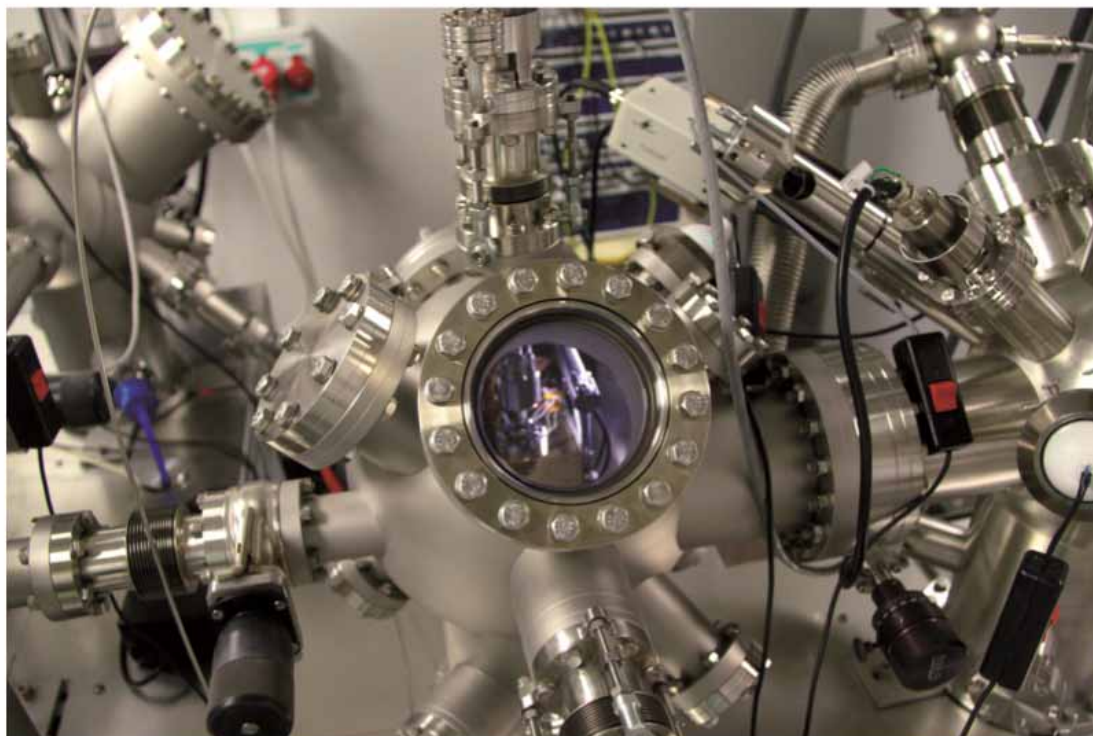




UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

Campus d'Excel·lència Internacional



UPC

Universitat Politècnica de Catalunya. BarcelonaTech
2016/17



The **Universitat Politècnica de Catalunya. Barcelona-Tech (UPC)** is a **public higher education and research institution** that is specialized in the fields of architecture, science and engineering.





International Campus of Excellence

The UPC has consolidated its position as an International Campus of Excellence with the **UPC Energy Campus project**.

In 2009, it was awarded this distinction for the **Barcelona Knowledge Campus (BKC)**, a project carried out with the University of Barcelona. These marks of excellence strengthen the UPC's position, both within Spain and internationally, as a hub of talent, innovation, technology transfer and regional development.





21 *schools*

in **7** *Catalan cities*

33,128

*undergraduate and postgraduate
students*

86%

*of new students whose first-choice
university was the UPC*

42

departments

18

research institutes

126

*research groups recognised
by the Catalan government
in the SGR call*

3,015

*teaching and research
staff members
(59% PhD holders)*

1,832

*administrative
and service staff
members*



Creating knowledge

The UPC adapts its **range of bachelor's, master's and doctoral degree courses** to the surrounding community's social and economic needs, while positioning itself strategically and geographically in different fields of cutting-edge knowledge and research.





