820730 - REG - Energy Resources (DRAFT VERSION)

Coordinating unit: 820 - EUETIB - Barcelona College of Industrial Engineering

Teaching unit: 721 - FEN - Department of Physics and Nuclear Engineering

Academic year: 2014

Degree: ERASMUS MUNDUS MASTER IN ENVIRONOMICAL PATHWAYS FOR SUSTAINABLE ENERGY SYSTEMS (Syllabus 2012). (Teaching unit Compulsory)
MASTER IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: LLUIS BATET MIRACLE

Opening hours

Timetable: Just after the lectures. Other time frames to be appointed by e-mail.

Prior skills

The typical of the Master's accessing degrees.

Degree competences to which the subject contributes

Specific:

CEMT-1. Understand, describe and analyse, in a clear and comprehensive manner, the entire energy conversion chain, from its status as an energy source to its use as an energy service. They will also be able to identify, describe and analyse the situation and characteristics of the various energy resources and end uses of energy, in their economic, social and environmental dimensions, and to make value judgments.

Transversal:

CT1a. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

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Teaching methodology

The course is organized as a series of theoretical sessions (thought as participative conferences) that will provide transversal synthesis elements complementing the contents of other subjects, and an overarching vision of the energy system from different standing points. There will also be some assisted exercises sessions, where students, working in group, will try to solve a set of exercises related to the contents of the course.

In parallel, the students will have to follow the non-contact part of the course (readings and exercises).

During the semester the students will work, in teams of 3 or 4 people, on a tutored project about a specific energy topic, and will write a technical report (or a general scope article, depending on the subject) on that topic, that will defend before their tutor.

Learning objectives of the subject

General objectives:

Cognitive:
- To make evident the need for energy and its relationship to sustainable human development.
- To show all the transformations that energy suffers from its state as "energy source" to its use as "energy service".
- To raise awareness of the strategic and security of supply implications of the different energy alternatives.

Attitudinal:
- To raise students' awareness on aspects such as energy efficiency, environmental impact minimization, security of supply, etc.
- To develop in the students the values of justice, solidarity and equality from the fact of relating conflict and underdevelopment situations with the global energy needs.

Learning outcomes

Cognitive. The student:
- Understands the need for energy and its relationship to sustainable human development.
- Knows all the transformations that energy suffers from its state as "energy source" to its use as "energy service".
- Is aware of the strategic and security of supply implications of the different energy alternatives.
- Knows the structure of the electricity system.

Attitudinal. The student:
- Understands and is aware of the importance of issues such as energy efficiency, environmental impact minimization, security of supply, etc.

Study load

Total learning time: 125h	Hours large group:	30h	24.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	15h	12.00%
	Self study:	80h	64.00%

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Planning of activities

Course lectures	Hours: 28h Theory classes: 22h Guided study: 6h

Degree competences to which the activity contributes:

Description:

The contact part of the course is organized as a series of conferences. Some of the sessions will consist of exercises solved in team with the assistance of the teacher.

The programme of the course sessions consists of a series of conferences lectured by several experts both from UPC and external. The titles of the sessions are tentative.

General scope introductory sessions

1. Energy systems
2. The energy model
3. Energy resources in developing countries

Sessions on fossil resources

4. Geopolitics of oil and gas
5. Coal use in electricity generation
6. NG and LNG chains

Sessions on other resources and other issues

7. The nuclear fuel cycle
8. Advanced cycles for the nuclear fuel (including nuclear fusion)
9. Renewable resources
10. Towards the hydrogen economy
11. CO2 capture and sequestration

Support materials:

In the virtual campus the documents with the class presentations will be available to the students.

Descriptions of the assignments due and their relation to the assessment:

At the end of each practical session, the groups will deliver a copy of the work done during the session.

The attendance is mandatory. To be eligible for qualification, a minimum 75% attendance to these activities will be required.

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Specific objectives:

The contents of the course are transversal and aimed to summarize a knowledge which, in most of the cases, is the object of other courses. So, listing objectives of low level in Bloom's Taxonomy is unnecessary here. In the context of the course, it is considered important to explore the interrelationships of all the concurrent factors in the structure of the energy system and the implications of this structure

Limiting the list of objectives to those of high level in Bloom's Taxonomy, at the end of this course, students will be able to:

1. Explain a certain energy conversion chain from the source to the product and make calculations of varying complexity related to it (e.g. how much energy is required to produce a tin can?).
2. Determine the suitability of a particular energy solution (expressed as pros and cons) for a particular need (e.g. use of natural gas to produce electricity, future use of electric vehicles vs. hybrid vehicles ...) from global data on energy economy and from environmental impact and energy efficiency analyses.
3. Explain the relationship between the energy use and the human development, providing examples of different World regions (e.g. comparing per capita energy consumption vs. HDI).
4. Compare the environmental impact of different energy solutions.
5. Explain the relationship, expressed in terms of energy intensity, between energy consumption and economy in a country.
6. Analyse the security of energy supply in a region from cyclical and structural data.
7. Give a reasoned opinion on the projections and scenarios of future global and regional trends in energy, considering the demand, production capacity and reserves.
8. Give a reasoned opinion on the energy demand and the adequacy of the present coverage of energy services (e.g. railroad vs. automobile mobility) and on the essence of these services themselves (e.g. mobility vs. urban planning).
9. Draw energy flowcharts (synthesis) combining diverse statistical data.

Tutored course project	Hours: 39h Self study: 33h Laboratory classes: 6h

Degree competences to which the activity contributes:

Description:

The students, in groups of three or four students, will develop a course project throughout the semester.

Support materials:

Students will have a guide relative to the project in the virtual campus. This guide describes the requirements of form and content and of interaction with the tutor, along with the project's evaluation criteria.

Students may choose the topic of the project from a list of subjects that will be available as well on the virtual campus.

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Descriptions of the assignments due and their relation to the assessment:
The project will be delivered by the end of the semester. Afterwards, the defence of the project will take place; defence will consist of a group and an individual session. Therefore, the qualification of the project will have a strong individual component.

The detection of plagiarism or copying of this activity will cause the automatic suspension of qualification of the whole course.

Specific objectives:
Students must demonstrate that:
- they have achieved the specific objectives of the various topics of the course related to their project.
- they have achieved higher level objectives in the development of the course project.

It is intended that students develop the following skills by doing the course project:
- Teamwork
- Search and processing of information related to energy and environmental issues
- Writing technical reports
- Identification of the added value
- Evaluation of the quality of a technical report
- Presentation and oral defence of technical reports

It is also intended that students:
- Develop a values matrix regarding issues such as risk, environmental impact, security of supply, access to energy and economic optimization.
- Think about a set of values such as solidarity, dialogue, honesty and justice

Activities and works of reduced scope	Hours: 46h Self study: 40h Laboratory classes: 6h

Degree competences to which the activity contributes:

Description:
Students will perform activities individually or in teams (depending on the activity) and will deliver a paper before the deadline set for each activity. The expected duration of each activity will depend on its scope.

Support materials:
The description of each activity will be available to the students in the virtual campus. The description will provide information about possible sources of information (if needed) as well as the evaluation criteria.

Descriptions of the assignments due and their relation to the assessment:
A deadline will be set for each activity. Sessions will be scheduled for the defence of the activities. To qualify for the assessment of the activities, students must validate their work during these sessions.

The detection of plagiarism or copying in the activities will cause the automatic suspension of qualification of the whole course.

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Specific objectives:
Will be defined for each activity.

Final exam	Hours: 12h Self study: 10h Theory classes: 2h

Degree competences to which the activity contributes:

Description:
Students will do a written test for evaluating the contents of the course. This test will consist of a part based on the concepts explained in the theory sessions and a part with some exercises based on practical sessions.

Qualification system

The course evaluation is based in the student self-learning activities (40%), in the tutored course team project (30%), in small activities done in the classroom (10%) and in a final exam (20%).

The self-learning activities are split into exercises (10% - 20%) and other (20% - 30%). There will be a validation exam (written and oral) of these activities and of the course team project. Only after the validation exam the mark obtained for the activity will be considered definitive (if the result of the validation is positive).

In summary:
20% Final exam
30% Tutored course project
40% Other individual or team activities along the semester
10% Attendance and participation in theoretical and practical sessions

Attendance to contact activities is mandatory. In order to be evaluated of the course, a minimum 75% attendance to the contact sessions (lectures, conferences, exercises) is required. In case this requirement is not fulfilled, the student will be considered as Not Shown.

The qualificaction corresponding to the self-learning activities done during the semester (40% in total) will be built as a weighted average of the different marks, using as weighting factor the time allocated for each activity.

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Regulations for carrying out activities

Attendance to contact activities is mandatory. In order to be evaluated of the course, a minimum 75% attendance to the lectures is required.

The evaluation of individual and team activities will depend on the results of the validation test. In the case of the course team project, the final defence (in group and individual) will be used as validation test. For other activities suitable controls will be established.

The detection of plagiarism or copying in any learning activity or the final exam will cause the automatic suspension of qualification of the whole course.

For each activity a deadline will be set that must be not overpassed.

Bibliography

Complementary:

V. Smil. Energy at the Crossroads. Global Perspectives and Uncertainties. 2003 (posterior reed.). MIT Press,