Universitat Autònoma de Barcelona

**2021/2022**

# Renewable and non-Renewable Energies

Code: 102851
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 2501915 Environmental Sciences | OT | 4 | 0 |

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

## Contact

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## Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

## Teachers

Raquel Montes Martinez
Eduard Madaula Izquierdo
Jordi García Orellana

## 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

## Methodology

The course includes 38 hours of theoretical classes, 6 hours of practical cases 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 project-based methodology, in which the students will develop a viability and feasibility project using data from a real situation.

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.

In the last class we will exmploy 15 minutes to let the students answer the institutional survey about 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.

## Activities

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Field work/visits | 6 | 0.24 | 2, 7, 3, 5, 6, 8, 10, 9 |
| Practical cases | 6 | 0.24 | 2, 3, 5, 6, 8, 1, 9 |
| Theoretical classes | 38 | 1.52 | 2, 4, 3, 6, 8 |
| Type: Autonomous | | | |

| | | | |
|---|---|---|---|
| Autonomous study | 72 | 2.88 | 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 30% in the final mark.

ii) Additionally, the students must prepare a written project (in small groups) to evaluate its level of understanding about the concept and methods of dessign of facilities based on renewables energies. This project will represent 25% of the final mark.

iii) In order to control the continuous work of the student during the course, there will be some minor assignments based on the summary of working examples discussed in the classroom. These assignments will represent 5% of the final mark.

iv) Finally, the attendance to the two sessions of field work programmed during the course will be taken into account for evaluation. The attendance (unjustified non-attendance) to these sessions will represent an increment (penalization) of 0,5 points over 10 in the final mark.

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 'written project' and 'written summaries' activities cannot be retaken in case they are not delivered on the date determined by the responsibles of the course.

## Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Partial exam 1 | 40 | 2 | 0.08 | 2, 7, 5, 6, 8, 1 |
| Partial exam 2 | 30 | 2 | 0.08 | 2, 7, 5, 6, 8, 1 |
| Written project | 25 | 23 | 0.92 | 2, 7, 4, 3, 5, 8, 1, 10, 9 |
| Written summary (examples from the classroom) | 5 | 1 | 0.04 | 2, 7, 4, 3, 5, 6, 8, 1, 10, 9 |

## Bibliography

* González Velasco, J. Energías renovables. Reverté (2009). (Available online through the UAB website: https://ebookcentral-proquest-com.are.uab.cat/lib/uab/detail.action?docID=3430257#goto_toc)

* Boeker, E. and van Grondelle, R. Environmental Science. Wiley (2001).

* Boeker, E. and van Grondelle, R. Environmental Physics. Wiley (1999).

* MacKay, D. Sustainable energy- Without the hot air. (http://www.withouthotair.com/)

* Jiménez, J.M. Ingenios Solares. Pamiela (2009, 6a Ed.)

Energy International Agency: www.eia.gov

World Energy Council - Sustainability Index: www.worldenergy.org/data/sustainability-index/

PVGIS: ec.europa.eu/jrc/en/pvgis

Gorona del viento: www.goronadelviento.es

Red Eléctrica España: www.ree.es/en

## Software

Only Microsoft Excel will be used during the course.