

ENV-501

**Material flow analysis and resource management**

Binder Claudia R., Felix Martin Del Campo Francisco Xavier

<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Energy Science and Technology	MA1, MA3	Opt.
Environmental Sciences and Engineering	MA1, MA3	Opt.
Managmt, dur et tech	MA3	Opt.
Minor in Engineering for sustainability	H	Opt.
Minor in Integrated Design, Architecture and Sustainability	H	Opt.
Territories in transformation and climate minor	H	Opt.
Urban Planning and Territorial Development minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
Project	1 weekly
<b>Number of positions</b>	

**Summary**

This course provides the basis to understand material and energy production and consumption processes. Students learn how to develop a material flow analysis and apply it to resource management cases. 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
- (Spatially explicit) urban, regional and national metabolism
- Dynamics of minerals, metals, water and energy use
- Circular economy
- Combination of material and social science models
- Course project based on industry and/or regional 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
- Material flow analysis
- Dynamic and spatially explicit modeling
- Cities, regions and nations
- Circular economy
- Integrating economic, social and material perspectives
- 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 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 scholars
- 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.
- Keep appropriate documentation for group meetings.
- Chair a meeting to achieve a particular agenda, maximising participation.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

### **Teaching methods**

Interactive lectures and exercises with a graded group project

Invited lecturers from the private sector

Collaboration and exchange with the research group for sustainable energy and material flow management from University of Freiburg iBr. (Germany)

### **Expected student activities**

We expect students to participate in all lectures and exercise and project sessions. 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 students 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 colleagues and/or practice partners.

### **Assessment methods**

Student will be evaluated in two ways:

- A final exam to evaluate theoretical part of the course (50 % 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 (50 % 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.

Brunner, P. H., & Rechberger, H. (2016). *Handbook of material flow analysis: For environmental, resource, and waste engineers*. CRC press.

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

Additional literature references will be provided during the semester on moodle

### Ressources en bibliothèque

- [Metabolism of the Anthroposphere / Baccini, Brunner](#)
- [Material Flow Analysis \(MFA\). Berkshire Encyclopedia of Sustainability: measurements, indicators, and research methods for sustainability / Binder](#)
- [Handbook of material flow analysis / Brunner, Rechberger](#)
- [Material and Energy Flow Analysis / Moreau, Massard](#)

### Notes/Handbook

All teaching material will be accessible via moodle during the semester

### Moodle Link

- <https://go.epfl.ch/ENV-501>

### Videos

- [http://Will be provided on Moodle](#)