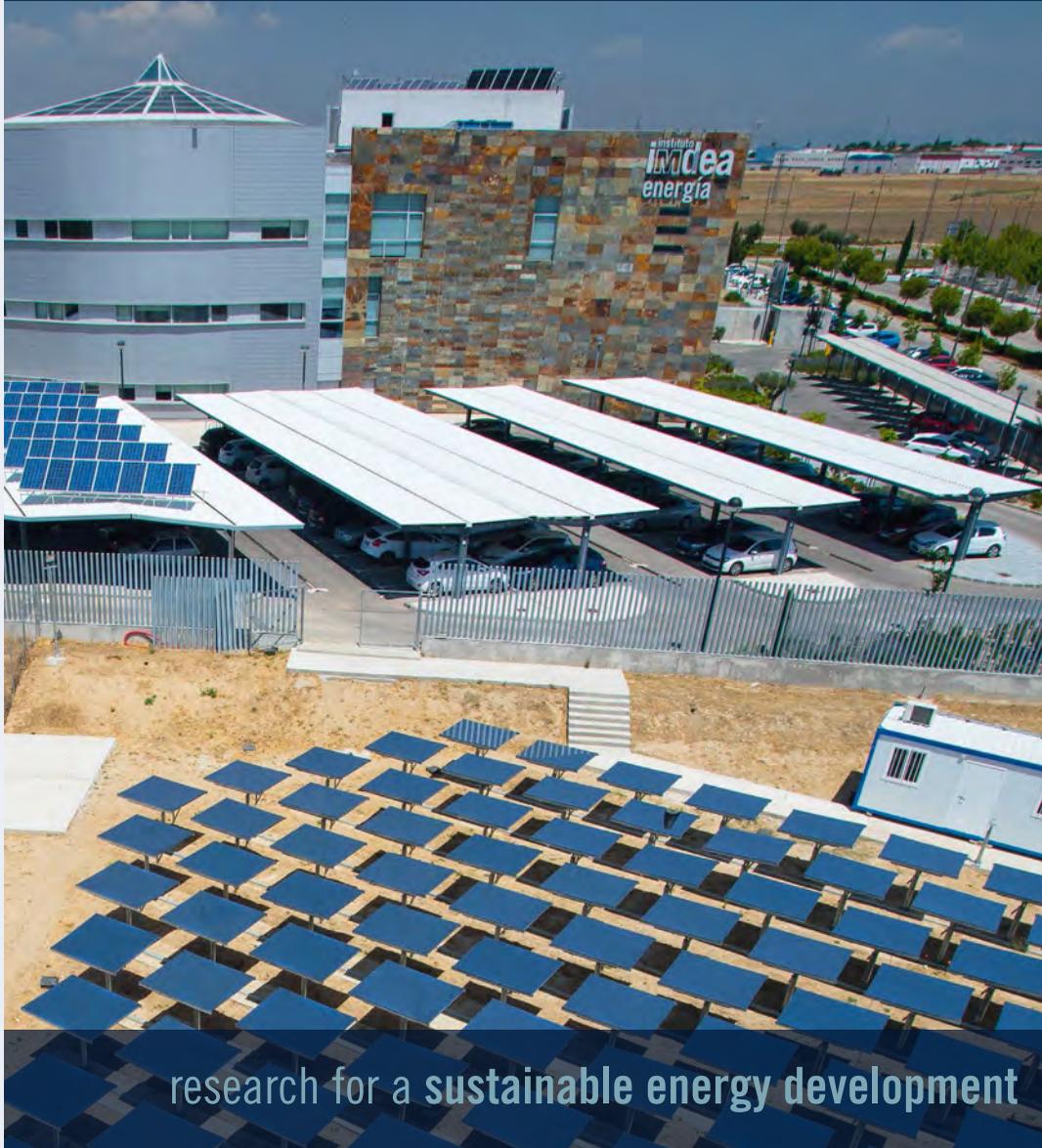


annual report

2020

www.energy.imdea.org

imdea energy institute



research for a sustainable energy development





David Serrano

Director of IMDEA Energy
Móstoles, September 2021

As everywhere, the COVID19 pandemic has strongly impacted the IMDEA Energy activities during the year 2020. Our facilities were almost completely closedown from mid-March through mid-June, whereas important restrictions were imposed thereafter limiting the face-to-face work and promoting telecommuting. In addition, a variety of health safety measures were adopted to prevent any coronavirus transmission within the Institute. As soon as the national lockdown declined at the end of June, the experimental activity gradually started and already in summer the most relevant experimental commitments in projects and also in key contracts with companies could be realized.