63

bachelor's degrees

70

master's degrees

5,600

*graduates of first- and second-cycle
and master's degrees*

100

international double-degree

*agreements with **51** universities*

49

doctoral degrees,

25

with a quality award

355

doctoral theses defended

4,926

*undergraduate students on a
scholarship*



Engaged in economic development

Businesses require knowledge, talent and technology. The UPC transfers its expertise to the business community through research and innovation projects, and also by helping its students and graduates to find employment. The UPC provides facilities and equipment and participates in the **creation of technology-based companies**, as well as in the growth of spin-offs and start-ups.





979

new agreements and research projects

€49,003,263

in income for R&D projects

17

*companies created last year (Innova
programme)*

68

patents

4,325

*students participating in educational
cooperation*

791

*pieces of science
and technology equipment services
for companies*



A force for progress

As a **public research and teaching institution**, the UPC bases its involvement with society on a series of commitments informed by principles of **sustainability, cooperation, equal opportunity, regional outreach, internationalisation, and guidance and professional support for students and graduates.**





2,494

*companies and other entities that have signed
Collaboration agreements with the UPC*

2,613

students in international mobility programmes

13

*Erasmus Mundus
master's degrees*

26

*master's degrees
taught in English*

19

NGOs and development cooperation projects

60

development cooperation projects

*in **31** countries*

6

*UPC campuses with sustainable
mobility plans*



The UPC in the world

1. Barcelona
2. Castelldefels
3. Igualada
4. Manresa
5. Mataró
6. Sant Cugat del Vallès
7. Terrassa
8. Vilanova i la Geltrú





Fields of study

- Aerospace Engineering
- Architecture, Urbanism and Building Construction
- Applied Sciences
- Audiovisual Communication
- Biosystems Engineering
- Business Management and Organisation
- Civil Engineering
- Environment, Sustainability and Natural Resources
- Health Sciences and Technology
- Industrial Engineering
- Informatics Engineering
- Naval, Maritime and Nautical Engineering
- Telecommunications Engineering



Fields of research

- Architecture, Urbanism and Building Construction
- Civil Engineering
- Industrial Engineering
- Information and Communication Technology Engineering
- Sciences



ENERGY TO EXCEL

Energy Campus is aimed at leading the transformation of the energy sector with clear local impact and wide international recognition. In this campus, knowledge and technology will generate innovation for a more sustainable economy, and it will become a reference in the field of governance and social responsibility.



Positive feedback of the first years of Energy Campus



The International Commission appointed by the Ministerio de Educación, Cultura y Deportes, has highly assessed the progress of the Campus of International Excellence project led by the **Universitat Politècnica de Catalunya·BarcelonaTech** in the field of energy. [+]



Energy Campus

Campus of International Excellence

Energy Campus is supported by several units and departments to drive innovation, research valorisation and knowledge transfer:

Programa Innova

Programa Innova aims to promote the research carried out in the campus, to encourage a culture of innovation and entrepreneurship among researchers, students and teachers, and to help increase the innovative potential of their groups and units, favoring the creation of new companies and valuation instruments fruit of knowledge.

Oficina de Patents i Llicències UPC

The Office of Patents and Licensing is responsible for the protection and exploitation of intellectual property rights in all research activities carried out by members and groups of the university community, and in the process of knowledge and technology transfer developed in the framework of these activities.

Parc UPC

Parc UPC was conceived with the mission to become a dynamic socioeconomic agent between university, government and businesses, and to promote the social commitment of the university by encouraging research, innovation, transfer of results and technological progress.



Technology Offers is the online catalog of available technology in campus launched to give visibility to the portfolio of patents resulting from research activity, a window of the R&D performed at the university in scientific and technological emerging areas such as energy and environment.



The purpose of the UPC Technology Center (CIT UPC) is to create better conditions for the transfer of research results and technology developed by the TECNIO centres to the business world for commercialisation and, by extension, to society at large.



