UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID

COURSE SYLLABUS 2026-2027

GENERAL INFORMATION

Course information	
Name	Natural gas industry and fuel markets
Code	MEPI-622-The natural gas
Degree	[MSEE 09 RD2007] [MRE 13 RD2007] [MEPI 13 RD2007] [PDEMTEES]
Year	1
Semester	2nd (Spring)
ECTS credits	3 ECTS
Type	Elective
Department	Electric Engineering
Area	
Coordinator	Ernesto Parrilla Pozzy

Instructor	
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Area	
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Office hours	Arrange an appointment through email.

DETAILED INFORMATION

Contextualization of the course

Contribution to the professional profile of the degree

Understanding the fuel markets is an essential skill for any professional that want to play a significant role in the energy industry. Nuclear fuel, coal, oil and natural gas sectors have a huge impact in worldwide economy and in particular the power systems. Among them, the natural gas, as the cleanest burning fossil fuel available, is call to play the most important role in the coming years as a transition technology towards the renewables era.

By the end of the course, students will understand the basic principles of: the natural gas industry, rules for suitable regulation in the gas industry, the supply chain of nuclear fuel, coal, oil and gas; basic concepts of long-term gas and LNG contracts clauses and negotiations. They will be able to have a clear idea of the relevant issues to be considered regarding fuel markets without being an expert.

Prerequisites

Students willing to take this course should be familiar with basic mathematical and power concepts. It is also desired a previous experience on the energy systems but not strictly required.

CONTENTS

Contents
Theory
Chapter 1. Course essentials
1.1 Introduction to natural gas and fuel markets
Chapter 2. Natural Gas Industry and markets
2.1 Natural gas chain 2.2 Regulation of the natural gas sector 2.3 Gas system economic regulation 2.4 LNG and natural gas contracts 2.5 Global LNG markets 2.6 Renewable gases: Hydrogen and Biomethane
Chapter 3. Oil industry
3.1 Oil physical market 3.2 Oil financial markets/Hedging
Chapter 4. Coal
4.1 Coal market and Clean coal
Chapter 5. Nuclear technology
5.1 Nuclear fuel and technology
Laboratory
Lab 1. Strategy definition
Students will form groups of 3-5 persons, and 4 of them will be nominated to do the gas suppliers role. Under a real situation that faces every power utility around the world, every group will need to define a strategy for gas procurement, defining the desired attributes of a long-term contract portfolio and its final destination.
Lab 2. Negotiation
Under an open set of rules impose by the instructor and its supervision, the different groups will negotiate with the different suppliers the typical clauses of a long-term gas contract, simulating a real situation. This

negotiation will lead to offers that the groups will summit to suppliers which will finally decide which ones will be accepted and rejected. At the end of this negotiation process, each group will have a portfolio of long-term contracts.

Lab.3 Oral LT portfolio defense

Once all portfolios have been defined each group will need to orally defend its portfolio in public, and open to the questions of the other students and the teacher. This defense will be part of the course assessment, and will consider:

- The material presented and its coherence
- The understanding of the main conceptual and practical concepts regarding natural gas industry
- The communication and persuasion skills
- The capacity to value its portfolio, strengths, weakness, opportunities and threats.

Competences and Learning Outcomes

Competences

Basic Competences

CG02. Saber aplicar e integrar sus conocimientos, la comprensión de estos, su fundamentación científica y sus capacidades de resolución de problemas en entornos nuevos y definidos de forma imprecisa, incluyendo contextos de carácter multidisciplinar tanto investigadores como profesionales altamente especializados.

Specific Competences

CE16. Comprender el modelo de negocio del gas natural, en sus aspectos regulatorios, económicos y comerciales desde una perspectiva internacional, y las principales implicaciones para el sector en España y Europa.