Travel limitations negatively affected the exchange of researchers with other institutions, although a reasonable number of visiting scientists were hosted by IMDEA Energy. Likewise, compared to previous years, the cancellation of many scientific events led to a sharp decrease in the communications presented in conferences, congresses and workshops, the remaining ones being celebrated in on-line form. While the total number of personnel working at IMDEA Energy was kept almost constant, a significant reduction took place in respect to the students collaborating with the different research units, also due to the strong limitations for carrying out face-to-face activities.

However, in spite of those negative impacts of the pandemic, the most important indicators of the IMDEA Energy performance were improved during 2020:

- Thus, the total number of projects/contracts active along the year reached a new maximum (up to 82). In particular, I would like to point out that as many as 18 international projects were running and contributed with about 50% of the total external funding. In the same way, the collaborations and technology transfer activities with the industry were reinforced, as denoted by the 31 contracts signed with companies and the development of 8 industrial projects. In overall, the incomes generated by these projects/contracts, as well as from personnel grants, provided a self-funding ratio over 50%.

- In the same way, the scientific productivity in terms of indexed scientific publications in the form of articles/reviews was sharply increased in comparison with previous years passing from 85 in 2019 to 103 in 2020. This improvement was also reflected in the quality of the journals of those publications with a Q1 share of 88% according to SCIVAL.

- Other aspect to be highlighted is the reinforcement of the outreach activities. In particular, it was intensified the use of the Institute's website and social networks for posting news about our achievements, which allowed a sustained growth in the number of IMDEA Energy followers.

A remarkable fact was that in 2020 IMDEA Energy received the "María de Maeztu" recognition as an excellent research unit, awarded by the Spanish Ministry of Science and Innovation. This relevant achievement implies that our Institute becomes member of the prestigious SOMM alliance, receiving during a four-year period (2020-2023) additional funding aimed to consolidate its top position at both national and international rankings. The topic proposed to be developed in the "María de Maeztu" Strategic Research Programme is focused on sustainable mobility with the aim of reinforcing a variety of research lines, such as new concepts of electromobility, the production of solar fuels and green hydrogen, as well as of fourth generation transport fuels to be applied.

In summary, I am really proud to state that IMDEA Energy has successfully overcome most of the negative effects of the pandemic, maintaining a high degree of operability thanks to the great effort and commitment of researchers, technicians, administration and management personnel. Accordingly, and in spite of the great current uncertainty, we are facing the future challenges with optimism and unmitigated motivation.



words from the director...

annual report
2020
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editor
imdea energy institute

graphic design
base 12 diseño y comunicación

D.L.
M-13736-2020

contents

6	about us	IMDEA Energy Unit of Excellence “María de Maeztu”	8
10	our structure		
		in figures	12
14	cooperation		
		networking	16
18	research lines	scientific facilities	20
22	research units		
		annex	72
		R&D projects, contracts and grants	73
		scientific results	95
		training and dissemination activities	112

contents



The IMDEA Energy Institute is a research centre created by the Regional Government of Comunidad de Madrid in the year 2006 that operates as a non-profit foundation. The Scientific Programme of the IMDEA Energy Institute aims at contributing to the future establishment of a sustainable and decarbonised energy system, economically competitive and securing energy supply.

The IMDEA Energy Institute is committed with having a significant impact on R&D energy challenges by bringing together high quality researchers, providing them with excellent infrastructures and resources, and promoting their close collaboration with the industrial sector.



