

Course guide

480073 - 480073 - Energy Economics and Sustainable Energy Systems

Last modified: 22/05/2025

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
Degree: MASTER'S DEGREE IN SUSTAINABILITY SCIENCE AND TECHNOLOGY (Syllabus 2013). (Optional subject).
Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: MARIA ELENA MARTIN CAÑADAS

Others: Helena Martín
Jordi de la Hoz

TEACHING METHODOLOGY

Master class, guided study sections, continuous evaluation activities

LEARNING OBJECTIVES OF THE SUBJECT

The aim of the course is to bring students to the fundamentals of energy economics and the close relationship between economics and sustainable energy systems, providing them the basic tools needed to understand the current energy problems and their interconnection with other fields. In essence it is intended:

- To know the basic terminology and classifications related to energy products
- To understand the accounting of energy flows from the original supply sources (through conversion processes) to end-use demands
- To get familiar with the main energy data sources available at international level
- To be able to analyse the supply and demand situation of a country from its energy balance
- To understand and analyse energy demand from various perspectives and methodologies.
- To know the basis of the European renewable energy policy and the mechanisms so far applied to promote it and the lessons learned
- To know and understand the fundamentals behind the investment decision on a renewable energy asset
- To be familiar with the electricity market prices mechanism and its impact on the energy consumers' electricity cost

STUDY LOAD

Type	Hours	Percentage
Hours large group	20,0	15.99
Hours medium group	10,0	7.99
Self study	88,4	70.66
Hours small group	6,7	5.36

Total learning time: 125.1 h

CONTENTS

1. INTRODUCTION.

Description:

- 1.1. Basic definitions: primary and secondary, renewable and non-renewable, commercial and non-commercial, conventional and non-conventional energy products.
- 1.2. Energy supply chain components.
- 1.3. Flow of energy products.

Full-or-part-time: 1h 30m

Theory classes: 1h 30m

2. ENERGY BALANCE

Description:

- 2.1. Definition of energy balance, structure and typologies.
- 2.2. Analysis of the information of the energy balance. Energy supply mix, self-reliance in supply, share of renewable energies, efficiency of electricity generation, power generation mix, refining efficiency, overall energy transformation efficiency, per capita consumption of primary and final energy, energy intensity.

Full-or-part-time: 3h

Theory classes: 3h

3. ECONOMIC FOUNDATIONS OF ENERGY DEMAND

Description:

- 3.1. Microeconomics basic concepts.
- 3.2. Analysis of the consumer's demand for energy: Utility maximization problem. Consumer's preferences, utility function, budget line, indifference curves. The method of Lagrange multipliers. Energy demand curve of an individual, energy demand curve of the market.
- 3.3. Cost minimization problem of the producer. Production function, isoquant curves, total cost of production, isocost lines, conditional factor demand functions, production expansion path.

Full-or-part-time: 3h

Theory classes: 3h

4. ALTERNATIVE APPROACHES TO ENERGY DEMAND ANALYSIS.

Description:

- 4.1. Descriptive analysis. Growth rates: year-on-year growth rate and annual average growth rate over a period. Demand elasticities. Energy intensities.
- 4.2. Decomposition analysis. Analysis of change in total energy demand. Analysis of changes in energy intensities.

Full-or-part-time: 3h

Theory classes: 3h

5. EUROPEAN RENEWABLE ENERGY POLICY IN THE ELECTRICITY SECTOR

Description:

- 5.1. Energy balance and renewable energy policy
- 5.2. Legal framework and policy targets
- 5.3. Support mechanisms to promote renewable energy systems
- 5.4. Lessons learned from the European experience and prospective

Full-or-part-time: 1h 30m

Theory classes: 1h 30m

6. ECONOMICS OF RENEWABLE ENERGY ASSETS FROM INVESTORS' PERSPECTIVE

Description:

- 6.1. Fundamentals for the economic evaluation of the renewable energy asset
- 6.2. Economic indexes and selection criteria
- 6.3. Investment decision, uncertainty and risk
- 6.4. Regulatory retroactivity and investment risk

Full-or-part-time: 3h

Theory classes: 3h

7. ENERGY CONSUMERS AND ELECTRICAL ENERGY COST

Description:

- 7.1. Regulated and liberalized activities in the electricity sector
- 7.2. Day-ahead electricity market. Energy producers and retailers
- 7.3. Electricity bill. Regulated costs and energy consumers

Full-or-part-time: 3h

Theory classes: 3h

8. Guided activities

Description:

- Preparation of an energy balance from data of energy products flows.
- Analysis of the energy balance of a country.
- Data collection and analysis of the primary energy demand and energy intensity at world and regional levels in a determined period, identifying the most significant trends and performing international comparisons.
- Application of different decomposition analysis methodologies to primary energy demand and energy intensity data at world and regional levels in a determined period, identifying the most significant trends and performing international comparisons.
- Determination of a simplified model for depicting the clearing market price mechanism and determining the energy producer's revenues.
- Renewable energy asset investment. Suitability analysis and determination.
- Energy consumers and electricity bill. Understanding the roles and revenues of the most relevant electricity sector subjects

Full-or-part-time: 27h

Guided activities: 27h

GRADING SYSTEM

50% mid-course exam and 50% final exam



BIBLIOGRAPHY

Basic:

- Dorsman, A.; Simpson, J.L.; Westerman, W. Energy economics and financial markets [on line]. Berlin, Heidelberg: Springer-Verlag, 2013 [Consultation: 15/02/2021]. Available on: <https://link-springer-com.recurtos.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, 2011 [Consultation: 15/02/2021]. Available on: <http://dx.doi.org/10.1007/978-0-85729-268-1>. ISBN 9780857292681.