Course guide
820322 - EEEN - Energy Storage

Last modified: 10/07/2025

Unit in charge: Barcelona East School of Engineering
Teaching unit: 748 - FIS - Department of Physics.
709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE LOPEZ LOPEZ

Others: Primer quadrimestre:
JUAN ANTONIO GARCÍA-ALZÓRRIZ PARDO - Grup: T11, Grup: T12

REQUIREMENTS

SISTEMES ELECTRÒNICS - Prerequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Analyse and simulate specific energy systems.
3. Understand the fundamentals of automatic control methods.

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

- Class of theory where the program is explained and are oriented and discuss the topics studied by students autonomously.
- Practices Laboratory.
- Students will perform two different projects; a transversal project in coordination with the other subjects of the 6th semester of Grade Energy and a second project (doing partialment in clasroom) in group with specific content of the course.

LEARNING OBJECTIVES OF THE SUBJECT

To know the main energy storage technologies and their applications

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1.- Introduction. Fields of application: generation, transmission and distribution, final customer.

Description:

Full-or-part-time: 9h
Theory classes: 3h
Self study : 6h

2.- Storage of electricity in batteries. Batteries. Parameters. Regulations.

Description:

Full-or-part-time: 33h 30m
Theory classes: 7h 30m
Laboratory classes: 6h
Self study : 20h

(ENG) 3.- Càrrega i supervisió de bateries. Electrònica de potència. Convertidors estàtics. Sistemes de gestió de bateries (BMS).

Description:

Full-or-part-time: 22h 30m
Theory classes: 3h
Laboratory classes: 6h
Self study : 13h 30m

4.- Thermal Energy Storage. Storage in Tanks. Thermal salts. Thermal Energy Concentration Systems

Description:

Full-or-part-time: 12h
Theory classes: 4h 30m
Self study : 7h 30m

5. Compressed air energy storage (CAES). Geological CAES facilities. CAES facilities in the world

Description:

Full-or-part-time: 12h
Theory classes: 4h 30m
Self study : 7h 30m

6. Other forms of energy storage: Storage superconductors (SMES), pump, flywheel, supercapacitors, fuel cell.

Description:

Full-or-part-time: 31h
Theory classes: 10h 30m
Laboratory classes: 3h
Self study : 17h 30m

7.- Applications: Electric Vehicle, uninterruptible power supplies (UPS), renewable energy, microgrids, smartgrids.

Description:

Full-or-part-time: 30h
Theory classes: 12h
Self study : 18h

ACTIVITIES

work about Isolated House in Self-Consumption

Description:
720 minutes of the total 1350 minutes to dedicate to this activity, will be done in the classroom.

On a chosen house, an energy proposal must be made, based on renewable energies, that completely covers its needs.
The consumption profiles must be defined (power graph as a function of time) for the four seasons, differentiating between weekdays and weekends. One of the restrictions of the work is that at least 65% of the energy generated is of mini-eolic origin; with turbines that have a power LOWER than 10 kW.
To ensure that the energy needs are covered, apart from the miniwind energy, other renewable sources can be added, as long as, in their entirety, they do not exceed 35% of the energy generated.
The elements that make up the installation of various renewable sources will be chosen.
Apart from the graphs of consumption profiles, annual (and in some cases weekly) graphs must be made of:
- Power generated with mini wind.
- Generated Power-Consumed Power (it must be understood how: generated power minus consumed power).
If all needs are not covered with this source, other renewable sources must be added. The following must be done:
- Power generated with miniwind and other renewable sources (Total Power).
- Total Generated Power-Consumption.
- Energy generated with mini wind and other renewable sources (Total energy).
- Total Energy Generated - Energy Consumed.

If with these solutions, it is not always possible to cover the energy needs, it is necessary to add a storage system that is able to cover the needs. A commercial solution must be chosen by choosing the energy capacity of this storage.

- Total Generated Energy + Energy provided by the storage system - Energy Consumed.
- Graphics of the State of Charge (SoC) of the chosen storage system.
Connection diagram of all energy systems
System budget and investment recovery
Environmental study of the proposal
Conclusions

Full-or-part-time: 22h 30m
Theory classes: 22h 30m

GRADING SYSTEM

Final Note: Exam (40%) + Large Installation Work (20%) + Laboratory (20%) + Work on a) Self-consumption insulated housing or b) Hydrogen as an energy storage and support system (20%)
Reevaluation exam is not necessary