

ENV-421

Sustainability, climate and energy

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Cursus	Sem.	Type
Environmental Sciences and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	5 weekly
Lecture	3 weekly
Exercises	2 weekly
Number of positions	

Summary

The course provides students with a comprehensive scientific understanding of the links between climate and energy systems in the context of sustainability. It will cover topics related to natural and anthropogenic climate change, the fundamentals of energy systems and their efficiency.

Content**The climate system**

1. Earth energy balance
2. Biosphere and carbon cycle
3. Climate archives
4. Natural forcings, slow and fast factors
5. Anthropogenic forcings, climate sensitivity and feedbacks

The energy systems

1. Evolution of resources and demands
2. Power cycles
3. Conventional and renewable energy resources, advantages and drawbacks
4. Energy, life cycle and carbon budget

Climate impact on energy

1. Case studies as a function of energy resources
2. Social acceptance of energy transitions

Keywords

Climate change, Earth system, greenhouse gases, energy system, energy conversion, fossil and renewable sources, feedbacks

Learning Prerequisites**Required courses**

None

Recommended courses

ENV-320: Physics and chemistry of the atmosphere

Important concepts to start the course

Thermodynamics
Conservation principles

Learning Outcomes

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

- Discuss the concepts of climate variability at different time scales and climate sensitivity
- Draw the energy balances of an energy conversion system
- Describe the climate limitations to energy conversion scenarios
- Interpret climate data and model outputs

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Communicate effectively with professionals from other disciplines.
- Summarize an article or a technical report.
- Access and evaluate appropriate sources of information.

Teaching methods

Course ex-cathedra and exercises.

Project work with teams.

Field visit.

Expected student activities

Lecture attendance, exercise assignments, project work, presentations

Assessment methods

20% exercises

30% project

50% exam

Supervision

Assistants	Yes
Forum	Yes

Resources

Moodle Link

- <https://go.epfl.ch/ENV-421>