ENV-501

Material and energy flow analysis

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

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

It is not allowed to withdraw from this subject after the registration deadline.

Summary

This course provides the bases to understand material and energy production and consumption processes. Students learn how to develop a material flow analysis and apply it to cases of resource management. They analyze the implications of their models on resource use, economic activities and policy.

Content

- Resource management and Industrial Ecology
- Methods for analysing resource management issues
- Material Flow Analysis
- Extended input output analysis
- Urban and regional metabolism
- Applications to minerals, metals, water and energy
- Course project based on industry cases
- Data sources, quality and uncertainty
- Overview of existing software packages and databases
- MFA as support system for decision and policy making

Keywords

- Industrial Ecology
- Resource management
- Modeling
- Material flow analysis
- Input output analysis
- Industry cases
- Policy implications

Learning Prerequisites

Recommended courses

Life cycle assessment

Important concepts to start the course

Linear algebra
Transport phenomena

Learning Outcomes

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

- Develop a material and energy flow analysis for a relevant resource problem
- Justify and critically reflect on system analysis
- Derive policy implications for production and consumption processes based on their results
- Assess / Evaluate and understand the modeling results of other students
- Apply a software package for system modeling

Transversal skills

- Access and evaluate appropriate sources of information.
- Use both general and domain specific IT resources and tools
- Use a work methodology appropriate to the task.
- Give feedback (critique) in an appropriate fashion.
- Demonstrate the capacity for critical thinking
- Demonstrate a capacity for creativity.
- Write a scientific or technical report.
- Collect data.

Teaching methods

Interactive lectures and exercises with a graded group project
Invited lecturers from the private sector

Expected student activities

We expect students to participate in all lectures and exercise sessions including visits in the industry. Students should complete the exercises on a weekly basis to understand the theory and practice of MFA. The course and group project build on MFA models and student are expected to work effectively on their own, in small groups and with the help of lecturers. They are expected to present their projects' results to practice partners.

Assessment methods

Student will be evaluated in two ways:

- A midterm exam to evaluate theoretical part of the cours (40 % of the final grade)

- An oral presentation and a written report for a group project to evaluate the students capability to model, analyze and interpret a practical resource problem (60 % of the final grade)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Baccini, P., Brunner P., Metabolism of the Anthroposphere - Analysis, Evaluation, Design. The MIT Press, Cambridge, Massachusetts, 2012
Binder CR. Material Flow Analysis (MFA). Berkshire Encyclopedia of Sustainability: measurements, indicators, and research methods for sustainability, Berkshire Publishing Group; 2012.
Moreau, V., & Massard, G. (2017). Material and Energy Flow Analysis. In *Oxford Encyclopedia of Environmental Sciences*. Oxford University Press. DOI: 10.1093/acrefore/9780199389414.013.10
Additionnal literature references will be provided during the semester on moodle

Ressources en bibliothèque

- Metabolism of the Anthroposphere / Baccini

Notes/Handbook

All teaching material will be accessible via moodle during the semester