



3-day course

# Energy geostructures: analysis and design

February 21 to 23, 2022

## Target audience

Professionals - such as civil and energy engineers, architects, urban project managers or geologists - and scientists who want to acquire knowledge on the energy, geotechnical and structural performance of energy geostructures.

The course will be given in English.

## Requirements

- No specific experience with energy geostructures is needed.
- Basic knowledge of soil and structural mechanics.

Participants should bring their own laptop (for use during the practical application exercises).

## Dates and schedule

- Monday, February 21, 2022
  - Tuesday, February 22, 2022
  - Wednesday, February 23, 2022
- from 9 am to 5 pm (UTC+2)

## Certification

A certificate of attendance will be delivered at the end of the course.

## Course venue

The course can be attended either face-to-face (EPFL, Lausanne, Switzerland) or online.

## Organisation

Laboratory of Soil Mechanics (LMS), Swiss Federal Institute of Technology Lausanne (EPFL)

## Overview

The application of environmentally friendly technologies that exploit renewable energy sources is key to follow international agreements for the development of low-carbon buildings and infrastructures. Energy geostructures are an innovative, multifunctional technology that can be used to address the aforementioned challenge. By coupling the role of the ground structures with that of the geothermal heat exchangers, energy geostructures can serve as structural supports as well as heating and cooling elements for buildings and infrastructures.

The analysis and design of energy geostructures require the integrated knowledge of various aspects in the broad field of engineering. How can energy geostructures be analysed and designed from an energy point? What will be the energy performance of energy geostructures over time? How can energy geostructures be analysed and designed from a geotechnical and structural point of view? How can the coupled action of thermal and mechanical loads be considered through current standards and latest international recommendations?

## Objectives

- Understand and analyse the thermal and mechanical behaviour of energy geostructures, with reference to the latest scientific achievements
- Be able to perform the energy, geotechnical and structural design of energy geostructures
- Learn how to exploit current standards available at the European level (e.g., the so-called "Eurocodes") for the design of energy geostructures
- Be able to perform all of the key steps involved in the analysis and design process of energy geostructures with practical application exercises
- To learn on some practical examples of recent projects worldwide

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Register on [www.formation-continue-unil-epfl.ch](http://www.formation-continue-unil-epfl.ch)

## Course fee

1900.- Swiss Francs, including:

- Course material
- Three-month license of academic version of the Thermo-Pile software
- 10% special discount for contributing members of EPFL Alumni

## Registration deadline

December 17, 2021

Number of face-to-face participants is limited.

## Programme Directors

- **Prof. Lyesse Laloui, Ph.D.**  
*Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland*
- **Prof. Alessandro F. Rotta Loria, Ph.D., P.E.**  
*Northwestern University, Chicago, U.S.A.*

## Invited speakers

- **Mr. Tony Amis**  
*Energy expert, GI-Energy, U.S.A.*
- **Mr. Didier Mülhauser**  
*Contractor expert, Marti SA, Switzerland*
- **Mr. Luis de Pereda Fernández**  
*Architect, ENERES, Spain*

## Teaching approach

- Optimum balance between theory and practice (application sessions including analytical and numerical simulation exercises)
- Teaching based on cutting-edge scientific achievements
- Case studies based on real energy geostructure projects, for which the Programme Directors worked as expert consultants



## Programme

### PART A - Introduction (Day 1)

- Renewable energy exploitation for a sustainable development
- Energy geostructures: the technology

### PART B - Energy aspects (Day 1)

- Heat and mass transfers in the context of energy geostructures
- Analytical modelling of steady heat and mass transfers
- Analytical modelling of transient heat transfer
- Estimation of thermal potential of sites and design parameters
- *Application exercise: Analysis of the thermo-hydraulic behaviour of an energy geostructure*

### PART C - Geotechnical and structural aspects (Days 2 & 3)

- Thermo-mechanical behaviour of single and groups of energy piles
- Thermo-mechanical behaviour of energy walls and energy tunnels
- Thermo-hydro-mechanical behaviour of soils
- Thermo-mechanical behaviour of soil-concrete interfaces
- *Application exercise: Analysis of the thermo-mechanical behaviour of an energy geostructure*

### PART D - Integrated energy, geotechnical and structural design (Day 3)

- Analysis of constructed energy geostructure projects around the world
- Performance-based design of energy geostructures in the context of Eurocodes

Detailed programme on the website



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