The strategic framework guiding the R&D priorities of IMDEA Energy is based on goals and priorities established by energy plans and research programmes at regional, national and international levels; such as the UN's Sustainable Development Goals, the Green Deal for Europe, the Clean Energy Transition Partnership, new European Strategic Energy Technology (SET) Plan with the selected

targets for 2030 and 2050; the European Research Framework HORIZON EUROPE; the National Integrated Plan on Energy and Climate; the Spanish Strategy on Science, Technology and Innovation; technology roadmaps of recognized international institutions and associations and implementation agreements of the International Energy Agency.



laboratories

The building and laboratories of IMDEA Energy Institute are located at the Technological Park of Mostoles, Madrid, over a land of 10,000 m².

Research topics

Production of sustainable fuels

Concentrated solar power

Energy storage

Smart management of electricity demand

Energy systems with enhanced efficiency

Valorization of CO₂ emissions

Techno-economic evaluation of energy systems

The excellent R&D capabilities and the first class research facilities make IMDEA Energy the ideal partner for companies, research centres and universities

The building has been awarded with the prestigious LEED Gold Certificate and the A Energy Efficiency Certificate.



building

- 8 scientific labs
- 2 pilot plants
- 1 solar field
- office work areas and an auditorium

IMDEA Energy

Unit of Excellence “María de Maeztu”

The sustained policy of IMDEA Energy, towards the excellence in the recruitment of talented researchers, the selection of cutting edge lines of research and the implementation of worldclass singular scientific facilities has been awarded in 2020 with the accreditation as Unit of Excellence “María de Maeztu” by the National Agency of Research of the Spanish Ministry of Science and Innovation.

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- The evaluation, conducted by an independent international committee composed of prestigious scientists, has recognized the outstanding position of IMDEA Energy at international level in terms of scientific results, innovation capacity and close cooperation with industry.
- The implementation of the program of work associated to the development of the Unit of Excellence “María de Maeztu” entails the establishment of a specific strategic research plan with the incorporation of 12 postdoctoral and 8 predoctoral researchers within a period of 4 years.
- Three new lines of research on the field of decarbonization of transport sector are launched under the “María de Maeztu” program of work, aiming at contributing to the ambitious targets on carbon-neutral transport by 2050:
 1. New concepts for electromobility
 2. Production of solar fuels and hydrogen
 3. Production of sustainable fourth generation fuels, from residues and wastes

In 2020 it has been implemented a Governance and supervision model to enhance the current indicators of excellence of the Institute, with the following operational committees:

- Executive Committee of the MdM for the supervision of the Strategic Plan of the MdM Excellence Unit and the monitoring of indicators.
- Training and Mobility Committee to supervise the training and mentoring program, the organization of internal workshops and the stays of IMDEA Energy researchers in other research centers.
- Exploitation and Dissemination Committee, to develop the IPR strategy and technology transfer, the dissemination and communication activities.
- Internationalization Committee, to strengthening the links with international centers of excellence, the presence in international networks and the exchange of researchers.
- Human Resources Committee, which supervises the hiring and incorporation procedures, the professional career development and promotes reconciling family life and gender balance.
- Ethics and Claims Committee, to solve conflicts, managing complaints and claims and establishing an ethical code and a manual of good practices.
- Health and Safety Committee, as the responsible for the health and safety plan, the emergency plan and to supervise the protection systems.
- Research Infrastructures and Resources Committee, which supervises the research infrastructures, bibliographic resources and information search tools.

our structure



Responsible of managing and dealing with the main business administration and scientific activities of the Institute.



THERMOCHEMICAL PROCESSES UNIT

ELECTROCHEMICAL PROCESSES UNIT

BIOTECHNOLOGICAL PROCESSES UNIT

HIGH TEMPERATURE PROCESSES UNIT

ELECTRICAL SYSTEMS UNIT

PHOTOACTIVATED PROCESSES UNIT

SYSTEM ANALYSIS UNIT

ADVANCED POROUS MATERIALS UNIT

- Financial management and human resources.
- Project management.
- External relationships and technology transfer.
- Infrastructure and facilities management.
- Health and safety.
- Central research laboratories and resources.
- Dissemination and communication.

