



## IDENTIFYING DATA

### Thermal energy management

Subject	Thermal energy management			
Code	V09G290V01706			
Study programme	Degree in Energy Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Eguía Oller, Pablo			
Lecturers	Baqueiro Vidal, María Eguía Oller, Pablo Lopez Mera, David Ogando Martínez, Ana			
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Web	<a href="http://fatic.uvigo.es/">http://fatic.uvigo.es/</a>			
General description	Introduction to energy management for the acquisition of basic knowledge necessary for energy audit. It includes from the economic analysis of an investment to the thermal simulation of a building. The student will obtain fluency in the use of techniques such as cogeneration, the use of different fuels or energy efficiency, as well as an overview of current regulations. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## Competencies

Code	
C45	Op8 Capacity to manage energy installation audits.
C46	Op9 Understanding and mastery of concepts concerning energy saving and efficiency, and how to manage them when solving applied energy engineering problems.
C47	Op10 Capacity for innovation in the development of new lines, projects and products in the energy engineering field.
D1	Capacity to interrelate all the acquired knowledge and interpret it as components in a body of knowledge with a clear structure and strong internal coherence
D3	Propose and develop practical solutions, which develop suitable strategies based on theoretical knowledge, for problem phenomena and situations that arise as everyday realities in engineering
D5	Know what sources are available for ongoing and continual updating of all the information required to undertake their work, with access to all the current and future tools for seeking information and adapting it in the light of technological and social changes
D6	Know and handle legislation applicable to the sector, know the social and business environment and know how to work together with the Administration and use acquired knowledge to draw up engineering projects and develop any of the aspects of professional work required
D7	Capacity to organise, interpret, assimilate, create and manage all the information needed to organise their work, handling the I.T., mathematical, physical and other tools required
D8	Conceive engineering within a framework of sustainable development with an awareness of environmental issues
D9	Know the importance of the security aspects and be able to transmit this information to the stakeholders.
D10	Become aware of the need for training and continual improvement in quality, developing the values associated with scientific thinking and showing a flexible, open and ethical attitude towards diverse opinions and situations, particularly in matters of non-discrimination on the grounds of gender, race or religion, respect for fundamental rights, accessibility, etc

## Learning outcomes

Expected results from this subject	Training and Learning Results
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To be able to employ the technological base that supports most of the recent investigations in energetic efficiency	C45 C46 C47	D8 D9 D10
To be able to employ, once understood, the basics of the cogeneration	C45 C46	
To be able to complete an energetic audit, mastering the available technics	C45 C46 C47	D6
To deeply understand the techniques involved in energy efficiency	C45 C46 C47	D6 D7 D9 D10
To master the current available techniques for the analysis of thermal systems and devices	C46 C47	D5
To properly understand and apply the regulation affecting thermal installations	C46	D1 D6 D7
To know how to make projects of energy efficiency by integrating different processes and technologies	C45 C46	D3 D8 D9

## Contents

Topic	
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.
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.
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.
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.

## Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	17.5	20	37.5
Practices through ICT	37.5	37.5	75
Presentation	1.3	2.7	4
Lecturing	20	25	45
Essay questions exam	2.5	20	22.5
Essay	0	41	41

\*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 treated in the lectures.
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.

## 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, FAITIC forums, ...) with prior agreement.

## Assessment

	Description	Qualification	Training and Learning Results
Practices through ICT	Weekly preparation of the parts of an energy audit. All the learning results considered in the subject are evaluated.	20	C45 D1 C46 D3 C47 D5 D6 D7 D8 D9 D10
Presentation	Oral presentation of the work done weekly during practice hours and out of class. All the learning results considered in the subject are evaluated.	10	C45 D1 C46 D9 C47 D10
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. All the learning results considered in the subject are evaluated.	20	C45 D9 C46 D10 C47
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 learning results considered in the subject are evaluated.	50	C45 D1 C46 D3 C47 D5 D6 D7 D8 D9 D10

## Other comments on the Evaluation

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 energética**, 1ª Edición, Paraninfo, S.A., 2018