CE17. Tener una visión global sobre el funcionamiento y regulación de los mercados de combustibles en especial del carbón, el combustible nuclear, el gas natural y los hidrocarburos derivados del petróleo, las reservas y perspectivas internacionales y sus implicaciones con el desarrollo sostenible, la competitividad y la seguridad de suministro

Learning outcomes

The aim of this course is for the student to become knowledgeable about the natural gas industry and other fuels markets. In particular, under the completion of this course the participant should be:

RA1. Be familiar with fuel markets -natural gas, coal, nuclear fuel and oil products-, their international perspectives and their implications in competitiveness, security of supply in power systems and energy sustainable development.

RA2 Able to integrate the knowledge of this multidisciplinary area where technological aspects of the natural gas and other fuels, need to be taken into account when developing or applying its corresponding regulation.

RA3. Understand the technical aspects of natural gas industry and its implications in power markets (value chain, long-term contracting, international markets, etc.), recognizing the main commercial and economics aspects of the different market agents, and to understand the current regulation of the natural gas markets in Spain, the European Union and its future developments.

TEACHING METHODOLOGY

General methodological aspects

Consequently, all the proposed activities focus on providing students with the tools they require to be able to successfully develop an understanding of fuel markets.
The use of AI is permitted for documentation, research and presentation tasks on topics selected by students, as well as in the preparation of practical presentations for the course, in accordance with Levels 2 and 3 of the guide https://aiassessmentscale.com:

• Level 2: “AI may be used for activities prior to the task, such as brainstorming, outlining, or initial research. This level focuses on planning, synthesis, and idea generation, but the assessment should focus on the student’s ability to develop and refine those ideas independently.”

• Level 3: “AI may be used to help complete the task, including idea generation, drafting, feedback, and final refinement. The student must critically analyse and modify the outputs provided by AI, demonstrating their understanding.”

In all cases, the use of AI must be properly cited, and the sources must be verified by the student.

The use of AI is not permitted in exams or performance assessment tests.

In-class activities	Competences
Lectures and problem-solving sessions (26 hours): The lecturer will introduce the fundamental concepts of each chapter, along with some practical recommendations, and will go through worked examples to support the explanation. Active participation will be encouraged by raising open questions to foster discussion.	CG02, CE16, CE17
▪ **Lab sessions (4 hours):** Under the instructor’s supervision, students, divided in small groups, will apply the concepts and techniques covered in the lectures to real problems and will become familiar with the most relevant aspects of natural gas markets.	CG02, CE16, CE17
Out-of-class activities	**Competences**
▪ Personal study of the course material (15).	CG02, CE16, CE17
▪ Lab session preparation (20).	CG02, CE16, CE17
▪ Lab results analysis and report writing (10h).	CG02, CE16, CE171
▪ Final exam preparation (15h).	CG02, CE16, CE171

UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID

COURSE SYLLABUS
2026-2027

ASSESSMENT

Assessment activities	Grading criteria	Weight
Final exam	▪ Understanding of the theoretical concepts.	60%
Oral presentation	▪ Problem analysis. ▪ Information search skills. ▪ Quality of the proposed solution. ▪ Oral presentation and communication skills. ▪ Class participation.	40%

GRADING AND COURSE RULES

The student has two periods of final evaluation during one academic year. The first one (regular assessment) 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 (Retake) at the end of the academic year. The dates of evaluation periods will be announced in the web page.

Grading
Regular assessment
In order to pass the course, (i) the mark of the final exam must be greater or equal to 4 out of 10 points, (ii) the mark of the oral presentation must be at least 5 out of 10 points and the average of the two previous marks shall be at least 5. If the student satisfies (i) and (ii), the final grade will be the average of the two previous marks, if not, it will be the lower of the two marks ((i) and (ii)).
Retake
In order to pass the course, the student will have to pass an oral exam regarding all the contents of the course, obtaining at least 5 out of 10 points.
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.