KIC INNOENERGY

RESEARCH & INNOVATION

EDUCATION & TRAINING

RESEARCH & INNOVATION

- > Technology Concept
- > Innovation concept
- > **UPC Energy Research Map**
 - Alphabetic order
 - **Energy topics**
 - UPC Research Document
- > CC Project Organization

Energy topics

Energy Topics List

- ▶ Wind Energy
- ▶ Solar PV
- ▶ Solar Thermal
- ▶ Smart Grids
- ▶ Bioenergy & Biomass
- ▶ CO2 Storage and Absorption/Desorption
- ▶ Nuclear Energy
- ▶ Energy Efficiency
- ▶ Transport Management & Innovation
- ▶ Sustainable Architecture
- ▶ Hydropower
- ▶ Materials for Energy Applications





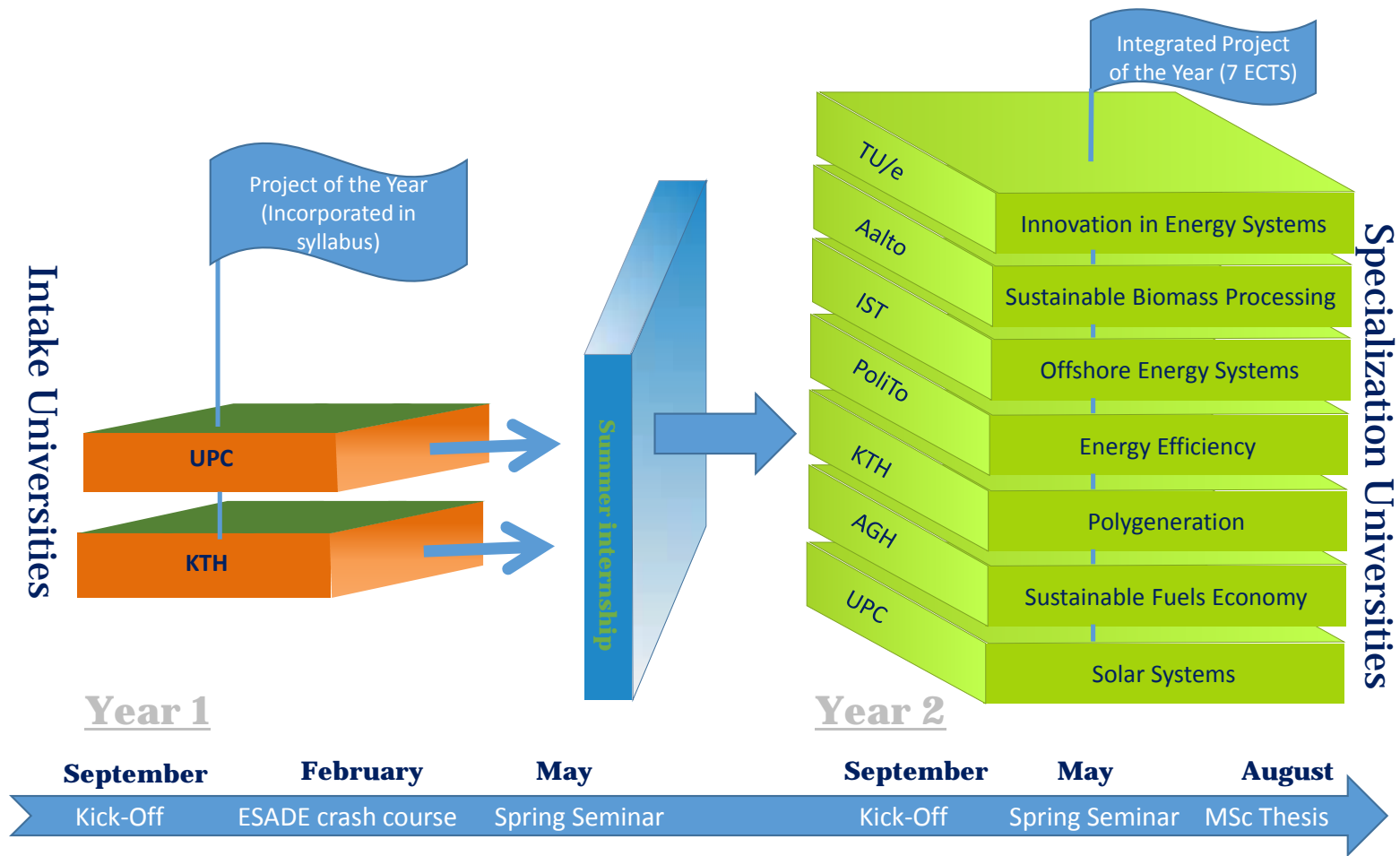
MSc programme in Environomical Pathways for Sustainable Energy Systems (SELECT)



