

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

It presents the fundamentals of operational energy management in buildings while emphasizing the need for comfort of occupants (thermal&air quality). The learning is supported by exercises that offer an opportunity to understand interactions and trade-offs between energy use and comfort requirements

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**Required 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:

- Comprehend the heat flows and energy use in buildings
- Evaluate interactions between comfort needs of occupants, buildings envelope and HVAC systems
- Learn how to interpret the indoor environmental quality standards
- Learn the basics of a building energy simulation software

Transversal skills

- Set objectives and design an action plan to reach those objectives.

Teaching methods

Lecture presentations, group discussions, and exercises

Assessment methods

Two written tests on the lecture materials : 50% + 50%

Supervision

Office hours	Yes
Assistants	Yes

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. Energétique 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. Energétique du bâtiment](#)
- [SIA 380/1](#)
- [ISO standards available online on sagaweb](#)
- [Edward Allen. How Buildings Work : ebook en commande](#)
- [Y. A. Çengel; A. J. Ghajar, Heat and Mass Transfer](#)
- [ASHRAE Handbook of Fundamentals, 2017](#)
- [ASHRAE 62.1](#)

Notes/Handbook

Ressources en bibliothèque : Energétique du bâtiment / Roulet
 Polycopiés : Energétique du bâtiment

Prerequisite for

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