# Universida<sub>de</sub>Vigo

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IDEI	NTIFYIN	IG DATA			
The	rmal En	ergy Management			
Subj	ect	Thermal Energy			
Code	<u> </u>				
Stud		Grado en			
prog	ramme	Ingeniería de la Energía			
Desc	riptors	ECTS Credits	Choose	Year	Quadmester
	•	6	Mandatory	4th	1st
Teac	ching	#EnglishFriendly			
lang	uage	Spanish			
Depa	artment				
Coor	dinator	Eguía Oller, Pablo			
Lect	urers	Eguia Oller, Pablo			
Emi	sil	perez Orozco, Raquel			
		http://moovi uvigo.gal			
Gene	eral	Introduction to energy management for the	acquisition of basic knowle	edge necessary	for energy audit. It
		obtain fluency in the use of techniques such well as an overview of current regulations. English Friendly subject: International stude references in English, b) tutoring sessions in	n as cogeneration, the use ents may request from the n English, c) exams and as	of different fuels teachers: a) mat sessments in Eng	erials and bibliographic glish.
Trai	ning an	d Learning Results			
A1	That the education aspects	e students demonstrate to possess and unde on (second level), and often found at a level s that involve knowledge from the avant-gard	rstand knowledge in an are that, although based on ad le of the field of study	ea of study that i lvanced textboo	s part of the general ks, also includes some
A2	That the possess resolution	e students know how to apply their knowledg s the competences that are usually demonstr on of problems within their area of study	ge to their work or vocation rated through the elaboration	in a professiona on and defense (	l way and that they of arguments and the
A3	That the judgme	e students have the capability to gather and nts that include a reflection on relevant socia	interpret relevant data (us al, scientific or ethical issue	ually within theii es	area of study) to issue
A4	That the audience	e students can transmit information, ideas, p ce	roblems and solutions to a	specialized and	non-specialized
A5	That the autonor	e students develop those learning capabilitie my.	s necessary to undertake f	urther studies w	ith a high degree of
B1	Ability t of a boo	o draw links between the different elements dy of knowledge with a clear structure and st	of all the knowledge acqui rong internal cohesion.	red, understandi	ng them as components
B3	To sugg situatio	gest and develop practical solutions, using the ns of ordinary reality that are specific to eng	e relevant theoretical know ineering, developing appro	vledge, to pheno priate strategies	mena and problems-
B5	To be fa professi technol	amiliar with the relevant sources of information competently, accessing all the present ar ogical and social changes.	on, including constant upda nd future tools of informatio	ating, in order to on search, const	practice one[]s antly adapting to
C39	Ability t	o manage audits of energy facilities.			
C40	Underst applicat	tanding and ability to use concepts pertaining tion for solving problems specific to the field	g to energy efficiency and s of energy engineering.	saving, as well a	s their management and
C41 D1	Ability t To be fa	to innovate in the development of new lines, amiliar with and to be able to use the leaislat	projects and products in th ion applicable in this secto	e field of energy r, to be acquaint	engineering.

business environments and to be able to deal with the relevant administration, integrating this knowledge into the drawing up of engineering projects and into the implementation of every aspect of their professional work. D2 Ability to organize, understand, assimilate, produce and handle all the relevant information to develop their

- professional work, using appropriate computing, mathematics, physics tools, etc. when these are required. Understanding engineering within a framework of sustainable development with environmental awareness.
- D3

- D4 Understanding the importance of safety issues and being able to foster awareness about safety among people within their environment.
- D5 To become aware of the need for continuous training and the constant improvement of quality, developing the values that are characteristic of scientific thinking, showing flexible, open and ethical attitudes in the face of different situations and opinions, particularly as regards non-discrimination on the grounds of gender, race or religion, respect for fundamental rights, accessibility, etc.

