

Course guide

330810 - IER - Renewable Energy Installations

Last modified: 15/07/2026

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.
709 - DEE - Department of Electrical Engineering.

Degree: MASTER'S DEGREE IN INDUSTRIAL FACILITY DESIGN AND MANAGEMENT (Syllabus 2026). (Optional subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Francesco Greco

Others: Francesco Greco

TEACHING METHODOLOGY

The subject combines lectures, problem solving, case studies and practical activities. Lecturers will present the main concepts and guide autonomous work through materials, exercises and activities available on the digital campus. Assessable activities will allow students to apply the contents to energy installation cases and prepare technical documentation. Assessment will be completed with two oral examinations linked to the subject content blocks.

LEARNING OBJECTIVES OF THE SUBJECT

The course covers the evaluation and preliminary design of renewable energy installations, with emphasis on geothermal energy, solar thermal energy, biomass, electrical systems and solar photovoltaic energy.

Upon completion of the course, students will be able to achieve the following learning outcomes:

M6.K1 Describe the technological specificities of a specific type of industrial installation (e.g. fire protection systems, electrical protection systems, etc.), or management methods (e.g. logistics, risk prevention, etc.)
M6.K2 Identify the specific software, open source or otherwise, commonly used in the field of study
M6.K3 Apply scientific-technical concepts and advanced digital tools to the design and management of specific installations
M6.S1 Apply scientific-technical concepts and advanced digital tools to the design and management of specific installations
M6.C1 Draft technical documents for use in professional contexts

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	100.00

Total learning time: 45 h

CONTENTS

Industrial Geothermal Systems

Description:

Geothermal resources, classification, project phases and main applications. Heat pumps, heating and cooling uses, and integration with existing thermal systems.

Specific objectives:

Identify suitable geothermal applications, estimate thermal demand, select a preliminary solution and discuss technical, environmental and implementation constraints.

Full-or-part-time: 21h

Laboratory classes: 7h 30m

Self study : 13h 30m

Solar Thermal Energy for Industrial Processes

Description:

Solar radiation data, collector types, main components and basic sizing of solar thermal installations. Applications include hot water, washing, drying, preheating and low- or medium-temperature heat.

Specific objectives:

Use irradiance data to estimate useful energy, collector area and solar fraction. Assess the interest and limitations of a solar thermal installation.

Full-or-part-time: 21h

Laboratory classes: 7h 30m

Self study : 13h 30m

Biomass and Waste-to-Energy Valorization

Description:

Biomass types, fuel properties, storage, logistics, combustion systems, boilers and environmental aspects. Use of biomass for heat production and replacement of conventional fuels.

Specific objectives:

Characterize biomass fuels, estimate their energy potential, identify installation requirements and compare biomass with conventional fuels.

Full-or-part-time: 21h

Laboratory classes: 7h 30m

Self study : 13h 30m

Electric Power System and Integration of Renewable Energies

Description:

Electric power system, electricity grid, voltage levels, demand curves and generation management. Integration of renewable energies in industrial installations and basic connection, operation and environmental impact criteria. European regulatory framework for decarbonization and climate targets for 2030.

Specific objectives:

Interpret the electrical demand of an installation, identify connection requirements, place renewable integration within the European emissions regulatory framework for 2030, and assess the role of renewable energies in the operation of industrial electrical systems.

Full-or-part-time: 21h

Laboratory classes: 7h 30m

Self study : 13h 30m

Solar Photovoltaic Installations in Industrial Environments

Description:

Solar resource, photovoltaic cell, modules, current-voltage curves, panel association, inverters and basic schemes of photovoltaic installations. Generation configurations for on-site consumption or export to the grid. Stand-alone, grid-connected and hybrid systems in industrial environments.

Specific objectives:

Estimate photovoltaic production, compare self-consumption alternatives versus grid injection, select a basic installation configuration and assess its integration in the electrical consumption of an industrial activity.

Full-or-part-time: 41h

Laboratory classes: 15h

Self study : 26h

ACTIVITIES

Geothermal Feasibility Project

Description:

Students prepare a preliminary feasibility study for a geothermal installation. The work includes thermal demand, application type, estimated savings and main constraints.

Specific objectives:

Analyze thermal loads, use reliable technical data and prepare a concise technical document.

