



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicación

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93001300 - Energy System: Market, Technologies And Perspectives

DEGREE PROGRAMME

09BP - Master Universitario En Energia Solar Fotovoltaica

ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	93001300 - Energy System: Market, Technologies And Perspectives
No of credits	4 ECTS
Type	Core
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	09BP - Master Universitario en Energia Solar Fotovoltaica
Centre	09 - Escuela Tecnica Superior De Ingenieros De Telecomunicacion
Academic year	2022-23

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Ignacio Rey-Stolle Prado (Subject coordinator)	IES-107	ignacio.reystolle@upm.es	Sin horario. Concertar cita por email
Carlos Del Cañizo Nadal	IES-113-1	carlos.canizo@upm.es	Sin horario. Concertar cita por email

Alejandro Datas Medina	IES-202	a.datas@upm.es	Sin horario. Concertar cita por email
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Skills and learning outcomes *

3.1. Skills to be learned

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CB6 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB7 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB8 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CE1 - Comprender, analizar y juzgar la relevancia de cualquier contribución en este campo, en relación con su entorno social, energético y científico-técnico.

CE6 - Aplicar metodologías de diseño e implementación de técnicas de aprendizaje y clasificación automáticas para una gestión inteligente del conocimiento

CG5 - Gestión de la información: buscar y gestionar recursos bibliográficos adecuados con eficiencia, aprender a continuar los estudios de manera ampliamente autónoma como base para la futura actividad de investigación e innovación

CG8 - Aplicar metodologías, procedimientos, herramientas y normas del estado del arte para la creación de nuevos componentes tecnológicos; Construir nuevas hipótesis y modelos, evaluarlos y aplicarlos a la resolución de problemas

CG9 - Comunicar juicios, y conocimientos a audiencias especializadas y no especializadas, de una manera razonada, clara y sin ambigüedades

CT3 - Uso de la lengua inglesa: comprender los contenidos de clases magistrales, conferencias y seminarios en lengua inglesa; redactar en inglés informes y artículos científico-técnicos usando herramientas informáticas; realizar exposiciones públicas en inglés de trabajos, resultados y conclusiones de investigación, por ejemplo, en las asignaturas del Máster o en congresos de carácter mayoritariamente internacional o en estancias en centros extranjeros, todo ello con la ayuda de medios informáticos audiovisuales

CT4 - Liderazgo de equipos: realizar trabajos en equipo (como los de algunas de las actividades de evaluación de las asignaturas), integrarse en un grupo de investigación participando activamente en sus reuniones, colaborando con iniciativa propia en trabajos o proyectos de I+D+i; interaccionar con efectividad con los miembros del equipo de trabajo multidisciplinar

3.2. Learning outcomes

RA14 - RA4 - Capacidad para analizar los resultados

RA16 - RA27 - Capacidad crítica para analizar los diferentes modelos en términos de principios básicos de la física

RA19 - RA45 - Capacitar al alumno a hacer presentaciones en público

RA20 - RA46 - Adiestrar al alumno en el trabajo en equipo

RA27 - Conocer la evolución energética de la humanidad

RA21 - RA47 - Aprender a argumentar convincentemente

RA29 - Conocer el catálogo de energías renovables

RA15 - RA5 - Relacionar los principios básicos con los aspectos prácticos

RA26 - Conocer la definición y concepto de energía

RA28 - Entender el contexto energético del mundo actual

RA30 - Conocer los impactos de la energía en diferentes mercados y sectores

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The general goal of this course is to consolidate and expand the general knowledge around energy in a broad sense of students who will become experts in a particular energy field as is Photovoltaic Solar Energy. Graduate courses are necessarily specific so it is mandatory to raise your head, look around and understand the wide context. This general goal will be accomplished by means of achieving this set of specific goals:

- To think about the definition and concept of Energy
- To know the energetic evolution of humankind

- To understand the energetic situation of our contemporary world
- To analyze the role of fossil fuels in the world energy system
- To define and understand what Renewable Energies are
- To know the fundamentals and degree of development of the main Renewable Energies
- To understand how energy impacts different markets and sectors
- To develop a basic knowledge of the envisaged future energy technologies currently under basic research

4.2. Syllabus

1. Energy basics

- 1.1. Around the concept of energy and energetic machines
- 1.2. Energy along human history

2. World energy structure

- 2.1. World energy system
- 2.2. World electricity system
- 2.3. Fossil fuels
- 2.4. Renewable energies

3. Markets and impacts

- 3.1. Energy and ecology
- 3.2. Energy and climate change
- 3.3. Energy and gender issues
- 3.4. Energy and food
- 3.5. Energy and transport

4. Emerging and future energy technologies

- 4.1. Energy storage
- 4.2. Hydrogen energy

4.3. Clean coal technologies

4.4. Nuclear fusion

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<p>Course Presentation Duration: 01:00</p> <p>Unit I.1 Basic Concepts around Energy and Energetic Machines Duration: 02:00</p>			<p>Assignment 1: On the concept of Energy</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
2	<p>Unit I.2 Energy in Human History Duration: 02:00</p> <p>Unit II.1 World Energy System Duration: 01:00</p>			
3	<p>Unit II.1 World Energy System Duration: 01:00</p> <p>Unit II.2 World Electricity System Duration: 02:00</p>			<p>Assignment 2: World Energy System</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
4	<p>Unit II.3 Electricity Markets Duration: 02:00</p> <p>Unit II.4 Fossil Fuels. Coal Duration: 01:00</p>			<p>Assignment 3. Electricity markets</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
5	<p>Unit II.4 Fossil Fuels. Oil Duration: 01:00</p> <p>Unit II.4 Fossil Fuels. Natural gas Duration: 01:00</p> <p>Unit II.5 Renewable Energy Technologies Duration: 01:00</p>			<p>Assignment 4: Fossil fuels</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
6	<p>Unit II.5 Renewable Energy Technologies Duration: 01:00</p> <p>Unit III.1 Energy, Ecology and Demography Duration: 01:00</p>			<p>Assignment 5: Energy and climate change</p> <p>Continuous assessment Not Presential Duration: 04:00</p>