Expected results from this subject						
Expected results from this subject			Training and Learning			
			Results			
Know the technological base on which support the most recent investigations in energy savings	A1	B1	C39	D1		
	A3		C41	D3		
	A5			D4		
				D5		
Comprise the basic appearances of CHP	A1	B5	C40	D1		
	A2			D3		
				D4		
Dominate the available current techniques for the analysis of energetic audits	A4	B1	C39	D5		
	A5	B3	C40			
		B5	C41			
Deepen in the techniques of energetic efficiency	A1	B3	C39	D2		
	A2			D3		
	A3			D4		
	A4			D5		
	A5					
Dominate the available current techniques for the analysis of systems and thermal devices	A4	B1	C40	D1		
	A5	B3		D2		
		<u>B2</u>		D3		
Know the rule and the regulations needed in the thermal installations	A3	B3	C39	D1		
	A5	B2	C40	D3		
			C41	D5		
Project a system of energy savings by means of the integration of processes and technologies	A2	B1	C39	D1		
	A3	B3	C40	D2		
	A4	B5	C41	D3		
	A5			D4		
				D5		

Contents	
Торіс	
1. THE SOCIETY AND THE USE OF THE ENERGY	Introduction. Basic concepts. Energy and society. Sources of energy: renewable and no renewable. Energy Utilisation and Management. Energetic efficiency. Energy and environment
2. THE ENERGY AUDIT	Energy management. Energetic approach. Phases of an audit. Justification of investments. Building Energy Simulation.
3. ECONOMIC ANALYSIS	Introduction to economic analysis. Capital in time. investment evaluation criteria.
4. FUELS	Energy and fuels. Storage, transport and manipulation of fuels. Regulation.
5. INDUSTRIAL AUDITS	Introduction. Main differences with the tertiary sector. Boilers and systems of thermal generation. Simulation of Thermal Instalations.
6. LEGISLATION AND TARIFF STRUCTURE OF FUELS	Introduction. Prices of Electricity. Prices of Natural Gas. Prices of LPG. Prices of Diesel. Prices of Biomass. Prices of Coal.
7. SAVING AND IMPROVEMENTS PROJECTS	Natural resources. Waste energy resources. Improvements in the construction. Losses in engines. Saving Programs. Use of simulations in energy saving projects.
8. REGULATION OF THERMAL INSTALLATIONS	RD 1027/2007. Annex 1: general disposals. Annex 2: technical instructions.
9. INSTRUMENTATION	Demand Parameters. Inner thermal conditions. Envelope Conditions. Energetic efficiency measures.
10. COMBINED HEAT AND POWER	Introduction: definitions and parameters. Classification of CHP Systems. CHP Systems. CHP in the industry and in the tertiary sector. CHP Projects and savings. Legislation.
Diamaina	

Planning	Class hours	Hours outside the classroom	Total hours
Problem solving	12	12	24

Practices through ICT	20	20	40	
Presentation	2	2	4	
Lecturing	12	15	27	
Mentored work	4	4	8	
Essay questions exam	2.5	20	22.5	
Essay	0	24.5	24.5	
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\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

#### Methodologies

	Description
Problem solving	Formulation of problems, analysis, resolution and debate about the results. Consolidation of content
Practices through ICT	Development of computer software for the resolution of real complex problems. Introduction to
	advanced concepts of simulation and data processing. The student will report the weekly work that
	will be evaluated for the final grade.
Presentation	During the last weeks the work carried out during the course will be explained individually.
Lecturing	Presentation of the contents of the subject by teachers . Prior to the explanation in a lecture, the
	reading of the topic to be discussed will be recommended.
Mentored work	Delivery of a report on simulation of indoor environmental conditions in buildings and compliance
	with the regulations that exist in this regard.

 Personalized assistance

 Methodologies
 Description

 Practices through ICT
 The student will be able to expose his doubts and advance in the domain of energy audits every week in computer practices. For all the modalities of teaching, the tutorial sessions may be carried out by telematic means (email, videoconference, Moovi forums, ...) with prior agreement.

