

R&D ON SUSTAINABLE BUILDINGS AT THE UPC

2022



Generalitat
de Catalunya



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



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01 THE UPC

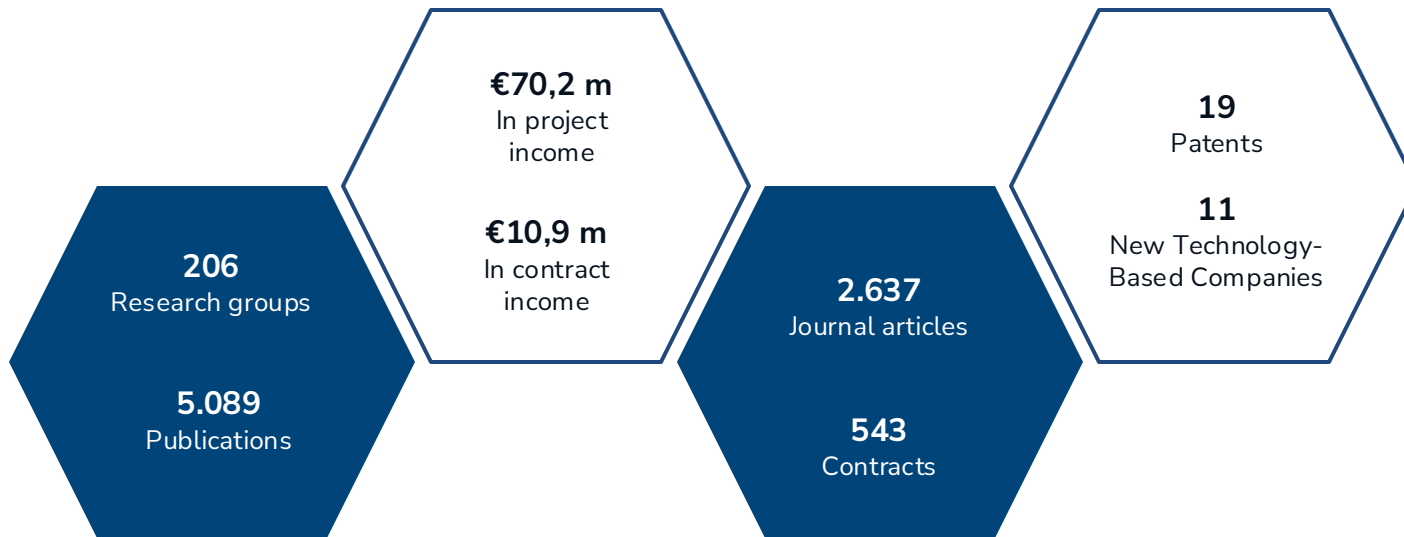
The Universitat Politècnica de Catalunya (UPC) is a public institution of research and higher education in the fields of engineering, architecture, sciences and technology, and one of the leading technical universities in Europe.

The UPC participates in the innovation system of Catalonia with projects and contracts for research, development, valorization of knowledge and commercialization of technology.



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RESEARCH, DEVELOPMENT AND INNOVATION ACTIVITY AT THE UPC IN 2021



02 SUSTAINABLE BUILDINGS

MATERIALS AND BUILDING CONSTRUCTION

The building sector has increased its level of technology and with a decline in the construction of new buildings, they are taking a lot of concepts such as comfort, biomaterials, sustainability and energy efficiency, as well as recovery, conservation and improvement of the built heritage.



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LANDSCAPE ARCHITECTURE

Landscape architecture (LA) is about creating great cities, streets, parks and public spaces that inspire well-being and healthy living while protecting natural environments. But it also tries to create safe, sustainable and resilient landscapes that evolve but endure over time.



Examples of activity I

Development of new construction materials through the design of low environmental impact products using recycled materials.

Contribution of proposals for constructive solutions under **energy efficiency** criteria in the life cycle of buildings.

Planning, design, construction, service life, operation, maintenance, dismantling and recycling taking into account economic, social, environmental, quality and health and safety aspects.

Technological interpretation of the **built heritage** and its integration in the urban territory.

Decrease in **water and energy consumption** in buildings and improve the quality of life in cities.

Analysis of perceived barriers and opportunities in relation to the implementation of **agro-green roofs** in cities.

Impact on the development of a sustainable building that guarantees safety criteria.

Examples of activity II

Sustainable approach to construction, closing the cycle of water and materials and reducing energy consumption in the sector.

Sustainable designs both on the roofs surrounding the buildings and on the roofs.

Replacement of conventional roofs with a roof with a built-in greenhouse.

Creating new strategies to turn cities into a **green oasis**, reduce carbon footprint and fight global warming.

Study of the forms of growth and **urban morphology**, the development of the modern city, the theory and practice of the urban project and the teaching of urban planning in the world.

Study of **agri-food technology** from both an agronomy and sustainability perspective.

Work on the design and characterization of new materials and construction systems.

A close-up photograph of a microscope lens, showing the text '100/1.25' and 'OIL' on its black barrel. The lens is positioned on the left side of the frame, with a white and blue geometric overlay on the right.

03

RESEARCH & INNOVATION

Through the research groups distributed by its Schools and Faculties, the UPC has facilities and resources to provide its own services, in the areas of diagnosis, advice, development, demonstration, training, promotion and support to industry, the public sector and civil society in the promotion and deployment of sustainable buildings technologies.



SPECIFIC RESEARCH CENTERS GROUPS AT UPC

RESEARCH

AGROTECH

Centre de
Recerca de
Tecnologia
Agroalimentària

AD&RM

Arquitectura, Disseny:
Representació i
Modelatge

EC

Enginyeria de la
Construcció

GAT

Grup
d'Arquitectur
a i
Tecnologia

GICITED

Grup Interdisciplinari
de Ciència i
Tecnologia en
l'Edificació

CPSV

Centre de
Política de
Sòl i
Valoracions

GREI

P
Grup de Recerca
en Edificació i
Patrimoni

GRIC

Grup de Recerca i
Innovació de la
Construcció

GRU

Grup de Recerca
en Urbanisme

LUB

Laboratori
d'Urbanisme
de Barcelona



04 UPC EXCELLENCE PROJECTS

In this document are considered excellence projects those in which:

- The scientific process is rigorous and complex with high quality standards.
- They are strategic and tractors.
- They acquire a commitment to both social aspects and to great scientific and socioeconomic impact.
- They have repercussions on the territory.
- They comprise the different entities participating in the quadruple helix, so that the projects remain multidisciplinary.

The UPC excellence projects are financed by various programs, such as the State Plan or Horizon Europe.



FDBR - Development of green facades using bio-receptive concrete

Over the last few years, the need to have green areas in urban areas has increased, in order to improve the quality of life in our increasingly degraded cities. In this sense, green facades and roofs and vertical gardens make it possible to take advantage of existing infrastructures as support for these new areas. The main disadvantage of the currently existing solutions lies in the high cost of their maintenance and the high water consumption required for biological growth.

The UPC patented a new concept of biological facade using a new concept of concrete: concrete with improved bioreceptivity. This material manages to optimize biological colonization by modifying three fundamental factors of the concrete composition.



UPC EXCELLENCE PROJECTS



MEDULA - Use of plant pith to improve building higrothermal behaviour

This project aims to contribute to reducing the environmental impact of the building sector by developing ecological, low-cost and fully biodegradable insulating systems, formulated from agricultural by-products and natural rubbers. In this way, the energy demand of the buildings would decrease but also the incorporated energy and other associated impacts such as the depletion of non-renewable raw materials or the generation of waste.

The hydrothermal characteristics of the materials obtained have a positive effect on the regulation of internal humidity and on the increase of the thermal inertia of the material. The project also works on the development of an external thermal insulation system that contains the vegetable panels obtained to produce a system that, as a whole, can be considered as a material with low environmental impact.



UPC EXCELLENCE PROJECTS

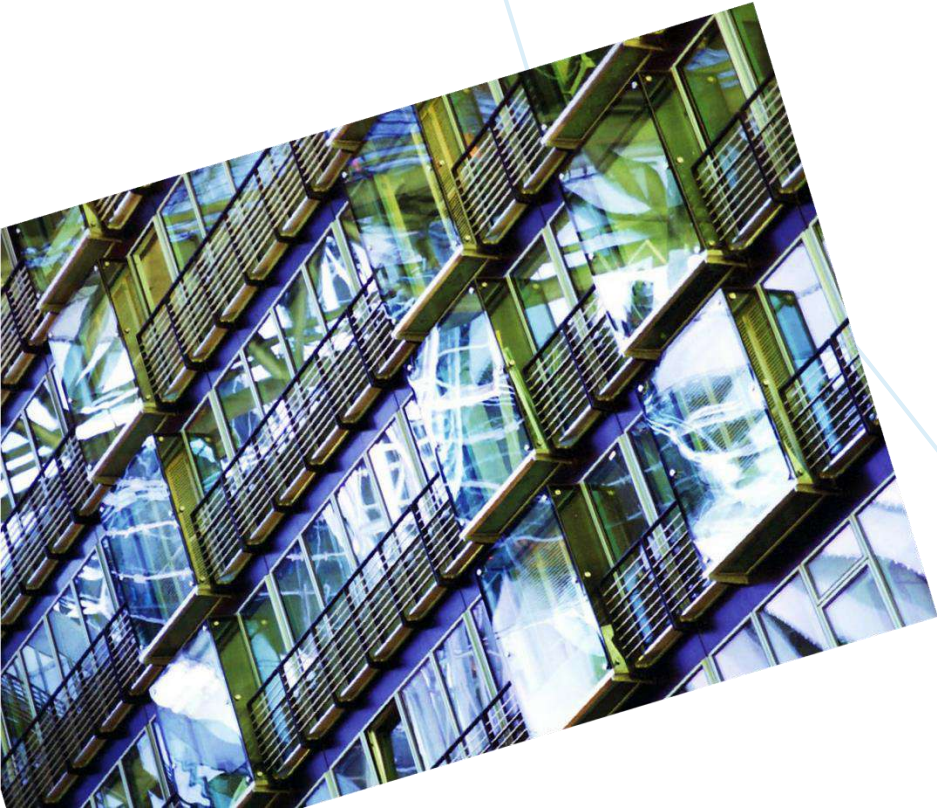
FERTILECITY - Integrated rooftop greenhouses: symbiosis of energy, water and CO2 emissions with the building Towards urban food security in a circular economy

The project focuses on the two-way connection of the building and the greenhouse; recirculation of water and nutrients (resources) used in agricultural production; detailed energy modeling of the greenhouse and integrated building and its comparison with conventional greenhouses; study of architecture and construction, both at building and neighborhood scale; reuse of generated waste; partial (environmental, economic, social) and global sustainability analysis; and identifying business models and opportunities with horticultural products derived from the greenhouse for all types of companies.

This greenhouse-construction symbiosis (energy, water, CO2, ...) requires a multidisciplinary approach covered by UPC researchers (experience in energy, environmental impact, architecture and sustainability assessment) and other partners.



UPC EXCELLENCE PROJECTS



InnoLAND - Launching Innovation-based Landscape Architecture Training Framework in Europe

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UPC EXCELLENCE PROJECTS

SBES - Sustainable building envelope solutions

One of the aims of this project is to achieve the integration of the bio thermal insulation panel in constructive systems that incorporate all the elements to guarantee successful behavior in real conditions.

The final objective of SBES is to minimize the environmental impact of the building sector and to achieve this, both the energy demand of buildings and the consumption of resources should be reduced. The proposed strategy attacks the problem to be solved from different perspectives. On the one hand, with a line of research into insulation systems with low environmental impact, low cost and fully biodegradable formulated from crop by-products, and on the other, adding a line that deepens the knowledge of green roofs



05

EDUCATION



EDUCATION – BACHELOR'S DEGREES



Architecture, Urbanism and Building Construction

- [Bachelor's degree in Architectural Technology and Building Construction](#)
- [Bachelor's degree in Landscape Architecture](#)



Civil Engineering

- [Bachelor's degree in Environmental Engineering](#)



Industrial Engineering

- [Bachelor's degree in Energy Engineering](#)

Més
informació
dels graus
[UPC](#)



EDUCATION – MASTER'S DEGREES



Architecture, Urbanism and Building Construction

- [Master's degree in Landscape Architecture \(MBLandArch\)](#)
- [Master's degree in Advanced Building Construction](#)
- [Master's degree in Diagnosis and Intervention Techniques in Building Construction](#)
- [Master's degree in Advanced Studies in Design- Barcelona \(MBDesign\)](#)



Civil Engineering

- [Master's degree in Structural and Construction Engineering](#)



EDUCATION – MASTER'S DEGREES



Industrial Engineering

- [Master's degree in Energy Engineering \(linked to the InnoEnergy programme\)](#)



Environment, Sustainability and Natural Resources

- [Master's degree in Environmental Engineering](#)
- [Master's degree in Sustainability Science and Technology](#)
- [Master's degree in Sustainable Intervention in the Built Environment \(MISMeC\)](#)

UPC SCHOOL

- Master's degree in Urban Planning and Sustainability.
- Master's degree in Landscape Architecture.
- Master in Architecture and Sustainability: Design, Simulation and Control in nZEB Buildings.
- Master in Urban and Territorial Development: Management and Transformation of Cities.
- Master in Architecture and Environment: Urban Space, Light and Energy Integration.
- Postgraduate in Urban Environment and Sustainability.
- Postgraduate in Sustainable Urban Space.
- Postgraduate in Smart Cities: Urban Planning, Technology and Sustainability.
- Postgraduate in Bioclimatic Architecture and Certifications.
- Postgraduate in Renewable Energies in Architecture.
- Postgraduate in Passive Design and Energy Efficiency in nZEB Buildings.
- Continuous training course in Intensive International. Reset Landscapes.
- Continuing education course in Sustainable Urbanism.

[More information about
courses of UPC
SCHOOL](#)



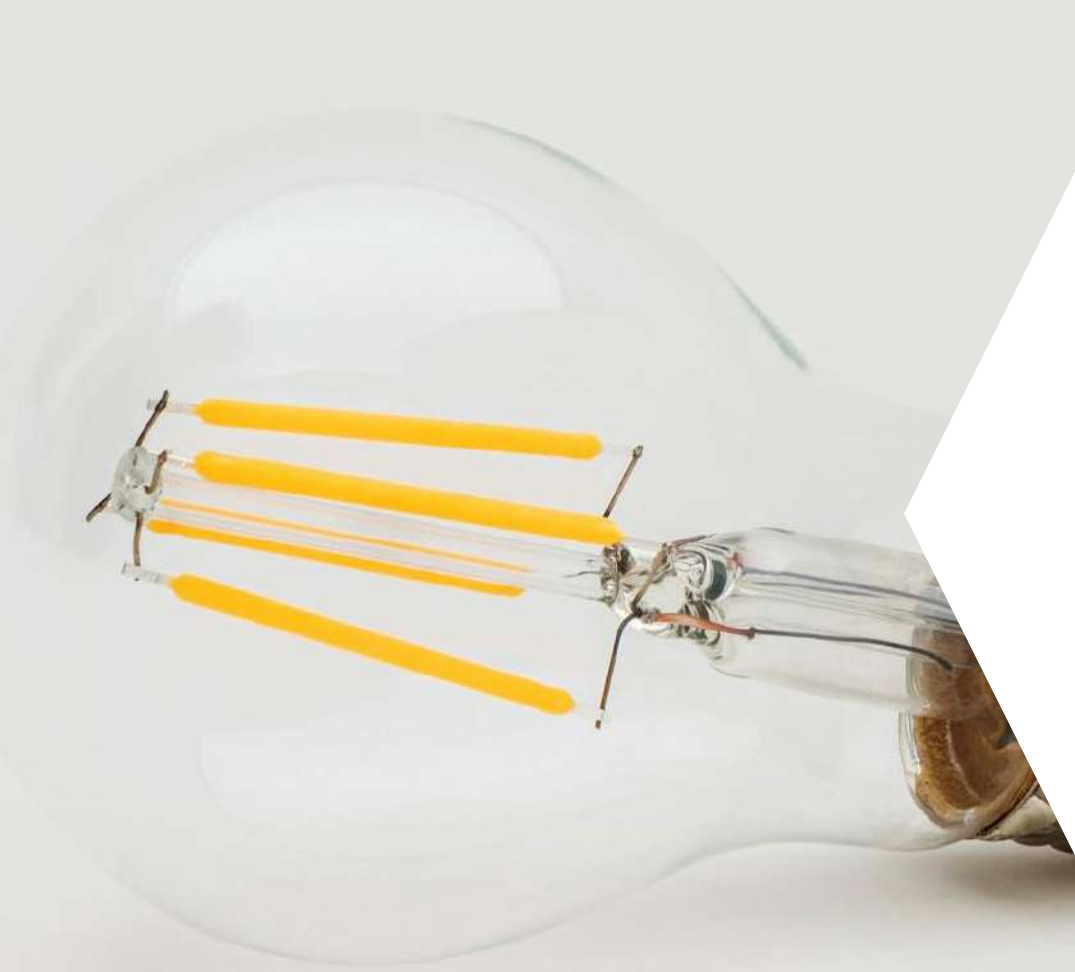
BATLLEROIG - UPC 'MERGING CITY & NATURE'

Chair aimed at training, research, knowledge transfer and scientific dissemination in the field of research for excellence in architecture and, more specifically, in the relationship between the city and nature from the point from an architectural point of view.

Under the slogan "Merging City and Nature", the UPC Batlleiroig Chair works on the search for environmental, sustainable and inclusive solutions to combat the climate emergency in the urban environment.

In the field of training and talent detection, it promotes the Càtedra Batlleiroig Award for the best final master's thesis and a program of paid annual scholarships. And in the field of technology transfer and innovation, a line of research on "Merging City and Nature" is created.






RESEARCH AND INNOVATION SUPPORT SERVICE

 <https://rdi.upc.edu>

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 Research, Development
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