BOARD OF TRUSTEES

The highest decision-making body responsible of the government, representation and administration, aiming to ensure the achievement of the established goals.

Prof. Dr. Martin Kaltschmitt
President of the Foundation
Full Professor of the Institute for Environmental Engineering and Energy Economics
Hamburg University of Technology, Germany

Mr. Eduardo Sicilia
Vice-president of the Foundation
Regional Minister of Science, Universities and Innovation
Comunidad de Madrid, Spain

REGIONAL ADMINISTRATION REPRESENTATIVES

Mrs. María Luisa Castaño
General Director of Research and Technological Innovation
Comunidad de Madrid, Spain

Mrs. Irene Delgado
General Director of Universities and Artistic Education
Comunidad de Madrid, Spain

Mrs. Bárbara Fernández-Revuelta
Deputy General Director for Research
Comunidad de Madrid, Spain

Mr. José de la Sota
Scientific and Technical Coordinator
Fundación para el Conocimiento madri+d
Comunidad de Madrid, Spain

INSTITUTIONAL TRUSTEES

Prof. Dr. Juan Antonio Melero
Vice-Rector of Innovation and Technology Transfer
Rey Juan Carlos University, Spain

Prof. Dr. Máximo León
Professor of Applied Physics
Autónoma University of Madrid, Spain

Prof. Dr. Carlos del Cañizo
Director of the Solar Energy Institute
Polytechnic University of Madrid, Spain

Dr. Carlos Alejaladre
General Director
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT
Spain

IMDEAS TRUSTEES

Prof. Dr. Arturo Romero
Emeritus Professor of Chemical Engineering
Complutense University of Madrid, Spain
(appointed by IMDEA Water)

Prof. Dr. Paula Sánchez
Full Professor of Chemical Engineering
Castilla – La Mancha University, Spain
(appointed by IMDEA Materials)

SCIENTIFIC TRUSTEES

Prof. Dr. Manuel Berenguel
Full Professor of the Department of Computing Sciences
University of Almería, Spain

Dr. Francisco Girio
Coordinator of the Bioenergy Unit
National Laboratory of Energy and Geology
Portugal

Prof. Dr. Antonio Monzón
Director of the Chemical Engineering and Environmental Technologies Department
University of Zaragoza, Spain

Dr. Rufino Navarro
Scientist
Institute of Catalysis and Petrochemistry, CSIC
Spain

EXPERT TRUSTEES

Dr. José Jacinto Monge
Rey Juan Carlos University, Spain

Mr. Juan Manuel García
AENOR, Spain

COMPANIES TRUSTEES

Ms. Adriana Orejas
Repsol, S.A.
Director of Downstream Technology Projects
Spain

Mr. Agustín Delgado
Iberdrola España, S.A.U.
Director of Innovation and Sustainability
Spain

Mr. Vicente Alvarado
Empresarios Agrupados Internacional S.A.
Director of Engineering
Spain

SECRETARY

Mr. Alejandro Blázquez
Consultalia
Spain

SCIENTIFIC COUNCIL

Advisory body responsible of the elaboration of the scientific programme and of the establishment of the goals to be achieved by periods of four years as well as of the assessment of the annual performance.

Prof. Dr. Martin Kaltschmitt
Full Professor of the Institute for Environmental Engineering and Energy Economics
Hamburg University of Technology, Germany

Prof. Dr. Antonio Monzón
Director of the Chemical Engineering and Environmental Technologies Department
University of Zaragoza, Spain

Dr. Carmen M. Rangel
Research Coordinator
National Laboratory of Energy and Geology, Portugal

Prof. Dr. Aldo Steinfeld
Full Professor of Renewable Energy Carriers at the ETH
Zurich, Switzerland

Dr. Francisco Girio
Coordinator of the Bioenergy Unit
National Laboratory of Energy and Geology, Portugal

