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| Course Unit | Energy Efficiency | Field of study | Energy |
| Bachelor in | Renewable Energy Engineering | School | School of Technology and Management |
| Academic Year | 2023/2024 | Year of study | 3 |
| Type | Semestral | Semester | 2 |
| Level | 1-3 | ECTS credits | 6.0 |
| Code | 9910-743-3201-00-23 | | |
| Workload (hours) | 162 | Contact hours | T - TP 30 PL 30 TC - S - E - OT - O - |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Orlando Manuel de Castro Ferreira Soares

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. have knowledge on Rational Use of Energy; to know to apply Plans of Rationalization of Energy Consumptions and to know the tariff legislation and systems applicable;
2. establish and to implement energy management methods in industrial buildings and services; to identify losses, solutions and to establish goals;
3. have and to apply knowledge on energy surveys and energy audits with analysis of the economic viability of the investments;
4. have and to apply knowledge on conception, implementation and administration of a centralized management system.

Prerequisites

Before the course unit the learner is expected to be able to:
Knowledge of Calculation software;

Course contents

Introduction to Energy Management; Management System of Intensive Energy Consumptions; Practical Applications and Opportunities for Rationalization of Energy; Installation of special Systems and Equipment; Domotics systems and Intelligent Buildings; Energy audits; Energy diagnostics; Elaboration of Report; Installation of renewable energies in Buildings and Microgrids; Energy Systems Analysis.

Course contents (extended version)

1. Introduction to Energy Management and Energy Efficiency
 - Objectives of energy management;
 - Implementation of energy management methods;
 - Examination of the installation;
 - Energy sustainability.
2. Management Regulations for Energy Consumption
 - Application of the Energy Management System Intensive Consumption;
 - Energy diagnosis - Information collection and preliminary analysis;
 - Energy audits;
 - Rationalisation Plan of Energy Consumption.
3. Practical Applications and Opportunities for Rationalization of Energy
 - Distribution networks and Power factor;
 - Lighting systems;
 - Motor systems and Variable-Speed Drives;
 - HVAC systems;
 - Pumping systems;
 - Industrial refrigeration systems;
 - Thermal equipment and machinery;
 - Compressed air systems;
 - Ventilation systems.
4. Analysis of Energetic Systems
 - The chain of energy - Forms of energy and Energy degradation;
 - Sankey diagram;
 - Input-Output Model: Matrix of Leontief, Energy Balance;
 - Block diagrams: Specific Consumption of complex units of production.
5. Electricity Tariff Systems
 - The Tariff Regulations - Applicable legislation;
 - Activity tariff in Portugal;
 - Rates for the retail;
 - Analysis of the contractual supply of electricity;
 - Opportunity to rationalize energy based on the tariff.

Recommended reading

1. W. C. Tuner, "Energy Management Handbook", The Fairmont Press, 2001
2. I. Lazar, "Electrical Systems Analysis and Design for Industrial Plants", McGraw-Hill, 1980
3. Morgan, M. e S. Talukdar, "Electric Power Load Management: some technical, economic, regulatory and social issues", IEEE Trans. On Power Apparatus and Systems, vol PAS-67, No 2, Feb. 1979
4. A. J. Pansini, "Electric Distribution Engineering", McGraw-Hill, 1983
5. "Manual do Gestor de Energia" e "Regulamento de Gestão do Consumo de Energia", Direcção-geral de Geologia e Energia, Ministério da Economia e Inovação

Teaching and learning methods

Presentation of the different modules/subjects concepts followed by the resolution of exercises, using practical examples. Exploration of the topics by means of application exercises and worksheets. Study visits guided to specific real installations of the area. Sessions techniques carried through in partnership with companies and specialists invited of the area.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
 - Practical Work - 40%
 - Final Written Exam - 60% (Minimum score of 7 in the exam (on a scale of 20) to obtain approval for the course.)

Assessment methods

- 2. Alternative 2 - (Regular, Student Worker) (Special)
 - Final Written Exam - 100%
- 3. Alternative 3 - (Student Worker) (Supplementary)
 - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

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| Orlando Manuel de Castro Ferreira Soares | José Luís Sousa de Magalhaes Lima | Ana Maria Alves Queiroz da Silva | José Carlos Rufino Amaro |
| 29-02-2024 | 06-03-2024 | 11-03-2024 | 16-03-2024 |

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