SELECT at UPC



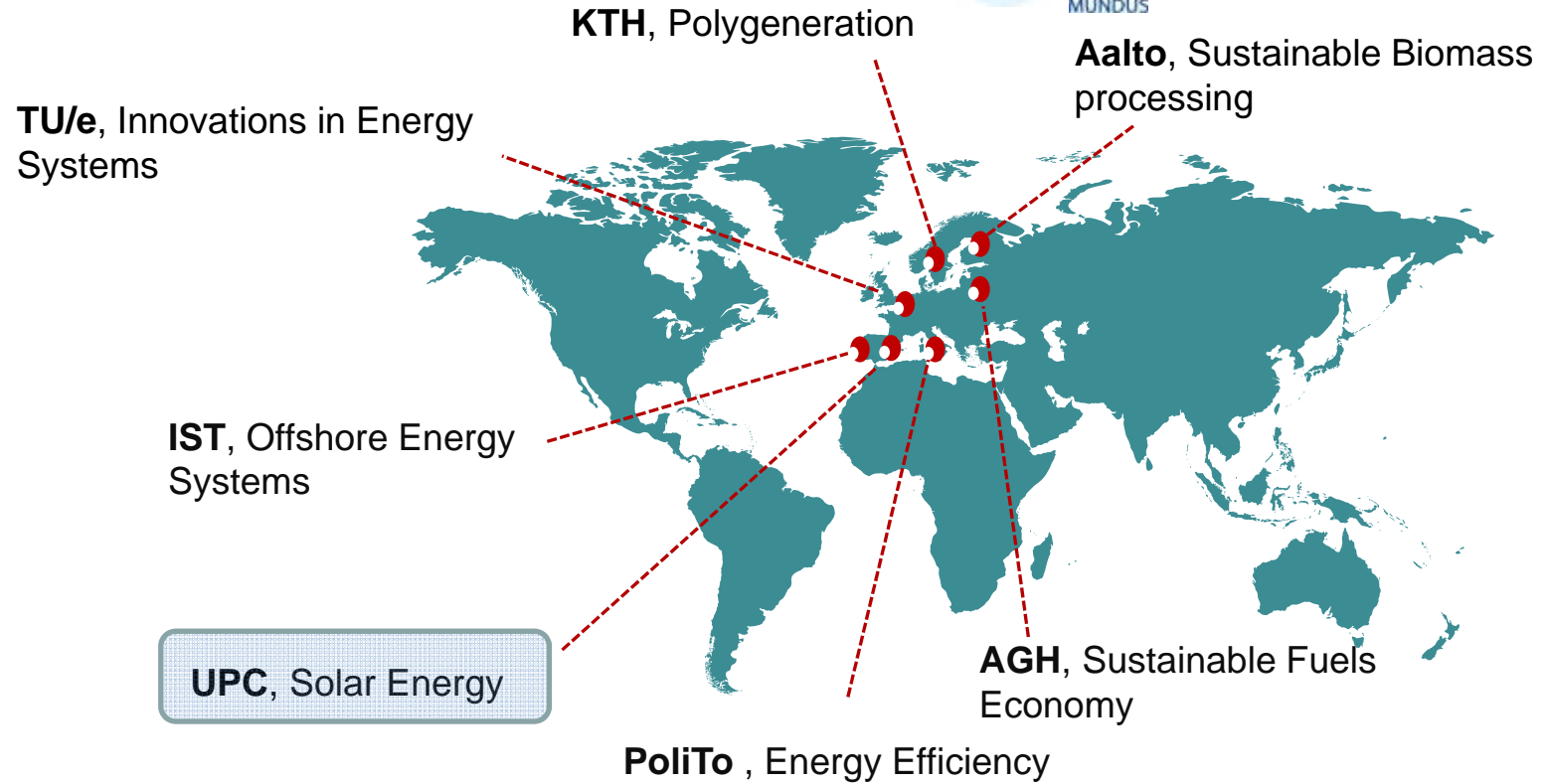
Programme Outline





SELECT Year2

Area of specialization





After completing the second year of the programme, the student will:

■ Knowledge and understanding

- Have a broad, scientific foundation to be able to work within the energy engineering area. It should comprise **knowledge about sustainable systems**, energy sources and usage, and judgments of technical, economical, and environmentally-related consequences related to different energy conversion processes.
- Be **a competent problem-solver** using the energy engineering tools.
- Have a broad, technical and organizational foundation to be able to work in the **organization, planning and execution of engineering projects**.
- Have a broad understanding of the mechanisms that underlie **scientific research**, and the mechanisms and instruments of **knowledge transfer** between different socio-economic actors involved in the processes of research and innovation.
- Have a broad understanding on the **organization of companies** and on the principles that define their activity, their rules, and the relationships between planning, strategy, quality and profit.
- Have a broad understanding of the use of a **business plan**, as well as its important parts and how to gather the required information to complete a plan.



After completing the second year of the programme, the student will:

■ Skills and abilities

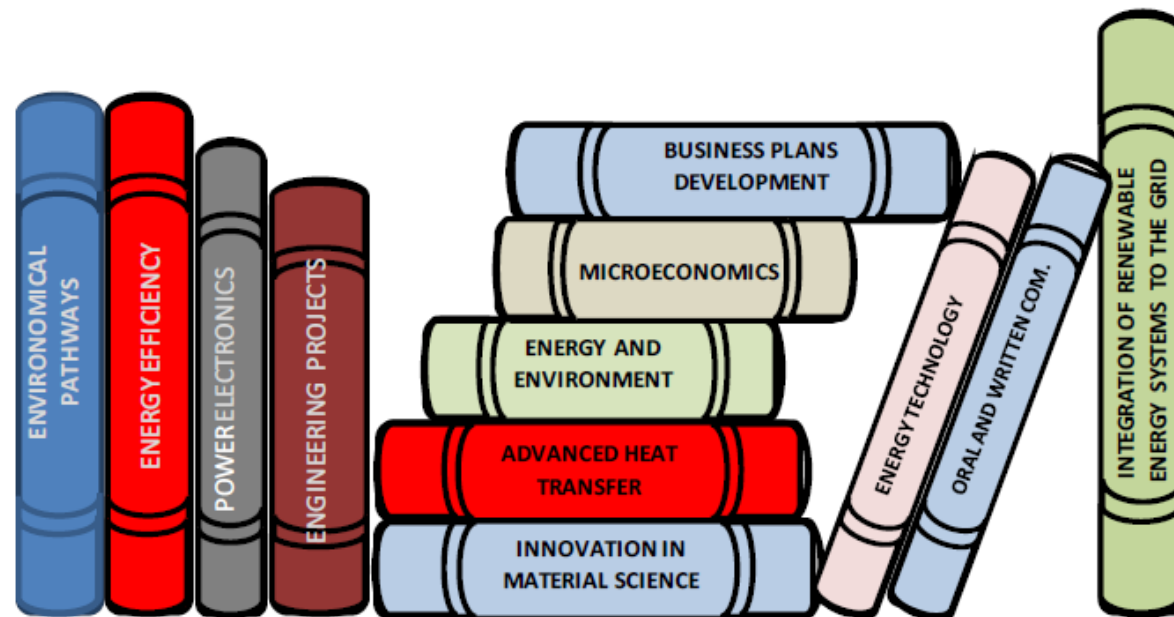
- Show the ability to, independently as well as in a group, be able to **apply knowledge and abilities in practical activities** with regard to relevant scientific professional and social judgements and viewpoints.
- Show ability to **analyse, formulate and manage the technical problems** from a system perspective, with a holistic view of their life cycle, from concept / requirements to specification, development, operation and decommissioning, and the ability to set limits, determine the necessary resource usage and manage processes for problem solving / realization.
- Show **professional skills like leadership, project management, and communication** for work as an engineer in a leadership role or as a leader in a technical intensive company, or in order to be able to continue toward a research career.
- Be able to construct a **business plan** for an innovation in the field, including the assessment of IP-value, market potential while identifying needs for commercializing the innovation.