Prof. Dr. Michael Froeba
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Department of Applied Inorganic Chemistry
University of Hamburg, Germany

Prof. Dr. Manuel Berenguel
Full Professor
Department of Computing Sciences
University of Almería, Spain

Dr. José A. Olivares
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Prof. Dr. Gumersindo Feijoo
Full Professor of Chemical Engineering
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Scientist
Institute of Catalysis and Petrochemistry, CSIC, Spain

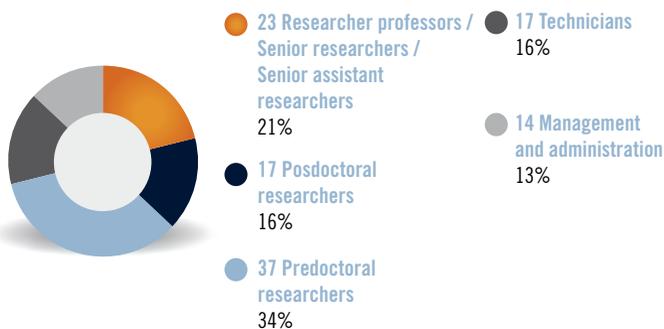
in figures

IMDEA Energy is firmly committed to the objective of providing the Institute with a world-class staff and prestigious researchers. Accordingly, the Institute is developing from the beginning a selective process for the recruitment of scientists.

human resources



Human resources distribution by the 31st of December of 2020



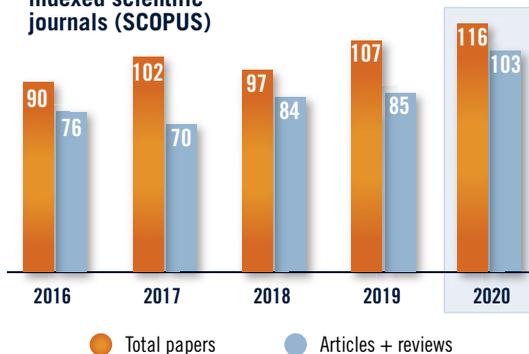
24 students in connection* with the IMDEA Energy Institute in 2020 within the framework of educational cooperation agreements

Mobility actions in 2020*

1 secondment of Imdea Energy researchers
19 visiting researchers

* There has been a notable reduction compared to previous years due to the COVID-19 pandemic.

Publications in indexed scientific journals (SCOPUS)



2020

23 congress communications, 6 invited conferences and 22 poster communications.

33 Ph.D. thesis under development and 6 Ph. D. thesis defended.

3 new patents applied.

