

ENG-445

Building energetics

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Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Obl.
Energy Management and Sustainability	MA1, MA3	Opt.
Energy Science and Technology	MA1, MA3	Opt.
Energy minor	H	Opt.
Minor in Integrated Design, Architecture and Sustainability	H	Opt.

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

Summary

The course presents the fundamentals of energy management in buildings while emphasizing the need for human comfort. The learning is supported by building energy modeling of a case study building which offers an opportunity to understand trade-offs between energy and comfort.

Content

- Energy concepts in buildings
- Fundamentals of heat balance at a building level, Building envelope
- Thermal comfort in buildings
- Indoor air quality
- Building ventilation
- Occupant behavior in buildings
- Heating and cooling demand in buildings
- Heating and cooling generation systems

Keywords

Energy demand; human comfort; indoor environmental quality; building energy modeling, HVAC and building envelope

Learning Prerequisites**Recommended courses**

Elementary building physics

Important concepts to start the course

- Heat transfer
- Comfort and indoor climate
- Energy demand in buildings

Learning Outcomes

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

- Estimate heat flows and energy use in buildings
- Interpret interactions between comfort needs of occupants, building envelope and HVAC systems
- Interpret indoor environmental quality standards
- Complete basic building energy simulation software operations

Transversal skills

- Take account of the social and human dimensions of the engineering profession.
- Demonstrate the capacity for critical thinking
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Communicate effectively, being understood, including across different languages and cultures.
- Make an oral presentation.

Teaching methods

Lecture presentations, group discussions, project work and exercises

Assessment methods

Group work on the case study: 40%

Two written tests on the theoretical bases: 60% (35+25)

Resources

Bibliography

- Lecture notes (primary source)
- Y. A. Çengel; A. J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications. McGraw Hill Education, 5th edition
- Edward Allen. How Buildings Work: The natural Order of Architecture, 3rd ed.
- ASHRAE Handbook of Fundamentals, 2018
- Claude-Alain Roulet. Énergétique du bâtiment - Tome 1 and 2. PPUR.
- Different building standards such as ISO 17772, ISO 6946, ASHRAE 55, ASHRAE 62.1, SIA 380/1, SIA 2024.
- Peer-reviewed papers and websites – it will be provided throughout the semester.

Ressources en bibliothèque

- [ASHRAE 55](#)
- [SIA 2024](#)
- [Claude-Alain Roulet. Énergétique du bâtiment](#)
- [SIA 380/1](#)
- [ASHRAE 62.1](#)
- [Edward Allen. How Buildings Work](#)
- [Y. A. Çengel; A. J. Ghajar, Heat and Mass Transfer](#)
- [ASHRAE Handbook of Fundamentals, 2017](#)
- [ISO standards available online on sagaweb](#)

Notes/Handbook

Ressources en bibliothèque : Énergétique du bâtiment / Roulet

Polycopiés : Énergétique du bâtiment

Prerequisite for

"Le contenu de cette fiche de cours est susceptible d'être modifié en raison du covid-19"