COURSE SYLLABUS
2017-18

GENERAL INFORMATION

Course information	
Name	Energy Economics: Primary Sources, Electric Power Systems and Markets
Code	ENEECO
Degree	Bachelor's Degree in Electromechanical Engineering (IEM 10, IEM-I 10), Bachelor's Degree in Telematics Engineering (ITL 10, ITL-I 10)
Year	2017-2018
Semester	2
ECTS Credits	3
Type	Elective
Department	Department of Electrical Engineering
Coordinators	Carlos Batlle – Pablo Rodilla

Instructor	
Name	Carlos Batlle
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Area	MIT Energy Initiative
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Tutoring hours	Contact with Professor

Instructor	
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DETAILED INFORMATION

Course context

Contribution to the professional profile of the degree

The course presents an interdisciplinary perspective of the energy sector, with a special focus on the electric power sector, linking the engineering, economic, legal and environmental viewpoints. The course reviews the whole electricity supply value chain, from the analysis of the key primary energy sources (hydrocarbons, nuclear and renewable ones) to the description of the main electricity activities (generation, transmission, distribution and retail) and the different regimes in which they operate (regulated monopolies or under competitive conditions), with a special focus on the review of the fundamentals needed to approach the market designs currently implemented worldwide.

The knowledge acquired in the course will provide the comprehensive understanding of electric power systems that will be needed for research in this field, as well as for future professional activities in the energy sector, whether in industry, government or consulting.

Pre-requirements

CONTENTS

MODULE 1
Introduction
Introduction to Energy Economics Sources, units, sector structure and prospectives
MODULE 2
Review of the primary energy sources
Review of the primary energy sources (exploitation, transport, markets)
MODULE 3
Energy commodities markets
Spot and futures/forward markets
MODULE 4
Financial fundamentals of the energy sector
Project financing.
Portfolio theory.
MODULE 5
Electric power systems
System balance: Demand and Generation
Networks: Transmission & distribution
MODULE 6
Electric power markets
From monopolies to markets
Operation
Investment

Competences and learning outcomes

Competences

General Competences

CG3. Knowledge of basic and technological subjects, which enables students to learn new methods and theories, and gives them versatility to adapt to new environments.

CG4. Ability to solve problems with initiative, decision, creativity, and critical reasoning; and to communicate and transfer knowledges, abilities and skills in the field of Engineering.

CG5. Knowledges to perform measurements, calculations, valuations, studies, reports, work plans and similar tasks

CG7. Ability to analyze and assess the social and environmental impact of technical solutions.

CG9. Ability for organization and planning in firms and other institutions.

CG10. Ability to work in a multilingual, multidisciplinary environment.

RI10. Knowledge of basic and technological subjects, environmental and sustainability technologies.

Learning outcomes

At the end of the course, the students will have to be able to:

RA1. Be aware of the social, political and economic implications of energy.

RA2. Quantify the orders of magnitude of the different energy vectors.

RA3. Understand the role of primary energy sources and the basic economic principles underlying the energy business.

RA4. Understand the role of markets as tools to help agents pricing and trading the different sources.

RA5. Understand the differential aspects of the electric power business.

RA6. Know the key factors that condition the electricity business and the main techniques to manage them.

TEACHING METHODOLOGY

General methodological aspects of the course	
The teaching method is focused on easing the learning of knowledge and increasing the student critical thinking on energy economics theory and practice	
Classroom Methodology: Activities	**Competences**
Breaking news discussion: Brief discussion on the key energy and especially electric power systems news appearing in the media. (5 hours)	**CG7, CG10**
Lectures: The teaching method is structured around a series of modules built first on the basic energy economics principles and then on the different electric power system activities. The lectures are structured as follows (23 hours):	
- The theoretical basis are presented and discussed.	**CG3, CG5, CG7, CG9, RI10**
- Case studies: The presentations will include the analysis of different case studies. These cases will be geared at allowing the student understanding how the theoretical concepts apply in real electricity systems.	**CG4, CG10**
Office hours: the instructors are available for the students to support the students learning process.	
Non-Classroom Methodology: Activities	**Competences**
Teaching resources require the active participation of the student. In addition, the classroom activity should be complemented by the individual student work performed out of class. Both aspects are taken into account in the evaluation method.	
Personal work of the student:	
- As the course progresses, the students need to keep themselves updated on the news related to the course as they appear in the media. The students are weekly asked to share with their colleagues the pieces of news they find of interested. The instructors choose the most relevant ones, which are briefly discussed at the beginning of the class. (10 hours)	**CG7, CG10**
- Study of the course contents (40 hours).	**CG3, CG5, CG7, CG9, RI10**
Term task. The students have also to complete an individual term task. The students are assigned one particular hot topic related to the issues discussed throughout the course, for which they have to develop a critical analysis. (6 hours).	**CB3**

