UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID

**COURSE SYLLABUS**
**2024-25**

## GENERAL INFORMATION

| Course information | |
|---|---|
| Name | Wholesale and retail electricity markets |
| Code | WHO |
| Degree | Official Master's Degree in the Electric Power Industry (MEPI) |
| Year | 2024-25 |
| Semester | 1 |
| ECTS Credits | 6 |
| Type | Compulsory |
| Department | - |
| Area | Electric power systems regulation |
| Coordinator | Carlos Batlle & Pablo Rodilla |

| Instructor | |
|---|---|
| Name | Carlos Batlle |
| Company | ICAI |
| Area | Electrical Engineering Department |
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| Tutoring hours | Contact with Professor |

| Instructor | |
|---|---|
| Name | Pablo Rodilla |
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| Tutoring hours | Contact with Professor |

## DETAILED INFORMATION

### Course context

**Contribution to the professional profile of the degree**

The overall objective of the course is that students get to know, understand and analyze the fundamental principles on which wholesale and retail markets for electricity are based.

**Pre-requirements**

Not binding requirements, but having passed the course “Regulation of the electric power industry” is more than advisable

## CONTENTS

## Competences and learning outcomes

### Competences

#### Basic Competences

CB3. Know how to evaluate and select the appropriate scientific theory and precise methodology of their field of study to make judgments based on incomplete or limited information including, where necessary and appropriate, a critical review on the social and ethical responsibilities linked to the solution proposed in each case

#### Specific Competences

CE9. Acquire a technical, economic and legal understanding of the power business in a liberalized context, from the perspective of the different agents acting in power markets: generators, market operators, retailers, traders, consumers and regulators.

CE10. Understand the role of consumers in wholesale and retail markets and the mechanisms implemented in perfect and imperfect electricity markets.

### Learning outcomes

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

- Assess and to select the most appropriate market design (both at the wholesale and retail level), considering its social and economic implications.
- Have a technical, economic and legal understanding and vision of power production markets and business, from the viewpoint of the different actors involved: generators, market operators, traders, consumers and regulators.
- Acquire an understanding of all wholesale markets in which the various energy products that are needed to support the power supply business are traded.
- Analyze in detail the operating rules needed for the technical and financial management of markets.
- Understand the retail market, the role played by each of the agents, the value added by supplying companies and the most appropriate strategies for risk management.
- Have knowledge of the consumer perspective in the wholesale and retail markets.

## TEACHING METHODOLOGY

### General methodological aspects of the course

The teaching method is structured around a series of modules, covering the following aspects:

- Discussion of the fundamental theoretical principles of market design and functioning are presented.
- Detailed revision of the sequence of short-term generation markets.
- Analysis of the long-term markets and operations. Stakeholders representing the different players in long-term markets expose their role in these markets and describe their activities.
- Review of the main international experiences, covering the European, North American and Latin American markets. Specific sessions are devoted to analyze the historical evolution of the Spanish electricity market and to the Brazilian case.
- In depth analysis of the retail business, assessing the expected outcomes of retail liberalization and describing in detail the structure and processes of an electricity retailer.

The objective is that the knowledge gathered by the student in the course will allow him/her to analyze and operate in these markets. The course requires and encourages the active participation of the students, who are expected to take advantage of the opportunity to discuss with the key stakeholders about the way they perform their business activities.
The lectures in the class need to be complemented with personal homework of the student, and consequently it will be taken into consideration at the time of grading.
The students have to complete an individual term task. The students are assigned a number of relevant topics being debated at the moment in which the course is running. They are expected to present the problem and enounce their judgment.
At the end of the semester, the students have to present their work and respond to the questions posed by the course professor and also by the rest of students. Both the quality of the arguments and the questions and discussions from the rest of the class are evaluated to get to the final grades.

| Classroom Methodology: Activities | Competences |
|---|---|
| **Lectures and class discussions/exams.** Description of the course contents and open discussion of concepts. The students have also to try to respond to the numerous questions posed by the instructors throughout the lecture (**58 hours**). | **CB3, CE4, CE5** |
| **Term paper discussion.** The papers will be discussed with the instructors of the course in closed sessions with about 5 students each and between half and an hour duration per group, on the basis of a brief slide presentation to support the main points of the discussion raised by the student (**2 hours**). | **CB3** |
| **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.<br>**Personal work of the student.** Study of the course contents (**60 hours**). | **CB3, CE9, CE10** |
| **Term task.** Analysis of a relevant report discussing one of the timely debates regarding power market design. The student has to face her own research, in order to develop the ability to first investigate the current state of the discussion of a real case, and also to apply the critical skills acquired to build recommendations (**60 hours**). | **CB3** |
| **Tutorial activities.** Available according to the need of the student (**10 hours**) | **CB3, CE9, CE10** |

