Link

- <https://go.epfl.ch/CIVIL-470>