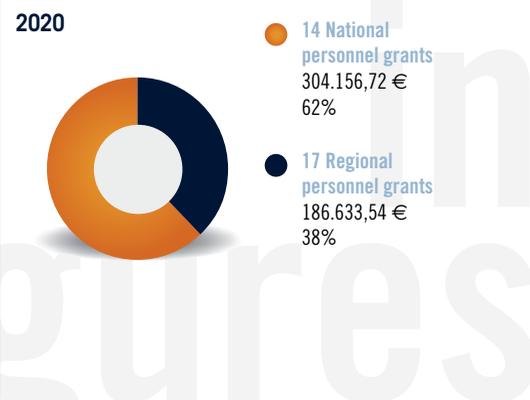
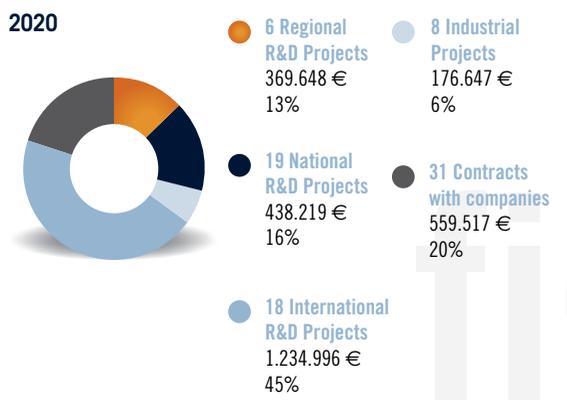
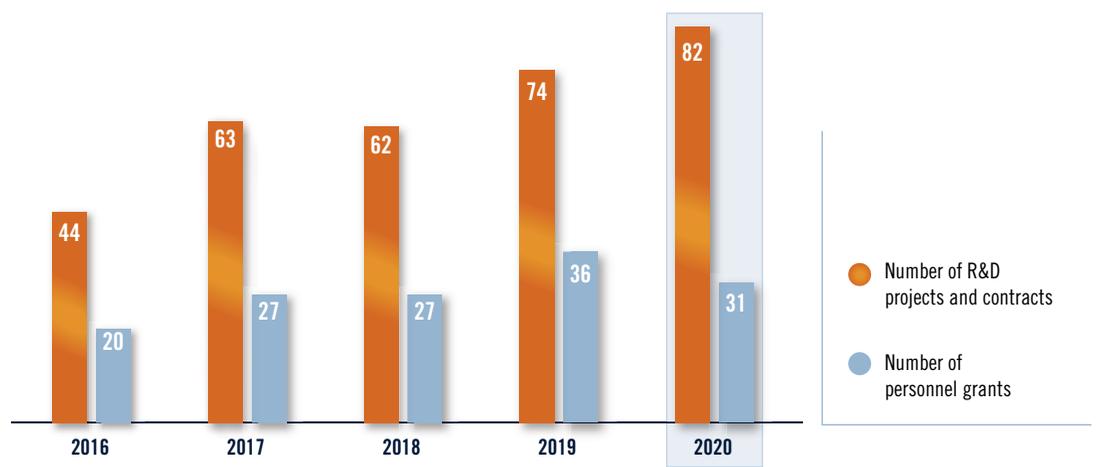
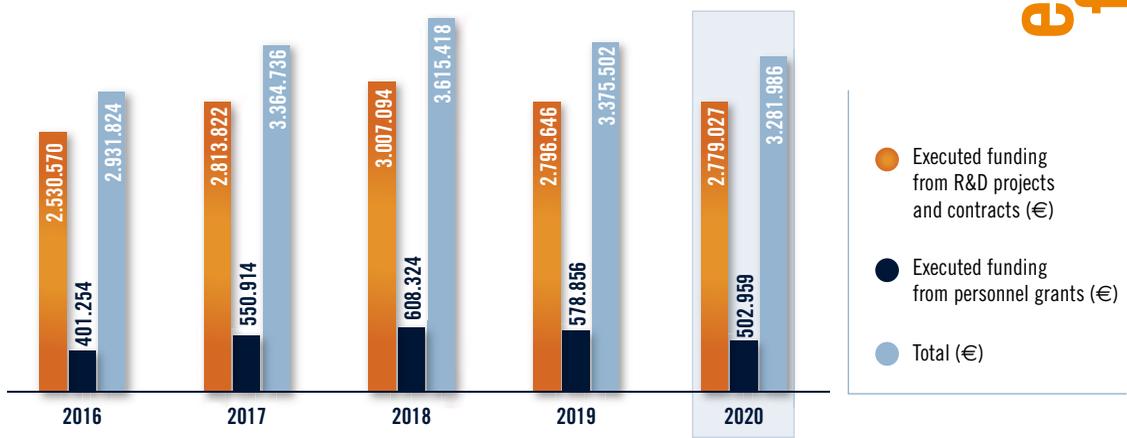
R&D results



The portfolio of the Institute research projects is characterized by its diversity in terms of funding source, being remarkable the high degree of collaboration with industries and research institutions of the energy sector.

Along the year 2020 the Institute was hosting two Consolidator Grants awarded by the European Research Council with a total budget of 4.5 M€.

external funding



figures

cooperation

IMDEA Energy collaborates with universities and research centers worldwide, both within the framework of research projects and for the development of educational programs. Cooperation with industry in collaborative projects of R&D and innovation is one of the key objectives of the IMDEA

Energy Institute. Because of that, the Institute has maintained an intense activity with the aim to promote collaboration with industrial partners and a strong presence in networks and international platforms with participation of companies.