## EVALUATION ACTIVITIES AND GRADING CRITERIA

| Evaluation activities | Grading criteria | Weight |
|---|---|---|
| **Exams** (2 exams, the first representing 35% and the second 20%). | Exams are a combination of short questions and a multi-option test.<br>- Understanding of the theoretical concepts<br>- Application of concepts to the solution of practical problems | **55%** |
| **Participation in the class** | - Contribution to the class discussions | **10%** |
| **Term paper** | The term paper will be evaluated from two points of view:<br>- The quality of the analysis itself, the clarity and comprehensiveness of the discussion developed. The soundness of the references used are also pondered.<br>- The oral presentation of the work, the way the students build up their discussions, and their ability to back their proposals and to respond to the questions received. | **35%** |

## GRADING AND COURSE RULES

### Grading

#### Regular assessment

- Theory accounts for 55%: two exams.
- Participation in the class grade accounts for 10%.
- Term paper accounts for 35%.

#### 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:

- 55% New exam covering all the material.
- 35% Term task (the student can resubmit to improve the first grade received).
- 10% Participation in the class

#### 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 Académicas*) 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 present the term task during the regular assessment period.

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 | | Out-of-class activities | | |
|---|---|---|---|---|---|---|
| # | hours | Lectures | hours | Self-study | hours | Term paper |
| 1 | 2 | Chapter 1: INTRODUCTION TO WHOLESALE AND RETAIL ELECTRICITY MARKETS | 12 | * Textbook: Chapter 7 and Chapter 12<br>* Slides | | |
| 2 | 2 | | | | | |
| 3 | 2 | | | | | |
| 4 | 2 | | | | | |
| 5 | 2 | | | | | |
| 6 | 2 | | | | | |
| 7 | 2 | Chapter 2: POWER MARKETS OPERATORS | 12 | Slides | | |
| 8 | 2 | | | | | |
| 9 | 2 | | | | | |
| 10 | 2 | | | | | |
| 11 | 2 | | | | | |
| 12 | 2 | | | | | |
| 13 | 2 | Chapter 3: ROLES AND PROCESSES OF MARKET AGENTS IN POWER MARKETS | 12 | Slides | 60 | Term task |
| 14 | 2 | | | | | |
| 15 | 2 | | | | | |
| 16 | 2 | | | | | |
| 17 | 2 | | | | | |
| 18 | 2 | | | | | |
| 19 | 2 | Chapter 4: POWER MARKETS: CASE EXAMPLES | 12 | Slides | | |
| 20 | 2 | | | | | |
| 21 | 2 | | | | | |
| 22 | 2 | | | | | |
| 23 | 2 | | | | | |
| 24 | 2 | | | | | |
| 25 | 2 | Chapter 5: RETAIL BUSINESS | 10 | * Textbook: Chapter 9<br>* Slides | | |
| 26 | 2 | | | | | |
| 27 | 2 | | | | | |
| 28 | 2 | | | | | |
| 29 | 2 | | | | | |
| 30 | 2 | Term papers discussion | 2 | | | |

| SUMMARY OF WORKING HOURS OF THE STUDENT | | | |
|---|---|---|---|
| CLASSROOM HOURS | | | |
| **Lectures** | **Exams** | **Term paper discussions** | |
| 56 | 2 | 2 | |
| NON-CLASSROOM HOURS | | | |
| **Personal work of the student** | **Term task** | **Tutorial activities** | |
| 60 | 60 | 10 | |
| | | **ECTS CREDITS:** | **6 (180 hours)** |

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

## BIBLIOGRAPHY AND RESOURCES

**Bibliography**

**Readings**


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- http://regulationbodyofknowledge.org/
- Stoft, S., 2002. Power System Economics, Wiley-IEEE Press.
- Joskow, P. L., 2003. "The difficult transition to competitive electricity markets in the U.S." May 2003. Available at http://dspace.mit.edu/handle/1721.1/45001.
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- Evolution of Global Electricity Markets. New paradigms, new challenges, new approaches. F. Sioshashi Ed., Academic Press, 2013.
- MIT, "The Future of the Electric Grid", Chapter 7: "Engaging electricity demand", Dec-2011.
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- J. Vasconcelos, "Survey of regulatory and technological developments concerning smart metering in the EU electricity market", RSCAS Policiy Paper 2008/01, Florence School of Regulation
- S. Tierney, T. Schatzki, "Competitive procurement of retail electricity supply: Recent trends in State policies and utility practices", The Electricity Journal, Jan/Feb 2009.
- Competitive electricity markets: design, implementation, performance. Ed.
- www.iit.upcomillas.es/batlle/Publications.html
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  - Rodilla, P. & Batlle, C. 2010. "Security of electricity supply at the generation level:

problem analysis". Working Paper IIT-10-027A, Energy Policy, vol. 40, pp. 167.185.

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- Batlle, C., Mastropietro, P., Rodilla, P., Pérez-Arriaga I.J., 2014. The system adequacy problem: lessons learned from the American continent. Capacity Mechanisms in the EU Energy Market: Law, Policy, and Economics. ISBN 978-0-19-874925-7.