AR-403

Bioclimatic buildings and districts

Cursus	Sem.	Type
Energy Science and Technology	MA2	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	12
Hours	**2 weekly**
Courses	1 weekly
Exercises	1 weekly
Number of positions	

Remark

pas donné en 2019-20

Summary

The objective of this course is to identify, understand and design energy fluxes and energy systems from the building to the district scale.

Content

- Definition of the bioclimatic principles from buildings to urban scale.
- Analysis of the energy fluxes within the buildings and districts.
- Passive and active solar systems and their integration within the urban environment.
- Renewable energy sources (for heating and electricity) and storage technologies.
- Sustainable energy systems, e.g. heat pumps, cogeneration, etc.
- Energy renovations, existing strategies and economical potential.
- Analysis of the buildings energy balance and its optimisation to cope with climate change.
- Indoor and outdoor thermal comfort.
- Building Energy Analysis tools (e.g. LesoSai, Insight for Revit, Ladybug Tools for Rhino) and national/ international standards.

Keywords

- Bioclimatic technology
- Energy efficiency
- Renewable energy

Learning Prerequisites

Recommended courses

Building physics.

Important concepts to start the course

Fundamental principles of building physics and sustainable development.

Learning Outcomes

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

- Assess / Evaluate the renewable energy potential (active and passive), from the building to the district scale, as well as the storage strategies.
- Quantify the energy behaviour of a building, and a district, and being able to optimise it.
- Assess / Evaluate and quantify the heating and cooling demand of buildings, in order to face the climate change.
- Propose concrete strategies to reduce the energy footprint of constructions.

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Take account of the social and human dimensions of the engineering profession.
- Demonstrate a capacity for creativity.
- Access and evaluate appropriate sources of information.
- Write a scientific or technical report.
- Use both general and domain specific IT resources and tools

Teaching methods

The course is subdivided into two main parts: i) in class teaching and ii) a practical exercise. The in class teaching consists in one hour course, and weekly exercises. The practical exercise is the real application of the theory, focusing on the study and the energy optimisation of real building.
A dedicated web site is available for the students, to complete the resources available in the Moodle.

Expected student activities

Students are expected to actively participate to the course. Students will work in groups. Each group will carry-out a comprehensive study on the assigned theme during the semester.

Assessment methods

The evaluation is based on a written report (50%) of the work performed during the semester, and the final exam (50%).

Supervision

Office hours	Yes
Assistants	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

A comprehensive bibliography is provided during each course.
The following readings are recommended during the semester:
Erell, Pearlmutter, Williamson (2011). *Urban Microclimate. Designing the Spaces between Buildings*. Earthscan
Robinson (2011). *Computer Modelling for Sustainable Urban Design: Physical Principles, Methods and Applications*. Earthscan
Roulet (2004). *Santé et qualité de l'environnement intérieur dans les bâtiments.*

Ressources en bibliothèque

- Urban Microclimate. Designing the Spaces between Buildings / Erell
- Computer Modelling for Sustainable Urban Design / Robinson
- Santé et qualité de l'environnement intérieur dans les bâtiments / Roulet

Websites

- https://www.epfl.ch/labs/leso/