After completing the second year of the programme, the student will:

■ Judgement and Approach

- Base conclusions of work on sound engineering/scientific **judgment**.
- Be aware of the **responsibility and the ethical viewpoints** which can arise in connection with different technical, organizational, economical, ecological and social activities.

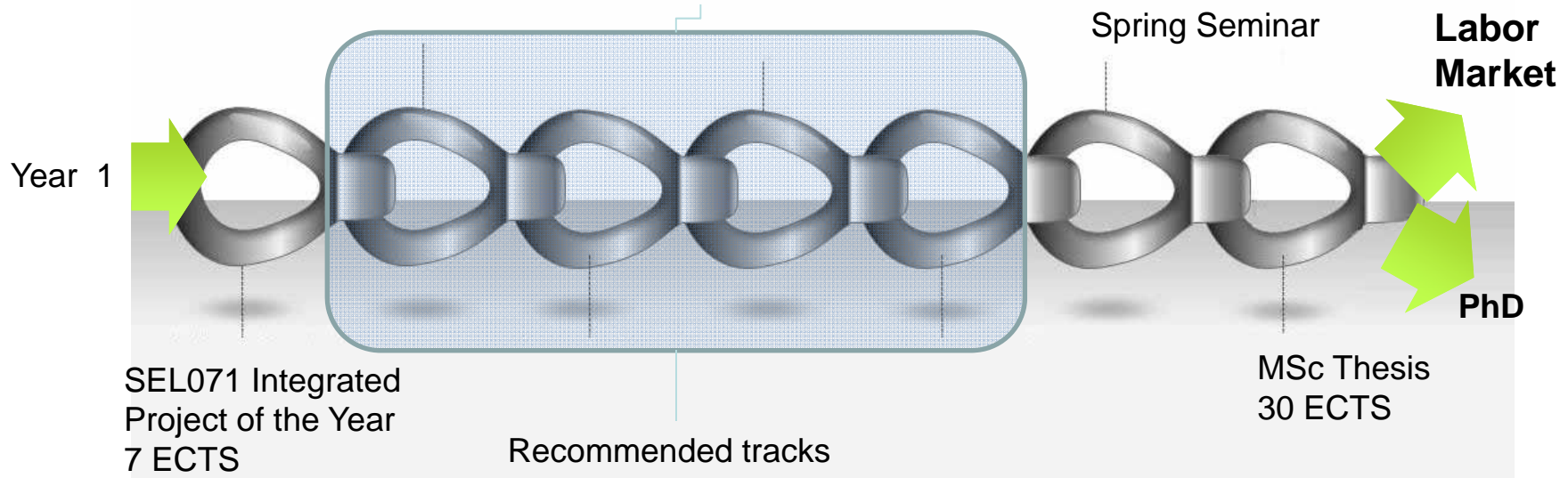




Year 2 specialization tracks for SELECT at UPC					
	Solar Systems				
820740	Solar photovoltaics		PV		
820743	Photovoltaic devices		PV		
820750	Power electronics applied to distributed energy resources		PV		
820747	Integration of renewable energy systems to the grid		PV	CSP	
820744	Solar thermal energy			CSP	
820757	Computational Methods in Energy Technology			CSP	
820763	Thermal and thermochemical energy storage			CSP	



Elective courses 23-30 ECTS



Solar Thermal Systems
Solar Photovoltaics Systems



Solar Systems

Solar Photovoltaics Systems (SPV)

Basic concepts of electrical engineering
(circuit theory).

Basic knowledge in power electronics.
A basic background in physics of
semiconductors is desirable.

Solar Thermal Systems (CSP)

At least 12 ECTS credits in the area of
thermal science (e.g. fluid dynamics,
thermodynamics, heat transfer).

A basic background in applications and
theory of numerical methods for solution
of differential equations.



Solar Energy and Thermal Systems. Development Aerodynamics and CFD&HT

Director: Prof. Assensi Oliva

Research co-director: Prof. Carlos D. Pérez-Segarra

Promoter: Prof. Joaquim Rigola

50 researchers full time (30 Ph.D. students)

More than 60 research projects with companies, and within national and EU frameworks in last 10 years

A renowned worldwide research group in Solar Energy ,Thermal Systems and Computational Fluid Dynamics and Heat Transfer

<http://www.cttc.upc.edu/research/node/138>



Solar Energy and Thermal Systems. Development Aerodynamics and CFD&HT

- Solar Thermal Energy (Low -to Medium- Temperature applications)
- Concentrated Solar Power CSP plants (High Temperature applications)
- Thermal Energy Storage for CSP plants
- Thermal and Thermo-chemical Storage
- Energy Efficiency in Buildings and/or districts

<http://www.cttc.upc.edu/research/node/138>



Solar Energy and Thermal Systems. Development Aerodynamics and CFD&HT

The research activities are focused on two main lines:

- Mathematical formulation, numerical resolution and experimental validation of fluid dynamics and heat and mass transfer phenomena.
- Thermal and fluid dynamic optimization of thermal system and equipment.

<http://www.cttc.upc.edu/research/node/138>



Thermal and fluid dynamic optimization of thermal system and equipment.

- Refrigeration (vapour compression cycles, absorption refrigerating systems, compressors, expansion devices, etc.).
- HVAC (ventilation, diffusion of contaminants in buildings,...).
- Active and passive solar systems (solar collectors using transparent insulation materials, building facades with transparent layers and ventilation, etc.).
- Concentrated Solar Plants (CSP) (solar tower, storage tanks, etc.)
- Wind Energy (blade design, thermal nacelle, wind farms, etc.)
- Heat exchangers (single – phase and two – phase heat exchangers, combustion heaters,...).
- Heat storage by liquids and using phase change materials.
- Engine cooling and air conditioning in the automobile and the aeronautical fields.



Mathematical formulation, numerical resolution and experimental validation of fluid dynamics and heat and mass transfer phenomena

- Natural and forced convection
- Turbulence simulation (RANS, LES, DNS)
- Combustion
- Two-phase flow (VOF, two fluid models)
- Solid-liquid phase change (PCM materials)
- Radiation (surface and participating media)
- Porous media
- Computational Fluid Dynamics and Heat Transfer (CFD&HT)
- Compressible effect and noise evaluation
- Computational Structure Dynamics (CSD) and Fluid Structure Interaction (FSI)
- Aerodynamics



Area of Specialisation

Solar Systems



Thesis Subject	Thesis placement (Country/University/Industry/Research Center)
Modelling, control and experimental validation of a DFIG-based wind turbine test bench	IREC (Research Center, Spain)
The analysis of reciprocating expander for organic rankine cycle in solar thermal application, both experimental and numerical simulation	Imperial College (London, UK)
Deployment of Microgrids for Diverse Electricity Markets using Distributed Energy Technologies	Urban Green Energy (New York, USA)-UPC
Investigation of High Temperature Receivers in a Heat Loss Test Bench	SCHOTT solar (Mitterteich, Bavaria, Germany)
Categorizing carrier-byproduct metal pairs to assess materials criticality - Focus on price elasticity of photovoltaics related metals	Massachusetts Institute of Technology (MIT)-UPC
Thermo-economic optimization of a parabolic trough Concentrated Solar Power (CSP) plant using innovative collectors Heat Transfer Fluid (HTF) selection	Massachusetts Institute of Technology (MIT)-UPC
Numerical simulation of in-compressible laminar flow over square cylinder	Centre Tecnologic de Transferencia de Calor - CTTC, UPC



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