Energy and renewables

Professor: Marco Raugei
Office hours: by appointment
Course Type: Elective
Credits: 3 ECTS
Term: Third

Course Description

The course reviews the fundamentals laws of thermodynamics, and how these govern and constrain all energy transfers and transformations, and it introduces the principal tools and metrics of energy analysis. It enables students to understand the difference between energy from fossil and nuclear fuels and energy from renewable resources, and to distinguish the main energy conversion systems. It provides an overview and critical discussion of the expected energy futures trends, the main environmental problems associated with the use of energy, and the technical problems associated with the incorporation of variable renewable energies in the energy mix, including issues of grid balancing and energy storage, and potential synergies with the transport sector. The course also provides a brief overview of EU energy objectives and directives, and of related national strategic documents (e.g., Renewable Energy Action Plans, etc.). Finally, the course provides the student with a global map of international organizations in the energy sector.

The course in the study plan

This **elective** course belongs to the subject of **Environmental Dimension of Sustainability** of the study plan. It takes place in the **third quarter**.

Objectives (resultados de aprendizaje) and competences

At the end of the course, students should:

- Be familiar with the different types of energy and technologies, and understand the ways in which energy is transformed to be used in human activities.
- Gain deep understanding of renewable energy technologies, their advantages and challenges.
- Be aware of energy transition experiences in different countries and industries.
- Develop decision-making skills based on the results and progress made from science and research.

COURSE LEARNING PLAN

Methodology

The course comprises eight 3-hour sessions, which combine theory lecturing with general debates and applied discussions on business cases and exercises. Participants will also engage in presentations of reports, cases, or project assignments. Activities will require both individual and group work.

The course also involves a substantial amount of autonomous work outside the classroom combining readings that will help the students gain a deeper understanding of the material covered in class.

Hours devoted by the student (according to ECTS) 75

Evaluation criteria

Three elements concur in the final mark:

- **Final exam (40%):** the final exam is used to assess the individual level of knowledge and understanding of each student. It will include questions covering topics from all the classes. This item counts for 40% of the final mark. To pass the exam the minimum grade is 5.
- **Project and presentation (40%):** Students will apply their knowledge to a real life situation. They are expected to use the topics they learnt to use during the classes.
- **Class attendance and active participation (20%):** Attendance in every session is expected and recorded by means of an attendance sheet. It is your responsibility to comply with this measure. Class attendance is compulsory and will be considered in your final grades; punctuality is a must. Note that unexcused absences reduce your score on the "attendance and participation" element of your final grade. In fact, two or more unexcused absences will result in an automatic score of zero and, in all likelihood, a fail mark for the course as a whole.

Attended all the sessions + actively and consistently participated in the class discussions during the entire course period	20
Attended all the sessions + actively and consistently participated in most of the class discussions	15-19
No more than one unexpected absence + often participated in the class discussions	10-14
No more than one unexpected absence + participated in some class discussions	5-9
No more than one unexpected absence + limited or no participation in class discussions	1-4
Otherwise	0

Other evaluation criteria to take into consideration:

Retake

Students who fail the course during regular evaluation will be allowed ONE re-take of the examination/evaluation. Students that pass any Retake exam should get a 5 by default as a final grade for the course. If the course is again failed after the retake, students will have to register again for the course the following year.

No-show

In case of a justified no-show to an exam, the student must inform the corresponding faculty member and the director(s) of the program so that they study the possibility of rescheduling the exam (one possibility being during the "Retake" period). In the meantime, the student will get an "incomplete", which will be replaced by the actual grade after the final exam is taken. The "incomplete" will not be reflected on the student's Academic Transcript.

Plagiarism

Plagiarism is to use another's work and to present it as one's own without acknowledging the sources in the correct way. All essays, reports or projects handed in by a student must be original work completed by the student. By enrolling at any ESCI UPF BSM Master of Science and signing the "Honor Code," students acknowledge that they understand the schools' policy on plagiarism and certify that all course assignments will be their own work, except where indicated by correct referencing. Failing to do so may result in automatic expulsion from the program.

Bio of Professor

Dr. Marco Raugei holds a PhD in Chemical Sciences, and is an experienced researcher in energy and sustainability assessment. His main research interests are: (i) the theoretical improvement of existing tools for environmental sustainability assessment, including Life Cycle Assessment (LCA), Material Flow Analysis (MFA) and Net Energy Analysis (NEA); and (ii) their application to sustainable energy, transport, and construction scenarios.

Currently, he is Senior Research Fellow and Senior Lecturer in the School of Engineering, Computing and Mathematics, Oxford Brookes University (UK), and Senior Transport LCA consultant at Ricardo Energy and Environment. He is also a Visiting Scientist at the Center for Life Cycle Analysis, Columbia University, NY (USA), a contracted collaborator of the Center for Ecosystems in Architecture, Yale University, CT (USA), and of the Peter Guo-hua Fu School of Architecture, McGill University, QC (Canada), and a member of the International Energy Agency Photovoltaic Power Systems (PVPS) programme.

So far, he has published 70 scientific papers in peer-reviewed international journals (H-index: 33), as well as over 100 other scientific documents among conference proceedings, reports, and chapters for scientific books and encyclopaedias.

Reading Materials/ Bibliography/Resources

No textbook is required for this course. All the required material will be provided. Any readings, notes, handouts, dataset, or additional course material will be available through the course website.