Assessment						
	Description	Qualification	Le	Trair earni	ning a ng Re	nd sults
Practices through ICT	Weekly preparation of the parts of an energy audit. All the expected results from this subject are evaluated.	30	A1 A2 A3 A4 A5	B1 B3 B5	C39 C40 C41	D1 D2 D3 D5
Presentation	Oral presentation of the work done weekly during practice hours and out of class. All the expected results from this subject are evaluated.	5	A1 A2 A3 A4 A5	B1 B3 B5	C39 C40 C41	D1 D2 D3 D4 D5
Mentored work	Simulation of a HVAC instalation using Energyplus. All the expected results from this subject are evaluated.	\$ 10	A1 A2 A4	B5	C40 C41	D2 D3 D5
Essay questions exam	Necessary test to be able to pass the subject where questions will be asked about concepts developed in master classes and in computer classroom practices. AAll the expected results from this subject are evaluated.	20	A1 A2 A3 A4 A5	B1 B3 B5	C39 C40 C41	D1 D2 D3 D4 D5
Essay	Realization of a work / energy audit project: presentation of a real case, analysis of the possible measures to be taken, economic evaluation of the measures, realization of a report, plans and budgets. All the expected results from this subject are evaluated.	35	A1 A2 A3 A4 A5	B1 B3 B5	C39 C40 C41	D1 D2 D3 D4 D5

# Other comments on the Evaluation

#### **Continuous assessment-First Opportunity:**

The students have to obtain a minimun qualification of 5 points on 10 in all the items/proofs of the subject. In the official date of the exam only the essay questions exam will be made.

#### **Continuous assessment-Second Opportunity:**

The students have to obtain a minimun qualification of 5 points on 10 in all the items/proofs of the subject. In the official date of the exam only the essay questions exam will be made.

## Global assessment-First and second opportunity:

The students that has renounced to the continuous assessment, will deliver the energy audit work before the official date for the exam, and will be valued with 50% of the final grade and, also, will have to pass the Essay questions exam that will be valued with 50% of the final grade.

The student who does not attend the class must take a test on the contents of the subject in which he/she demonstrates that he/she has mastered the tools used by the students in the computer practices, as well as an exam on knowledge imparted in the theory classrooms where he/she will answer questions about issues to develop and problems.

Exams timetable:

http://minasyenergia.uvigo.es/gl/docencia

Sources of information
Basic Bibliography
J.M. Rey Hernández, F.J. Rey Martínez, E. Velasco Gómez, : Eficiencia energética de los edificios. Certificación
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A.M. Díez Suárez, A. González Mártinez, L. de Sousa Díaz, A. de la Puente Gil, B. Vega Barrallo, M., Eficiencia energética
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Ian Beausoleil-Morrison, Fundamentals of Building Performance Simulation, 1ª Edición, Routledge (Taylor \$ Francis
Group), 2020
Antonio Madrid Vicente, Cogeneración, trigeneración y microcogeneración, 8412095456, Antonio Madrid Vicente,
Editor, 2019
Pablo Eguía Oller, Apuntes de la asignatura, 2017
Complementary Bibliography
U.S. Department of Energy, EnergyPlus: Energy simulation software, 9.4.0, 2021
National Renewable Energy Laboratory, <b>OpenStudio Application</b> , 1.1.0, 2021
Clark, William H., Análisis y gestión energética de edificios, 1ª Edición, McGrawHill, 1998

Sala Lizarraga, José M<sup>a</sup>., **Cogeneración. Aspectos termodinámicos, tecnológicos y económicos**, 1<sup>a</sup> Edición, Serivicio Editorial de la Universidad del País Vas, 1994

Ministerio de Energía, Turismo y Agenda Digital, **Publicaciones**, 2011

## Recommendations

#### Other comments

The student is recommended to attend the theoretical and practical classes to be able to acquire the necessary ease for the realization of documents on energy efficiency and energy audit. Thus, in a progressive manner, the student will carry out the work that will be presented at the end of the semester, being reviewed and commented by the professors of the subject, who will be able to advise the student as he deepens in the subject related to the management of thermal energy.