COOPERATION WITH COMPANIES 2020



In 2020, more than 100 meetings were held with companies related to the energy sector and covering the entire spectrum of sizes and business areas. In addition, IMDEA Energy has intensified all activities related to communication and outreach, giving highest priority to the presence and visibility of the Institute during the pandemic by posting news on the web and social media with more than 3,600 followers, submitting press reports and disseminating 4 editions of the newsletter aimed to more than 1,800 subscribed professionals and stakeholders.



COOPERATION WITH RESEARCH INSTITUTIONS 2020

Logos of research institutions: INP, Cirs, GORD, SuperGrid Institute, IBERDROLA ESPAÑA, HIU, LEI, iit, VTT, CSIC, Ciemot, Fraunhofer, ICIQ, ARCES, INRAE, POLYMAT, INSA, DLR, ENEA.

COOPERATION WITH UNIVERSITIES 2020

Logos of universities: Universidad Rey Juan Carlos, Universidad de Alcalá, USC, Imperial College London, Universidade Federal do Ceará, UNED, Universidad de Burgos, Université de Nantes, Universidad Carlos III de Madrid, Universidad Pontificia Comillas, Universiteit Leiden, Università degli Studi di Salerno, DTU, Universidade da Coruña, Universiteit Antwerpen, Technische Universität Hamburg.



networking

IMDEA Energy Institute considers as a relevant activity the active participation in associations, technology platforms, expert groups and alliances of the energy sector. This is also a means of increasing the external visibility of IMDEA Energy Institute, establishing new links with companies and research institutions and to gain updated information on the initiatives being planned and launched related to the different energy topics.



The following lists summarizes the main associations in which IMDEA Energy Institute has participated as a member in 2020:

NATIONAL



INTERNATIONAL



network

research lines

Energy storage coupled to renewable energy and transport



Technologies and systems for the storage of energy enabling the increased penetration of renewable energies and the distributed generation of electricity.

Electrochemical energy storage

- Nanostructured materials for electrochemical capacitors and advanced batteries.
- Electrochemical capacitors with high energy density.
- Low-cost redox flow batteries.
- Development of testing protocols for batteries and super-capacitors.

Thermal and thermochemical energy storage

- Phase change materials (PCM) with macro-encapsulated structures and storage systems for solar thermal power plants and industrial waste heat recovery.
- Thermal energy storage with gas/solid systems in thermoclines and moving bed exchangers.
- Thermochemical storage systems making use of high temperature redox reactions.

Production of sustainable fuels



Biofuels, alternative fuels and bioproducts aiming at the decarbonisation of the transport sector.

- Biofuels and bio-products from microalgae carbohydrates.
- Biofuels via fast pyrolysis or catalytic pyrolysis of lignocellulose biomass and residues.
- Upgrading of bio-oils by catalytic hydrodeoxygenation processes.
- Development of CO₂-free fuels by solar driven thermochemical cycles.
- Solar fuels production by artificial photosynthesis.
- Valorization and dehalogenation of plastic wastes.

Concentrated solar power

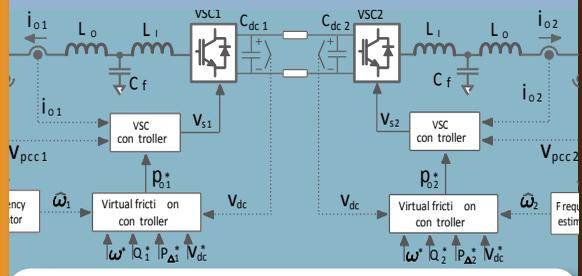


Efficient and dispatchable solar concentrating technologies for power generation, industrial process heat and production of solar fuels and chemicals.

- Optical design of modular schemes for solar thermal power plants.
- Solar receivers and reactors for new heat transfer fluids.
- Solar technologies for fuels and chemicals production with CSP.
- Increasing solar-to-electricity conversion efficiency and dispatchability.



