

## Course guide

### 340670 - FSER - Renewable Energy Sources and Systems

**Last modified:** 18/05/2023

**Unit in charge:** Vilanova i la Geltrú School of Engineering  
**Teaching unit:** 709 - DEE - Department of Electrical Engineering.

**Degree:** BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** Rodríguez Bernuz, Joan Marc

**Others:** Rodríguez Bernuz, Joan Marc

#### REQUIREMENTS

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There are no prerequisites for taking the course.

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. CE28. Applied knowledge of renewable energies.

#### TEACHING METHODOLOGY

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The subject is developed between theory classes, problems and activities that will be carried out in an interspersed way.

-In the theory classes, the topics included in the program will be exposed. They will consist of theoretical explanations complemented with activities designed to stimulate participation, discussion and critical analysis by students.

-In the problem classes, exercises will be posed and solved. individually or in groups.

-The activities that will be carried out in groups complement specific sections of the syllabus of the subject.

## LEARNING OBJECTIVES OF THE SUBJECT

To fight climate change that affects the planet it is necessary to make structural changes in the more or less distant future. Our society consumes large amounts of energy, much of it in the form of electricity, which must be produced from primary sources where fossil fuels (causing greenhouse gas emissions) have a high weight.

In this respect, renewable energy sources have and must play a key role in achieving a zero-emission energy system in the shortest possible time. Since the climate summit in Paris in 2015, different countries have committed to promoting these renewable energies in their territory, adopting various types of measures and / or policies to achieve this energy transition.

The basic objectives that are pursued in this subject are:

- To study the characteristics of the different types of renewable energy sources that have or can play an important role in this transition that we have mentioned.
- Analyze the weight of the EERRs within the electrical mix and the current regulatory framework.
- Describe the different technological aspects of each of them, with special emphasis on those that have a greater weight today such as wind and photovoltaic generation.
- Learn to evaluate the renewable resources that can be available in a location.
- Dimension renewable energy facilities based on the resources obtained.
- Evaluate the profitability of the facilities.
- Analyze the environmental impact.

## STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### 1.- General concepts on renewable energies.

#### Description:

- 1.1.- Types and characteristics of renewable energy sources.
- 1.2.- Situation of the technologies within the electrical "mix".
- 1.3.- Regulatory framework. Renewable energy support plans. Specific remuneration.
- 1.4.- General perspective of the different technologies for the use of renewable resources.

#### Full-or-part-time: 11h

Theory classes: 4h

Laboratory classes: 2h

Self study : 5h

## 2.- Wind energy.

### Description:

- 2.1.- The wind. Variability. Determination of the wind potential of a site.
- 2.2.- Fundamentals of aerodynamics. Types of wind turbines.
- 2.3.- Constituent parts of a wind turbine.
- 2.4.- Terrestrial and offshore wind farms. Network integration.
- 2.5.- Regulatory and environmental aspects.

**Full-or-part-time:** 44h

Theory classes: 7h

Laboratory classes: 4h

Self study : 33h

## 3.- Solar energy.

### Description:

- 3.1.- Use of solar energy. Irradiance and irradiation. Model for the determination of incident solar radiation.
- 3.2.- Technological aspects on photovoltaic generation. Types of installations and constituent parts.
- 3.3.- Photovoltaic module. Operation, types and models.
- 3.4.- Other constituent parts: inverters, accumulators, .... Main features, types and configurations.
- 3.5.- Sizing networked installations. Self-consumption. Profitability.
- 3.6.- Dimensioning isolated photovoltaic installations.
- 3.7.- Overview of high temperature solar generation. Solar thermal power plants.
- 3.8.- Regulatory and environmental aspects.

**Full-or-part-time:** 44h

Theory classes: 8h

Laboratory classes: 4h

Self study : 32h

## 4.- Hydraulic energy

### Description:

- 4.1.- The water cycle. Hydraulic energy. Determination of water resources.
- 4.2.- Constituent elements of the hydraulic power station. Minihydraulics and microhydraulics.
- 4.3.- Initial sizing of a hydraulic power plant in a site.
- 4.4.- Ocean energy.
- 4.5.- Regulatory and environmental aspects.

**Full-or-part-time:** 19h

Theory classes: 4h

Laboratory classes: 2h

Self study : 13h

#### 5.- Geothermal energy.

**Description:**

- 5.1.- General aspects on geothermal energy.
- 5.2.- Low enthalpy facilities. Constituent parts. Thermodynamic cycles.
- 5.3.- High temperature geothermal.

**Full-or-part-time:** 26h

Theory classes: 4h

Laboratory classes: 2h

Self study : 20h

#### 6.- Other sources of renewable energy. Biomass, waste, biofuels.

**Description:**

- 6.1.- Biomass, waste and biofuels. Current state of exploitation technologies.
- 6.2.- Constituent parts of the facilities.
- 6.3.- Regulatory and environmental aspects.

**Full-or-part-time:** 6h

Theory classes: 2h

Self study : 4h

### GRADING SYSTEM

- Test done during the course (30%)
- Test done at the end (40%)
- Carrying out problems, practices and works, in group or individual (30%)

### EXAMINATION RULES.

- The written tests are face and individual.
- In the classes of problems and / or laboratory practices will be assessed, where appropriate, the prior work with the presentation of results of each activity.

### BIBLIOGRAPHY

**Basic:**

- Ghosh, Tushar K; Prelas, Mark A. Energy Resources and Systems [Recurs electrònic]. Vol. 2, Renewable Resources [on line]. Dordrecht: Springer Netherlands, 2011 [Consultation: 10/03/2022]. Available on: <https://link.springer.com/book/10.1007/978-94-007-1402-1>. ISBN 94-007-1402-5.
- Ghosh, Tushar K.; Prelas, Mark A. Energy Resources and Systems [Recurs electrònic]. Vol. 1, Fundamentals and Non-Renewable Resources [on line]. Dordrecht: Springer Netherlands, 2009 [Consultation: 10/03/2022]. Available on: <https://link.springer.com/book/10.1007/978-90-481-2383-4>. ISBN 1280383984.
- Hau, Erich. Wind Turbines [electronic resource] : Fundamentals, Technologies, Application, Economics [on line]. 3rd ed. Berlin: Springer, 2013 [Consultation: 03/05/2022]. Available on: <https://link.springer.com/book/10.1007/978-3-642-27151-9>. ISBN 3642271510.
- Michaelides, Efstathios E. (Stathis). Alternative Energy Sources [Recurs electrònic] [on line]. Berlin, Heidelberg: Springer Berlin Heidelberg, 2012 [Consultation: 22/02/2022]. Available on: <https://link.springer.com/book/10.1007/978-3-642-20951-2>. ISBN 9783642209512.
- Kaltschmitt, Martin; Streicher, Wolfgang; Wiese, Andreas. Renewable energy : technology, economics and environment [on line]. Berlin [etc.]: Springer, 2007 [Consultation: 22/04/2022]. Available on: <https://link.springer.com/book/10.1007/3-540-70949-5>. ISBN 9783540709473.