	<p>Unit III.2 Energy and Climate Change Duration: 01:00</p>			
7	<p>Unit III.3 Energy and Gender Duration: 01:00</p> <p>Unit III.4 Energy and Food Duration: 01:00</p> <p>Unit III.5 Energy and Transport Duration: 01:00</p>			<p>Assingment 6: Energy and transport</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
8	<p>Unit IV.1 Energy Storage Duration: 02:00</p> <p>Unit IV.2 Hydrogen Energy Technologies Duration: 01:00</p>			<p>Assingment 7. Energy storage</p> <p>Continuous assessment Presential Duration: 04:00</p>
9	<p>Unit IV.2 Hydrogen Energy Technologies Duration: 01:00</p> <p>Unit IV.3 Clean Coal Technologies Duration: 01:00</p> <p>Unit IV.4 Nuclear Fusion Duration: 01:00</p>			<p>Assingment 8. Hydrogen</p> <p>Continuous assessment Not Presential Duration: 04:00</p>
10	<p>Unit IV.4 Nuclear Fusion Duration: 01:00</p> <p>Final Presentations Duration: 02:00</p>			<p>Final paper</p> <p>Continuous assessment Not Presential Duration: 06:00</p>
11	<p>Final Presentations Duration: 03:00</p>			<p>Final presentation</p> <p>Continuous assessment Presential Duration: 01:00</p>
12				
13				<p>Final exam</p> <p>Final examination Not Presential Duration: 02:00</p>
14				<p>Assessment of Class participation</p> <p>Continuous assessment Presential Duration: 01:00</p>

15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Assignment 1: On the concept of Energy		No Presential	04:00	5%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
3	Assignment 2: World Energy System		No Presential	04:00	5%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
4	Assingment 3. Electricity markets		No Presential	04:00	5%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4

5	Assingment 4: Fossil fuels		No Presential	04:00	5%	5 / 10	CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CG5 CT3 CT4
6	Assingment 5: Energy and climate change		No Presential	04:00	5%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
7	Assingment 6: Energy and transport		No Presential	04:00	5%	5 / 10	CG9 CB8 CG5 CG8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
8	Assingment 7. Energy storage		Face-to-face	04:00	5%	5 / 10	CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4 CG5

9	Assingment 8. Hydrogen		No Presential	04:00	5%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
10	Final paper		No Presential	06:00	25%	5 / 10	CG9 CB8 CB9 CE6 CG5 CG8 CB6 CB10 CE1 CB7 CT3 CT4
11	Final presentation		Face-to-face	01:00	25%	5 / 10	CG8 CG5 CG9 CB8 CB9 CE6 CB6 CB10 CE1 CB7 CT3 CT4
14	Assessment of Class participation		Face-to-face	01:00	10%	5 / 10	CG9 CB8 CB9 CE1 CT3

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
13	Final exam		No Presential	02:00	100%	5 / 10	CG5 CG8 CG9 CB8 CB9 CE6 CB6 CB10

																				CE1	
																				CB7	
																				CT3	
																				CT4	

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

Continuous evaluation

Assignments

40% of your final score will be linked to the results of the 8 assignments of the course (exercises, problems, comments on proposed readings, ...). What will be assessed is the depth, quality, and level amid your classmates.

Final paper and presentation

50% of your final score will be associated with an individual paper with a free topic to be completed and presented in the final session of the course. What will be assessed in this exercise will be depth, quality, and level amid your classmates of the written essay, For the presentation, we will assess the clarity, quality of replies to questions, fitting to time and format.

Class participation

10% of your final score will be linked to your attitude and participation (quality and quantity) in class

Final evaluation

For those following final evaluation only, you will have a final written exam covering the complete course.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Course web page	Web resource	<p>
</p> <p>The course web page at UPM's Moodle server contains all material needed to follow the course. This includes:
</p> <ol style="list-style-type: none">1) Presentations for all units in PDF format
2) Assignments
3) Ancillary material (readings, reports, videos, ...)

8. Other information

8.1. Other information about the subject

This course is closely related to SUSTAINABLE DEVELOPMENT GOAL 7, *Ensure access to affordable, reliable, sustainable, and modern energy for all.*

Many of the specific targets of SDG 7 are explicitly covered in the syllabus. For instance, the current structure of the world energy system, the degree of penetration of renewable energies in the generation pool, energy efficiency, and the impacts of our energy model on ecology, climate, demography, and gender, are dealt with. Accordingly, there are also connections with other SDGs, for example, SDG 11: Sustainable cities and communities; and SDG 13: Climate Action. Finally, it should be mentioned that SDGs in general, and SDG 7 in particular, are discussed in one of the topics in the course