Course guide
480USE010 - 480USE010 - Just Energy Transition

Last modified: 17/06/2026

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

Degree: MASTER'S DEGREE IN SUSTAINABILITY AND STRATEGIES FOR A JUST GLOBAL TRANSITION (Syllabus 2026). (Optional subject).

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

LECTURER

Coordinating lecturer: José López López

Others: María Elena Martín Cañadas
Jordi de la Hoz Casas

TEACHING METHODOLOGY

Class of classroom Theory
Throughout the course, it is proposed to carry out work in theory sessions to practice with the concepts introduced in the subject.

LEARNING OBJECTIVES OF THE SUBJECT

Know the energy model of our society and identify the problems associated with it.
To understand how the electricity market works and how electricity prices are set
Identify the changes necessary to move towards a decarbonized energy model.
Know the different sources of energy without CO2 emissions and their associated problems to implement.
Economically assess the cost of changing the energy model as well as the introduction of the electric vehicle in the mobility of our societies.

STUDY LOAD

Type	Hours	Percentage
Hours large group	22,7	18.15
Hours medium group	11,4	9.11
Hours small group	11,0	8.79
Self study	80,0	63.95

Total learning time: 125.1 h

CONTENTS

1.Introduction to the energy transition

Description:
a. Conceptualization and Foundations of the Energy Transition
b. The Energy Transition in the Context of the European Union
c. Objectives and Pillars of the Energy Transition in Spain
d. Measures Aimed at the Energy Transition in Spain
e. Outlook and Impacts of the Energy Transition in Spain

Full-or-part-time: 15h
Theory classes: 5h 24m
Self study : 9h 36m

2. Electrification: key vector of the energy transition

Description:
a. Electrification by sector: prioritization decisions
b. Electrification and new infrastructure
c. Digitization and data management
d. Electrification and trade-offs

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

3. Electric sector as a catalyst for transition

Description:
a. Guarantee of electrical supply and associated activities
b. Architecture of the electricity production market and objectives
c. Design of incentives, prices and signals: investment, operation and risk
d. Formation of prices: elements and components of the electricity bill
e. Vulnerable consumers: protection and compatibility with the structure and formation of prices

Full-or-part-time: 20h
Theory classes: 7h 12m
Self study : 12h 48m

4. Energy Sources: Renewables, Integration, and Flexibility

Description:
a. Non-renewable Sources: Associated Problems
b. Nuclear and Firm Capacity: Boundary Conditions and Analysis
c. Mature Renewable Energy Sources: Wind, Hydropower, Biomass, Solar Thermal, and Photovoltaics
d. Hydrogen and Other Energy Carriers: Role, Limits, and Conditions
e. Challenges of Renewable Generation: Variability, Grid Flexibility, and Operation
f. Bioenergy: sustainability, MRV, and the trilemma
g. System cost and planning

Full-or-part-time: 30h
Theory classes: 10h 48m
Guided activities: 13h
Self study : 6h 12m

5. Distributed Generation, Self-Consumption, and Communities (Transition with New Actors)

Description:
a. The New Role of the Consumer: Prosumer, Aggregation, and Communities
b. Self-Consumption of Electricity: Between Value and System Limits
c. Communities and Aggregation: New Structures, Actors, and Equitable Distribution Solutions
d. Electric Mobility: Infrastructure, Grid, and Smart Charging
e. The Risk of a Two-Speed â□□â□□Energy Transition and Its Mitigation

Full-or-part-time: 20h
Theory classes: 7h 12m
Self study : 12h 48m

6. Financing and a Just Energy Transition

Description:
a. Evolution of financing mechanisms (1998-2020). Lessons learned
b. Current mechanisms: categories, conditions for success, costs, and benefits
c. A just energy transition and its foundations
d. Energy, social, and economic transition: legitimacy, costs, and distribution
e. Rubric and analysis of actions in the field of energy transition

Full-or-part-time: 15h
Theory classes: 5h 24m
Self study : 9h 36m

GRADING SYSTEM

Continuous avaluation.
- A first theory exam (30%).
- A second theory exam (40%)
- Work on the issues of discontinuity of renewable sources or substitution of non-renewable sources (30%)

EXAMINATION RULES.

The first theory exam will be held halfway through the course.
The second theory exam will be held at the end of the course.
The work on the issue of the discontinuity of renewable energy sources or the replacement of renewables will be submitted at the end of the semester and can be made during the course, taking advantage of the theory sessions.

BIBLIOGRAPHY

Basic:
- Carta González, J.A. Centrales de energías renovables: generación eléctrica con energías renovables [on line]. 2ª ed. Madrid: Pearson Educación : UNED, 2013 [Consultation: 29/07/2021]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1324. ISBN 9788483229972.
- Dorsman, A.; Simpson, J.L.; Westerman, W.. Energy economics and financial markets [on line]. Berlin, Heidelberg: Springer-Verlag,, 2013Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007%2F978-3-642-30601-3. ISBN 9783642306013.
- Bhattacharyya, S.C.. Energy Economics : concepts, issues, markets and governance [on line]. London: Springer London, 2011Available on: http://dx.doi.org/10.1007/978-0-85729-268-1. ISBN 9780857292681.

Complementary:
- Barnes, F.S.; Levine, J.G. Large energy storage systems handbook. Boca Raton: CRC Press, 2011. ISBN 9781420086003.