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]

In and out-of-class activities	Date/Periodicity	Deadline
Oral presentation	April	
Final exam	May	
Lab sessions	February to May	
Review and self-study of the concepts covered in the lectures	After each lesson	–
Lab preparation	February to April	–
Final exam preparation	April/May	–

STUDENT WORK-TIME SUMMARY			
IN-CLASS HOURS			
Lectures	**Lab sessions**		
26	4		
OUT-OF-CLASS HOURS			
Self-study	**Lab preparation**		

[1] A detailed work plan of the subject can be found in the course summary sheet (see following page). Nevertheless, this schedule is tentative and may vary to accommodate the rhythm of the class.

30	30		
		ECTS credits:	**3 (90 hours)**

BIBLIOGRAPHY

Basic bibliography

- Notes prepared by the lecturer (available in Moodle).

Complementary bibliography

- Babcock & Wilcox, Steam: its generation and use, Edited by S.C. Stultz and J.B. Kitto
- Black & Veatch, Chapman & Hall Edited, Power Plant Engineering, by Larry Drbal
- J.B. Horlock, Combined Power Plants, including CCGT Plants, Pergamon Press
- Rolf Kehlhofer, Combined Cycle gas & Steam Turbine Power Plants, Pennwell
- Publishing Co - 2nd Edition ISBN 0-87814-736-5
- J.H. Horlock (2003) Advanced Gas Turbine Cycles. Brief Review of Power Generation
- Thermodynamics., Pergamon Press
- Santiago Sabugal García - Florentino Gómez Moñux (1996), Centrales Térmicas de Ciclo
- Combinado: Teoría y Proyecto, Editorial Díaz de Santos -
- J. Barquín (2004), Energía: técnica, economía y sociedad, Publicaciones de la UPCo,. Madrid
- Uranium 2005 - Resources, Production and Demand , OECD Nuclear Energy Agency,
- International Atomic Energy Agency (IAEA), Paris, 2006
- Philip Kiameh, Power Generation Handbook, Ed. McGraw-Hill, 2002

SCHEDULE

UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID

COURSE SYLLABUS 2026-2027

	IN-CLASS ACTIVITIES				OUT-OF-CLASS ACTIVITIES			LEARNING OUTCOMES
Week	**h/w**	**LECTURE & PROBLEM SOLVING**	**LAB**	**ASSESMENT**	**h/w**	**SELF-STUDY**	**LAB PREPARATION AND REPORTING**	**Learning Outcomes**
1	2	Introduction to Natural gas and fuel markets			1	Review and self-study (1h)		RA1, RA2, RA3
2	2	The oil market			8	Review and self-study (1h)	Lab preparation (7h)	RA1, RA2, RA3
3	2	The oil market: financial/hedging perspective			4	Review and self-study (4h)		RA1, RA2, RA3
4	2	Natural gas Chain			3	Review and self-study (1h)	Lab preparation (2h)	RA1, RA2, RA3
5	2	Regulation of the natural gas sector			3	Review and self-study (1h)	Lab preparation (2h)	RA1, RA2, RA3
6	2	Renewable gases: Biomethane			3	Review and self-study (1h)	Lab preparation (2h)	RA1, RA2, RA3
7	2	Natural gas markets situation			6	Review and self-study (1h)	Lab preparation (5h)	RA1, RA2, RA3
8	2	Economic and commercial aspects of natural gas			7	Review and self-study (1h)	Lab preparation (5h)	RA1, RA2, RA3
9	2	The perspective of a market agent (1h)	Lab 1 (1h)		7	Review and self-study (1h)	Lab preparation (6h)	RA1, RA2, RA3
10	2	The perspective of a market agent	Lab 0 (1h)		4	Review and self-study (4h)		RA1, RA2, RA3
11	2	Coal market and clean coal			4	Review and self-study (4h)		RA1, RA2, RA3
12	2	The perspective of a market agent	Lab 2 (2h)		1	Review and self-study (1h)		RA1, RA2, RA3
13	2	The nuclear technology and fuel			4	Review and self-study (4h)		RA1, RA2, RA3
14	2	Renewable gases: Hydrogen			4	Review and self-study (4h)		RA1, RA2, RA3
15	2	Test		Final Exam	1	Review and self-study (1h)		