EVALUATION ACTIVITIES AND GRADING CRITERIA

Evaluation activities	Grading criteria	Weight
Mid-term exam (after half of the material has been covered)	Exams are a combination of short questions and a multi-option test. - Understanding of the theoretical concepts - Application of concepts to the solution of practical problems	**30%**
Final term (chapters 4 to 6)	- Understanding of the theoretical concepts - Application of concepts to the solution of practical problems	**40%**
Participation in the class	- Contribution to the class discussions	**10%**
Term paper	The term paper will be evaluated according to the quality of the document itself, the clarity and comprehensiveness of the description of the regulation implemented in the power system assigned. The soundness of the references used are also pondered.	**20%**

GRADING AND COURSE RULES

Grading

Regular assessment

- Theory accounts for 70%: mid-term exam (30%) + final exam (40%).
- Participation in the class grade accounts for 10%.
- Term paper accounts for 20%.

In order to pass the course, the averaged mark of the exams must be greater or equal to 4.5 out of 10 points and the mark of the final project must be at least 5 out of 10 points. Otherwise, the final grade will be the lower of the two.

Retakes

The student has two periods of final evaluation during one academic year. The first one will be carried out at the end of course (end of the semester). In case that this was not passed obtaining 5 or more points, the student has another opportunity of final evaluation at the end of the academic year. The dates of evaluation periods will be announced in the web page.

The new grade will by obtained as follows:

- 70% New exam covering the whole course.
- 10% Participation in class
- 20% Term task (the student can resubmit to improve the first grade received).

The mark of the retake final exam must be greater or equal to 4.5 out of 10 points and the mark of the final project must be at least 5 out of 10 points. Otherwise, the final grade will be the lower of the two.

Course rules

Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Article 6 of the Academic Rules (Normas Academicas) of the ICAI School of Engineering. Not complying with this requirement may have the following consequences:

- Students who fail to attend more than 15% of the lectures may be denied the right to take the final exam during the regular assessment period.
- Regarding laboratory, absence to more than 15% of the sessions can result in losing the right to take the final exam of the regular assessment period and the retake. Missed sessions must be made up for credit.

Students who commit an irregularity in any graded activity will receive a mark of zero in the activity and disciplinary procedure will follow (cf. Article 168 of the General Regulations (Reglamento General) of Comillas Pontifical University).

WORK PLAN AND SCHEDULE[1]

Session		In-class activities
#	hours	Lectures
1	2	Introduction to Energy Economics
2	2	Sources, units, sector structure and prospectives
3	2	Review of the primary energy sources I
4	2	Review of the primary energy sources II
5	2	Spot and futures/forward markets I
6	2	Spot and futures/forward markets II
7	2	Project financing
8	2	Portfolio theory
9.1	1	Mid-term exam
9.2	1	Demand
10	2	Generation
11	2	Networks
12	2	Regulatory models
13	2	Short-term markets operation
14	2	Investment management
15	2	Final exam

SUMMARY OF WORKING HOURS OF THE STUDENT			
CLASSROOM HOURS			
News discussion	Lectures	Exams	
5	23	2	
NON-CLASSROOM HOURS			
Personal work of the student	Term task		
40	6		
		ECTS CRÉDITS:	6 (180 hours)

[1] This schedule is tentative and may vary to accommodate the rhythm of the class.

BIBLIOGRAPHY AND RESOURCES

Bibliography
Basic bibliography
J. Barquín. Economía, energía y sociedad. Universidad Pontificia Comillas. 2004.
Readings
- D.G. Luenberger. Investment science. Oxford University Press 1998. - I.J. Pérez-Arriaga. Regulation of the Power Sector. Springer-Verlag, 2013.