ME-409

Energy conversion and renewable energy

Maréchal François, Moret Stefano

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.
Energy Management and Sustainability	MA1, MA3	Opt.
Energy minor	H	Opt.
Environmental Sciences and Engineering	MA1, MA3	Opt.
Minor in Integrated Design, Architecture and Sustainability	H	Opt.
Nuclear engineering	MA1	Opt.

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

Summary

The goal of the lecture is to present the principles of the energy conversion for conventional and renewable energy resources and to explain the most important parameters that define the energy conversion efficiency, resources implications and economics of the energy conversion technologies.

Content

Overview of energy stakes
Thermodynamic principles relevant for energy conversion systems, review of thermodynamic power cycles, heat pumps and refrigeration cycles, co-generation
Carbon capture and sequestration
Renewable energy vectors, their physical principles and essential equations: Solar (photovoltaics and thermal - collectors/concentrators), geothermal, biomass (a.o. gasification, biogases, liquid biofuels), hydro, wind
Fuel cells and hydrogen as energy vector
Storage of energy: Batteries, compressed air, pumped hydro, thermal storage
Integrated urban systems

Keywords

Energy conversion, renewable energy

Learning Prerequisites

Required courses

Physics I
Physics II

Important concepts to start the course

Conservation principles (energy, mass, momentum)
Some basis in thermodynamics

Learning Outcomes

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

- Quantify the efficiency and the main emission sources of energy conversion processes
- Explain the efficiency and the main emission sources of energy conversion processes
- Model energy conversion systems and industrial processes
- Draw the energy balances of an energy conversion system

- Elaborate energy conversion scenarios
- Describe the principles and limitations of the main energy conversion technologies
- Compare energy conversion systems

Transversal skills

- Use a work methodology appropriate to the task.
- Demonstrate the capacity for critical thinking
- Write a scientific or technical report.
- Access and evaluate appropriate sources of information.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.

Teaching methods

ex cathedra courses 2 hours per week and 1 hour of exercice with teaching assistant

Expected student activities

- active partiicpation to the lecture
- exercice for the exam presentation
- a mini project consisting in writing a 6 page report on an energy scenario for Switzerland

Assessment methods

Written exam (66%) and a project report (34%).

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Notes/Handbook

Slides, videos and other documents are available on moodle

Websites

- http://moodle.epfl.ch
- http://www.energyscope.ch

Moodle Link

- http://moodle.epfl.ch/course/view.php?id=15230

Videos

- http://available on moodle