

Unidade Curricular: Energy Sustainability

Área Científica: CE

Duração: Semestral

Horas de trabalho: 121.5

Horas de contacto: 45

ECTS: 4.5

Docente Responsável: João Fernando Pereira Gomes

Outros docentes: Jaime Filipe Borges Puna

Learning outcomes of the curricular unit

- 1 - Understand the key issues and challenges (technological, environmental, and economic) of the energy sector in the various spheres of analysis: global, European, national and enterprise;
- 2 - Be able to make simplified technical and economic analysis of energy production/management projects;
- 3 - Be aware of key aspects of the production, transformation, and energy use technologies, enough to examine its applicability to specific situations.
- 4 - Develop and implement the concept of energy sustainability including renewable generation and the rational use of energy.
- 5 - Know the regulatory framework and key energy policy instruments at European and national level

Syllabus

- 1 - Concepts and basic principles: production, processing and use of energy; yield, efficiency, average and marginal consumption. Sankey diagrams. Primary, final, useful, and productive energy. Applications
- 2 - Renewable Energy and Non-renewables energy: oil, natural gas, coal; wind, hydro, solar, geothermal, tides and waves; biomass. Main biofuels.
- 3 - Energy and Environment: climate change. The greenhouse gases (GHG). Environmental impacts. The limits of natural resources. Treatment of waste from industrial activities linked to energy production and management. Technologies of sequestration and storage of carbon dioxide.
- 4 – The Energetic Certification System in Portugal: concepts, methodologies, and applications. Case Studies.
- 5 - Energy Policies. EU energy policy and national energy policy, objectives, targets, and instruments. The national energy system.
- 6 - Technical and economic analysis of projects of energy management and use. Case studies.

Demonstration of the syllabus coherence with the curricular unit's learning objectives.

In the beginning, the student is led to know the fundamental aspects of the energy sector. He is then introduced into the study and analysis of the various forms and technologies of energy production and use; followed by the study of the environmental implications of these activities. Problems are studied in parallel with the respective solutions, in terms of sustainable energy. The European and national framework is studied in terms of the broad lines of energy policy and its relationship to the environment and sustainability. Technical and economic analysis of energy production and management projects is studied, and case studies

analysed. This set of issues converges consistently into a sustainability vision for the energy sector.

Teaching methodologies (including evaluation)

The teaching methodology includes classroom lectures, the analysis and discussion of themes and autonomous assignments by students, with teachers' supervision. The assignment will be presented and discussed by the pupils. Continuous evaluation consists of two components, assignments with oral presentation and discussion, corresponding the arithmetic average to 40% of the final grade and an exam corresponding to 60% of the final grade. The final classification is the weighted average of the marks obtained in the two components, and it's necessary to obtain a minimum of 9.5 in any one of them. The evaluation comprises a written exam, corresponding to 60% of the final grade and the assignments, corresponding the arithmetic average to 40% of the final grade. The final classification is the weighted average of the marks obtained in the two components, and it's necessary to obtain a minimum of 9.5 in any one of them.

Demonstration of the coherence between the teaching methodologies and the learning outcomes

The teaching methodologies and evaluation, that include classroom work combined with independent work by the student, but with close monitoring of teacher, seek to ensure that, on the one hand, the understanding of the overall UC by the student is achieved and, on the other hand, to stimulate students' autonomy in the matters of UC. The classroom component aims to give the student the knowledge about the main issues related to the energy sector in its various aspects: policy, technology, and environmental implications. The independent work by the student is designed to complement this knowledge with specific issues deemed relevant to a holistic understanding of the energy sector and its interaction with the environment and sustainability.

Mandatory consultation/existence bibliography:

- [1] Pelkmans, L. et. al., European Biofuels Strategy, International Journal of Environmental Studies, 64, 325-346, 2007.
- [2] Nersesian, Roy L., Energy for the 21st Century. M. E. Sharp, 2009
- [3] Capehart, B., et al., Guide to Energy Management, 7th Edition, The Fairmont Press Inc., 2009.
- [4] Kreith, F., Goswami, D.Y. (Eds.), Energy Management and Conservation Handbook, 2nd Ed. CRC Press, 2016
- [5] Energy Policy of AIE Countries, Portugal Review, Agência Internacional de Energia, 2009.
- [6] Rincon-Mejia, E., Heras, A., Sustainable Energy Technologies, CRC Press, 2017.
- [7] Blazev, A., Power Generation and The Environment, Fairmont Press, 2014.