UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Non-Renewable Resources – Global Abundances, Incidences, and Accessibility

2526-1-F7603Q005-F7603Q00501

Aims

The teaching of this module is aimed at providing the knowledge and the methodological basis to understand the principles concept related to the interface between resource, production and consumption systems and related environmental pressures and impacts.
The course will focus on the key processes, practices and sectors relying on resources and how their pressure and impacts on environment could be systematically addressed by means of approaches assessing supply chains, like life cycle assessment. These approaches allow assessing the interplay between resources and impacts, modelling cause-effect chains, and comparing effects with the limits of the planet.
Hence, this course provides an in-depth examination of the challenges and opportunities associated with non-renewable resources, resource efficiency, circularity. Students will learn about the impacts of human activities on the environment, the importance of sustainable resource management, and the principles and practices of supply chain assessment. The course aims to equip students with the knowledge, skills, and tools to design and implement sustainable solutions that minimize environmental degradation and promote resource efficiency.

Students are invited to consult the syllabus of the entire course for details regarding learning- and skill-related objectives.

Contents

• Definition of abiotic resources and raw materials.
• Understand the concept of non-renewable resources and their environmental impacts.
• Responsible and sustainable use of non-renewable resources such as metals, aspects of recycling within a circular economy.
• Learn about resource efficiency and circularity and its importance in sustainable development.
• Understand the concept of planetary boundaries in relation to abiotic and non-renewable sustainable resource

management.
• Analyse case studies and real-world examples of sustainable resource management.
• Learn about life cycle assessment and its role in relation to planetary boundaries, addressing relative and absolute sustainability concepts.
• The main EU and international policies linking resources, supply chains assessment., planetary boundaries and sustainability.

Detailed program

• Definition of abiotic resources, availability, supply risk, demand in main sectors and technologies.
• Distribution of elements across various environments using (anthro)biogeochemical cycles.
• Sustainable mining activities.
• Global trends and challenges in non-renewable resource management.
• Definition and importance of resource efficiency.
• Strategies for improving resource efficiency and circularity (reduce, reuse, recycle, etc.).
• Key concept of circular economy, including recycling, downcycling and upcycling.
• Description of the challenges associated with the recycling and reuse of various materials, including precious metals, concept of urban mining.
• Abiotic resources and associated environmental impacts due to extraction, use, and waste management.
• The integration of sustainable processes within the circular economy.
• The novel entities.
• Introduction to life cycle assessment (LCA) methodology and supply chain assessment.
• Applications of LCA in sustainable resource management.
• Relevance of planetary boundaries to sustainable resource management.
• Overview of EU and international policies for sustainable resource management (e.g. Circular Economy Package, critical Raw Materials Act) and link with planetary boundaries (e.g. 8th Environmental Action Program “Living well within the limits of our Planet”).
• Overview of EU and international policies for supply chain assessment.
• International cooperation and global governance of sustainable resource management.
• Case studies on key sectors and technologies.

Prerequisites

• Basic understanding of environmental science.
• Basic understanding of sustainability concepts.

Teaching form

4 CFUs of mixed theoretical and interactive lessons (32 hours):
• 8 two-hour lectures, in person, mostly frontal teaching and discussion in class, Delivered Didactics.
• 4 two-hour lectures, online, mostly frontal teaching and discussions, Delivered Didactics.

1 CFU, of mixed didactics in the classroom (16 hours):
• 4 two-hour lectures, in person, including group presentations, group debates, discussion of relevant caselaw and reading of relevant material in class, Interactive Teaching.

Attendance to lectures and interactive exercises is highly recommended.

Textbook and teaching resource

• United Nations Environment Programme (2024): Global Resources Outlook 2024: Bend the Trend – Pathways to a liveable planet as resource use spikes. International Resource Panel. Nairobi. https://wedocs.unep.org/20.500.11822/44901
• World Economic forum (2025) 2025 Global risk report https://www.weforum.org/publications/global-risks-report-2025/
• Juan F. Velasco-Munoz, Chaudhery Mustansar Hussain (2021) Sustainable Resource Management: Modern Approaches and Contexts. Elsevier ISBN: 9780128243428
• Hauschild, M. Z., Rosenbaum, R. K., & Olsen, S. I. (2018). Life cycle assessment Springer International Publishing, Cham. https://doi. org/10.1007/978-3-319-56475-3.
• Slides
• Notes shown during lectures and additional material on selected topics, *i.e.*, scientific articles, made available on the e-learning website of the course.

Semester

I semester (October - January)

Assessment method

The final exam consists of a single written exam at the end of the course, which comprises the discussion of various topics covered in the course within the three modules, with an emphasis also on the connections between concepts and processes, such as to arrive at a critical evaluation of work from the point of view of planetary boundaries and responsible use of renewable and non–renewable resources.

The final score will be between 18/30 and 30/30 *cum laude*, based on the overall assessment considering the following criteria:
(1) knowledge and understanding;
(2) ability to connect different concepts;
(3) autonomy of analysis and judgment;
(4) ability to correctly use scientific language.

Office hours

Always, after scheduling an appointment *via* phone or e-mail.

Sustainable Development Goals

QUALITY EDUCATION | INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION