Energy Research Portfolio

Research and Innovation Support Service

May 2019
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1. INTRODUCTION

Since 2010, the Universitat Politècnica de Catalunya (UPC) is Campus of International Excellence in the field of energy and core partner of one of the first knowledge and innovation communities funded by the EIT, InnoEnergy.

One of the tools derived from those projects was the systematic collection of information about the energy research capacity of the different centres and groups of the UPC.

The result of this effort is this document, which briefly and synthetically collects a first approach to the Energy Research Map of the University.
2. THEMATIC CLASSIFICATION OF THE RESEARCH GROUPS IN ACCORDANCE WITH STRATEGIC ENERGY TECHNOLOGY PLAN OF THE EUROPEAN UNION, SET PLAN

Energy Topics, percentage of research

- Smart Grids: 16%
- Smart Cities: 6%
- Wind Energy: 15%
- Photovoltaic Solar Energy: 12%
- Fuel Cells and Hydrogen: 6%
- Ocean Energy: 2%
- Nuclear Materials & Power: 2%
- Road Transport Efficiency & Electric mobility: 11%
- Hydropower: 2%
- Heating and Cooling Technologies: 3%
- Advanced Fossil Fuel Power Generation: 1%
- Energy Efficiency in Industrial Processes: 2%
- Energy Systems Integration: 3%
- Energy / Electricity Storage: 5%
- AMPEA (materials & processes): 5%
- Bioenergy & Biofuels: 5%
- Economic, environmental & social impacts: 3%
- Energy Efficiency in Industrial Processes: 2%
- Advanced Fossil Fuel Power Generation: 1%
- Heating and Cooling Technologies: 3%
- Smart Cities: 6%
- Shale Gas: 2%
- Smart Grids: 16%
- Wind Energy: 15%
- Photovoltaic Solar Energy: 12%
- Fuel Cells and Hydrogen: 6%
- Ocean Energy: 2%
- Nuclear Materials & Power: 2%
- Road Transport Efficiency & Electric mobility: 11%
- Hydropower: 2%
- Heating and Cooling Technologies: 3%
- Advanced Fossil Fuel Power Generation: 1%
- Energy Efficiency in Industrial Processes: 2%
- Energy Systems Integration: 3%
- Energy / Electricity Storage: 5%
- AMPEA (materials & processes): 5%
- Bioenergy & Biofuels: 5%
- Economic, environmental & social impacts: 3%
- Energy Efficiency in Industrial Processes: 2%
<table>
<thead>
<tr>
<th>Energy Topics</th>
<th>UPC Research groups</th>
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</thead>
<tbody>
<tr>
<td>AMPEA - Materials &amp; Processes</td>
<td>UPC Research groups</td>
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<tr>
<td>Bioenergy &amp; Biofuels</td>
<td>Energy Efficiency in Industrial Processes</td>
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<td>Economic, Environmental &amp; Social Impacts</td>
<td>Energy / Electricity Storage</td>
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<td>Energy Systems Integration</td>
<td>Fuel Cells and Hydrogen</td>
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<td>Nuclear Materials &amp; Power</td>
<td>Ocean Energy</td>
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<td>Photovoltaic Solar Energy</td>
<td>Shale Gas</td>
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<tr>
<td>Smart Cities</td>
<td>Wind Energy</td>
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<tr>
<td>Smart Grids</td>
<td>Wireless Networks</td>
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<tr>
<td>Water/Energy</td>
<td>Renewable Energy Sources</td>
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<tr>
<td>Geothermal and Biomass</td>
<td>Nuclear Energy</td>
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<tr>
<td>Radio &amp; Microwave</td>
<td>Advanced Control of Energy Systems</td>
</tr>
<tr>
<td>ACES - Advanced Control of Energy Systems</td>
<td>ADBD - Analysis of Complex Data for Business Decisions</td>
</tr>
<tr>
<td>AIEM - Architecture, Energy and Environment</td>
<td>ANT - Advanced Nuclear Technologies Research Group</td>
</tr>
<tr>
<td>AMPEA - Materials &amp; Processes</td>
<td>ATEM - Structural and Materials Technology</td>
</tr>
<tr>
<td>BIT - Barcelona Innovative Transportation</td>
<td>BIT - Barcelona Innovative Transportation</td>
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<tr>
<td>CBA - Broadband Communications Research Group</td>
<td>CBA - Broadband Communications Research Group</td>
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<tr>
<td>CDIE - Center for Industrial Design</td>
<td>CDIE - Center for Industrial Design</td>
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<td>CDIB - Center for Industrial Diagnostics</td>
<td>CDIB - Center for Industrial Diagnostics</td>
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<tr>
<td>CEMAD - Electrical Characterisation of Materials and Devices</td>
<td>CEMAD - Electrical Characterisation of Materials and Devices</td>
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<tr>
<td>CIEFMA - Structural Integrity, Micromechanics and Materials Reliability Centre</td>
<td>CIEFMA - Structural Integrity, Micromechanics and Materials Reliability Centre</td>
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<tr>
<td>CTTC - Centre of Technological Innovation on Power Electronics and Drives</td>
<td>CTTC - Centre of Technological Innovation on Power Electronics and Drives</td>
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<tr>
<td>CoDAlab - Control, Dynamics and Applications</td>
<td>CoDAlab - Control, Dynamics and Applications</td>
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<tr>
<td>CREMIT - Centre for Engines and Heat Installations</td>
<td>CREMIT - Centre for Engines and Heat Installations</td>
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<tr>
<td>CTCE - CRAS Merece Surface and Technology Research Group</td>
<td>CTCE - CRAS Merece Surface and Technology Research Group</td>
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<tr>
<td>CTTC - Heat and Mass Transfer Technological Centre</td>
<td>CTTC - Heat and Mass Transfer Technological Centre</td>
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<tr>
<td>DSO - SCDM Industrial Engineering and Logistics</td>
<td>DSO - SCDM Industrial Engineering and Logistics</td>
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<tr>
<td>EPIC - Energy Processing and Integrated Circuits</td>
<td>EPIC - Energy Processing and Integrated Circuits</td>
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<tr>
<td>EFISOG - Engineering Sciences and Global Development</td>
<td>EFISOG - Engineering Sciences and Global Development</td>
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<td>GEMMA - Group of Environmental Engineering and Microbiology</td>
<td>GEMMA - Group of Environmental Engineering and Microbiology</td>
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<tr>
<td>GREENTECH - Green Technologies Research Group</td>
<td>GREENTECH - Green Technologies Research Group</td>
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<td>GREP - Power Electronics Research Group</td>
<td>GREP - Power Electronics Research Group</td>
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<tr>
<td>IMP - Information Modeling and Processing</td>
<td>IMP - Information Modeling and Processing</td>
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<td>IG Group - Instrumentation, Sensors and Interfaces</td>
<td>IG Group - Instrumentation, Sensors and Interfaces</td>
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<tr>
<td>JLH - Maritime Engineering Laboratory</td>
<td>JLH - Maritime Engineering Laboratory</td>
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<tr>
<td>MCA - MCA Center Innovation Electronics</td>
<td>MCA - MCA Center Innovation Electronics</td>
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<tr>
<td>MNT - Micro and Nanotechnologies Research Group</td>
<td>MNT - Micro and Nanotechnologies Research Group</td>
</tr>
<tr>
<td>SCA - Advanced Control Systems</td>
<td>SCA - Advanced Control Systems</td>
</tr>
<tr>
<td>SARTI - Technological Development Center for Remote Acquisitiion and Data Processing System</td>
<td>SARTI - Technological Development Center for Remote Acquisitiion and Data Processing System</td>
</tr>
<tr>
<td>SEF - Power and Control Electronics Systems</td>
<td>SEF - Power and Control Electronics Systems</td>
</tr>
<tr>
<td>SGPC - Signal Processing and Communications Group</td>
<td>SGPC - Signal Processing and Communications Group</td>
</tr>
<tr>
<td>STI - Sustainability, Technology and Nanomaterials</td>
<td>STI - Sustainability, Technology and Nanomaterials</td>
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<tr>
<td>SUMM Lab - Sustainability Measurement and Modelling Lab</td>
<td>SUMM Lab - Sustainability Measurement and Modelling Lab</td>
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<tr>
<td>TRAMMI - Research group on maritime transport and logistics</td>
<td>TRAMMI - Research group on maritime transport and logistics</td>
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<tr>
<td>UNIM - Wireless Networks Group</td>
<td>UNIM - Wireless Networks Group</td>
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<tr>
<td>Number of UPC Research groups linked to this topic</td>
<td>6 6 4 3 6 4 2 2 15 2 7 20 19 1 4 2 13</td>
</tr>
</tbody>
</table>
3. RESEARCH GROUPS

ACES

RESEARCH CENTRE/GROUP

Name: Advanced Control of Energy Systems (IOC - IRII)
Web: https://futur.upc.edu/ACES

GENERAL DESCRIPTION OF THE ACTIVITY

The aim of the group is to contribute to the progress of scientific knowledge, the training of specialized personnel and the diffusion of technological advances, in the field of modelling and control of complex systems, and its application to problems related to the generation, conditioning, management and storage of electrical energy.

The facilities of the group include laboratories of control, power electronics, electrical drives and fuel cells, together with the ancillary instrumentation and equipment to perform experimental validations. As for higher education, the group participates at the UPC in four masters (robotics and automation, applied mathematics, engineering mathematics and electronics) and three PhD programs (Automation Robotics and Vision, Applied Mathematics and Electronics).

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The group focuses its research in the energy field concerning the subject of generation, quality and conversion of Electric power.

The research activities can be divided in the following areas:

- Modelling and control of PEM fuel cells
- Modelling and control of Ethanol Reformers
- Modelling and Control of Power electronic Converters
- Modelling and control of Electrical Machines

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Innovative cost improvements for balance of plant components of automotive PEMFC systems (INN-BALANCE)

The aim of INN-BALANCE is to develop a novel and integrated development platform for developing advanced Balance of Plant components in current fuel cell based vehicles, in order to improve their efficiency and reliability, reducing costs and presenting a stable supply chain to the European car manufacturers and system integrators. Amount: 240.125,00 €

| Competitive Project 1 | MICAPEM: Parameter estimation, diagnosis and control for the improvement of efficiency and durability of PEM fuel cells. DPI2015-69286-C3-2-R. Amount: 171.820,00 €. Start date: 2016-01-01; End date: 2019-12-31 |
Competitive Project 2  
Eines per a la gestionabilitat de les plantes de generació elèctrica amb fonts renovables (Tools for the management of power generation plants with renewable sources). RIS3CAT COMRDI15-1-0043-02. Amount: 5,683,59 €. Start Date: 2016-03-01; End Date: 2018-10-15

Competitive Project 3  
Software battery Management Controller (BMC). 2014 DI 069. Amount: 3,268,96 €. Start date: 2015-02-09; End date: 2017-02-08

KEY WORDS
- Complex systems  
- Non-linear systems  
- Control theory  
- Electric energy systems  
- Power electronics  
- Fuel cells  
- Hybrid drive  
- Hydrogen  
- Generators  
- Electric engines

RESEARCH TEAM
- Arocas Pérez, José  
- Arias Pujol, Antoni  
- Batlle Arnau, Carles  
- Biel Solé, Domingo  
- Colomer Riera, Jordi  
- Cardoner Parpal, Rafael  
- Doria Cerezo, Arnau  
- Fossas Colet, Enric  
- Franch Bullich, Jaime  
- Griñó Cubero, Roberto  
- Olm Miras, Josep Maria  
- Repecho Del Corral, Victor

CONTACT
- Jordi Riera Colomer (jriera@iri.upc.es) Institut de Robòtica i Informàtica Industrial Parc Tecnològic de Barcelona, Edifici U. C/ Llorens i Artigas 4-6, 2on, 08028 Barcelona Tel: (+34) 93 401 57 81, Fax: (+34) 93 401 57 50
- Person in charge: Enric Fossas Colet (enric.fossas@upc.edu) Institut d’Organització i Control de Sistemes Industrials (IOC), Universitat Politècnica de Catalunya (UPC), Campus Sud Edifici H, Avda. Diagonal 647, pl. 11, 08028 Barcelona Tel: (+34) 93 401 77 79, Fax: (+34) 93 401 66 05
ADBD

**RESEARCH CENTRE/GROUP**

Name: ADBD - Analysis of Complex Data for Business Decisions  
Web: https://futur.upc.edu/ADBD

**GENERAL DESCRIPTION OF THE ACTIVITY**

The Analysis of Complex Data for Business Decisions (ADBD) Research Group is a multidisciplinary group of professors and investigators from the Universitat Politècnica de Catalunya (UPC) dedicated to the world of statistics.

The group members would like to offer a platform where useful information may be found, regarding the theoretical and practical aspects of statistics: consultancy, training, scientific collaboration or classroom learning.

**SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD**

The following activities define the priorities currently pursued by ADBD group:

- **Industrial Statistics**, with applications to improve the quality and productivity of industrial processes, industrial logistics, forecasting, quality management and improvement (Six Sigma) and the emotional design of products (Kansei Engineering).

- The use of **analytics in business and industrial environments**. We are working on customer characterization, Churn (early detection of abandonment), reliability, and preventive maintenance of remote machines.

- **The analysis of complex data, discrete and often dependent spatial and / or temporal applications** of Bayesian nonparametric methods and engineering and analysis of election results, demographics, ecology, and the statistical analysis of literary style.

- Better ways to **teach statistics** to university students and also to business and industry professionals

**COMPETITIVE PROJECTS**

A current project to be highlighted in the energy field is:

*Forecast and optimization of wind generation in energy markets*  
Amount: 59.290,00 €

**KEY WORDS**

- Bayesian statistics  
- Analytics  
- Data science  
- Design of experiments  
- Forecasting  
- Non parametric statistics  
- Quality control  
- Quality management  
- Six sigma  
- Spatial modelling
**Research Team**

- Acosta Argueta, Lesly Maria
- Delicado Useros, Pedro Francisco
- Fontdecaba Rigat, Sara
- Marco Almargo, Lluis
- Puig Oriol, Xavier
- Rodero De Lamo, Lourdes
- Font Valverde, Martí
- Ginebra Molins, Josep
- Grima Cintas, Pedro
- Sanchez Espigares, Jose Antonio
- Tort-Martirell Llabres, Javier

**Contact**

- Department of Statistics and Operations Research. Avinguda Diagonal 647, 6th floor, 08028, Barcelona (Spain). Phone: +34 (00) 93 401 60 48. E-mail: adbd@upc.edu
- Person in charge: Tort-Martorell Llabres, Javier – xavier.tort@upc.edu
AIEM

Research Centre/Group

Name: AIEM – Architecture, energy and environment

Web: http://www.aie.upc.edu/

General Description of the Activity

The AIEM research group is oriented towards the investigation of architecture from the environmental point of view. Its research considers both the environmental parameters affecting human comfort and perception as well as the possible impact that building activities can cause to cities and the environment.

The activity carried out considers different scales, from architectural indoor qualities and building elements to public spaces and urban morphology features. Following this line of interest, the group has developed extensive research related with integration of renewable energies, materials life cycle, life quality, bioclimatic architecture and other fields involving architecture, energy and environment. This previous work, carried out since 1980, along with the expertise of the group members, puts AIEM in an excellent position to progress in the right path towards a high-level research.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by AEIM group:

- Bioclimatic architecture
- Interior and urban comfort
- Integration of renewable energies in architecture
- Urban morphology and energy

Competitive Projects

A current project to be highlighted in the energy field is:

Characterization of Mediterranean urban morphology: repercussion of irregularities and exceptions of the tissue in architecture energy efficiency.
Amount: 148.830,00 €

| Competitive Project 2 | Caracterización de la Morfología urbana mediterránea; repercusión de las irregularidades y excepciones de la Trama en la eficiencia (Characterization of Mediterranean urban morphology; repercussion of the irregularities and Exceptions of the Plot in the efficiency) BIA2016-77675-R. Amount: 148.830,00 € Start Date: 2016-12-30; End Date: 2020-12-29 |
| Competitive Project 3 | Fundamentos para la caracterización de la morfología urbana mediterránea: identificación de parámetros urbanos y su repercusión en la eficiencia energética de la arquitectura (Fundamentals for the characterization of Mediterranean urban morphology: identification of urban parameters and their impact on the energy efficiency of architecture). BIA2013-45597-R. Amount: 68.970,00 € Start date: 2014-01-01; End date: 2017-03-31 |
KEY WORDS

- Architecture
- Comfort
- Energy
- Energy Efficiency in Building Renovation
- Energy Performance of Urban Compact cities
- Environment
- Façades Performance
- Lighting
- Renewables
- Transport and Walkability in Cities
- Urban Morphology
- Water Management

RESEARCH TEAM

- Coch Roura, Helena
- Isalgué Buxeda, Antonio
- Crespo Cabillo, Isabel
- Pardal March, Cristina
- Cuchi Burgos, Albert
- Roset Calzada, Jaume
- Pagès Ramon, Anna
- Alonso Montolio, Carlos
- López Besora, Judit
- García Gil, Manuel
- Solsona I Pairó, Xavier
- Zamora Mestre, Joan Lluis
- Marin Herrera, Juan Antonio
- López Viana, Marta
- Garrido Torres, Pablo
- Prous Martin, Jaime
- García Nevado, Elena
- Torres Quezada, Jefferson
- Serra Coch, Glòria
- Rotger Vincent, Josep
- Rogora, Alessandro
- Beckers, Benoit
- Cecere, Carlo
- Moroganti, Michele
- Salvati, Agnese

CONTACT

- Avinguda Diagonal 649, 7th floor, 08028, Barcelona (Spain). Phone: +34 (00) 93 401 08 68.
- E-mail: master.aem@upc.edu
- Person in charge: Coch Roura, Helena – helena.coch@upc.edu
**ANT**

**RESEARCH CENTRE/GROUP**

Name: ANT – Advanced Nuclear Technologies Research Group

Web: https://futur.upc.edu/ANT

**GENERAL DESCRIPTION OF THE ACTIVITY**

The ANT research group is born from the convergence of three research lines that have been cooperating in the recent years and that have in common their relationship with the nuclear technology and the physics that support it. The lines are:

- Thermal-hydraulics and safety
- Fusion technology
- Nuclear data measurement.

Energy in general and nuclear power in particular represent a strategic area of knowledge. Whatever the position of the society regarding nuclear energy in the future, industry will need experts who must be trained not only at the highest scientific and technical level, but also must be imbued with a safety culture based on rigor, honesty and self-demand. In addition, the public administration will need professionals with the highest levels of expertise to carry out the tasks of supervision and regulation of the nuclear industry.

There are other more basic reasons for the confluence of the three lines of research. The Group’s participation in several national and international projects has shown that there may be powerful synergies between the three lines that can open up possibilities yet to be explored. Separately, each of the groups work with simulation tools at different scales and degree of detail (neutron transport code and radiation by means of Monte Carlo techniques – MCNPX, GEANT4, FLUKA-, CFD codes with MHD simulation capabilities developed by the group, thermal-hydraulic system codes with coupling of reactor kinetics codes). The combination of all the capabilities allow us to deal with problems that require an interdisciplinary approach and a multi-physics simulation.

**SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD**

The following activities define the priorities currently pursued by ANT group:

- Experimental Nuclear Physics
- Thermal-Hydraulics and Nuclear Safety
- Nuclear Fusion Technology
- Nuclear Instrumentation

**COMPETITIVE PROJECTS**

A current project to be highlighted in the energy field is:

*Implementation of activities described in the Roadmap to Fusion during Horizon 2020 through a Joint programme of the members of the EUROfusion consortium*

A Roadmap to the realization of fusion energy was adopted by the EFDA system at the end of 2012. The roadmap aims at achieving all the necessary know-how to start the construction of a demonstration power plant (DEMO) by 2030, in order to reach the goal of fusion electricity in the grid by 2050. The roadmap has been articulated in eight different Missions. The present proposal has the goal of implementing the activities...
described in the Roadmap during Horizon 2020 through a joint programme of the members of the EUROfusion Consortium. **Amount: 168.192, 83€**

<table>
<thead>
<tr>
<th>Competitive Project</th>
<th>Description</th>
<th>Amount</th>
<th>Start Date: 2016-09-01; End Date: 2019-08-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 1</td>
<td>Integrating Social Sciences and Humanities into Teaching about Energy. 2016-1-PLD1-KA203-026286.</td>
<td>€40.385,00</td>
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</tr>
<tr>
<td>Competitive Project 2</td>
<td>Experimentos de estructura nuclear y astrofísica con haces radioactivos y neutrons y aplicaciones (Nuclear and astrophysical structure experiments with radioactive beams and neutrons and applications). FPA2017-83946-C2-2-P.</td>
<td>€48.400,00</td>
<td>Start date: 2018-01-01; End date: 2019-12-31</td>
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<td>Competitive Project 3</td>
<td>Integrating Social Sciences and Humanities into Teaching about Energy. 2016-1-PLD1-KA203-026286.</td>
<td>€40.385,00</td>
<td>Start Date: 2016-09-01; End Date: 2019-08-31</td>
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<td>Competitive Project 4</td>
<td>Investigación y desarrollo de metodologías de gestión informada por el riesgo en centrales nucleares españolas mediante la aplicación del análisis probabilista seguridad (Research and development of management methodologies informed by risk in Spanish nuclear power plants through the application of probabilistic safety analysis). ENE2015-67633-R</td>
<td>€61.710,00</td>
<td>Start date: 2016-01-01; End date: 2019-12-31</td>
</tr>
</tbody>
</table>

**KEY WORDS**

- ADS
- APS
- Radiation detectors
- Energy
- Nuclear fusion
- Nuclear fission
- Nuclear experimental physics
- Nuclear instrumentation
- NTOF
- Neutron
- Nuclear
- Exotic nuclides
- Environmental radioactivity
- Effective section
- Nuclear safety
- CFD simulation
- Monte Carlo simulation of radiation transport
- Thermoholthic
- Transmutation
- Triti

**RESEARCH TEAM**

- Batet Miracle, Lluis
- Baeza Perez, Eduard
- Blas Del Hoyo, Alfredo de
- Calviño Tavares, Francisco
- Martinez Quiroga, Victor Manuel
- Pretel Sanchez, M del Carmen
- Riego Pérez, Albert
- Suarez Cambra, Daniel
- Casanovas Hoste, Adria
- Cortes Rossell, Guillem Pere
- Freixa Terradas, Jordi
- Garcia Sanchez, Roger
- Tarifeñi Saldiva, Ariel Esteban

**CONTACT**

- Avinguda Diagonal 647, 08028, Barcelona (Spain).
- Person in charge: Cortes Rossell, Guillem Pere – guillem.cortes@upc.edu
ATEM

RESEARCH CENTRE/GROUP

Name: ATEM – Structural and Materials Technology
Web: https://futur.upc.edu/ATEM

GENERAL DESCRIPTION OF THE ACTIVITY

The scientific activity of the group focuses on the analysis and design of structures through the development of conceptual and numerical models and the realization of laboratory tests to know their behaviour and verify the developed models. The objective is to evaluate the safety, functionality and durability of the structures under static, seismic and environmental actions. The activity of the group also includes the mechanical, physical and chemical characterization and the recycling of structural materials as well as the sustainable design of structures and interventions for their reinforcement and remodelling.

The scope of work extends to buildings and transport infrastructures as well as historical heritage buildings, offshore structures for wind energy collection and other types. Structures of reinforced and pre-stressed concrete, metallic and mixed, of factory work, of wood, of reinforced polymers with fibres and of alloys with shape memory, among others are studied.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by ATEM group:

- Analysis, design and construction of civil engineering structures.
- Development of conceptual and numerical models
- Sustainability of the constructive procedures and the recycling of the structural materials.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

**Cost reduction and increase performance of floating wind technology (COREWIND)**

The COREWIND project aims to achieve significant cost reductions and enhance performance of floating wind technology through the research and optimization of mooring and anchoring systems and dynamic cables.

COREWIND aims to strengthen the European Leadership on wind power technology (and specially floating). To do so, the project consortium has been designed to ensure proper collaboration between all stakeholders (users, developers, suppliers, academia, etc.) which is essential to accelerate commercialization of the innovations carried out in the project.

Amount: 291.625,00 €

<table>
<thead>
<tr>
<th>Competitive Project 2</th>
<th>Evaluación multinivel de la vulnerabilidad sísmica y mitigación de riesgo de edificios de obra de fábrica para centros urbanos históricos resilientes. Amount: 173.030,00 € Start date: 2019-01-01; End date: 2021-12-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 3</td>
<td>Valorisation of knowledge for European pre-QUALified steel JOINTS. Amount: 62.021,95 € Start date: 2017-07-01; End date: 2019-06-30</td>
</tr>
<tr>
<td>Competitive Project 4</td>
<td>Elements d’aïllament sísmic i dissipació energètica en ponts de ferrocarril en zones d’alta sismicitat (Elements of seismic isolation and energy dissipation in railway bridges in areas of high seismicity). 2014 DI 035. Amount: 27.360,00 € Start date: 2015-01-14; End date: 2018-01-13</td>
</tr>
</tbody>
</table>

**KEY WORDS**

- Analysis
- Cement
- Design
- Durability
- Factory work
- Fibre reinforced polymers (FRP)
- Historic buildings
- Large-scale tests
- Materials
- Metal Structures
- Numerical models
- Offshore structures
- Pre-stressed Concrete
- Recycled concrete
- Reinforced concrete
- Reinforcement
- Resilience
- Shape memory alloys (SMA)
- Steel
- Structures
- Sustainability

**RESEARCH TEAM**

- Arrayago Luquin, Itsaso
- Bairan Garcia, Jesus Miguel
- Chacon Flores, Rolando Antonio
- Duarte Gomez, Noemi
- Molins Borrell, Climent
- Oller Ibars, Eva
- Pelà, Luca
- Real Saladrigas, Esther
- Etxeberria Larrañaga, Miren
- Fernández Carrasco, Lucía
- Mari Bernat, Antonio Ricardo
- Mirambell Arrizabalaga, Enrique
- Roca Fabregat, Pedro
- Saloustros, Savvas

**CONTACT**

✉ C/ Jordi Girona, Universitat Politècnica de Catalunya- Campus Nord. 1-3. Enginyeria de la Construcció. Building C1. Office 201C, 08034, Barcelona (Spain). Phone: (+34) 93 401 10 53. E-mail: climent.molins@upc.edu

✉ Person in charge: Mari Bernat, Antonio Ricardo – antonio.mari@upc.edu
BIT

RESEARCH CENTRE/GROUP
Name: BIT – Barcelona Innovative Transportation
Web: https://futur.upc.edu/BIT

GENERAL DESCRIPTION OF THE ACTIVITY
The group’s aims are to generate knowledge on transport, mobility and logistics and to transmit this knowledge to society through research, innovation, education and technology transfer. The group comprises a full university professor and four young PhD holders whose doctoral theses were supervised by the professor. All four of these were unanimously awarded as mark of Excellent cum laude and have received research awards from enterprise chairs and special doctoral awards.

Every year, this tight-knit group produces 10 SCI papers that are published in high-impact ISI journals in the field of transport engineering, and one or two doctoral theses are defended. The group is complemented by another full professor who works part-time and obtained practical experience from his brilliant work at the European Investment Bank.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD
The following activities define the priorities currently pursued by BIT group:

- Transport engineering

COMPETITIVE PROJECTS
A current project to be highlighted in the energy field is:

ELIPTIC electrification of public transport in cities
ELIPTIC aims to develop new concepts and business cases in order to optimise existing electric public transport infrastructure and rolling stock, saving both money and energy. The project strengthens the role of electric public transport, leading to reduced fossil fuel consumption and improved air quality. Amount: 58,000,00€

<table>
<thead>
<tr>
<th>Competitive Project</th>
<th>Description</th>
<th>Funding Entity</th>
<th>Amount</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 1</td>
<td>Cooperative freeway driving strategies in a mixed environment driverless and traditional vehicles.</td>
<td>Funding Entity: International Association of Maritime Universities.</td>
<td>141,570,00 €</td>
<td>2016-12-30</td>
<td>2019-12-29</td>
</tr>
<tr>
<td>Competitive Project 2</td>
<td>Development of a ship weather routing software for academic purposes.</td>
<td>International Association of Maritime Universities.</td>
<td>141,570,00 €</td>
<td>2018-05-01</td>
<td>2019-03-31</td>
</tr>
<tr>
<td>Competitive Project 3</td>
<td>NOVELOG: New cooperative business models and guidance for sustainable city logistics.</td>
<td>European Commission.</td>
<td>1114,530,00 €</td>
<td>2015-01-01</td>
<td>2018-12-31</td>
</tr>
</tbody>
</table>

KEY WORDS
- ITS
- Airports
- Appraisal
• Autonomous vehicles
• Bicycles
• Bus
• Concessions
• Demand
• Emergencies
• Feasibility
• Freight transportation
• Funding
• Inter-modality

• Logistics
• Management
• Mobility
• Mobility as a Service
• Motorbikes
• Operations
• Optimization
• Pedestrians
• Planning
• Ports

• Pricing
• Public transport
• Railways
• Regulation
• Road safety
• Smart cities
• Taxi
• Traffic
• Tramway
• Transportation

RESEARCH TEAM

• Campos Cacheda, José Magín
• Caram Muller, Bruno
• Estrada Romeu, Miguel Angel
• Grifoll Colls, Manel

• Medina Tapia, Marcos Christian
• Robuste Anton, Francesc
• Sala Sanmarti, Marcel
• Soriguera Marti, Francesc

CONTACT

✉ C/ Jordi Girona, Universitat Politècnica de Catalunya- Campus Nord. Enginyeria Civil i Ambiental. Building B1. Office 101, 08034, Barcelona (Spain). Phone: 93 401 71 04. E-mail: f.robuste@upc.edu
✉ Person in charge: Robuste Anton, Francesc – f.robuste@upc.edu
CBA

**Research Centre/Group**

Name: CBA – Communications and Broadband Architectures Lab

Web: [https://futur.upc.edu/CBA](https://futur.upc.edu/CBA)

**General Description of the Activity**

The research group started in 1992 and belongs to the Department of the Technical University of Catalonia (UPC BarcelonaTech). The University has been granted as Campus of International Excellence (Barcelona Knowledge Campus) and the Computer Architecture Department holds a PhD Program awarded by a Quality Mention with Honours by the Spanish Ministry since 2003.

The research group is recognized both as a research group of the UPC and as a consolidated research group of the Catalan Government Generalitat de Catalunya.

Most of the topics covered by this research group are strongly related with broadband networks and broadband services and applications: switching, protocol development and performance, traffic modelling, network resource management policies and bandwidth allocation, traffic and congestion control, routing strategies, internetworking, network management, IP and optical networks convergence, quality of service management and transport protocols.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by CBA group:

- Network Architectures
- Knowledge-defined Networking
- Optical Networking
- Traffic Monitoring and Analysis
- Green Networking
- Nano-networking Communications
- Network-on-Chip

**Competitive Projects**

A current project to be highlighted in the energy field is:

**SUNSET Sustainable Network Infrastructure Enabling the Future Digital Society**

The main objective of the SUNSET project is to overcome the "bottlenecks" of current networks and provide solutions for a future sustainable Digital Society, paving the way for innovative ICT services "in the cloud", and favouring the sustainable use of these services by mature economic sectors, improving their competitiveness through "cloud" -TIC technologies. More specifically, SUNSET proposes a new architecture including all segments (access, metro, and trunk) and data centre network, thanks to advanced optical techniques and Software Defined Network (SDN) technologies, capable of responding to the growing demands of resources of the new generation networks. **Amount: 232,320,00€**

Key words

- 5G architectures
- 5G network architecture
- ASON/GMPLS
- Digital Identity
- Energy-aware Networks
- Inter-domain QoS/TE
- LOC/ID split
- Nano networking
- Network Economics
- Network on a Chip
- New Network Architectures
- NVF
- OBS/OPS
- QoS monitoring
- QoS provision
- SDN
- Seamless Mobility
- Traffic
- Traffic Analysis and Classification
- Traffic Anomaly Detection
- WNoC
- WNSN

Research Team

- Abadal Cavalle, Sergi
- Roberto de Almeida Amazonas, José
- Barlet Ros, Pere
- Cabellos Aparicio, Alberto
- Careglio, Davide
- Cruellas Ibarz, Juan Carlos
- Domingo Pascual, Jordi
- Perelló Muntan, Jordi
- Santos Boada, Germán
- Solé Pareta, Josep
- Lopez Bresco, Albert
- Suarez-varela Macia, Jose Rafael

Contact

✉ C/ Jordi Girona, Universitat Politècnica de Catalunya- Campus Nord 1-3. Departament d’Arquitectura de Computadors. Building D6. 08034, Barcelona (Spain). Phone: (+34) 93 401 89 81/(+34) 93 401 89 82. E-mail: jordid@ac.upc.edu/pareta@ac.upc.edu
✉ Person in charge: Domingo Pascual, Jordi – jordi.domingo@ac.upc.edu
CDEI

**Research Centre/Group**

Name: CDEI – Centre of Industrial Equipment Design

Web: [https://futur.upc.edu/CDEI-DM](https://futur.upc.edu/CDEI-DM)

**General Description of the Activity**

CDEI-UPC (Centre for Industrial Equipment Design) is a technology innovation centre at the Catalonia Polytechnic University with over a decade of experience carrying out research projects, technology transfers, and training sessions.

It's objective is lend support to the technology innovation and training needs of industrial, scientific and recreation equipment manufacturers to give them a competitive edge and collaborate in their designs and development. CDEI professionals are experts in engine engineering. Their field of activity encompasses everything from the conception, design, simulation and calculations of equipment and products to handling their prototypes and testing stages.

To complement our specialization, on projects requiring the integration of different technologies, the CDEI enlists the broad knowledge of other centres. As a member of TECNIO, a group pertaining to the *Generalitat de Catalunya* (Catalan government) and created by ACC1Ó, top experts around Catalonia in the fields of applied research and technology transfer can be brought together.

CDEI is also a member of the Centre for Innovation and Technology at the Polytechnic University of Catalonia (CIT UPC), a non-profit organization created with the aim of to put the research capacity of universities to serve the Company.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by CDEI group:

- Environmental analysis of procedural and production equipment.
- Renewable energies: conceptual design and equipment construction.
- Saving energy through design

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Optimization of electrification systems with renewable energies and micro-grids*

Amount: 78,650,00 €

**Key Words**

- Conceptual design
- Energy consumption
- Equipment development
- Mechatronics design
- Process analysis
- Solar energy
- Wave energy generator
- Wind generator
RESEARCH TEAM

• Riba Romeva, Carles
• Domènech Mestres Carles
• Paz Bernales, Huáscar
• Blanco Romero, Elena
• Presas Renom, Andreu
• Gavilán, Adrián
• Houghton, Orion
• Canuto, Juanjo
• De la Fuente, Albert
• Dra. Irene, Buj
• Dr. Jordi Ramón Martínez
• Dra. Laia, Ferrer
• Ridaura, Gregorio
• Garcia, Gabriel

CONTACT

C/ Llorens Artigas, 4, Floor 0, building U, Parc Tecnòlogic de Barcelona, 08028, Barcelona (Spain). Phone: (+34) 93 401 08 31/Fax: (+34) 93 401 19 89. E-mail: info@cdei.upc.edu / Carles Riba: riba@cdei.upc.edu  +34 93 401 08 34

Person in charge: Martinez Miralles, Jordi Ramon– jmartinez.miralles@upc.edu
CDIF

RESEARCH CENTRE/GROUP
Name: CDIF – Centre of Industrial Diagnostics
Web: http://www.upc.edu/cdif

GENERAL DESCRIPTION OF THE ACTIVITY
CDIF is a R&D centre within the Polytechnic University of Catalonia (UPC). It belongs to the TECNIO network, a technology transfer initiative from ACC10, the Technology Innovation Agency of Catalonia.

The group goal is to provide technological support to industry worldwide in areas related to the field of power generation group’s diagnosis, focusing on hydropower.

The centre offers technology transfer services to industry by means of consultancy and technological innovation projects in our areas of expertise: analysis and diagnosis of vibration problems in turbomachinery, remote on-line monitoring, predictive maintenance, fluid dynamics studies and on-site specialized training.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD
The following activities define the priorities currently pursued by CDIF group:

- **Structural Analysis:**
  Structural dynamics. Effects of fluid on structural response. Fluid-structure interaction. Responses of hydraulic systems.
- **Cavitation:**
  Experimental and numerical investigation of cavitation flows. Research on dynamic behaviour of two-phase structures and their interactions with the main flow and the solid boundaries.
- **Diagnosis:**
  Vibration diagnosis for large hydraulic machines: application to advanced monitoring and damage detection. Fluid dynamic vibrations; fluid/structure interaction problems.
- **Simulation:**
  Numerical simulation of momentum, heat- and mass-transfer problems in turbulent flows related to industrial fluid flows and turbomachines, including effects due to the changes in flow phase that are linked to cavitation problems.

COMPETITIVE PROJECTS
A current project to be highlighted in the energy field is:

*Optimisation of heavy duty vehicles for alternative fuels use*

**Bio-methane mixed into liquefied natural gas:** LNG is an attractive option to mitigate the high dependence of HDV on diesel. However, to achieve a significant level of GHG emission reduction, it is essential to shift from natural gas to bio-methane. Proposals should consider the results of the LNG Blue Corridors projects and other projects funded by the EU under the European Green Vehicles Initiative.

**Biofuels ED95 and B30:** the use of E95 (95 % ethanol and 5% ignition improver) and B30 (30% Biodiesel and 70% of diesel) for HDV could reduce the EU dependence on diesel. E95 has been already been demonstrated in urban fleets but could be an appropriate fuel for trucks running over short and medium distances. Proposals should contribute to the transition from the 1st to the 2nd generation of such biofuels. **Amount: 166,102,50€**
HYDROPOWER PLANTS PERFORMANCE AND FLEXIBLE OPERATION TOWARDS LEAN INTEGRATION OF NEW RENEWABLE ENERGIES. FP7-608532-HYPERBOLE. Amount: 489.732,00 €. Start date: 2013-09-01; End date: 2017-02-28

KEY WORDS
- Dynamic behaviour by hydraulic turbomachines
- Hydraulic engineering fluid
- Hydraulic structure interactions
- Submerged structures response
- Fluid dynamic CFD simulation
- Fluid dynamics vibrations

RESEARCH TEAM
- Alvarez Florez, Jesus Andres
- Bossio, Matias
- Castañer Rioboo, David
- Fontanals Garcia, Alfred
- Guardo Zabaleta, Alfredo de Jesús
- Jou Santacreu, Esteban
- Egusquiza Estevez, Eduardo
- Egusquiza Montagut, Monica
- Escaler Puigoriol, Francesc Xavier
- Valentín Ruiz, David
- Valero Ferrnando, Mª Del Carmen

CONTACT

C/ Campus Diagonal Sud, Edifici PI (Pavelló I). Av. Diagonal, 647, 08028, Barcelona (Spain). Phone: (+34) 93 401 25 96/Fax: (+34) 93 401 58 12. E-mail: CDIF@mf.upc.edu

Person in charge: Egusquiza Estevez, Eduardo — aduard.egusquiza@upc.edu
**Research Centre/Group**

Name: CEMAD – Electrical Characterization of Materials and Devices  
Web: [http://cemad.upc.edu](http://cemad.upc.edu)

**General Description of the Activity**

Professors and researchers form the Materials and Devices Electrical Characterization Research group (CEMAD), which mostly belong to the Department of Physics of the Universitat Politècnica de Catalunya (UPC). The group was created at beginning of 90' decade and took the present name in 2008.

CEMAD group is focused in three areas: Ferroelectric and Piezoelectric Materials (synthesis, processing, and properties of polar dielectric materials for electronic devices), Nanomaterials and Nanocomposites (obtainment, characterization, and applications of nanostructures based on carbon nanotubes), Non-smooth Dynamical Systems (characterization of nonlinear dynamical systems, which include discontinuities).

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by CEMAD group:

- **Physical properties of materials:**  
  Electric, dielectric, piezoelectric, pyroelectric and elastic responses. Low and high temperature measurement. Non-linear and hysteretic behaviour.

- **Materials synthesis and processing:**  
  Lead-based piezo-ceramics with morphotropic phase boundary. Lead-free piezoelectric ceramics. High-permittivity ferroelectric ceramics. Low dimensional conductors.

- **Nano-characterization of materials:**  
  Surfaces characterization of nano-structures and nanocomposites. Local response by atomic force microscopy (PFM, EFM ...).

- **Characterization of nonlinear systems:**  
  Specific properties of nonlinear systems: dynamics, bifurcations. Discontinuity induced bifurcation. Nonlinear tools adapted to power electronics.

- **Devices and applications:**  
  Test and characterization of piezoelectric sensors and transducers. Obtaining and characterization of CNT based nanocomposites. Switching in power electronics.

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Tools for standardization in analysis and design of the interconnection of electronic power converters.*

Amount: 164.629, 00€

| Competitive Project 1 | Análisis, diseño e implementación de nano redes inteligentes en generación y distribución avanzada de energía en aplicaciones residenciales (Analysis, design and implementation of nano-smart grids in generation and advanced energy distribution in residential applications), DPI2013-47293-R. Amount: 100.000,00 € Start date: 2014-01-01; End date: 2016-12-31 |
### KEY WORDS
- Ferroelectric materials
- Nanostructures materials
- Non-linear systems
- Organic conductors
- Piezoelectric ceramics
- Polar dielectric

### RESEARCH TEAM
- Benadero Garcia-morato, Luis
- Ferrer Anglada, Nuria
- Garcia Garcia, Jose Eduardo
- Suñol Galofre, Francesc Xavier
- Gomis Arbones, Vicente
- Levit Valenzuela, Rafael
- Ochoa Guerrero, Diego Alejandro

### CONTACT
- C/Jordi Girona 1-3, 08034, Barcelona (Spain). Campus Diagonal Nord, Building B5. Phone: (+34) 93 401 77 61/Fax: (+34) 93 401 60 90. E-mail: administracio@fa.upc.edu
- Person in charge: Garcia Garcia, Jose Eduardo – jose.eduardo.garcia@upc.edu
CIEFMA

Research Centre/Group

Name: CIEFMA - Structural Integrity, Micromechanics and Materials Reliability Centre
Web: https://futur.upc.edu/CIEFMA

General Description of the Activity

CIEFMA is a Research Centre of the Universitat Politècnica de Catalunya (UPC) whose main aim is to study the structural integrity, reliability and behaviour of materials for structural applications in engineering, particularly fracture, fatigue, corrosion and micromechanics of advanced ceramics, hard metals and composites, steels and new alloys.

In addition, CIEFMA is part of the TECNIO network and offers support to businesses. It also has a quality management system for managing projects and handling incidents and the use of facilities. The research group’s strategy mainly targets the materials engineering sectors in which it has expertise: metallurgy, transport, energy, biomedicine and education. Its most significant research lines are the following: mechanical behaviour, fracture, fatigue and corrosion of steels, titanium alloys and new alloys; advanced technical ceramics, nanostructured ceramics, resistance to degradation and surface modification; metal-ceramic composites, cemented carbides and fracture, fatigue and surface modification; and coatings, micromechanics and Nano indentation.

Specific Areas of Research in Energy Field

The group specializes in the mechanical behaviour, the reliability and the relationship between microstructure and in-service performance of a wide range of advanced materials. The current lines of research are:

- **Metallic materials** (stainless steels, tool steels, powder metallurgical alloys, titanium alloys, metal matrix composites, etc.)
- **Ceramic materials**, composites and nanocomposites of ceramic matrix (dental zirconia, bio ceramics, alumina, composites).
- **Coatings for cutting**, forming and high temperature protection applications (thermal barriers, solid oxide fuel cells, etc.).
- **Hard materials** (hard metals, cermet, diamond, boron nitride, alumina, etc.).

Competitive Projects

A current project to be highlighted in the energy field is:

*Development and optimization of interconnectors for their application in systems of generation of high temperature energy based on fuel cells.*
Amount: 33.960,00 €

KEY WORDS

- Advanced Characterisation
- Cermet
- Coatings
- Contact loading
- Corrosion
- Failure analysis
- Fatigue
- Fracture
- Hard metals
- High strength steels
- High temperature
- Mechanical properties
- Mechanical integrity
- Micromechanics
- Microstructural design
- Nano mechanics
- Stainless Steel
- Surface integrity
- Titanium alloys
- Toughness
- Tribology
- Wear
- Zirconia

RESEARCH TEAM

- Anglada Gomila, Marcos Juan
- Chen, Yu-Hsiang
- El Azhari, Idriss
- Fargas Ribas, Gemma
- Sandoval Ravotti, Daniela Andreina
- Tovar Vargas, Daniela
- Garcia Marro, Fernando
- Jimenez Pique, Emilio
- Llanes Pitarch, Luis Miguel
- Mateo Garcia, Antonio Manuel
- Roa Rovira, Joan Josep
- Roitero, Erica
- Salán Ballesteros, Mª Núria

CONTACT

Av/ Eduard Maristrany, 10-14, 08019, Barcelona (Spain). Campus Diagonal Besòs, Building I.
Phone: (+34) 93 401 07 12/Fax: (+34) 93 401 67 06. E-mail: ciefma.info@upc.edu
Person in charge: Llanes Pitarch, Luis Miguel - luis.miguel.llanes@upc.edu
CITCEA

Research Centre/Group

Name: CITCEA – Centre of Technological Innovation in Power Electronics and Drives

Web: http://www.citcea.upc.edu/

General Description of the Activity

CITCEA-UPC is a technology transfer centre based in the UPC Barcelona Tech. CITCEA-UPC is specialized in design and development of functional prototypes for several industrial and power system applications. Furthermore, CITCEA-UPC conducts intensive research and technological transfer to industry in the field of modern power systems, power electronics, renewable energy (onshore wind, offshore wind, and solar energy), digital energy systems, smart grids and energy economics. CITCEA-UPC is expert in applications where energy and/or movement control is necessary: electricity, control electronics, power electronics, industrial communications and digital control with microprocessors.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by CITCEA group:

- **Enertronics:**
  Enertronics is a synergetic combination of power electronics, signal processing and analysis, computer science and control systems to promote and create efficient and sustainable energy systems.
  - Electric vehicle
  - Wind power
  - Smarts grids
  - Solar energy
  - Micro networks

- **Mechatronics:**
  Mechatronics consists in the development of intelligent machines through the integration of power electronics, communications, digital systems and control.
  - Power electronics
  - Digital control
  - Automation
  - Electric machine

Competitive Projects

A current project to be highlighted in the energy field is:

*Renewable penetration levered by Efficient Low Voltage Distribution grids*

RESOLVD aims to contribute to setting the next generation of competitive technologies and services for smart grids addressed in the topic LCE-01-2016-2017 (Area: 4-Intelligent electricity distribution grid). The objective is to improve the efficiency and the hosting capacity of distribution networks, in a context of highly distributed renewable generation by introducing flexibility and control in the low voltage grid. **Amount: 684.375,00 €**
Competitive Project 1
Desarrollo y análisis de algoritmos de gestión de baterías en parques fotovoltaicos (Development and analysis of battery management algorithms in photovoltaic parks). GREEN POWEMONITOR SISTEMAS. Amount: 150.000,00 €. Start date: 2018-09-27; End date: 2021-09-26

Competitive Project 2
Desarrollo de herramientas para el control efectivo de grandes plantas de energía fotovoltaica (Development of tools for effective control of large photovoltaic power plants). PCI2018-092882. Amount: 188.000,00 €. Start date: 2018-07-30; End date: 2021-07-29

Competitive Project 3
Sistema de almacenamiento de energía híbrido para plantas de producción de energía eléctrica renovables (Hybrid energy storage system for renewable electric power production plants). ENE2017-86493-R. Amount: 194.810,00 €. Start date: 2018-01-01; End date: 2020-12-31

Patent 1

KEY WORDS
- Control and industry 4.0
- Electric markets
- Electric vehicles
- Electrical engineering
- Electrical networks
- Industrial automation
- Power electronics
- Renewable energies
- Smart cities
- Smart grids
- Solar energy
- Wind energy

RESEARCH TEAM
- Aragüés Peñalba, Mónica
- Bergas Jane, Joan Gabriel
- Boix Aragonès, Oriol
- Bullich Massague, Eduard
- Capo Lliteras, Macia
- Cheah Mañé, Marc
- Chillon Anton, Cristian
- De La Fuente Morato, Albert
- Llonch Masachs, Marc
- Lloret Gallego, Pau
- Marín Macaya, Maria
- Miguel Espinar, Carlos
- Montesinos Miracle, Daniel
- Munné Collado, Ingrid
- Olivella Rosell, Pol
- Prieto Araujo, Eduardo
- Díaz Gonzalez, Francisco
- Ferrer San Jose, Ricards
- Galceran Arellano, Samuel
- Girbau Llistuella, Francesc
- Gomis Bellmut, Oriol
- Gross, Gabriel Igor
- Heredero Peris, Daniel
- Lledo Ponsati, Tomas
- Rull Duran, Joan
- Sánchez Sánchez, Enric
- Sau Bassols, Joan
- Sudria Andreu, Antoni
- Sumper, Andreas
- Vidal Clos, Josep Andreu
- Villafafila Robles, Roberto

CONTACT
- Av/ Diagonal, 647. Planta 2, 08028, Barcelona (Spain). ETS d’Enginyeria Industrial de Barcelona. Phone: (+34) 93 401 67 27/Fax: (+34) 93 401 74 33.
- Person in charge: Montesinos Miracle, Daniel – daniel.montesinos@upc.edu
CoDAlab

**RESEARCH CENTRE/GROUP**

Name: CoDAlab – Control, Dynamics and Applications  
Web: [https://futur.upc.edu/CoDAlab](https://futur.upc.edu/CoDAlab)

**GENERAL DESCRIPTION OF THE ACTIVITY**

The **Control, Dynamics and Applications** (CODALAB) group belongs to the Department of Applied Mathematics III at the Technical University of Catalonia (UPC). The group is active at the interdisciplinary meeting point of applied mathematics, systems and control theory, and engineering. The group covers both theoretical and applied research, and has grown through the collaboration with leading research groups in various fields, both in Spain and abroad. The collaborations are usually organised through joint competitive projects and mobility grants funded by national and international agencies.

The group contributes to the state of the art of its research field and is present at conferences, meetings and in cooperative networks. The group is composed of researchers whose backgrounds include mathematics, physics, control engineering and civil engineering.

**SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD**

The following activities define the priorities currently pursued by CoDAlab group:

- **Robust control**: Work on control of uncertain systems using methods and tools such as guaranteed cost control, Hinf, LMI's and Lyapunov based design. Deal with uncertainties in parameters, excitations and failures in controllers.

- **Structural control**: CoDAlab are interested in active, semi-active and passive control of vibrations due to undesired excitations in structures from civil, mechanical and related engineering areas.

- **Adaptive predictive control**: CoDAlab are interested in applications of predictive control within adaptive and expert-ruled scenarios.

- **Control of irrigation channels**: Development of control methods and algorithms to improve the water management efficiency through automatic operation.

- **Dynamic systems**: CoDAlab are interested in the qualitative and analytic theory of continuous and discrete dynamic systems. In particular, it studies bifurcations, periodic orbits, and global asymptotic stability and integrability issues.

**COMPETITIVE PROJECTS**

A current project to be highlighted in the energy field is:

*Development and validation of intelligent monitoring systems, pitch and structural damping control strategies for floating offshore wind turbines*

Amount: 96.800,00 €
Competitive Project 1
Diseño de estrategias avanzadas de control y detección de fallos para sistemas mecatrónicos complejos (Design of advanced control strategies and fault detection for complex mechatronic systems). DPI2015-64170-R. Amount: 157.300,00 €. Start date: 2016-01-01; End date: 2019-12-31

Competitive Project 2
Desarrollo y validación de sistemas de detección de fallos y diseño de estrategias de control tolerante a fallos con aplicación a plantas de energía eólica offshore (Development and validation of fault detection systems and design of fault tolerant control strategies with application to offshore wind power plants). DPI2014-58427-C2-1-R. Amount: 134.431,00 €. Start date: 2015-01-01; End date: 2018-12-31

Patent 1
Método y circuito electrónico analógico para la detección de fallos en el sistema hidráulico de variación de paso de pala de una turbina eólica (Method and analogue electronic circuit for the detection of faults in the hydraulic system of variation of blade pitch of a wind turbine). Patent Number: P201730664. Date: 2017-05-06

KEY WORDS
- Automatic image classification for haematological diagnosis
- Big scale systems
- Control of irrigation channels
- Control of structures
- Detection of damage to structures
- Dynamic systems
- Modelling and identification of non-linear systems
- System control
- Vibration control

RESEARCH TEAM
- Acevedo Lipes, Andrea
- Acho Zuppam Leonardo
- Ikhouane, Fayçal
- Mañosa Fernández, Victor
- Merino González, Anna
- Mujica Delgado, Luis Eduardo
- Palacios Quiñonero, Francisco
- Ponce de León Puig, Nubia Ilia
- Pozo Montero, Francesc
- Pujol Vazquez, Gisela
- Quiroga Méndez, Jabid
- Rodellar Benede, Jose Julian
- Rossell Garriga, Josep Maria
- Rubió Massegú, Josep
- Ruiz Orgoñez, Magda Liliana
- Tutivén Gálvez, Christian
- Vidal Segui, Yolanda

CONTACT
Av/ Eduard Maristrany, 16. Building A - Floor 9, Office A9.35, 08019, Barcelona (Spain). Phone: (+34) 93 401 68 65/Fax: (+34) 93 401 18 25.
Person in charge: Rodellar Benede, Jose Julian – jose.rodellar@upc.edu Mathematics Department, Campus Nord, 08034, Barcelona (Spain)
RESEARCH CENTRE/GROUP

Name: CREMIT – Centre for Engines and Heat Installations
Web: https://futur.upc.edu/CREMIT

GENERAL DESCRIPTION OF THE ACTIVITY

The aim is to join two small, consolidated research groups, one of which specialises in heat engines and machines (CREMIT) and the other in cooling and heating equipment (CER). The common aims for the next three years are to produce knowledge for publication in scientific journals in the aforementioned fields and to transfer the results of research to companies and public institutions.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by CREMIT group:

- Thermal engines
- Thermal motors
- Refrigerating machines
- Heat pumps
- Heat transfer processes

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

*Optimization of electrification systems with renewable energies and micro-grids*
Amount: 78.650,00 €

| Competitive Project 1 | Análisis de la interacción fluido-estructura en perfiles hidráulicos de baja vorticidad y su efecto en la respuesta dinámica (Analysis of the fluid-structure interaction in hydraulic profiles with low vorticity and its effect on the dynamic response). DPI2012-36264 Amount: 58.500,00 € Start date: 2013-01-01; End date: 2016-06-30 |

KEY WORDS

- Automobile engines
- Cogeneration plants
- Energy
- Hybrid vehicle traction systems
- Internal combustion engines
- Stationary engines
- Thermal Engines
- Truck engines

RESEARCH TEAM

- Alvarez Florez, Jesus Andres
- Gutiérrez González, Ernesto
- Lopez Sanz, Jorge
- Masclans Abelló, Pol
- Medina Iglesias , Vicente Cesar de
- Santos Lopez, M. Antonia de Los
- Soriano Alfonso, Francisco
Av/ Diagonal, 647. ETSEIB - Building F, 08028, Barcelona (Spain). Phone: (+34) 93 401 66 98
Person in charge: Alvarez Florez, Jesus Andres – jalvarez@mmt.upc.edu
CTE-CRAE

RESEARCH CENTRE/GROUP
Name: CTE – CRAE Space Science and Technology Research Group
Web: https://futur.upc.edu/CTE-CRAE

GENERAL DESCRIPTION OF THE ACTIVITY
The Aerospace and Research Centre (CRAE) is the tool of the Universitat Politècnica de Catalunya (UPC) to foster R&D in the Aeronautics and Space fields, by increasing the collaboration between UPC groups and acquiring the critical mass required for large projects.

CRAE is UPC’s window to the world for Aeronautics and Space activities and articulates the participation of UPC researchers within the Institut d’Estudis Espacials de Catalunya (IEEC)

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD
The following activities define the priorities currently pursued by CTE - CRAE group:

- Aeronautics sector:
  - Electronic systems industry.
  - Autonomic vehicles.

- Space sector.

COMPETITIVE PROJECTS
A current project to be highlighted in the energy field is:

Atmospheric LIDAR remote sensing and cooperative observations: exploitation, signal processing and radiative balance

Amount: 88.935,00 €

KEY WORDS
- Astrodynamics
- Astronomy
- Autonomic vehicles
- Electronic systems
- Energy
- Microgravity
- Numerical Methods
- Surface treatment

RESEARCH TEAM
- Barragan Cuesta, Ruben
- Camps Carmona, Adriano Jose
- Chaparro Danon, David
- Crespo Artiaga, Daniel
- De La Torre Sangrà, David
- Duffo Ubeda, Nuria
- Garcia Rigo, Alberto
- Garcia Senz, Domingo
- Hernandez Pajares, Manuel
- José Pont, Jordi
- Masdemont Soler, Josep Joaquim
- Onrubia Ibañez, Raul
- Pablos Hernandez, Miriam
- Park, Hyuk
- Pascual Biosca, Daniel
- Piles Guillem, Maria
• Pino Gonzalez, David
• Ramirez de La Piscina Millan, Laureano
• Ramos Castro, Juan Jose
• Rocadenbosch Burillo, Francisco
• Rojas Gregorio, Jose Ignacio
• Sala Cladellas, Gloria
• Sicard, Michaël
• Torres Gil, Santiago
• Torres Torres, Francisco
• Vall-llossera Ferran, Mercedes Magdalena

CONTACT
✉ C/ Jordi Girona, 1-3. Campus Nord, Building C4, 08034, Barcelona (Spain). Phone: (+34) 93 401 67 63
✉ Person in charge: Ramos Castro, Juan Jose – jramos@eel.upc.edu
CTTC

Research Centre/Group

Name: CTTC – Heat and Mass Transfer Technological Centre
Web: http://www.cttc.upc.edu

General Description of the Activity

The main objectives of the centre are teaching, research and technology transfer in the field of heat and mass transfer. Studies are carried out either from a basic research perspective, in which mathematical formulation, numerical solutions and experimental validation are considered, or from the perspective of applied research, in which the know-how acquired in the basic research line is applied to thermal and fluid dynamic design and the optimisation of thermal systems and equipment.

The basic research line includes natural and forced convection, turbulence simulation, combustion, two-phase flow, solid-liquid phase change, radiation, porous media, computational fluid dynamics (CFD) and heat transfer, aerodynamics, high-performance computing (numerical algorithms and solvers, parallel computing), etc. In the applied research line, particular attention is paid to projects in the fields of refrigeration, HVAC, active and passive solar energy systems, heat exchangers, heat storage using liquids and phase change.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by CTTC group:

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

The Laboratory is working on:

- Refrigeration (vapour compression refrigerating systems, hermetically sealed reciprocating compressors, absorption refrigerating systems)
- 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)
- Heat exchangers (gas liquid compact heat exchangers for automobile radiators, evaporators and condensers)
- Heat storage (by liquids and using phase change materials)
- Aerodynamics
- Wind energy

Competitive Projects

A current project to be highlighted in the energy field is:

**Development of MODELICA Libraries for ECS and Thermal management architectures**

The goal of this project is the development of Modelica libraries (Dymola compatible) to simulate Electrical Environmental Control System (E-ECS) architectures including thermal management perimeter. The efforts will be focused on developing an optimized model to simulate vapour cycle systems (VCS) and liquid loop systems at both steady state and transient operational
conditions. In addition, an appropriate strategy will be adopted to couple the thermal and the electrical environments to achieve an integrated simulation of the complete architecture. **Amount: 323,812,50 €**

| Competitive Project 1 | Desenvolupament d’una bomba de calor d’absorció refrigerada directament per aire amb aigua com fluid de treball. Simulacions de les fenomenologies, validació i verificació (Development of an absorption heat pump directly cooled by air with water as a working fluid. Simulations of phenomenology, validation and verification). 2018 DI 076 Amount: 33,960,00 €. Start date: 2019-03-01; End date: 2022-02-28 |
| Competitive Project 2 | Algorismos NUMéricos avanzados para la mejora de la eficiencia energética en los sectores Eólico y SOLar-térmico: desarrollo/adaptación a nuevas arquitecturas computacionales (Advanced numerical algorithms for the improvement of energy efficiency in the wind and SOLAR-thermal sectors: development / adaptation to new computational architectures). ENE2017-88697-R. Amount: 151,250,00 €. Start date: 2018-01-01; End date: 2020-12-31 |
| Competitive Project 3 | Integrating National Research Agendas on Solar Heat for Industrial Processes. H2020-731287-INSHP. Amount: 10,000,00 €. Start date: 2018-01-01; End date: 2020-12-31 |

**KEY WORDS**

- Aerodynamics
- Computational Fluids Dynamics and Heat Transfer (CFD & HT)
- Experimental Analysis
- Heat Exchangers
- High Performance Computing (HPC)
- Numerical Simulation
- Refrigeration
- Solar Energy

**RESEARCH TEAM**

- Albanque Mejia, Nicolas
- Alvarez Farre, Xavier
- Amani, Ahmad
- Baez Vidal, Aleix
- Calafell Sandiumenge, Joan
- Capdevila Paramio, Roser
- Castro Gonzalez, Jesus
- Naseri, Alireza
- Oliet Casayagas, Carles
- Oliva Llena, Asensio
- Pavon Montoliu, Octavi
- Perez Segarra, Carlos David
- Pont Vilchez, Arnau
- Rigola Serrano, Joaquim
- Chiva Segura, Jorge
- Colomer Rey, Guillem
- Farnos Baulenas, Joan
- Gonzalez Acedo, Ignacio
- Kizildag, Deniz
- Morales Ruiz, Sergio
- Muela Castro, Jordi
- Ruano Perez, Jesus
- Ruiz Tellez, Victor
- Torras Ortiz, Santiago
- Trias Miquel, Francesc Xavier
- Valle Marchante, Nicolas
- Ventosa Molina, Jordi

**CONTACT**

- C/ Colom, 11. ETSEIAT - Building TR4 – Office 162, 08222, Terrassa (Spain). Phone: (+34) 93 739 81 92 / Fax: (+34) 93 739 89 20
- Person in charge: Oliva Llena, Asensio – oliva@cttc.upc.edu
Research Centre/Group

Name: EOLI – SCOM – Industrial Engineering and Logistics- Supply Chain and Operations Management
Web: https://futur.upc.edu/SCOM

General Description of the Activity

SCOM (Supply Chain and Operations Management) is a research group of the Universitat Politècnica de Catalunya, Barcelona Tech, formed by researchers and professionals with a wide and recognized experience in the study, analysis and resolution of organizational problems (design and management of systems that incorporate people and technological elements), through the use of advanced and fully updated knowledge and techniques.

SCOM specializes in problems related to the design and management of the supply chain, including the management of operations within it, in all types of organizations. The mission of SCOM is to encourage, develop research on the supply chain, and thus contribute to the improvement of the economic and environmental efficiency of organizations, specifically with regard to the processes of supply, production, distribution, recovery and remanufacturing or recycling.

SCOM’s vision includes its consolidation as an international reference group in the research and resolution of supply chain design and management problems.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by DF group:

- Production/operations management
- Management Science
- Industrial engineering
- Supply chain management and Logistics
- Goods and Services Production Management
- Operational Research

Competitive Projects

A current project to be highlighted in the energy field is:

**Optimization of electrification systems with renewable energies and microgrids.**

Amount: 78,650,00 €

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Mobility ecosystem 2016 DI 023. Amount: 33,960,00 €. Start date: 2016-07-29; End date: 2019-07-28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 2</td>
<td>Planificació de l’electrificació rural amb microxarxes i energies renovables (Planning of rural electrification with micro-networks and renewable energies). Amount: 6,000,00 € Start date: 2018-06-01; End date: 2019-02-28</td>
</tr>
<tr>
<td>Competitive Project 3</td>
<td>Metodologies i aplicatius per a l’elaboració de plans d’electrificació rural i l’avaluació de projectes energetics a l’Amèrica Latina II (Methodologies and applications for the elaboration of rural electrification plans and the evaluation of energy projects in Latin America II). Centre de Cooperació per al Desenvolupament, UPC. Amount: 4,385,00 € Start date: 2018-01-01; End date: 2020-12-31</td>
</tr>
</tbody>
</table>
KEY WORDS

- Developed/Developing countries
- Green logistics
- Logistics
- Management engineering
- Microgrids
- Quantitative methods
- Supply chain

RESEARCH TEAM

- Benedito Benet, Ernest
- Corominas Subias, Albert
- Domenech Lega, Bruno
- Ferrer Martí, Laia
- García Villoria, Alberto
- Lusa Garcia, Amaia
- Martinez Costa, M. Carmen
- Mateo Doll, Manuel
- Olivella Nadal, Jorge
- Pastor Moreno, Rafael
- Ribas Vila, Immaculada

CONTACT

- Av Diagonal, 647. ETSEIB, Building H, Floor 11. 08028 Barcelona (Spain). Phone: (+34) 93 401 17 01.
- Person in charge: Lusa Garcia, Amaia - amaia.lusa@upc.edu
EPIC

**Research Centre/Group**

Name: EPIC – Energy Processing and Integrated Circuits  
Web: [https://futur.upc.edu/SCOM](https://futur.upc.edu/SCOM)

**General Description of the Activity**

The research activity of EPIC group is focussed on energy processing and integrated circuits, encompassing CMOS technologies for future-generation multicore processors and RF transmitters, as well as new devices for exploring ultimate energy density limits.

These activities have been driven by ultra-low-power battery-operated devices that are now migrating into energy-harvesting-enabled wireless sensor networks and pushing down scalability limits through the concurrence of new devices (More than Moore, gallium nitride or GaN and graphene), circuit and system perspectives with the aim of a transversal impact to various applications, namely, downscaled portable terminals and distributed sensors for wireless monitoring and practically all applications within the integrated systems and circuits area.

New challenges include wireless networks-on-chip for next-generation many-core processors for high-performance computing, nano-satellite swarms, wireless energy transfer and smart grids.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by EPIC group:

- **Analog microelectronic design:**  
  - Nonlinear controllers for switching power processors  
  - Switching converters integration  
  - Switched power RF amplifiers for 6G mobile communications  
  - Tuning-on-chip continuous-time analogue filters  
  - Communication circuits  

- **Switching power converters control:**  
  Modelling, design and control (linear and nonlinear) of DC-DC and DC-AC power conversion systems. Application to renewable energy based distributed generation.  
  - Grid-connected photovoltaic systems  
  - Modular power conversion architectures: series-parallel association of power processors.  
  - Photovoltaic reconfigurable systems for energy extraction optimization.

**Competitive Projects**

A current project to be highlighted in the energy field is:  

**Specialization Project and Territorial Competitiveness (PECT)**  
Litoral Besòs Sustainable Territory. Operated Energy Talent. Intelligent Micro-Network Actuation  
Amount: 550.500,00 €
**Competitive Project 1**

Dissey i implementació d’una micro-xarxa trifàsica intel·ligent reconfigurable com a tres microxarxes monofàsiques col·laboratives (design and implementation of a reconfigurable intelligent triphasic micro-network as three thousands of collaborative monophasic). FEDER ECO 1823-2015 (Micro-red). Amount: 429.000,00 € Start date: 2016-01-01; End date: 2017-09-30

**Competitive Project 2**

Tècniques de control para la mejora de la estabilidad en redes eléctricas con convertidores electrónicos operando a potencia constante (Control techniques for the improvement of stability in electrical networks with electronic converters operating at constant power). Amount: 145.200,00 € Start date: 2014-01-01; End date: 2017-12-31

**Key Words**

- Battery management
- Energy capture
- Energy control and management
- Energy efficiency
- Energy management aesthetic converters
- Energy management in integrated circuits
- Hybrid micro network design with photovoltaic support

**Research Team**

- Alarcón Cot, Eduardo Jose
- Bargalló Perpiñà, Ramon
- Casellas Beneyto, Francisco Jose
- Cuadras Tomas, Angel
- Guinjoan Gispert, Francesc
- Martínez García, Herminio
- Moron Romera, Juan
- Pique Lopez, Robert
- Velasco Quesada, Guillermo

**Contact**

✉ C/ Jordi Girona, 1-3. Campus Nord - Building C4, 08034, Barcelona (Spain). Phone: (+34) 93 401 74 82/ Fax: (+34) 93 401 74 85
✉ Person in charge: Alarcón Cot, Eduardo Jose – eduard.alarcon@upc.edu / Guinjoan Gispert, Francesc – francesc.guinjoan@upc.edu
EScGD

**Research Centre/Group**

Name: EScGD – Engineering Sciences and Global Development
Web: https://futur.upc.edu/EScGD

**General Description of the Activity**

The EScGD group contribute and network with development actors promoting research for development through the engineering practice. The group approach include the analysis of reality and development problems with a systemic and holistic perspective, an essentially practical nature and a strong focus in the effective production and transfer of knowledge.

EScGD approach to local societies in connection with the Sustainable Development Goals 2030, with special emphasis on the most vulnerable people, communities and ecosystems.

Science, Technology, Engineering and Maths are in the basis of our work. Engineering Sciences offer the basis to transform new ideas into reality and contribute to more inclusive and sustainable societies.

Research and innovation with this aim are the main goals, and this is how EScGD work.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by EScGD group:

- **Global Development priorities**
  - Living standards
  - Sustainable growth
  - Natural resource management
  - Equality and justice
  - Peace and security

- **Challenges**
  - Climate change
  - Food security
  - Sustainable agriculture
  - Poverty eradication
  - Human development

- **Water and energy**
  Meeting basic needs through infrastructure and services promote universal development of societies and ensure sustainable management of natural resources.

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Securing future-proof environmentally compatible bioenergy chains*

Amount: 176.125,00 €
**Competitive Project 1**

**Pedagogy of the Social and Solidarity Economy: A privileged tool for inclusive development in the Mediterranean.** Funding entity: AGAUR. Amount: 33,960,00 €. Start date: 2019-04-01; End date: 2022-03-31

**Competitive Project 2**

**Learning for Innovative Design for Sustainability.** 575777-EPP-1-2016-1-ES-EPPKA2-KA. Amount: 256,766,00 €. Start date: 2016-11-01; End date: 2019-10-31

**Competitive Project 3**

**Enhancing Entrepreneurship, Innovation and Sustainability in Higher Education in Africa (EEIS-HEA).** Amount: 999,849,00 €. Start date: 2018-01-01; End date: 2020-12-31

## Key Words

- Civil engineering
- Environmental engineering
- Environmental sciences and sustainability
- International cooperation for development
- Mathematical modelling
- Sustainable development goal

## Research Team

- Arranz Piera, Pol
- Castro Coma, Mauro
- Ezbakhe, Fatine
- Pérez Foguet, Agustí
- Requejo Castro, David
- Ríos Hernández, Julio Alejandro
- Giné Garriga, Ricard
- Horta Sellares, Frederic
- Lazzarini, Boris
- Van Wunnik, Lucas Philippe
- Velo Garcia, Enrique

## Contact

- C/ Jordi Girona, 1-3. ETSECCPB – Campus Nord Building C2 206 C, 08034, Barcelona (Spain). Phone: (+34) 93 401 10 72 (Dept. of Civil and Environmental Engineering)
- Av/ Diagonal, 647. ETSEIB – Campus Sud Building H, 08034, Barcelona (Spain). Phone: (+34) 93 401 69 09 (Thermal Technology Lab)
- C/ Jordi Girona, 1-3. IS.UPC Building TG, 08034, Barcelona (Spain). Phone: (+34) 93 401 60 66 (University Research Institute)
- Person in charge: Pérez Foguet, Agustí – agusti.perez@upc.edu
GAECE

RESEARCH CENTRE/GROUP

Name: GAEC– Electronically Commutated Motor Drives Group
Web: https://futur.upc.edu/GAECE

GENERAL DESCRIPTION OF THE ACTIVITY

The Group of Electric Drives with Electronic Switching (GAEC) is a research group of the Polytechnic University of Catalonia (UPC). The activity of the group is diversified into four areas: Electric drives, Power electronics, Mechanics, energy, and sustainability. The objective of the group is to contribute to the progress of scientific knowledge, the training of specialized personnel, the diffusion of technological advances and the transfer of technology in these fields.

The group’s facilities include electrical drive laboratories, power electronics and mechanics equipped with instrumentation (hardware and software) that allow experimental validations.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by GAEC group:

- Modelling and simulation of electrical drives with electronic switching.
- The development of software for assisted calculation of electrical drives.
- Studies of energy storage in electrical drives.
- The possibility of developing electric drives, as well as auxiliary equipment adapted to specific needs and applications.
- The realization of tests, tests and diagnostic tests drives.
- The development of new conventional manufacturing processes with pulses of current and mechanical vibration.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

**Driving with hybrid engine of reluctance of the axial air gap located inside the wheel for electric shield**

Amount: 130,438,00 €

<table>
<thead>
<tr>
<th>Patent</th>
<th>Description</th>
<th>Patent Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent 1</td>
<td>An axial flux switched reluctance machine and an electric vehicle comprising the Machine.</td>
<td>PCT/EP2017/076976.</td>
<td>2016-10-26</td>
</tr>
<tr>
<td>Patent 2</td>
<td>Máquina eléctrica híbrida de reluctancia (Hybrid electric reluctant machine).</td>
<td>EP12382315.</td>
<td>2012-08-03</td>
</tr>
</tbody>
</table>

KEY WORDS

- Aqua-plasticity
- Axial air gap motors
- Conformed by assisted plastic deformation
- Converters
- Electric drives
- Electrical mobility
- Electro-plastic cutting
- Electro-plasticity
- Hybrid reluctance motor
- Motorcycles and electric generators with permanent magnets
- Self-switching reluctance motors
- Shaped by assisted chip removal
- Synchronous motors

**RESEARCH TEAM**

- Andrada Gascon, Pedro
- Blanqué Molina, Balduino
- González Rojas, Hernán Alberto
- Matrinez Piera, Eusebio

- Perat Benavides, Jose Ignacio
- Sanchez Lopez, Jose Antonio
- Torrent Burgues, Marcel

**CONTACT**

- **Av/ Victor Balaguer, 1. Campus UPC Vilanova - Building VG2, 08800, Vilanova I la Geltrú (Spain). Phone:** (+34) 93 896 78 19. E-mail: info@gaece.upc.edu
- **Person in charge: Perat Benavides, Jose Ignacio – iperat@ee.upc.edu**
GCEM

**Research Centre/Group**

Name: GCEM– Electromagnetic Compatibility Group

Web: [https://futur.upc.edu/GCEM](https://futur.upc.edu/GCEM)

**General Description of the Activity**

The Electromagnetic Compatibility Group (GCEM) of the Universitat Politècnica de Catalunya (UPC) offer to industry consulting and research services for companies in EMC area. Our facilities are ready for realising Electromagnetic Compatibility and Electrical Safety tests.

GCEM is made up of a team of researchers and highly qualified technical staff who are actively involved in applied research projects and technology transfer activities to the industrial sector.

The group focuses its activity on electromagnetic compatibility (EMC) innovation projects for companies. It therefore has a fully equipped laboratory for assessing, testing and measuring electronic equipment. It also has all the hardware and software resources necessary for the development of numeric simulation projects in EMC. The expertise of GCEM in the fields of electromagnetic compatibility and electrical safety enables it to provide companies with testing, assessment and training services, all with the support of its own personnel and facilities.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by GCEM group:

- Electric and hybrid vehicles
- Wind aero-generators
- Smarts electric grids

**Competitive Projects**

A current project to be highlighted in the energy field is:

**Electromagnetic Interference on Static Electricity Meters (MeterEMI)**

Smart electricity meters are currently being deployed by utilities across the EU. However, the accuracy of the energy readings from these static devices is crucial for correct billing, and, recent studies have shown that under certain grid interference conditions caused by modern power electronics, some static meters show significant errors in energy reading, despite the meters being certified according to existing harmonised standards. Therefore, new standardization in static meter testing and verification via development of new instrumentation, test methods and signal processing techniques is needed to ensure present and future customer confidence in static meter energy readings used for billing. **Amount:** 103.593,75 €

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**Competitive Project 1**

**Metrology for advanced energy-saving technology in next-generation electronics Applications. JRP-g04/16ENG06 ADVENT.** Amount: 105.000,00 €. Start date: 2017-09-01; End date: 2020-08-31
**KEY WORDS**
- Electric vehicles
- Electromagnetic compatibility
- Electronic instrumentation
- Interferences
- Smart electric grid

**RESEARCH TEAM**
- Aragon Homar, Marc
- Azpúrua Auyanet, Marco Aurelio
- Fernandez Chimeno, Mireya
- Pous Sola, Marc
- Ramos Castro, Juan Jose
- Riu Costa, Pere Joan
- Silva Martinez, Fernando

**CONTACT**
- C/ Jordi Girona, 1-3. Campus Nord – Building C4, 08034, Barcelona (Spain). Phone: (+34) 93 401 10 21. Email: info.gcem@upc.edu
- Person in charge: Silva Martinez, Fernando – ferran.silva@upc.edu
GEMMA

RESEARCH CENTRE/GROUP

Name: GEMMA– Group of Environmental Engineering and Microbiology
Web: https://futur.upc.edu/GEMMA

GENERAL DESCRIPTION OF THE ACTIVITY

The Group of Environmental Engineering and Microbiology (GEMMA) is located at the Department of Hydraulic, Maritime and Environmental Engineering (DEHMA) of the Universitat Politècnica de Catalunya BarcelonaTech (UPC).

The Group is dedicated to interdisciplinary research, innovation, knowledge transfer and education in environmental engineering; particularly in the fields of environmental biotechnology, water supply, wastewater and solid waste treatment, and bioenergy generation.

Also, is specialized in investigating non-conventional wastewater and sewage sludge treatment systems, such as constructed wetlands and high rate ponds. The production of bioenergy from wastewater through anaerobic digestion and microbial fuel cells is a complementary research field. Mathematical modelling and Life Cycle Assessment (LCA) of these treatment processes are also undertaken. In addition, it collaborates with the Research Group on Cooperation and Human Development (GRECDH) in the area of Sustainable Energy, through research projects on appropriate technologies for biogas production from organic wastes in developing countries.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by GEMMA group:

- Non-conventional wastewater and sludge treatment systems.
- Technologies for the production of bioenergy from wastewater and organic wastes.
- Mathematical modelling of processes.
- Environmental evaluation of treatment systems and technologies for bioenergy production.
- Anaerobic digestion of algal biomass and sludge from wastewater treatment.
- Microbial fuel cells for electricity generation in constructed wetlands for wastewater treatment.
- Biogas production in low-cost household digesters in developing countries.
- Life Cycle Assessment and Energy Balance of alternative treatment systems.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Innovative Eco-Technologies for Resource Recovery from Wastewater

INCOVER concept has been designed to move wastewater treatment from being primarily a sanitation technology towards a bio-product recovery industry and a recycled water supplier. INCOVER added-value plants will generate benefits from wastewater offering three recovery solutions: 1) Chemical recovery (bio-plastic and organic acids) via algae/bacteria and yeast biotechnology; 2) Near-zero-energy plant providing upgraded bio-methane via pre-treatment and anaerobic co-digestion systems; 3) Bio-production and reclaimed water via adsorption, biotechnology based on wetlands systems and hydrothermal carbonisation.
To improve added-value production efficiency, INCOVER solutions will include monitoring and control via optical sensing and soft-sensors. **Amount: 807.500,00 €**

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Potential and Validation of Sustainable Natural &amp; Advance Technologies for Water &amp; Wastewater Treatment, Monitoring and Safe Water Reuse in India</th>
<th>Amount: 224.812,50 € Start date: 2019-02-01; End date: 2023-01-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 2</td>
<td>Sustainable production of bioproducts from microalgae and reclaimed water.</td>
<td>Funding entity: Agencia Estatal de Investigación. Amount: 175.450,00 € Start date: 2019-01-01; End date: 2021-12-31</td>
</tr>
<tr>
<td>Competitive Project 3</td>
<td>Prêttraitement des déchets pour la production d’hydrogène (Pretreatment of waste for hydrogen production). Montpellier Université d’Excellence.</td>
<td>Amount: 180.000,00 € Start date: 2018-01-01; End date: 2021-06-30</td>
</tr>
<tr>
<td>Competitive Project 4</td>
<td>Sustainable Product, Energy and Resource Recovery from Wastewater — SuPER-W. H2020-676070-SuPER-W.</td>
<td>Amount: 452.545,92 € Start date: 2016-03-01; End date: 2020-02-28</td>
</tr>
<tr>
<td>Competitive Project 5</td>
<td>Improving sustainable sanitation and energy access in rural areas of Peru and Colombia: constructed wetlands and small-scale digesters.</td>
<td>Amount: 10.948,00 € Start date: 2018-05-01; End date: 2019-04-30</td>
</tr>
</tbody>
</table>

**KEY WORDS**

- Bioenergy
- Biogas
- Biomethanation
- Constructed wetlands
- Emergent pollutants
- Greenhouse gases emissions
- High rate ponds
- Life cycle assessment
- Microbial Fuel Cells
- Modelling
- Multicriteria
- Sludge
- Solid wastes
- Wastewater

**RESEARCH TEAM**

- Álvarez San millán, Eduardo
- Arashiro, Larissa Terumi
- Arias Lizarraga, Dulce Maria
- Carretero Ariza, Javier
- Ferrer Martí, Ivet
- Garcia Galan, Maria Jesus
- Garcia Serrano, Joan
- Garfi, Marianna
- Hartl, Marco
- Ortiz Ruiz, Antonio
- Puigagut Juarez, Jaume
- Uggetti, Enrica

**CONTACT**

- C/ Jordi Girona, 1-3. Campus Nord – Building D1, 08034, Barcelona (Spain).
- Person in charge Ferrer Martí, Ivet – ivet.ferrer@upc.edu - Phone: (+34) 93 401 64 63.
- Person in charge: Garcia Serrano, Joan – joan.garcia@upc.edu - Phone: (+34) 93 401 64 64.
GICITED

RESEARCH CENTRE/GROUP

Name: GICITED – Interdisciplinary Group on Building Science and Technology
Web: https://futur.upc.edu/GICITED

GENERAL DESCRIPTION OF THE ACTIVITY

GICITED joins researchers from two Departments of the Universitat Politècnica de Catalunya, which develop their activity at the School of Building Construction of Barcelona and share an interest for research in the field of Building Science.

The GICITED is a highly multidisciplinary group whose main objectives are to influence the development of a sustainable building, high performance and safety criteria. More specifically, it works on the design and characterization of new materials and construction systems with specific features for use in new open construction, as well as in rehabilitation. From the point of view of sustainability, we work in different lines: the revaluation of waste and by-products, the use of wood and other materials.

The interest of the group is mainly focused on Building Science and, more specifically, on research into building materials and the simulation of physical-chemical processes from mathematical modelling. We address problems concerning the development of new materials with specific characteristics, the use of non-destructive diagnostic techniques, the evaluation of energetic efficiency and acoustic comfort in buildings, the fire behaviour of materials, the computational simulation and the design of elements for a safer and sustainable building construction.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by GICITED group:

- Traditional building materials and diagnosis techniques
- Sustainability and energy saving
- Behaviour of materials against fire
- Computational simulations of fire propagations
- Acoustics

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Identification of barriers and sustainable opportunities in materials and applications of thermal energy storage.

Amount: 145.200,00 €

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Soluciones sostenibles para envolventes de edificios (Sustainable solutions for building envelopes). BIA2017-88401-R. Amount: 70.180,00 € Start date: 2018-01-01; End date: 2020-12-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 2</td>
<td>Identificación de barreras y oportunidades sostenibles en los materiales y aplicaciones del almacenamiento de energía térmica (Identification of barriers and sustainable opportunities in the materials and applications of thermal energy storage). ENE2015-64117-C5-2-R; Start date: 2016-01-01 ; End date: 2018-12-31</td>
</tr>
</tbody>
</table>

**Key Words**
- Analysis of resources consumptions
- Comfort factor
- Energetic efficiency
- Energy certification of buildings
- Energy savings
- Monitoring of consumptions
- Petrology
- Recycling
- Rehabilitation
- Sustainability
- Sustainable building construction
- Use and management

**Research Team**
- Arias Cuevas, José Gabriel
- Bosch González, Montserrat
- Calderón Peñafiel, Juan Carlos
- Carrazana di Lucia, Ariana
- Castellar da Cunha, Joana Amèrica
- Gimeno Torrente, Domingo
- Gómez Soberón, José Manuel Vicente
- Gomez Val, Ricardo
- Haurie Ibarra, Laia
- Hormias Laperal, Emilio
- Lacasta Palacio, Ana Maria
- Monton Lecumberri, Joaquin
- Navarro Ezquerra, Antonia
- Ramirez Casas, Judith
- Rodriguez Cantalapiedra, Inmaculada
- Rosell Amigo, Juan Ramon
- Segues Aguasca, Edgar
- Yang, Tunxian

**Contact**
- **Av/ Doctor Marañón, 44 – 50. EPSEB, 08028, Barcelona (Spain).** E-mail: gicited.epseb@upc.edu
- **Person in charge: Lacasta Palacio, Ana Maria – ana.maria.lacasta@upc.edu**
GNOM

RESEARCH CENTRE/GROUP

Name: GNOM – Group of Numerical Optimization Modelling

Web: https://futur.upc.edu/GNOM

GENERAL DESCRIPTION OF THE ACTIVITY

GNOM is a research group made up by lecturers and post-graduate students of the departments of Statistics and Operations Research, and of Applied Mathematics I at the Universitat Politècnica de Catalunya (UPC), Barcelona.

The group works on both the numerical optimisation and the modelling of problems that can be solved through optimisation. Its work on numerical optimisation includes the analysis of new optimisation algorithms (linear, nonlinear, continuous and integer) and their convergence, the development of numerical procedures for their efficient computational implementation, and the comparison to existing algorithms.

The work on modelling focuses on the solution of real problems, which are often large-scale, by finding an equivalent mathematical formulation leading to an optimisation problem, and applying a suitable solver, that either has been specially developed or is commercially available.

The expertise of the GNOM group in electricity market optimization incorporates an especially deep knowledge of the Iberian Electricity Market (MIBEL). The activity of the GNOM group has been focused in the following areas: Energy, Statistical Data Protection, Optimization and Supply Chain.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by GNOM group:

- Mathematical modelling of electric power system operation, and of generation management in medium and in short term, and in on-line optimization (state estimation, secure optimum dispatch and contingency analysis)
- Optimal management of classical, low-emission, and emission-free generation technologies in an electricity market.
- Integration of renewable energies in the electricity markets.
- Optimal management and operations of emerging energy technologies (micro-grids, wind-hydro systems...)
- Optimal management of emission limits.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Energy management and integration of urban districts into smart grids.

Amount: 25.894,00 €
---
Competitive Project 2  |  Previsión y optimización de la generación eólica en los mercados de energía (Forecast and optimization of wind generation in energy markets). MTM2013-48462-C2-1-R. Amount: 59.290,00 €; Start date: 2014-01-01; End date: 2017-12-31

**KEY WORDS**

- Analytics
- Electric power systems
- Electricity generation management
- Electricity markets
- Mathematical Optimization

- Mathematical Programming
- Modelling in Mathematical Programming
- Operations Research
- Optimization
- Renewable energies

**RESEARCH TEAM**

- Albareda Sambola, Maria
- Casanellas Peñalver, Glòria
- Castro Perez, Jordi
- Cuadrado Guevara, Marlyn Dayana
- De La Lama Zubirán, Paula
- Fernandez Areizaga, Elena

- Gonzalez Alastrue, Jose Antonio
- Heredia Cervera, Fco. Javier
- Huerta Muñoz, Diana Lucia
- Ramon Lumbierres, Daniel Jacobo
- Rebillas Loredo, Victoria
- Superchi, Cecilia

**CONTACT**

- C/ Jordi Girona, 1-3, Building C5. Campus Nord, 08034, Barcelona (Spain).
- Persona in charge: Castro Perez, Jordi – jordi.castro@upc.edu / Phone: (+34) 93 401 58 54
GREENTECH

**Research Centre/Group**
Name: GREENTECH – Green technologies Research group  
Web: [https://futur.upc.edu/GREENTECH](https://futur.upc.edu/GREENTECH)

**General Description of the Activity**
The vision of the GREENTECH’s group is the energetic map in the following decades will be characterized by the combination of multiple energetic sources, the use of efficient energy production, transport and distribution systems, and a relevant use of green energies.

The mission of the Group is the development thermal systems assuring a sustainable growth, by means of increased efficiencies and use of green energies.

Finally, the goal of the group is to become a leading group in the development of efficient and green thermal systems, by training professionals and specialists, developing basic research, and transferring know-how and technology to our society.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by GREENTECH group:

- Green thermal systems

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Improvement and re-design of hydrodynamic heat generators and their application to multi-stage evaporators*

Amount: 33.960,00 €

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Implementation of activities described in the Roadmap to Fusion during Horizon 2020 through a Joint programme of the members of the EUROfusion consortium. H2020-633053-EUROFUSION Amount: 113.339,98 € Start date: 2014-01-01 End date: 2020-12-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Project 2</td>
<td>Osciladores fluidicos: nuevas perspectivas y aplicación al control activo de flujo (Fluidic oscillators: new perspectives and application to active flow control). FIS2016-77849-R. Amount: 72.600,00 €; Start date: 2016-12-30; End date: 2020-12-29</td>
</tr>
</tbody>
</table>

**Key Words**

- Air conditioning
- Air conditioning
- Biofuels
- Biomass
- Cloud computing
- Combustion
- Computational fluid dynamics
- Energy efficiency
- Geothermal energy
- Green energy
- Heat pump
• Heating
• Heating,

• Renewable energies
• Solar energy

• Thermal systems
• Ventilating

RESEARCH TEAM

• Bonals Muntada, Lluís Albert
• Cadafalch Rabasa, Jordi
• Consul Serracanta, Ricard
• Mas de les Valls Ortiz, Elisabet
• Quera Miro, Manuel
• Ribe Torijano, Oscar
• Ruiz Mansilla, Rafael

CONTACT

✉ Av/Diagonal, 647, CER&C: Centre Experimental en Refrigeració i Climatització. ETSEIB - UPC, 08028, Barcelona (Spain).
✉ Person in charge: Ruiz Mansilla, Rafael – rafael.ruiz@upc.edu
GREP

RESEARCH CENTRE/GROUP

Name: GREP – Research Group in Power Electronics
Web: https://futur.upc.edu/GREP

GENERAL DESCRIPTION OF THE ACTIVITY

GREP is a research group of the Electronic Engineering Department at the Technical University of Catalonia (UPC - BarcelonaTech).

GREP is contributing to the field of Power Electronics, focusing on research projects and scientific publications, as well as in the development of new technologies, products, and services. In all cases, our orientation to research and innovation is aligned with our educational activity at the B.S., M.S., and Ph.D. levels.

The research group is focused on the design of power electronic converters, taking into account both two-level and multilevel structures, including the synthesis of new topologies, the development of new analytical and modelling tools, and the application of new modulation and control techniques. Converter structures that use high-switching-frequency transistors (MOSFETs, IGBTs) are of greatest interest to the group, and particular attention is devoted to new semiconductor technologies whose use may become widespread in the near future (IGCTs, SiCs, etc.).

The research explores the new applications of power electronic converters to energy management and power supply systems.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by GREP group:

- New power conversion topologies.
- Application of the power electronics technology to wind energy systems, grid-connected PV systems and stand-alone PV systems.
- Optimal energy extraction and connection to the load in renewable energy systems
- New power converter modulation strategies with improved performance in terms of distortion, voltage balance, losses, etc., and enabling a reduced converter size and cost.
- New converter control strategies to fulfil wind energy challenges in connecting with the grid.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

**Advanced Power Electronic Conversion based on Switching-Cell Arrays**

Amount: 124.630,00 €

<table>
<thead>
<tr>
<th>Competitive Project</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conversión electrónica de potencia avanzada basada en matrices de celdas de conmutación (Advanced power electronic conversion based on matrix switch cells). DPI2017-89153-P Amount: 124.630,00 € Start date: 2018-01-01 End date: 2021-12-31</td>
</tr>
<tr>
<td>2</td>
<td>Mobilising the research, innovation and educational capacities of Europe’s universities in the SET-Plan. FP7-609838-UNISET. Amount: 38.143,09 € Start date: 2014-09-01; End date: 2017-12-31</td>
</tr>
</tbody>
</table>

* * *
### Patent 1

Sistema de generación eólica de media tensión mediante el uso de convertidores multinivel (system of wind power generation of half tension using multilevel converters). Patent Number: P200602779. Date: 2006-10-25

### Key Words

- Converter control
- Electric vehicles
- Grid-connected PV
- Hybrid vehicles
- Modulation
- Multilevel converters
- Multilevel converters
- New converter topologies
- Power Electronics converters
- PV systems
- Renewable energy
- Solar energy
- Stand-alone PV
- Wind energy

### Research Team

- Bordonau Farrerons, José
- Busquets Mongue, Sergio
- Conesa Roca, Alfonso
- Filbà Martínez, Àlber
- Nicolás Apruzzese, Joan
- Peracaula Roura, Joan

### Contact

- Av/ Diagonal, 647. Campus Sud- Building PI, 08028, Barcelona (Spain).
- Person in charge: Bordonau Farrerons, José – josep.bordonau@upc.edu
IMP

**RESEARCH CENTRE/GROUP**

Name: IMP – Information Modelling and Processing
Web: [https://futur.upc.edu/IMP](https://futur.upc.edu/IMP)

**GENERAL DESCRIPTION OF THE ACTIVITY**

The IMP research group is a multidisciplinary group, made up of researchers from the Universitat Politècnica de Catalunya (UPC), the Universitat Autònoma de Barcelona (UAB) and the Open University of Catalonia (UOC), and the collaboration of members of the Innovation and Research Laboratory from the Faculty of Computing of Barcelona (inLab).

The group’s scientific activity focuses on research, technology transfer and training in issues related to information modelling and processing, such as conceptual modelling, data quality, business intelligence and data mining or service engineering.

**SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD**

The following activities define the priorities currently pursued by IMP Group:

- **Smart Cities**: Modelling and simulation of energy efficiency in buildings and transport. Smart mobility (public transport systems, traffic management, dynamic navigation applications, processing of traffic and mobility data).
- **Cybersecurity**.
- **Data Science and Big Data**.
- **Service and business process engineering**.
- **Learning Analytics**
- **Modelling, simulation and optimization**.
- **Ontologies and information modelling**.

**COMPETITIVE PROJECTS**

A current project to be highlighted in the energy field is:

**C-ROADS SPAIN**

Cooperative ITS (C-ITS or cooperative systems) encompass a group of technologies and applications that allow an effective data exchange through wireless communication technologies between components and actors of the transport system, between vehicles (vehicle to vehicle or V2V) or between vehicles and infrastructure (vehicle to infrastructure or V2I). **Amount: 255.000,00 €**

**KEY WORDS**

- Big Data
- Cybersecurity
- Data Science
- Learning Analytics
- Modelling
- Smart Cities
- Software engineering
## Research Team

- Aluja Banet, Tomas
- Arjona Martinez, Jamie
- Baruwa, Olatunde
- Casanovas Garcia, Jose
- Codina Sancho, Esteve
- Delgado Mercé, Jaime
- Estañol Lamarca, Montserrat
- Fonseca Casas, Pau
- Guasch Petit, Antonio
- Heras Navarro, Neus
- Linares Herreros, Maria Paz
- Llorente Viejo, Silvia
- Lobo, Jorge
- Marco Galindo, María Jesús
- Marco Simó, Josep M.
- Mayol Sarroca, Enric
- Medina Llinas, Manuel
- Montero Mercade, Lidia
- Moreno Ortiz, Romualdo
- Narciso Farias, Mercedes
- Nonell Torrent, Ramon
- Olive Ramon, Antoni
- Oriol Hilari, Xavier
- Pastor Collado, Juan Antonio
- Piera Eroles, Miguel Angel
- Ramos Gonzalez, Juan José
- Romero Moral, Oscar
- Sánchez Puchol, Félix
- Sancho Samsó, Maria Ribera
- Tarres Ruiz, Francisco
- Teniente Lopez, Ernest
- Urpi Tubella, Antoni

## Contact

- **C/ Jordi Girona, 1-3. Campus Nord. Building Omega, Office 132, 08034, Barcelona (Spain).** Phone: (+34) 93 413 78 96. E-mail: imp.info@upc.edu

- **Person in charge:** Teniente Lopez, Ernest – teniente@essi.upc.edu
ISI Group

**Research Centre/Group**

Name: ISI Group - Instrumentation, Sensors and Interfaces Group

Web: https://futur.upc.edu/GRUP+ISI

**General Description of the Activity**

ISI Group focuses his research on novel sensors and on measurement methods based on electrical impedance variations, and on their electronic interfaces for signal conditioning and processing. Particular interest on macro-sensors based on low-cost technologies, autonomous and smart sensors, sensor networks, analogue signal processing, data acquisition systems, impedance spectroscopy and tomography, noise and interference reduction in instrumentation, non-invasive physiological measurements and biotelemetry. Technology transfer in sensors and engineering measurement systems.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by ISI Group:

- **Autonomous sensors and wireless sensor networks for agro-environment applications, smart buildings, intelligent traffic systems, and body area networks.**
  - Harvesting of solar, RF, pyroelectric, and wind energy.
  - Power and energy management for low-power systems.
  - Low-power sensor signal interfaces.
  - Interoperability and physical network deployment.
  - Electromagnetic compatibility.
  - Wireless sensor networks based on micro-aerial vehicles (MAVs).

- **Instrumentation methods based on impedance measurements, including spectroscopy and tomography.**
  - Electrolyte conductivity measurements based on resistive electrodes.
  - Electrolyte conductivity sensors based on capacitive electrodes.
  - Battery condition (State of charge (SoC) and State of health (SoH)) estimated from impedance and temperature measurements.
  - Systems for shallow prospection applied to Archaeology, Civil Engineering and Environmental Assessment.

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Use of bioelectrochemical reactors to optimize the recovery of energy and nutrients from high-load wastewater*

Amount: €122,000.00

**Key Words**

- Autonomous sensors
- Biomedical instrumentation
- Electrical Impedance Measurements
- Electromagnetic compatibility
- Electronic Instrumentation
- Electronic Interfaces for sensors
- Energy harvesting
- Power and power system
• Sensors

**RESEARCH TEAM**

- Casanella Alonso, Ramon
- Casas Piedrafita, Jaime Oscar
- Hornero Ocaña, Gema
- Lopez Lapeña, Oscar
- Pallas Areny, Ramon
- Polo Cantero, Jose
- Quilez Figuerola, Marcos
- Serrano Finetti, Roberto Ernesto

**CONTACT**

✉ C/ Esteve Terradas, 7. Baix Llobregat Campus, Building C4. Campus Baix Llobregat. 08860, Castelldefels (Spain). Phone: (+34) 93 413 70 96 / (+34) 93 413 70 95. E-mail: isi.info@upc.edu
✉ Person in charge: Casas Piedrafita, Jaime Oscar– jocp@eel.upc.edu
LACÀN

Research Centre/Group

Name: LACÀN – Numerical Methods for Applied Sciences and Engineering
Web: https://futur.upc.edu/LAC%20-%20UPC

General Description of the Activity

LACÀN’s research is focussed on mathematical modelling and computational mechanics. More precisely, it strives on: (1) development and analysis of computational methods and (2) applications in applied sciences and engineering that provide significant added value. This includes disciplines embracing engineering and mathematics. This is reflected in the composition of the group, the nature of the research projects and the pattern of publications.

New models and technologies are developed for the resolution of partial differential equations that complement traditional methods such as finite element (Galerkin discontinuous; mesh generation; error estimation, certification and control; reduced order models; meshes methods...). This computational expertise allows significant impact in different areas, viz. acoustics, fluid and solid mechanics, geophysics and biomechanics... The applications of these techniques include automotive, civil and mechanical engineering, as well as aerospace and energy.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by LACÀN Group:

- Computational methods and tools:
  - High-fidelity simulations: high-order approximations (in particular HDG formulations) with exact geometrical descriptions (NEFEM).
  - Reduced order models (viz. PGD) for generalized parametric solutions.
  - Data assimilation and data-driven models.
  - Uncertainty quantification and model updating for reliable simulations with goal-oriented error assessment and adaptively.
  - Automatic generation of high-order meshes.

- Natural and engineered materials and structures
  - Modelling flexo-electricity (i.e. the coupling between electric polarization and strain gradients).
  - Mathematical models and efficient finite element methods for coupled systems of high-order partial differential equations.
  - Accurate models for electromechanical characterization of nanomaterials.
  - Modelling large-scale plate tectonics.
  - Coupling plate tectonics to heat and fluid transport, petrology and geochemistry.
  - Efficient models for the medium- and high-frequency range in building vibroacoustics.
  - Continuous-discontinuous models of material degradation and fracture.

Competitive Projects

A current project to be highlighted in the energy field is:

*Enabling flexoelectric engineering through modelling and computation*
Piezoelectric materials transduce electrical voltage into mechanical strain and vice-versa, which makes them ubiquitous in sensors, actuators, and energy harvesting systems. Flexoelectricity is a related but different effect, by which electric polarization is coupled to strain gradients, i.e. it requires inhomogeneous deformation. Flexoelectricity is present in a much wider variety of materials, including non-polar dielectrics and polymers, but is only significant at small length-scales. **Amount: 1,500,000,00 €**

### Competitive Project 1
Modelización y mecánica computacional para ingeniería basada en flexoelectricidad (Modelling and computational mechanics for engineering based on flexoelectricity). DPI2015-62731-ERC. Amount: 62,400,00 € Start date: 2015-10-01 End date: 2017-03-31

### Competitive Project 2

### Competitive Project 3
Enabling Flexo-Photovoltaics through modeling and computation. RTI2018-101662-B-I00. Amount: 181,500,00 € Start date: 2019-01-01; End date: 2021-12-31

### Key Words
- Adaptability
- Cell and tissue mechanics
- Computational mechanics
- Damage and fracture mechanics
- Electromechanical materials
- Finite element mesh generation
- Geophysical and geodynamics
- High order approaches
- Mechanobiology
- Models of reduced order
- Partial derivative equations
- Verification and validation
- Vibroacoustics

### Research Team
- Abdollahi Hosnijeh, Amir
- Algarra Pomedio, Susanna
- Arias Vicente, Irene
- Arroyo Balaguer, Marino
- Borchini, Luca
- Codony Gisbert, David
- de Villardi de Montlaur, Adeline
- Diez, Pedro
- Fernandez Mendez, Sonia
- Font i Reverter, Jordi
- Garcia Gonzalez, Alberto
- Giacomini, Matteo
- Greco, Francesco
- Huerta, Antonio
- Kale, Sohan Sudhir
- Kaurin, Dimitri Jean Antoine
- Marco Alacid, Onofre
- Mocci, Alice
- Mosaffa, Payman
- Muñoz Romero, Jose Javier
- Ouzeri, Adam Amine
- Parés Mariné, Núria
- Poblet Puig, Jordi
- Rodriguez Ferran, Antonio
- Saez Viñas, Pablo
- Santos Olivan, Daniel
- Sarrate Ramos, Jose
- Torres Sanchez, Alejandro
- Tozzi, Caterina
- Vermiglio, Simona
- Vilanova Caicoya, Guillermo
- Walani, Nikhil
- Zlotnik Martinez, Sergio

### Contact
C/Jordi Girona, 1. Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puentes de Barcelona. Campus Nord, Building C2, 08034, Barcelona (Spain). Phone: (+34) 93 401 60 92. E-mail: contact.lacan@upc.edu
GENERAL DESCRIPTION OF THE ACTIVITY

The Maritime Engineering Laboratory (LIM/UPC) of the Technical University of Catalonia has long-standing experience in the field of maritime engineering. It is a unit of the Department of Civil and Environmental Engineering of the School of Civil Engineering of Barcelona.

The LIM/UPC is made up of a team of highly qualified professionals who have solid experience and come from different technical and scientific disciplines (mathematics, physics, geology, civil engineering, oceanography, etc.), who are organised into specialised workgroups that are well-coordinated among themselves. This enables a naturally multidisciplinary approach to the services offered.

The basic aims are to undertake basic and applied research, to develop oceanographic and maritime technology, to draw up training programmes for different levels and to organise dissemination activities in the maritime and coastal engineering fields. The main research lines are coastal and estuarine hydrodynamics, maritime environment climate.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by LIM/UPC Group:

- Coastal oceanography and oceanographic engineering.
- Functional and robust analysis of port and coastal structures.
- Physicochemical quality coastal waters.
- Maritime climate: climate variability.
- Acoustic emission.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

*Copernicus Evolution and Applications with Sentinel Enhancements and Land Effluents for Shores and Seas*

The CEASELESS project will demonstrate how the new Sentinel measurements can support the development of a coastal dimension in Copernicus by providing an unprecedented level of resolution/accuracy/continuity with respect to present products. **Amount: 439,375,00 €**

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Modelo Avanzado de gestión integrada para la Red de Infraestructuras hidráulicas MARHIS (Advanced model of integrated management for the Hydraulic Infrastructure Network MARHIS). CGL2015-71925-REDI. Amount: 178,000,00 €. Start date: 2015-12-01; End date: 2017-11-30</th>
</tr>
</thead>
</table>
KEY WORDS

- Coasts
- Hydraulic modelling
- Hydrodynamics
- Maritime climate
- Morph-dynamics
- Numerical modelling
- Water quality

RESEARCH TEAM

- Alsina Torrent, Jose Maria
- Caceres Rabionet, Ivan
- Cateura Sabri, Jordi
- Cerralbo Peñarroya, Pablo
- Comas Ruano, Genoveva
- Espino Infantes, Manel
- Galego Garcia, Oscar
- Garcia Leon, Manuel
- Gironella i Cobos, Francesc Xavier
- Gomez Aguar, Jesus Javier
- González Marco, Daniel
- Gracia Garcia, Vicente
- Jimenez Quintana, Jose Antonio
- Lopez-doriga Sandoval, Uxia
- Marzeddu, Andrea
- Mestres Ridge, Marc
- Mósso Aranda, Octavio Cesar
- Mujal Colilles, Anna
- Rafols Bundó, Laura
- Ros Chaos, Sergio
- Sanchez-Arcilla Conejo, Agustin
- Sanuy Vazquez, Marc
- Sierra Pedrico, Juan Pablo
- Sospedra Iglesias, Joaquin
- Torres Lahuerta, Richard Manuel
- Valdemoro Garcia, Herminia

CONTACT

- C/ Jordi Girona, 1-3. Campus Nord. Building D1. 08034, Barcelona (Spain). Phone: (+34) 93 401 64 68.
- Person in charge: Sanchez-Arcilla Conejo, Agustin – agustin.arcilla@upc.edu
MCIA

Research Centre/group

Name: MCIA – Motion Control and Industrial Applications Research Group
Web: https://futur.upc.edu/MCIA

General Description of the Activity

The MCIA is a reference center of research, development and innovation for its scientific research, applied research and technology transfer activities in the areas of energy efficiency, electromobility and industrial systems. The activity of the MCIA centre is based on research and knowledge generation to allow a technology transfer of high innovative value and significant competitive level to the industrial sector. The MCIA Centre covers the whole innovation and development chain: conceptualization, design, implementation and validation. Thus, a high quality technology transfer until TLR6-7 providing solutions for the creation of new products and optimization of the existing ones, in the areas of electrical, electronic and ICT engineering. The MCIA is member of the Polytechnic University of Catalonia Technology Centre, CIT UPC, from where the MCIA cooperates and leads multiple research and technology transfer activities.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by MCIA Group:

- **Electric traction drives and Mechatronics**: The activity developed by MCIA Centre in this area is focused on the research and development of electric and electronic technologies, mainly related with the design of electric drives for plug-in hybrid electric vehicles and electric vehicles with energy recovering capabilities, higher power density, higher efficiency and lower weight. Interesting achievements have been found in electromagnetic and thermal design of the machines.

- **Energy efficiency**: The MCIA Centre experience in this research line is being applied in different projects: optimization of energy consumption in buildings and industrial plants, intelligent control of electrical networks and consumption patterns for the prognosis, diagnosis and optimization.

- **High voltage systems**: High Voltage Systems is focused on research and test activities related to high voltage apparatus, which are intended to support high voltage and/or high currents for a more efficient, and sustainable power transportation.

- **Industrial electronics**: The experience acquired during years of work on industrial electrical applications and designs implies a considerable experience in power converters, digital control, instrumentation and industrial communication systems.

- **Industrial maintenance**: Research in this area is focused on improving the classical diagnostic techniques by providing new techniques for signal processing, pattern recognition and expert systems.

Competitive Projects

A current project to be highlighted in the energy field is:

*Nonlinear modelling of wind turbine by means of SCADA data for electromechanical fault diagnosis*
### Competitive Project 1

**Metodologia d’optimització de motors elèctrics per millorar l’eficiència per aplicacions hidràuliques** (Methodology of optimization of electric motors to improve efficiency for hydraulic applications).

- Start date: 2018-09-24; End date: 2021-09-24

**Details:**
- Amount: 33.960,00 €
- 2018 DI 019

### Competitive Project 2

**Aircraft Electrical Model Simulation Identification and Fitting Toolbox.** H2020-755332-AEMSIDFIT.

- Start date: 2017-07-01; End date: 2020-06-30

**Details:**
- Amount: 331.250,00 €
- 2016 DI 065

### Competitive Project 3

**Desenvolupament de la futura generació de connectors intel·ligents d’alta tensió per a subestacions, amb autonomia energètica i amb capacitat de transmissió de dades** (Development of the future generation of intelligent high voltage connectors for substations, with energy autonomy and data transmission capability).

- Start date: 2017-08-28; End date: 2020-08-27

**Details:**
- Amount: 33.960,00 €
MNT

Research Centre/Group

Name: MNT – Micro and Nanotechnologies Research Group
Web: https://futur.upc.edu/MNT

General Description of the Activity

In its Clean Room facilities, the group focuses its research on the fabrication of photovoltaic solar cells using different technologies and approach:

- Crystalline silicon Solar Cells
- Heterojunction (amorphous silicon/crystalline silicon) solar cells (HITS)
- Organic solar cells
- Thermo-photovoltaic

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by MNT Group:

- Fabrication of crystalline silicon solar cells (>20%). Optimization passivation layers, laser contact, optical confinement.
- Large area HITS solar cells using PECVD and HWCVD deposition techniques.
- Thermo-photovoltaic Solar Cells using metallic photonic crystals as intermediate absorber and emitter.
- Organic solar cells based on small molecule semiconductors.
- Structural, optical and electrical characterization of semiconductors.

Competitive Projects

A current project to be highlighted in the energy field is:

*Advanced Si/thin film chalcogenide hybrid technologies for sustainable, low cost and very high efficiency photovoltaics*

Amount: 193.244,00 €

<table>
<thead>
<tr>
<th>Competitive Project 1</th>
<th>Células solares con contactos posteriores basadas en substratos delgados de silicio cristalino (Solar cells with posterior contacts based on thin crystalline silicon substrates). TEC2017-82305-R. Amount: 133.100,00 €. Start date: 2018-01-01. End date: 2020-12-31</th>
</tr>
</thead>
</table>

Key Words

- Amorphous silicon
- Crystalline silicon
- MEMS
- Microfluidics
- Nanotechnologies
- Organic semiconductors
• Photovoltaic solar cells
• Thermo-photovoltaic

• Third generation solar cells (plasmons, up-conversion, down shifting)

RESEARCH TEAM

• Alcubilla Gonzalez, Ramon
• Bermejo Broto, Alexandra
• Calle Martin, Eric
• Dominguez Pumar, Manuel M.
• Garin Escriva, Moises
• Gerling Sarabia, Luis Guillermo
• Jimenez Serres, Vicente
• Jin, Chen
• Kowalski, Lukasz
• Lopez Gonzalez, Juan Miguel
• Lopez Rodriguez, Gema

• Martin Garcia, Isidro
• Masmitja Rusiñol, Gerard
• Orpella Garcia, Alberto
• Ortega Villasclaras, Pablo Rafael
• Pons Nin, Joan
• Puigdollers Gonzalez, Joaquin
• Rodriguez Martinez, Angel
• Silvestre Berges, Santiago
• Todorov Trifonov, Trifon
• Voz Sanchez, Cristobal

CONTACT

✉ Person in charge: Alcubilla Gonzalez, Ramon – ramon.alcubilla@upc.edu
NEMEN

Research Centre/Group

Name: NEMEN – Nanoengineering of Materials Applied to Energy
Web: https://futur.upc.edu/NEMEN

General Description of the Activity

The NEMEN research group use the nanotechnology to prepare nanoparticles of controlled size and shape. With nanoparticles, the group can prepare new materials to design catalysts and photocatalysts for an improvement in the management of energy and the environment. With an applied mind-set, the NEMEN research group uses the fundamental concepts of science for the design of materials at the nanoscale, making possible the relationship between its structure and its properties.

Model catalysts are designed, normally nanoparticles supported on inorganic oxides, in order to find out the nature of their active centres with the help of "operating" techniques of spectroscopy and microscopy that are carried out in the laboratories of the group, which include a microtron, the Multiscale Science and Engineering Research Centre of Barcelona (Campus Diagonal-Besòs of the UPC) and the ALBA synchrotron.

The industrial application is oriented to the customized preparation of catalytic devices and to the engineering of the reaction. It works with reactors of catalytic walls, microreactors, membrane reactors and with 3D printing techniques. We are working in the catalytic and photocatalytic production of hydrogen and synthetic fuels, in the elimination of atmospheric pollutants (CO, VOCs and soot) and in the valorisation of CO2.

Specific Areas of Research in Energy Field

The NEMEN group works on the preparation, characterization and evaluation of catalysts to operate in a heterogeneous phase in reactions of fundamental and industrial interest in the field of energy.

The following activities define the priorities currently pursued by NEMEN Group:

- Design of new catalysts, usually nanoparticles supported on inorganic oxides, in order to correlate catalytic behaviour with the structure of the catalyst.
- Catalytic and photocatalytic hydrogen production.
- Synthetic fuels production

Competitive Projects

A current project to be highlighted in the energy field is:

Microreactors with 3D printing technology for the catalytic and photocatalytic generation of hydrogen

This project aims using 3D printing techniques to develop new ceramic and silicone microreactors with improved transport properties to perform catalytic and photocatalytic reactions to generate hydrogen for energy purposes. The catalytic generation of hydrogen will be carried out in ceramic microreactors and membrane reactors (to supply a pure hydrogen stream to a low-temperature fuel cell) by catalytic steam reforming and oxidative reforming reactions, while the photocatalytic hydrogen generation will be performed in silicone microreactors. In addition to manufacturing microreactors, the project will also develop and study new catalysts and photocatalysts, which will be used to coat the microchannels of the microreactors by using different physical parameters and chemical formulations. Amount: 206,910,00 €
Competitive Project 1: Simulation and development of catalytic reactors for the hydrogen technology. Amount: 33,960,00 €. Start date: 2019-01-14; End date: 2022-01-13

Competitive Project 2: Optical and electronic properties simultaneous modulation in order to generate hydrogen with photo-catalysers and solar light. ENE2014-61715-EXP. Amount: 60,500,00 €. Start date: 2015-09-01; End date: 2016-08-31

Industrial PhD: Simulació i desenvolupament de reactors catalítics per a la tecnologia de l’hidrogen (Catalytic reactors simulation and development for the hydrogen technology). Start date: 15/11/18, End date: 15/11/21. Thesis coordinator: Jordi Llorca Piqué/Ricardo Torres Cámara. ERC PANEL 1: PE8 Products and Processes Engineering. Enterprise: ADDLINK SOFTWARE CIENTIFICO SL.

Patent 1: Catalizador para la producción de hidrógeno a partir de etanol y procedimiento y usos correspondientes (Catalyst for the production of hydrogen from ethanol and the corresponding procedure and uses). Type of property: Invention patent. Number of request: P201230591 Date of request: 2012-04-20

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**KEY WORDS**

- Chemical reaction
- Energy
- Heterogeneous catalysis
- Photocatalysis
- Reaction engineering
- Surface science
- Synchrotron radiation
- Volatile organic Compounds (VOC)

**RESEARCH TEAM**

- Casanova Hormaechea, Ignasi
- Dominguez Escalante, Montserrat
- Elkoro Ugarteburu, Ander
- García De Andrés, Xènia
- Gómez Millán, Gerardo
- Jimenez Divins, Nuria
- Koubychine Merkulov, Youri Alexandrovich
- Llorca Pique, Jordi
- Lucentini, Ilaria
- Rodríguez Chiang, Lourdes Maria
- Rodríguez Rausis, Kwon Bok
- Serrano Carreño, Maria Isabel
- Soler Turu, Lluis
- Uddin, Azhar

**CONTACT**

- Person in charge: Llorca Pique, Jordi – jordi.llorca@upc.edu
SAC

RESEARCH CENTRE/GROUP

Name: SAC – Advanced Control Systems

Web: https://futur.upc.edu/SAC

GENERAL DESCRIPTION OF THE ACTIVITY

Advanced Control Systems group (SAC) is a research group from the UPC since 1990; the group was recognized on 2014 as a consolidated research group. From its beginnings, the interests of the group are related to the Security, supervision and automatic control field of systems and infrastructures.

The group aim is to carry out applied research in the following areas:

- Modelling, identification and simulation of continuous and discontinuous industrial processes
- Advanced control of dynamic systems
- Optimisation and constraint satisfaction
- Supervision and fault diagnosis of industrial processes and systems
- Fault-tolerant control; and related subjects.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The research lines of the group related to the energy field are:

- Design of fault-tolerant, resilient and safe-tolerant diagnostics and control systems;
- Design of optimum control systems and optimized production management
- Planning of trajectories and guiding of autonomous vehicles.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

MICAPEM: Parameter estimation, diagnosis and control for the improvement of efficiency and durability of PEM fuel cells

The aim of this project, which can be classified within the control area, is to improve the performance of the PEM fuel cells based systems. The project is building upon the accumulated experience of the group in the topic and is based on the results of different previous projects of the research group. Its approach is set on the conviction that it is possible to obtain more competitive systems through better control systems. This requires to have a deep knowledge of the different phenomena that affect the efficiency and degradation of the PEM fuel cells and to have tools to know the internal state of these systems.

The main objective of the project is to develop controllers that operate the PEM fuel cell based systems with maximum efficiency and minimum degradation. Additionally, the properties of these controlled systems for stationary Combined Heat & Power (CH&P) applications will be shown. Specifically, the tasks of the project include the design, development and implementation of the control system of a CH&P high temperature PEM fuel cell based unit that will be manufactured and integrated to a prototype home by the other two partners of the coordinated project. Amount: 171,820,00 €

### Key Words

- Communication and information technologies
- Distributed generation
- Energy storage
- High-concentration PV power plants
- Microgrids
- Off-shore wind power plants
- Photovoltaics
- Power converters
- Power electronics
- Renewable energy
- Smart grids
- Wind energy

### Research Team

- Abdollahi, Mostafa
- Candela Garcia, Jose Ignacio
- Garcia Marco, Borja
- Luna Alloza, Alvaro
- Mujal Rosas, Ramon Maria
- Remon Rodriguez, Daniel
- Rocabert Delgado, Joan
- Tarraso Martinez, Andres
- Verdugo Retamal, Cristian Andres

### Contact

- C/ Rambla Sant Nebridi, s/n. GAIA Building 2nd/3rd floor. 08222, Terrassa (Spain). Phone: (+34) 93 739 85 49. E-mail: info@seer.upc.edu
- Person in charge: Candela Garcia, Jose Ignacio – candela@ee.upc.edu
SEER

RESEARCH CENTRE/GROUP
Name: SEER – Renewable Electrical Energy Systems
Web: https://futur.upc.edu/SEER

GENERAL DESCRIPTION OF THE ACTIVITY
The SEER research group at the UPC, now also the Centre for Research in Electrical Systems of Renewable Energy of the TECNIO network, focuses its research activities in the field of the connection to the power grid of energy-based generation systems Renewables, mainly photovoltaic, wind and marine.

The main mission of the group is to contribute to the large-scale integration of renewable energies in the future power grids. The SEER group focuses its research work on the design of advanced control systems and power processors for new generators based on renewable energy sources. However, SEER develops analyses, auxiliary systems and control solutions for electrical systems with high penetration of distributed generation, which are necessary to increase the penetration of renewables while maintaining the operational stability of the electricity grid.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD
SEER focuses its research work on the competitive market of the modern power systems, making use of concepts such as renewable energies, mainly solar and wind, distributed generation, advanced power processing, electrical energy storage, demand response, and information and communication technologies.

- Solar Power Systems
- Wind Power Systems
- Modern Power Systems

COMPETITIVE PROJECTS
A current project to be highlighted in the energy field is:

Bio-valorisation of CO2 for the sustainable promotion of biomethane as an alternative system of surplus renewable energy

Amount: 124.336,20 €

| Competitive Project 1 | Nodos inteligentes con almacenamiento de energía para flexibilizar la operación de sistemas de distribución (Smart nodes with energy storage to ease the operation of distribution systems). ENE2017-88889-C2-1-R. Amount: 200.376,00 €. Start date: 2018-01-01; End date: 2020-12-31 |

KEY WORDS
- Communication and information technologies
- Distributed generation
- Energy storage
- High-concentration PV power plants
- Microgrids
- Off-shore wind power plants
- Photovoltaics
- Power converters
- Power electronics
- Renewable energy
- Smart grids
- Wind energy

**RESEARCH TEAM**

- Abdollahi, Mostafa
- Candela Garcia, Jose Ignacio
- Garcia Marco, Borja
- Luna Alloza, Alvaro
- Mujal Rosas, Ramon Maria
- Remon Rodriguez, Daniel
- Rocabert Delgado, Joan
- Tarraso Martinez, Andres
- Verdugo Retamal, Crisian Andres

**CONTACT**

✉️ C/ Rambla Sant Nebridi, s/n. GAIA Building 2nd/3rd floor. 08222, Terrassa (Spain). Phone: (+34) 93 739 85 49 E-mail: info@seer.upc.edu

✉️ Person in charge: Candela Garcia, Jose Ignacio – candela@ee.upc.edu
**SARTI**

**Research Centre/Group**

Name: SARTI – Technological Development Centre for Remote Acquisition and Data Processing System

Acronym: SARTI

Web: [https://futur.upc.edu/SARTI](https://futur.upc.edu/SARTI)

**General Description of the Activity**

The Centre for the Technological Development of Remote Acquisition and Information Processing Systems (SARTI) of the [Universitat Politècnica de Catalunya](https://www.upc.edu) has as a fundamental objective the scientific and technological development of equipment and systems for remote data acquisition, emphasizing the virtual instrumentation and oceanographic, including methods of simulation and statistical analysis, using the avant-garde techniques in electronic design. SARTI transfers these advanced technologies to industry, turning them into scientific knowledge of excellence for society.

Since its inception, SARTI has done training courses for employment, providing the experience of professors and staff at the Polytechnic University of Catalonia.

**Specific Areas of Research in Energy Field**

The aim of the group is the scientific and technological development of remote acquisition systems and equipment, with a particular emphasis on virtual instrumentation and oceanography, including simulations and statistical analysis methods, using advanced electronic design techniques.

The following activities define the priorities currently pursued by SARTI Group:

- Digital processing of signals
- Electronic design of remote data acquisition systems (including simulation methods and statistical analysis)
- Marine and terrestrial technologies
- Automation of complex measurement systems

**Competitive Projects**

A current project to be highlighted in the energy field is:

*Specialization and Territorial Competitiveness Project (PECT) Litoral Besòs Territorio Sostenible. Operation Energy Talent. Smart Microgrid Performance*

The aim of the PECT Litoral Besòs is to convert the territory of Sant Adrià de Besòs and Badalona into a pole of economic activity, applied technological research, a concentration of knowledge and social innovation in environmental sustainability. All of it in an attractive space to generate projects, attract research, companies and new investments; to improve the environmental quality and therefore the quality of life of the citizens; transforming the left bank of the river Besòs and part of the coast and improving the employability of the population of the municipalities of Sant Adrià and Badalona. **Amount: 550.500,00 €**
**Key Words**

- Biometric systems
- Distributed systems
- Electronic design
- Energy efficiency
- Signal processing in real time and Internet data
- Software applications
- Systems control

**Research Team**

- Antonijuan Rull, Josefina
- Artero Delgado, Carola
- Bghiel, Ikram
- Borras Cristofol, Ramon
- Cadena Muñoz, Francisco Javier
- Carandell Widmer, Matias
- Carbonell Ventura, Montserrat
- Del Río Fernandez, Joaquín
- Gaya Suñer, Pedro Francisco
- Gomariz Castro, Spartacus
- Lopez García, Mariano
- Martinez Padro, Enoc
- Masmitja Rusiñol, Ivan
- Massana Hugas, Immaculada
- Miquel Masalles, Jaume
- Moreno Lupiañez, Manuel
- Nogueras Cervera, Marc
- Olive Duran, Joaquim
- Parisi Baradad, Vicenç
- Prat Farran, Joana d’Arc
- Prat Tasias, Jordi
- Ramos Lara, Rafael Ramon
- Riera Perez, Genis
- Roset Juan, Francesc Xavier
- Sarria Gandul, David
- Sole Rovira, Juan
- Sospedra Capaces, Andrea
- Toma, Daniel Mihai
- Trullols Farreny, Enric
- Vidal Oliveras, Neus

**Contact**

- C/ Rambla de l’Exposició, 24. Centre Tecnològic de Vilanova i la Geltrú. 08800, Vilanova i la Geltrú (Spain).
- Phone: (+34) 93 896 72 00
- Person in charge: Olive Duran, Joaquim – joaquim.olive@upc.edu
RESEARCH CENTRE/GROUP

Name: SEPIC – Power and Control Electronics Systems

Web: https://futur.upc.edu/SEPIC

GENERAL DESCRIPTION OF THE ACTIVITY

The Power Electronics and Control Electronics Systems is a multidisciplinary research group of the Universitat Politècnica de Catalunya.

The research of the group is oriented toward non-linear control systems, and particularly toward non-linear control of power electronics converters and systems. Controllers are implemented by means of analogue or digital solutions, using in this case, and digital signal processors.

Our research group is specialized in Uninterruptible Power Systems, Active Filters, Multilevel Converters, etc. Our research results are transferred to private companies, and supported by contract.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The group carries out research and education within the broad fields of energy processing, power electronics and control systems. The following activities define the priorities currently pursued by SEPIC Group:

- Energy efficient systems,
- Distributed generation of electrical energy,
- Renewable energy systems (wind, photovoltaic),
- Transmission and distribution of electrical energy (microgrid, FACTS, active filtering)

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Management and control of alternating current microgrids and interconnection with DC buses in hybrid microgrids

Amount: 152.460,00 €

KEY WORDS

- Converters
- Electrical Energy
- Microgrid
- Non-linear Control
- Photovoltaic energy
- Power electronics
- Renewable energy
- Wind energy

RESEARCH TEAM
• Camacho Santiago, Antonio
• Castilla Fernandez, Miguel
• Cruz Vaquer, Juan
• de la Hoz Casas, Jordi
• Font Mateu, Josep
• Garcia de Vicuña Muñoz de la Nava, Jose Luis
• Guzman Sola, Ramon
• Martin Cañadas, Maria Elena
• Matas Alcala, Jose
• Miret Tomas, Jaume

CONTACT

Av/ Victor Balaguer, s/n. Escola Tècnica Superior d’Enginyeria de Vilanova i la Geltrú. 08800, Vilanova i la Geltrú (Spain).

Person in charge: Garcia de Vicuña Muñoz de la Nava, Jose Luis – vicuna@eel.upc.edu
SETRI – R2EM

RESEARCH CENTRE/GROUP

Name: SETRI – R2EM – Resource Recovery and Environmental Management

Web: https://futur.upc.edu/R2EM

GENERAL DESCRIPTION OF THE ACTIVITY

R2EM group is developing research activity on development of sustainable urban and industrial waste management cycles based on resource recovery approaches promoting circular solutions of waste to product and waste to energy.

Research also involves efforts on developing environmental remediation solutions for soils and ground water remediation, process and environmental monitoring and environmental risk assessment on ports.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by SETRI/R2EM Group:

- **Development of separation processes:**
  Applying different technologies either to recover metals with added value or to eliminate metals and organic pollutants.

- **Development and validation of analytical methods and new sensors for monitoring physical-chemical parameters of industrial and environmental interest:**
  Based on chromatographic (HPLC) and electrophoresis (CE) instrumental separation systems for determining dissolved organochlorine (DOC) and volatile organic compounds of gasoline (BTEX) in water and soil.

- **Study of characterization and treatment of waste:**
  Liquids and solids from industrial and nuclear processes, study of the management and minimization of industrial waste and its environmental impact, and analysis, evaluation and modelling of the behaviour of environmental pollutants, particularly chemical behaviour and migration of different species in the geosphere.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

*Conversion of Low Grade Heat to Power through closed loop Reverse Electro-Dialysis*

The concept is based on the generation of electricity from salinity gradient using Reverse Electro dialysis with artificial saline solutions operating in a closed-loop. The original salinity gradient is regenerated by a separation step that uses heat at 40 - 100 C.

The regenerated solutions can be stored at very low costs and the stack can react within seconds, providing flexibility to the power system. It is a quiet technology operating under normal pressures and temperatures imposing no risks. The industrial partners ensures the MRL will be kept aligned with the advances in TRL.

Amount: 509,295,00 €

| Competitive Project 1 | Estudios de corrosión y disolución de análogos químicos del combustible nuclear gastado en las condiciones esperadas durante su almacenamiento (Studies of corrosion and dissolution of chemical...)

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Competitive Project 2

Resource Recovery and Environmental Management. AGAUR. Amount: 36,000,00 €. Start date: 2017-01-01; End date: 2020-12-31

**KEY WORDS**

- Diffusion dialysis
- Electrodialysis
- Environmental management tools
- Environmental remediation
- Membrane technologies
- Nanofiltration
- Nanoparticles
- Nuclear waste characterization
- Pollutants removal
- Process and environmental monitoring
- Radionuclides migration
- Reactive sorbents
- Resource recovery
- Risk
- Sensors
- Separation Processes
- Technologies integration

**RESEARCH TEAM**

- Casas Pons, Ignasi
- Cortina Pallas, Jose Luis
- Darbra Roman, Rosa Maria
- Farran Marsa, Adriana
- Fernandez de Labastida Ventura, Marcos
- Florido Pérez, Antonio
- Gibert Agullo, Oriol
- Gimenez Izquierdo, Francisco Javier
- Granados Juan, Merce
- Javadian, Hamedreza
- Lopez Rodriguez, Julio
- Marti Gregorio, Vicenç
- Martinez Martinez, Maria R.
- Pablo Ribas, Joan de
- Pavon Regaña, Sandra
- Reig i Amat, Monica
- Ruiz Planas, Montserrat
- Sastre Requena, Ana Maria
- Valderrama Angel, Cesar Alberto
- Vecino Bello, Xanel
- Vera Canudas, Marc
- Yaroshchuk, Andriy
- You Chen, Xialei

**CONTACT**

- Person in charge: Cortina Pallas, Jose Luis – jose.luis.cortina@upc.edu
SPCOM

RESEARCH CENTRE/GROUP

Name: SPCOM – Signal Processing and Communications Group
Web: https://futur.upc.edu/SPCOM

GENERAL DESCRIPTION OF THE ACTIVITY

The Signal Processing and Communications Group performs research and teaching activities at the Signal Theory and Communications Department (TSC) of the Universitat Politècnica de Catalunya (UPC).

The research of the group focuses on the development and analysis of advanced digital signal processing techniques, with particular emphasis on their application to communication and/or localisation systems, sensor networks and smart grids. Areas of particular interest are all types of wireless communications in all domains, from personal, local and cellular to satellite, including the appropriate localisation techniques.

The group has substantial experience and is likely to be also active in the future in fields such as advanced satellite communication system design, the development of wireless communication systems with multiple antennas for transmission and/or reception, advanced localisation system design, and the optimisation of resource allocation schemes for non-centralised wireless communication systems.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The following activities define the priorities currently pursued by SPCOM Group:

- Personal and Mobile Communications
- Ground and On-Board Satellite Processing for Digital Communications
- Navigation Systems
- Hardware/Software Signal Processing System

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Innovative Architectures, Wireless Technologies and Tools for High Capacity and Sustainable 5G Ultra-Dense Cellular Networks

According to the 5G Public-Private Partnership (5GPPP) recently formed by the EU, 5G networks need to be designed, engineered and optimized by relying on innovative technologies capable of providing 1000 times higher capacity and a 90% reduction in energy consumption compared to the status quo. Such a fundamental and radical paradigm-shift in network design and architecture requires cross-sectoral skills&background and can very unlikely be realized by researchers that have not received personalized training on innovative technologies and adequate methodological tools to their analysis.

5Gwireless’ mission is to create a vibrant EU-based training and research environment for young researchers aiming at designing architectures, systems and algorithms for building the 5G cellular network of tomorrow.

Amount: 495,745,92 €

Competitive Project 1  Técnicas distribuidas para la gestión y operación de redes de comunicaciones celulares inalámbricas, de sensores y de la red eléctrica (Distributed techniques for the management and operation of...


KEY WORDS

- Cognitive radio
- Communications
- Cooperative systems
- Energy efficient networks
- Estimation theory and detection
- Information theory
- Localization
- Mobile communications
- Multi-antenna system
- Optimization
- Radio resource management
- Signal processing
- Smart grids
- Transmitter / receiver design

RESEARCH TEAM

- Agustin de Dios, Adrian
- Aravanis, Alexios
- Borras Pino, Jordi (2)
- Cabrera Bean, Margarita Asuncion (106)
- De Cabrera Estanyol, Ferran
- Fernandez Rubio, Juan-antonio
- Gimenez Febrer, Pedro Juan
- Lamarca Orozco, M. Meritxell
- Molina Oliveras, Francesc
- Munoz Medina, Olga
- Najar Marton, Montserrat
- Pages Zamora, Alba Maria
- Pascual Iserte, Antonio
- Raafat Hosny Mohamed Fahm, Ahmed
- Rey Micolau, Francesc
- Riba Sagarra, Jaume
- Rodriguez Fonollosa, Javier
- Sala Alvarez, Jose
- Salek Shishavan, Farzin
- Vazquez Grau, Gregorio
- Vidal Manzano, Jose
- Villares Piera, N. Javier

CONTACT

- C/ Jordi Girona, 1-3. UPC Campus Nord, Building D5, 08034, Barcelona (Spain).
- E-mail: spcom@tsc.upc.edu
- Person in charge: Pascual Iserte, Antonio — antonio.pascual@upc.edu
**STH**

**Research Centre/Group**

Name: STH– Sustainability, Technology and Humanism

Web: https://futur.upc.edu/STH

**General Description of the Activity**

The UPC's Research Group in Sustainability, Technology and Humanism (STH) was established in 2004 by the UNESCO Chair on Sustainability (CUS) of the Universitat Politècnica de Catalunya (UPC).

As of 2013, a second stage was initiated as an interdisciplinary group. Now, with members from the following departments of the UPC: Department of Fluid Mechanics, Department of Mechanical Engineering, Department of Mining Engineering and Natural Resources, Department of Chemical Engineering, Department of Textile and Paper Engineering, Department of Computer Languages and Systems, Department of Computer Architecture, Department of Applied Mathematics III, Department of Physics and Nuclear Engineering, Research Institute of Science and Technology for Sustainability.

**Specific Areas of Research in Energy Field**

The following activities define the priorities currently pursued by STH Group:

- **Sustainable human development.**
- **Technology and technological policies for sustainable human development; sustainable production and consumption; energy policy and climate change; green economy.**
- **Sustainable management of natural resources and waste and the environment in general; sustainability of urban environment.**
- **To deepen, contextualise, measure, model and realise future scenarios in the context of the sustainability paradigm.**
- **Social, environmental and economic dimensions of sustainability, all contributing to develop processes, directions and cross-disciplinary work goals alongside academics of sustainability, technology and human sciences.**
- **The imbalances and inequalities of globalization, as well as their composition, evolution and democratic governance towards sustainable human development.**
- **Better education in sustainability.**
- **Human rights and sustainability, cooperation and sustainability; territorial development and sustainability.**
- **Politics, decision-making and democratic governance of/towards sustainability, in the context of international agendas followed by international organisations.**
- **To influence the governance of climate change and the agendas of the UNFCCC.**
- **The social impacts of science and technology.**
- **Promoting peace through education, science, culture and communication (UNESCO).**

**Competitive Projects**

A current project to be highlighted in the energy field is:

**Learning for Innovative Design for Sustainability**

The goal of the Learning for Innovative Design for Sustainability (L4IDS) project is to promote sustainable consumption and production of products and services in Europe. This will be achieved through a knowledge co-
creation process and the development of training materials in order to teach and train students, faculty and enterprise staff of the design sector in Innovative Design for Sustainability (IDfS) strategies. The focus is on social business and educational innovation, enabling the creation of sustainable products and services, aligned with European Circular Economy policies and, in turn, a more sustainable society. The initiative aims at strengthening the triad Knowledge co-creation-Design for Sustainability-Innovation where there is a lack of specific learning schemes, courses, and teaching materials at higher education and through continuous professional development. To support the delivery of this project, country hubs (CH) have been developed in four European countries (Ireland, Spain, Sweden and The Netherlands). **Amount: 256.766,00 €**

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**Competitive Project 1**

*Enhancing Entrepreneurship, Innovation and Sustainability in Higher Education in Africa (EEIS-HEA).*

EACEA. TEC2013-41315-R DISNET. **Amount: 999.849,00 €** **Start date: 2018-01-01; End date: 2020-12-31.**

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**KEY WORDS**

- Biodiversity
- Cities and Urban Environment and Sustainability
- Climate change
- Cooperation for sustainable human development
- Energy
- Energy Policies
- Environment
- Global Crises
- Green Economy
- Higher Education in Sustainability,
- Natural Resource Management
- Prospective and future scenarios
- Technological Policies
- Sustainability Indicators
- Science and Technology and Society
- Sustainable Design
- Sustainable Development
- UNESCO
- UNFCCC

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**RESEARCH TEAM**

- Alcaraz Sendra, Olga
- Alvarez Del Castillo, Javier
- Bofill Soliguer, Pau
- Buenestado Caballero, Pablo
- Busquets Rubio, Pere
- Domingo Gou, Marta
- Hernandez Gomez, Maria de Los Angeles
- Navarro Gonzalo, M. Teresa
- Prieto Villanueva, Jesús Ángel
- Segalas Coral, Jordi
- Sureda Carbonell, Bàrbara
- Tejedor Papell, Gemma
- Xercavins Valls, Josep

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**CONTACT**

✉ Av/ Eduard Maristany, 10-14. 08019, Barcelona (Spain).
✉ **Person in charge:** Xercavins Valls, Josep – josep.xercavins@upc.edu
SUMMLab

**Research Centre/Group**

Name: SUMMLab – Sustainability Measurement and Modelling Lab

Web: [https://futur.upc.edu/SUMMLab](https://futur.upc.edu/SUMMLab)

**General Description of the Activity**

The Laboratory of Measurement and Modelling of Sustainability (Summer Lab) is a multidisciplinary research group dedicated to the measurement and modelling of the multiple branches of the science of sustainability, formed by teaching and research staff of the Polytechnic University of Catalonia.

The Summer Lab was born in 2009 and its activities are guided by its vision, mission and core values.

**Vision:** A world where social and ecological systems are understood and managed with the aim of improving the welfare of humanity to favour the sustainable co-evolution of human civilization and the biosphere.

**Mission:** To advance in the understanding of the complexity of social and ecological systems. Generate knowledge oriented to develop and apply management practices, governance and sustainable technologies through research and the transfer of international and transdisciplinary technology that integrate the different sciences (social, natural, technological, etc.). Promote scientific communication and meetings for the development of science within the paradigm of sustainability.

**Specific Areas of Research in Energy Field**

The research of SUMMLab group is based on a very specific line of research that is a measure of the sustainability and modelling of socio-ecological systems.

The research programs that are derived use: econometrics, systems dynamics, agents, complex networks and Geographic Information Systems (GIS) to develop specific research projects.

The following activities define the priorities currently pursued by SUMMLab Group:

- Optimization of technological infrastructures.
- Impact of climate change on economic activities.
- Intra- and trans-generational sustainability of social security systems.
- Calculation of emissions, prospective and energy plans.

**Competitive Projects**

A current project to be highlighted in the energy field is:

**CLIMTOUR Operational climate service for European tourism operators**

Amount: 50.220,00 €

| Competitive Project 1 | Enhancing Entrepreneurship, Innovation and Sustainability in Higher Education in Africa (EEIS-HEA). EACEA. TEC2013-41315-R DISNET. Amount: 999.849,00 € Start date: 2018-01-01; End date: 2020-12-31 |
| Competitive Project 2 | H2020-642201-OptimOre. Amount: 1.118.890,00 €; Start date: 2014-12-01; End date: 2018-02-28 |
KEY WORDS

- Climate Change
- Complex networks
- Ecodesign
- Energy
- Energy plan
- Lifecycle
- Renewable energy
- Sustainability
- Water

RESEARCH TEAM

- Alvarez Del Castillo, M. Dolores
- Felipe Blanch, Jose Juan de
- Garrido Soriano, Nuria
- Molins Duran, Gemma
- Morato Farreras, Jordi
- Rosas Casals, Marti

CONTACT

✉ C/ Colom, 1. Campus de Terrassa, Building TR1, 08222, Terrassa (Spain). Phone: (+34) 93 739 80 60
✉ Person in charge: Rosas Casals, Marti – marti.rosas@upc.edu / rosas@mmt.upc.edu
TRANSMAR

Research Centre/Group

Name: TRANSMAR – Research Group on Maritime Transport and Logistics
Web: https://futur.upc.edu/TRANSMAR

General Description of the Activity

TRANSMAR group is engaged in viability study of marine transport chains, compared with the road alternative. It is involved in exploring new tools and areas, to promote sea transport from different points of view like the operational, legal and economical, sides.

Specific Areas of Research in Energy Field

The following activities define the priorities currently pursued by TRANSMAR Group:

- Analysis of costs and the environmental impact of maritime routes based on optimization algorithms (specifically in short sea shipping lines), in order to reduce road congestion and pollution. The route optimization algorithm considers, among other things, the meteorological conditions of the route, ship's costs and polluting emissions.

- Analysis of the characteristics of ship manoeuvring (distance from the pier wall, distance from the propellers to the bottom, use of the stern or bow thruster) and obtaining a formulation that allows the ship’s physical characteristics to be related to the evolution of the erosion generated in the docks to be able to anticipate the damages in the structures.

- Sustainability of maritime transport

Competitive Projects

A current project to be highlighted in the energy field is:

Energy efficiency and environmental matters

Amount: 11.027,00 €

| Competitive Project 1 | DAME: Data Alternative for Marine Efficiency monitoring: overcoming constraints in the development of an on-board fuel data collection scheme. IAMU FY2016 C-70008. Amount: 60.000,00 € Start date: 2016-04-01; End date: 2017-05-05. |

Key Words

- Maritime transport
- Short sea shipping
- Port logistics

Research Team

- Boren, Clara
- Castells Sanabra, Marcel.la
- Martinez De Osés, Francisco Javier
- Ortigosa Barragán, Inmaculada
Plaça Pla de Palau, 18. Facultat de Nàutica de Barcelona, Building NT1, 08003, Barcelona (Spain).
Phone: (+34) 93 401 79 32. E-mail: cen@fng.upc.edu
Person in charge: Martinez De Osés, Francisco Javier – fmartinez@cen.upc.edu
WNG

RESEARCH CENTRE/GROUP

Name: WNG – Wireless Networks Group
Web: https://futur.upc.edu/WNG

GENERAL DESCRIPTION OF THE ACTIVITY

The group studies protocol architectures for third- and fourth-generation mobile systems, the fourth generation being that in which most communications will be wireless, Internet will be ubiquitous and it will be possible for all devices to be connected to the Internet. The crucial aspects to be studied in the field of protocol architecture design and evaluation are as follows:

- To increase the capacity of radio systems so that they can process large amounts of traffic and high-speed traffic.
- To analyse the capacity of radio systems. The aim is to analyse, in a realistic environment, the capacity of protocols that enable the radio medium to be shared, in order to maximise the capacity of the system and offer quality of service.
- To study protocols that enable the autoconfiguration of a network, including studying ad-hoc routing protocols, resource discovery and autoconfiguration.
- To design localisation techniques for 2G and 3G mobile communication networks and WLAN networks (A-GPS, E-OTD, OTDOA...)

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

The Wireless Networks Group (WNG) develops its research and consulting activities in several areas including mobile communications, heterogeneous networks, mesh and ad-hoc networks, sensor networks, etc.

The group has participated in a number of national and international projects.

The current research interests of the WNG are the following ones:

- To develop new communication paradigms in the sensor networks context, which could be extended and generalized, to contribute to the new global networks.
- To offer solutions to extend traditional networks (either fixed or mobile ones) to any place, in any time. The goal is to provide technical solutions to enable the ubiquitous Internet.

It must be noted that the group’s research work is mainly based on the development of real testbeds and specific platforms that allow dissemination and technology transfer to the companies.

COMPETITIVE PROJECTS

A current project to be highlighted in the energy field is:

Programmable Infrastructure Converging disaggregated neTwork and compUte Resources

The explosive growth of mobile internet traffic introduces the need to transform traditional closed, static and inelastic network infrastructures into open, scalable and elastic ecosystems supporting new types of connectivity, high mobility and new mission-critical services for operators, vendors and vertical industries. 5G-PICTURE will develop and demonstrate a converged fronthaul and backhaul infrastructure integrating advanced wireless and novel optical network solutions. Due to address the limitations of the current D-RAN
and C-RAN approaches, 5G-PICTURE will exploit flexible functional splits that can be dynamically selected, to optimise resource and energy efficiency. **Amount: 100,625.00 €**

|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**KEY WORDS**

- Automotive
- Communication protocol
- Energy Saving
- Home Automation
- Industry 4.0
- Internet
- Mobile networks
- Power Savings
- Protocols Internet
- Routing Protocols
- Sensor networks
- Smart Cities
- Smart metering
- Standardization
- Telecommunication Equipment
- Telecommunication Operator
- Wi-Fi
- Wireless Networks

**RESEARCH TEAM**

- Aizcorreta Carcedo, Aitor
- Calveras Auge, Ana M.
- Casademont Serra, Jordi
- Casals Ibañez, Lluis
- Cervià Caballé, Martí
- Demirkol, Ilker Seyfettin
- Garcia Villegas, Eduard
- Gomez Montenegro, Carlos
- Lopez Aguilera, Maria Elena
- Paradells Aspas, Jose
- Ruiz De Azúa Ortega, Juan Adrián
- Vidal Ferre, Rafael

**CONTACT**

- **C/ Jordi Girona, 1-3. Campus Nord, Building C3, 08034, Barcelona (Spain).**
- **Person in charge: Calveras Auge, Ana M. – anna.claveras@entel.upc.edu**
4. OTHERS

EXPLORATORI- Natural Resources

**Research Centre/Group**

Name: EXPLORATORI Natural Resources
Web: https://www.exploratori.org/

**General Description of the Activity**

EXPLORATORI- Natural Resources is a territorial project of the Campus of International Excellence BKC (Barcelona Knowledge Campus) of the Universitat Politècnica de Catalunya in conjunction with the City Hall of Berga.

The aim of the project is to promote the scientific and technological vocations, improving the learning to secondary and higher education and to contribute to the development of a territory rich in natural resources.

Moreover, the objective is to evaluate the impact of all actions, which must allow them to check their effectiveness. The activities that are carried out have as a backbone the use of the resources of nature, in order to demonstrate that they are the foundation of everything that surrounds us in our daily lives.

"Explora" means discovering and experimenting, which are two fundamental features of the activities carried out by EXPLORATORI, always complemented by theoretical background.

**Specific Activities in Energy Field**

- **Explora Courses:**
  Explora Courses are activities focused on offering to the participant the opportunity to participate and know research projects that are being carried out, doing experiments related to the resources offered by the nature. These courses combine theoretical classes with field trips.

- **Nature Summer Catalan University:**
  Concentrated Explora courses during July.

- **Knowledge Marketplace:**
  The Knowledge Marketplace aims to present the leading research projects related to the science and technology of the Universitat Politècnica de Catalunya (UPC) and of the different research centres. The aim is to increase the interest of young people on research in order to awaken scientific vocations and to show that science is everywhere.

- **Young Talent Forum of Catalonia:**
  The Main objective of this Forum is to award the best pre-university students of Catalonia. The ultimate goal is the incentive of science and technology among young people of the secondary school.

- **SAVEnergy:**
  It promotes energy saving at home. The main objective of this project is to carry out actions aimed at young people at secondary schools in order to calculate energy saving in their institute and in their own homes.

- **European Projects:**
  **Science Girls:** Why girls leave so prematurely the option to work on a science and technologic fields?
  The project find solutions to this question.
  **Open Science Schooling:** This project teach high school students to identify science in the closet environment (our town and cities).
• STEAM Working Day

KEY WORDS

• Environment
• Natural resources
• Science-technology
• STEAM
• Teaching / learning methodologies

RESEARCH TEAM

• Gorchs Altarriba, Roser
• Grau Vilalta, Maria Dolors
• Prieto Marquez, Kelly
• Torra Bitloch, Immaculada

CONTACT

✉ Av/ Bases de Manresa, 61. 08242, Manresa (Spain).
✉ Person in charge: Grau Vilalta, Maria Dolors – dolors.grau@upc.edu
INLAB – FIB UPC

RESEARCH CENTRE/GROUP

Name: INLAB – Laboratory of the Barcelona School of Informatics
Web: https://inlab.fib.upc.edu/ca

GENERAL DESCRIPTION OF THE ACTIVITY

InLab FIB UPC is a research and innovation laboratory that is specialized in applications and services based on the latest ICT technologies. InLab has over 30 years of experience collaborating in various projects and creating customized solutions for public and private institutions and organizations.

SPECIFIC AREAS OF RESEARCH IN ENERGY FIELD

- **Analysis, data processing and Big Data**: Smart Data. Methods and statistical techniques for analysing and processing data and their interoperability: data mining, advanced statistical analysis, measurement of intangibles, Open Data, integration, fusion and processing of large volumes of data, control panels, etc.

- **Smart Cities**: Modelling and simulation of energy efficiency in buildings and transport, Smart Mobility (public transport systems, traffic management, dynamic guide applications and services, traffic and mobility data processing).

- **Mobile applications and GIS**: Mobile applications for geoservices in areas such as transport, sports and health. Systems based on OpenStreetMap for monitoring and guiding vehicles or people. Alarm service based on position. Applications with augmented reality and mobile multimedia. Security of mobile applications.

- **Modelling, simulation and optimization**: Feasibility studies and/or improvements to systems and processes using modelling, simulation and optimization techniques applied to transport, manufacture, logistics, industrial processes or emergency systems. Simulation applied to the social sciences and environmental systems.

- **ICT environments and services to support learning and university management**: Learning Analytics, learning support environments based on ICT tools, information systems for university management, computer laboratories and the development of mobile applications. Systems for measuring and analysing learning results, monitoring mechanisms and improvements to training activities.

- **ICT security and infrastructure**: Information security (audits, forensic analysis, monitoring of networks), development of systems for detecting malware and electronic fraud, infrastructure management, high availability, resilience, server virtualization and other leading technologies in security, infrastructures and services.
**Collaborative internet:** Website environments and architectures, applications distributed on the internet, collaborative and social intranet, multimedia information systems, integration with social networks and technologies to ensure security, accessibility, interoperability and integration of systems.

### RESEARCH TEAM

| Albert Abelló | Gonzalo Abril | Manel Medina |
| Albert Obiols | Ignacio Herranz | Manel Rodero |
| Albert Renom | Iwona Maciejewska | Mari Paz Llinares |
| Alejandro Carlos Nalda | Jaime Arjona | Maria Cuatrecases |
| Alex Catalan | Jaume Barceló | Maria Ribera Sancho |
| Anna Casas | Jaume Figueras | Mario Albo |
| Antoni Guasch | Jaume Moral | Mathias Bertorelli |
| Antonia Gómez | Jordi Casanovas | Oscar Romero |
| Antonio Cabañete | Jordi Francisco Crespo | Pau Fonseca |
| Antonio Rodríguez | Jordi Guibernau | Rosa Maria Martin |
| Carla Divi | Jordi Montero | Sandra Marsà |
| Cristina Morales | Jordi Reñé | Susana Francisco |
| Dani Sànchez | Josep Casanovas | Tomàs Aluja |
| Elvira Pallàs | Josep de Cid | Xavier Oriol |
| Ernest Teniente | Josep Ramon Herrero | |
| Esteve Codina | Juan Salmeron | |
| Ferran Sabaté | Lidia Montero | |

### CONTACT

✉️ C/ Jordi Girona, 1-3, Campus Nord. Building B6. 08034, Barcelona (Spain). Phone: (+34) 93 401 69 41 / E-mail: inlab@fib.upc.edu
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<th>Topic</th>
<th>Number of UPC Research groups linked to this topic</th>
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Percentage of projects related to energy on the total of projects for each research group