Universitat Autònoma de Barcelona

2023/2024

Renewable and non-Renewable Energies

Code: 102851
ECTS Credits: 6

Degree	Type	Year	Semester
2501915 Environmental Sciences	OT	4	0

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Raquel Montes Martinez

Aline Concha Dimas

Prerequisites

There are several subjects that the student should have passed before joining the present course. So that, iw ould be advisory to pass previously:

-Physics (1r year)

-Chemistry (1r year)

-Geology (1r year)

-Physics of Radiations and Matter (2n year)

-Introduction to Environmental Engineering (3r year)

It is also interesting (but not necessary) that students joining this course join also the optative couse "Energy and Society", since both courses are complementary (one is focused on the social aspects of energy, while the present one is focused on more technical and scientific aspects).

Objectives and Contextualisation

The aims of the present course are:

- To acquire a general quantitative knowledge on the present state of energy problems at a planetary scale

- To develop scientific and critical criteria abut different the different energetic sources available at present and/or under investigation, and about the different models of energy management

- To know the different methods of extracting fossil fuels and the environmental implications they have.

- To know the physical and chemical processes behind energy extraction from fossil fuels.

- To identify the basic processes associated to energy generation in nuclear plants and the tratment of nuclear waste.

- To have a basic knowledge about environmental implications of energetic crops.

- To understand the main mechanisms of energy distribution at a local scale, in particular those related to grid networks.

- To identify the main methodologies of energy storage currently used and/or under investigation, ad understand their role within the context of a generating system based on renewables.

- To identify main renewable sources of energy available on the planet and the chemical/physical processes related to their exploitatin.

- To identify and quantify the main elements and technical aspects related to projects, plants and facilities for the use of renewable energies.

Competences

- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Collect, analyze and represent data and observations, both qualitative and quantitative, using secure adequate classroom, field and laboratory techniques
- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Learn and apply in practice the knowledge acquired and to solve problems.
- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Learning Outcomes

1. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
2. Analyze and use information critically.
3. Demonstrate concern for quality and praxis.
4. Demonstrate initiative and adapt to new situations and problems.
5. Describe the physical basis of the main energy systems.
6. Identify the physical processes in the surrounding environment and evaluate them properly and originally.
7. Learn and apply in practice the knowledge acquired and to solve problems.
8. Observe, recognize, analyze, measure, and so properly and safely represent physical processes applied to environmental sciences.
9. Teaming developing personal values regarding social skills and teamwork.
10. Work autonomously

Content

These are the main topics to be developed during the course:

1. The global energy problems. Models of energy management.

2. Fossil fuels

3. Nuclear energy

4. Nuclear accidents and nuclear waste

5. Bioenergy

6. Biomass and energetic crops

7. Geothermal energy

8. Distribution of electricity. Electric markets and networks.

9. Hydroelectric energy

10. Eolic energy

11. Solar thermal energy

12. Solar photovoltaic energy

13. Energy storage and energy transition

Methodology

The course includes 38 hours of theoretical classes, 6 hours of practices qhere we will develop an interactive and cooperative activity to study several aspects/examples related to energy management and energy transition, and 6 hours of field work or visits to institutions/organizations related to the field of renewable energies.

The final part of the course is based on a gamified and project-based methodology, in which the students will develop an interactive activity in groups reproducing a real situaion of energy management.

Additionally, the course takes into account that the student should devote some time to personal study and to develop the project and short assigments that are part of the evaluation activities.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	6	0.24	2, 3, 5, 6, 8, 1, 9

Practical classes	6	0.24	2, 7, 3, 5, 6, 8, 10, 9
Theoretical classes	38	1.52	2, 4, 3, 6, 8
Type: Supervised			
Mentoring	8	0.32	4, 3
Type: Autonomous			
Autonomous study	78	3.12	2, 7, 6, 8, 10, 9

Assessment

i) There will be two partial exams during the course. The first one (which includes the contents about conventional energies and those based on cumbustion processes) has weight of 40% over the final mark. The second one (which includes all contents about renewable energies, energy distribution and storage) has a weight of 35% in the final mark.

ii) Additionally, the students will participate in an iteractive activity in group in the classroom (during the last 3/4 weeks of the course) that will serve to evaluate the level of understanding about the concepts and methods of management of facilities based on renewables energies. This activity will represent 25% of the final mark and it will imply the compulsory attendance to the sessions where it is carried out.

iii) Finally, the attendance to the two sessions of field work programmed during the course will be taken into account for evaluation. The attendance to these sessions will give the student the opportunity to present a short assignment that can increase the final mark of the course up to 1 point.

To pass the course it is necessary:

i) To obtain an average mark of 5 (over 10) or higher.

ii) Additionally, the mark for each of the three main activities (the two partial exams and the written project) must be above 3,5 (over 10) for each. If this condition is not fullfilled, the final mark of the course cannot be higher than 4,5.