Full-or-part-time: 12h

Self study: 12h

Solar Thermal Integration Analysis for Processes

Description:

Students assess a solar thermal application using digital resource data. They estimate collector area, useful energy, solar fraction and integration constraints.

Specific objectives:

Use solar radiation data, size a preliminary installation and assess energy production and economic viability.

Full-or-part-time: 12h

Self study: 12h

Biomass Valorization Proposal

Description:

Students propose a biomass heating solution for a realistic case. The proposal includes fuel characterization, logistics, technology selection and emissions.

Specific objectives:

Assess fuel properties, logistics, environmental impact and technical viability.

Full-or-part-time: 12h

Laboratory classes: 12h

Electrical Integration Analysis of Renewable Energies

Description:

Students analyze the electrical demand of an installation and assess the integration of renewable generation considering connection, operation and impact on the internal network.

Specific objectives:

Interpret demand curves, identify electrical constraints and justify basic integration criteria.

Full-or-part-time: 12h

Self study: 12h

Industrial Photovoltaic Installation Project

Description:

Students carry out a preliminary study of a photovoltaic installation in an industrial environment. The work includes solar resource, sizing, estimated production, comparison between self-consumption and export to the grid, and justification of the chosen solution.

Specific objectives:

Size a basic proposal, estimate electrical production, compare integration alternatives and assess the energy, economic and environmental interest of the installation.

Full-or-part-time: 24h

Laboratory classes: 24h



Oral Examination on Contents 1-3

Description:

Oral examination on geothermal, solar thermal and biomass contents, including the defense of decisions made in the corresponding activities.

Specific objectives:

Communicate technical results clearly and justify hypotheses, calculations and conclusions.

Full-or-part-time: 2h 30m

Laboratory classes: 2h 30m

Oral Examination on Contents 4-5

Description:

Oral examination on electric systems and photovoltaic contents, including the defense of decisions made in the corresponding activities.

Specific objectives:

Communicate technical results clearly and justify hypotheses, calculations and conclusions.

Full-or-part-time: 2h 30m

Laboratory classes: 2h 30m

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the [Action Framework for Academic Integrity in Assessment at the UPC](#).

The final grade for the subject will be calculated as follows:

Activity 1: 10% of the final grade

Activity 2: 10% of the final grade

Activity 3: 10% of the final grade

Activity 4: 10% of the final grade

Activity 5: 20% of the final grade

Activity 6: 20% of the final grade

Activity 7: 20% of the final grade

To pass the subject, a final grade equal to or higher than 5.0 out of 10 is required. In addition, a minimum grade of 4.0 out of 10 is required in each of the two oral examinations: Activity 6, corresponding to contents 1-3, and Activity 7, corresponding to contents 4-5. If this minimum grade is not reached in either oral examination, the subject cannot be considered passed.

BIBLIOGRAPHY

Basic:

- Felipe Blanch, José Juan de. Sistemas solares térmicos de baja temperatura [on line]. Barcelona: Universitat Politècnica de Catalunya, 1999 [Consultation: 18/06/2026]. Available on: <https://upcommons.upc.edu/entities/publication/6d6503cb-30c8-4bbe-9ca3-bdb653d0f78e>. ISBN 8483013428.
- Fernández Salgado, José M. Guía completa de la energía solar térmica y termoeléctrica : (adaptada al Código Técnico de la Edificación y al nuevo RITE). Madrid: A. Madrid Vicente, 2010. ISBN 9788496709577.
- Fernández Salgado, José M. Guía completa de la biomasa y los biocombustibles. Madrid: A. Madrid Vicente, 2010. ISBN 9788496709621.
- Pareja Aparicio, Miguel. Energía solar fotovoltaica : cálculo de una instalación aislada [i.e. aislada] [on line]. 3a ed. Barcelona: Marcombo, 2016 [Consultation: 18/06/2026]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=31307325>. ISBN 9788426722300.

RESOURCES

Other resources:

Software and calculation tools: spreadsheets, basic sizing tools, RETScreen Expert, NREL System Advisor Model (SAM) or other tools introduced during the course.

Databases: NASA POWER, PVGIS and other digital climate and renewable resource databases.

Digital campus: ATENEA.