J.M. Rey Hernández, F.J. Rey Martínez, E. Velasco Gómez, **Eficiencia energética de los edificios. Auditorías energéticas**, Paraninfo, S.A., 2018

A.M. Díez Suárez, A. González Martínez, L. de Sousa Díaz, A. de la Puente Gil, B. Vega Barrallo, M., **Eficiencia energética en las instalaciones de climatización en los edificios**, 1ª Edición, Ediciones Paraninfo, S.A, 2017

### Complementary Bibliography

U.S. Department of Energy, **EnergyPlus: Energy simulation software**, 8.7.0., 2017

National Renewable Energy Laboratory, **OpenStudio**, 2.1.0., 2017

Clark, William H., **Análisis y gestión energética de edificios**, 1ª Edición, McGrawHill, 1998

Sala Lizarraga, José Mª., **Cogeneración. Aspectos termodinámicos, tecnológicos y económicos**, 1ª Edición, Servicio Editorial de la Universidad del País Vas, 1994

Pablo Eguía Oller, **Apuntes de la asignatura**, 2017

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

## Recommendations

## Subjects that it is recommended to have taken before

### **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.

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### **Contingency plan**

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#### **Description**

Considering the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University establishes an extraordinary planning that will be activated when the administrations and the institution determine it. It is based on safety, health and responsibility, and it guarantees teaching in an online or semi-presential modalities. These already planned measures will guarantee, at the required time, the development of teaching in a more agile and effective way, because they will be known in advance by students and teachers through the standardized tool for teaching guides DOCNET.

##### 1. Semi-presential modality

Once the semi-presential teaching is required, it would mean a reduction of the capacity of the teaching spaces used in the face-to-face modality. Therefore, as the first measure of the centre, the capacity of the teaching spaces would be reformulated and informed to the teachers, in order to proceed to reorganize the formative activities for the rest of the semester. It should be noted that the reorganization will depend on the moment throughout the semester in which this semi-presential modality is activated. For the reorganization of the teaching activities, the following guidelines would be followed:

Through the FaiTIC platform, all the students will be informed about the new conditions under which the formative activities and assessment tests will be carried out at the end of the semester.

The tutorial sessions will be carried out by telematic means (email, videoconference, FAITIC forums, ...) with prior agreement.

Once some of the students have carried out experimental or computer laboratory practices in the face-to-face modality, if it is possible, the rest of the students will have the possibility to perform the same or equivalent activities in the same modality.

For the rest of the activities until the end of the semester, it should be done a proper identification of those formative activities which can be done under face-to-face modality and those which will be carried out remotely.

Regarding the potential tools to be applied for the formative activities during the online mode, CampusRemoto and the FaiTIC platform will be used.

##### 2. Online modality

In the event that the non-face-to-face teaching modality is required (suspension of all face-to-face formative and assessment activities), the tools currently available at the University of Vigo, CampusRemoto and the FaiTIC platform will be used. The reorganization will depend on the moment throughout the semester in which this online modality is activated. In the reorganization of the teaching activities, the following guidelines would be followed:

###### 2.1. Communication

Through the FaiTIC platform, all the students will be informed about the new conditions under which the formative activities and assessment tests will be carried out at the end of the semester.

###### 2.2. Adaptation and / or modification of teaching methodologies

As the teaching methodologies have been conceived for the face-to-face teaching modality, the teaching methodologies that would be kept and those which would be modified or replaced in the online modality are indicated below.

The teaching methodologies will be kept except for some face-to-face practice (such as measuring air quality) that would be replaced by videos and master classes.

The teaching methodologies that would be modified are the following

(Indicate the teaching methodologies that would be modified or replaced. In the case of formative activities that appear in the face-to-face modality, ie. field tests, laboratory or other kind of practices, indicate the activities adapted to the online

modality. As an example: field trips to industrial facilities or companies will be replaced by interactive or explanatory videos of technological processes, or instrumental laboratory practices will be replaced by interactive videos)

### 2.3. Adaptation of tutorial sessions and personalized attention

The tutorial sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) with prior agreement.

### 2.4. Evaluation

No change will be applied.

### 2.5. Bibliography or additional material to facilitate self-learning

No further bibliography would be necessary

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