Second-chance exam:

For those students that have not passed the course (or those who want to improve their mark) there will be the option to retake the exam (they can choose between retaking only one of the two partial exams, or both). Only those students who have received a mark in activities that represent globally at least 2/3 of theglobal mark during the course are allowed to retake the exam.

The interactive activities activities cannot be retakenin case they are not delivered on the date determined by the responsibles of the course.

Given the characteristics of some of the evaluation activities, this course does not allow the option for a Single-assignment evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Interactive activity in the classroom	25	10	0.4	2, 7, 4, 3, 5, 8, 1, 10, 9
Partial exam 1	40	2	0.08	2, 7, 5, 6, 8, 1

Partial exam 2	35	2	0.08	2, 7, 5, 6, 8, 1

Bibliography

Books

V. Ruiz. El Reto Energético. Almuzara, 2013 (2a ed).

J. González-Velasco. Energías Renovables. Reverté, 2005.

C. Riba Romeva. Recursos Energètics i crisi. Octaedro, 2012.

D. Yergin. The New Map: Energy, Climate and the Clash of Nations. Penguin Books, 2021

R.L. Jaffe and W. Taylor. The Physics of Energy. Cambridge Univ. Press, 2018

D.J.C. Mackay. Sustainable Energy: Without the Hot Air. (https://www.withouthotair.com/)

B. Cassoret. Energy Transition. Taylor & Francis, 2021.

IEA Reports

World Energy Outlook. https://www.iea.org/reports/world-energy-outlook-2022

The Role of Critical Minerals in Clean Energy Transitions.
https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

Clean Energy Transitions Programme 2022.
https://www.iea.org/reports/clean-energy-transitions-programme-2022

Technology Innovation to Accelerate Energy Transitions.
https://www.iea.org/reports/technology-innovation-to-accelerate-energy-transitions

World Energy Investment 2023. https://www.iea.org/reports/world-energy-investment-2023

Global EV Outlook 2023. https://www.iea.org/reports/global-ev-outlook-2023

Renewable Energy Policies in a Time of Transition.
https://www.iea.org/reports/renewable-energy-policies-in-a-time-of-transition

Recommendations of the Global Commission on People-Centred Clean Energy Transitions.
https://www.iea.org/reports/recommendations-of-the-global-commission-on-people-centred-clean-energy-transitic

IRENA Reports

Critical Materials For The Energy Transition.
https://www.irena.org/Technical-Papers/Critical-Materials-For-The-Energy-Transition

Managing Seasonal and Interannual Variability of Renewables.
https://www.iea.org/reports/managing-seasonal-and-interannual-variability-of-renewables

Financing clean energy transitions in emerging and developing economies.
https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies

Smart Electrification with Renewables.
https://www.irena.org/Publications/2022/Feb/Smart-Electrification-with-Renewables

Innovation landscape for smart electrification.
https://www.irena.org/Publications/2023/Jun/Innovation-landscape-for-smart-electrification

Innovation landscape for a renewable-powered future.
https://www.irena.org/publications/2019/Feb/Innovation-landscape-for-a-renewable-powered-future

Community-Ownership Models.
https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jul/IRENA_Community_ownership_2020.pdf

Capturing Carbon. https://www.irena.org/Technical-Papers/Capturing-Carbon

Scenarios for the Energy Transition.
https://www.irena.org/publications/2020/Sep/Scenarios-for-the-Energy-Transition-Global-experience-and-best-pra

Other Reports

IPCC. Mitigation of Climate Change 2022. https://www.ipcc.ch/report/ar6/wg3/

World Energy Council: Five Steps to Energy Storage.
https://www.worldenergy.org/assets/downloads/Five_steps_to_energy_storage_v301.pdf

Technical support for RES policy development and implementation.
https://op.europa.eu/en/publication-detail/-/publication/949ddae8-0674-11ee-b12e-01aa75ed71a1

EEA: Energy Prosumers in Europe. https://www.eea.europa.eu/publications/the-role-of-prosumers-of

Carbon dioxide removal: Nature-based and technological solutions.
https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)689336

Recursos online

Demanda Red Eléctrica Española. https://demanda.ree.es/visiona/home

Global Wind Atlas. https://globalwindatlas.info/en

European Wind Atlas. https://map.neweuropeanwindatlas.eu/

Photovoltaic Geographical Information System. https://re.jrc.ec.europa.eu/pvg_tools/en/

Global Solar Atlas. https://globalsolaratlas.info/map

Energy Transition Model. https://energytransitionmodel.com/

De l'Euro al Joule. https://www.youtube.com/@deleuroaljoule-qy5qu/featured

Central Gorona del Viento. https://www.goronadelviento.es/

Web d'Energia de la UAB. https://www.uab.cat/web/energia-1345825228693.html

Software

Only Microsoft Excel will be used during the course.