Renewable and non-Renewable Energies

Code: 102851
ECTS Credits: 6

2024/2025

Degree	Type	Year
2501915 Environmental Sciences	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

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

1. Introduction: the global problem of the finiteness of energy and natural resources
2. The exploitation and consumption of resources in our society
3. Transport and distribution of energy in the current models
4. Fossil fuels
5. Extraction and management of nuclear fuels
6. Geothermal resources
7. Hydrolectric resources
8. Eolic resources
9. The energy from the Sun
10. Storage and recovery/reutilization of resources and energy
11. Future scenarios: the energy transition
12. Case studies

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	6	0.24	1, 2, 3, 5, 6, 8, 9
Practical classes	6	0.24	2, 3, 5, 6, 7, 8, 9, 10
Theoretical classes	38	1.52	2, 3, 4, 6, 8
Type: Supervised			
Mentoring	8	0.32	3, 4
Type: Autonomous			
Autonomous study	78	3.12	2, 6, 7, 8, 9, 10

The course includes 38 teaching hours of theory (including both lectures and practical demonstrations in the classroom), 8 teaching hours of seminars (where two interactive and cooperative activities will be developed, based on role-playing and serious games methodologies, to reproduce different case studies related to the management of natural resources and energy) and 2 teaching hours of external visits to several facilities avaiilable at the UAB Campus related to the consumption and management of energy in the university.

Additionally, the course includes a certain number of hours devoted to personal study (which includes both theoretical study and consultation of sources through the Internet and/or other channels), plus those hours that the students will need to prepare the different assigments during the course.

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Interactive activity in the classroom	30	10	0.4	1, 2, 3, 4, 5, 7, 8, 9, 10
Partial exam 1	35	2	0.08	1, 2, 5, 6, 7, 8
Partial exam 2	35	2	0.08	1, 2, 5, 6, 7, 8

) The evaluation of the course will include two independent partial exams covering each a part of the contents of the course, each representing a weight of 35%over the final grade.

ii) Additionally, there will be two interactive and cooperative activities in group based on a role-playing games (to be developed during the last 3/4 weeks of the week) based on practical case studies/projects. These activities will involve several assignments and/or oral presentations that will represent globally a 30% of the final grade, and will imply compulsory attendance to all the sessions where the activitites are developed.

iii) Finally, as a pàrt of the evaluation of the course, the attendance to the external visits included in the course program will give the student the right to present an assignement that will increase the final grade of the course up to 0,5 points.

To pass the course the student will have to:

i) Get a minimum average grade of 5 (over 10).

ii) Get a minimum grade of 3,5 (over 10) in each of the three main evaluation activities (the two partial exams and the interactive activitites). In case this requirement is not fullfilled the final grade that will appear in the expedient will be (i) the average grade in case it is below 4,5, (ii) 4,5 in case it is above this value.

Retake:

i) Those students that have attended a minimum part of the evaluation activites (corresponding at least to 2/3 of the final grade) but do not get the minimum grade to pass the course, or that want to improve their grades, have the option of a retake exam that will be independent for each partial.

ii) The interactive activities, as well as all assignments in the course, will not have a retake option.

Students who do not present any interactive activity and/or do not appear in any partial exam will be graded as "NOT ASSESSABLE".

Given the characteristics of some of its evaluation activities, this course does not offer the option ofa Unique-Assignment evaluation.

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-2023

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.eur2j.cat

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.

Language list

Name	Group	Language	Semester	Turn

(SEM) Seminars	1	Catalan	second semester	morning-mixed
(SEM) Seminars	2	Catalan	second semester	morning-mixed
(SEM) Seminars	3	Catalan	second semester	morning-mixed
(SEM) Seminars	4	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	morning-mixed