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.
21 schools in 7 Catalan cities

86% of new students whose first-choice university was the UPC

33,224 undergraduate and postgraduate students

205 research groups

18 research institutes

49,402 UPC Alumni members

3,015 teaching and research staff members (59% PhD holders)

1,832 administrative and service staff members
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.
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>bachelor's degrees (2016-2017)</td>
</tr>
<tr>
<td>70</td>
<td>master's programmes (2016-2017) (7 Erasmus Mundus and 23 taught in English)</td>
</tr>
<tr>
<td>6,522</td>
<td>graduates of first- and second-cycle and master's degrees</td>
</tr>
<tr>
<td>34</td>
<td>international double-degree agreements with 62 universities</td>
</tr>
<tr>
<td>49</td>
<td>doctoral programmes (2016-2017)</td>
</tr>
<tr>
<td>25</td>
<td>with a quality award</td>
</tr>
<tr>
<td>351</td>
<td>doctoral theses defended</td>
</tr>
<tr>
<td>4,325</td>
<td>students participating in educational cooperation agreements with companies</td>
</tr>
</tbody>
</table>
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.
<table>
<thead>
<tr>
<th><strong>979</strong></th>
<th><strong>€62,507,381</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>new agreements and research projects</td>
<td>in income for R&amp;D projects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>17</strong></th>
<th><strong>68</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>companies created last year (Innova programme)</td>
<td>patents</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>4,325</strong></th>
<th><strong>791</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>students participating in educational cooperation</td>
<td>pieces of science and technology equipment services for companies</td>
</tr>
</tbody>
</table>
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.
<table>
<thead>
<tr>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,494</td>
<td>companies and other entities that have signed Collaboration agreements with the UPC</td>
</tr>
<tr>
<td>2,726</td>
<td>students in international mobility programmes</td>
</tr>
<tr>
<td>7</td>
<td>Erasmus Mundus master’s degrees</td>
</tr>
<tr>
<td>23</td>
<td>master’s degrees taught in English</td>
</tr>
<tr>
<td>19</td>
<td>NGOs and development cooperation projects</td>
</tr>
<tr>
<td>60</td>
<td>development cooperation projects</td>
</tr>
<tr>
<td>6</td>
<td>UPC campuses with sustainable mobility plans</td>
</tr>
<tr>
<td>31</td>
<td>countries</td>
</tr>
</tbody>
</table>
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
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.
Driven by Excellence

The Universitat Politècnica de Catalunya - BarcelonaTech (UPC) is Campus of International Excellence (CEI) since, in the first round of the Ministry of Education in 2006, earned recognition for the project Barcelona Knowledge Campus (BKC) presented in conjunction with the University of Barcelona.

In the 2010 call, the University consolidated its position as Campus of International Excellence with Energy Campus project. Two campuses of knowledge that promote employability, social cohesion and regional economic development. Interacting with research centers, science and technology parks, businesses and other stakeholders, UPC wants to become a nexus for attracting talent: students, researchers and scientific facilities.

On February 19 took place in the auditorium of the North Campus the act of recognition of International Campus of Excellence Barcelona Knowledge Campus (BKC).

Energy Campus
Energy for excellence
UPC campus is a reference in the transformation of the energy sector. A campus with local impact and international recognition, where people, knowledge, innovation and education converge.

Barcelona Knowledge Campus (BKC)
Consolidation of excellence
BKC is now the main driver of scientific, social and territorial business environment where it is located, and a magnet for international talent. Two benchmark universities that collaborate...
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

Energia

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. [+]

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

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.

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

Intake Universities
- UPC
- KTH

Specialization Universities
- Innovation in Energy Systems
- Sustainable Biomass Processing
- Offshore Energy Systems
- Energy Efficiency
- Polygeneration
- Sustainable Fuels Economy
- Solar Systems

Year 1
- September: Kick-Off
- February: ESADE crash course
- May: Spring Seminar

Year 2
- September: Kick-Off
- May: Spring Seminar
- August: MSc Thesis

Project of the Year (Incorporated in syllabus)
SELECT Year2
Area of specialization

Aalto, Sustainable Biomass Processing

KTH, Combined Energy Systems

TU/e, Innovation in Energy Systems

IST, Offshore Energy Systems

UPC, Solar Systems

AGH, Sustainable Fuels Economy

PoliTo, Energy Efficiency
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.
### Courses offered at UPC

<table>
<thead>
<tr>
<th>Code</th>
<th>Courses</th>
<th>ECTS</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELECT Common courses (KTH &amp; UPC)</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>240SEL82</td>
<td>MJ2493 Environomical Pathways - Integrated Project of the Year (KTH)</td>
<td>6</td>
<td>Mandatory</td>
</tr>
<tr>
<td>SELECT Specialization core courses</td>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>820740</td>
<td>Solar photovoltaics</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820743</td>
<td>Photovoltaic devices</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820744</td>
<td>Solar thermal energy</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820747</td>
<td>Integration of renewable energy systems to the grid</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820750</td>
<td>Power electronics applied to distributed energy resources</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820757</td>
<td>Computational Methods in Energy Technology</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820763</td>
<td>Thermal and thermochemical energy storage</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>SELECT Specialization recommended courses</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>820739</td>
<td>Wind power</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820748</td>
<td>Hydrogen and fuel cells</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820755</td>
<td>Smart grids</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>820759</td>
<td>Thermal conditioning of buildings. Bioclimatic architecture</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>240EN31</td>
<td>Biomass and Vleste</td>
<td>5</td>
<td>Elective</td>
</tr>
<tr>
<td>Master Thesis</td>
<td></td>
<td>30</td>
<td>Mandatory</td>
</tr>
<tr>
<td>820775</td>
<td>Master Thesis</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Total ECTS</td>
<td></td>
<td>61</td>
<td></td>
</tr>
</tbody>
</table>
Year 2
Courses offered at UPC

Master Thesis schedule:

<table>
<thead>
<tr>
<th>UPC</th>
<th>End of autumn semester (end of January)</th>
<th>Submission of project proposal to the supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beginning of spring semester (middle of February)</td>
<td>Registration and Enrolment</td>
</tr>
<tr>
<td></td>
<td>Beginning of July</td>
<td>Submission of the final report</td>
</tr>
<tr>
<td></td>
<td>End of July</td>
<td>Oral presentation. Approval by the Master thesis committee and reporting of the grade to the local administration.</td>
</tr>
</tbody>
</table>
Study track at UPC

Year 1

- Integrated Project of the Year (IPOY) 6 ECTS
- Recommended tracks
  - Solar Thermal Systems
  - Solar Photovoltaics Systems

Elective courses 25 ECTS

Year 2

- Spring Seminar
- MSc Thesis 30 ECTS
- Labor Market
- PhD
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.

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
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
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

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

Cesar Valderrama
SELECT Programme Coordinator
Email: cesar.alberto.valderrama@upc.edu

Ana Brau
International Relations and Admissions Office
masters.etseib@upc.edu

Universitat Politècnica de Catalunya
www.upc.edu