Smart management of electricity demand



Management, reliability and stability aspects of future electricity networks and new algorithms for demand management and renewable integration.

- Demand forecasting and network management algorithms.
- Reliability of power systems with high penetration of renewables.
- Building and residential demand modelling.
- Distribution network applications and services.
- Power electronics and power interfaces.

Energy systems with enhanced efficiency



Technologies and strategies for efficient end-use of energy in buildings, industrial processes and environmental applications.

- Control systems and algorithms for energy efficiency in industrial applications.
- Capacitive deionization for energy efficient water treatment.
- Solar heat for medium and high temperature industrial processes.
- Integration of renewable energy technologies in buildings.

Valorization of CO₂ emissions



CO₂ valorization routes by its transformation into high-demand valuable products.

- CO₂ photoreduction for energy storage and fuels production.
- Multifunctional materials and solar reactors for photoactivated processes.
- Thermo-catalytic routes for CO₂ transformation in industrial processes.

Techno-economic evaluation of energy systems



Sustainability assessment, optimisation of processes and modelling for energy planning.

- Process simulation and optimization.
- Life cycle management, sustainability and social aspects.
- System modelling and technology roadmapping.

research lines

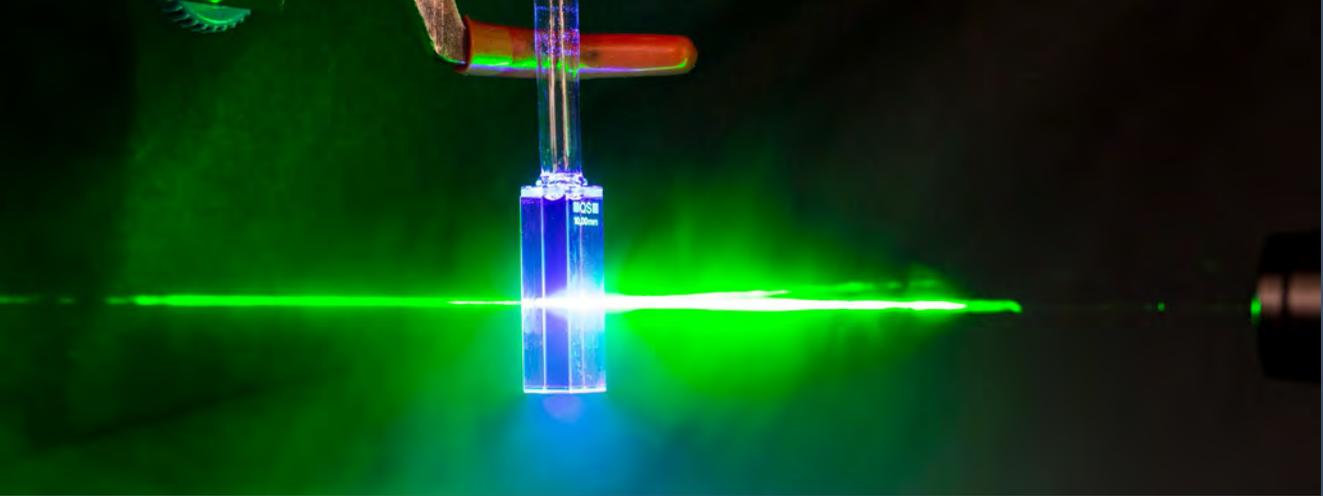
scientific facilities

Instrumental Techniques

- Chemical characterization techniques: mass spectrometry; gas/mass chromatography; NO_x chemiluminescence analyzer; pyrolyzer / gas chromatography- mass spectrometry (Py/GC-MS); elemental analysis ICP – OES; AOD decomposition system (calorimetric pump) and CHONS.
- Thermogravimetric analysis (TG-DTA) in an oxidising (air), inert (Ar) or reductive (10% H₂/Ar) atmosphere.
- Properties of solids: textural and chemisorption.
- X-ray diffraction with PDF structural analysis and controlled atmosphere chamber up to 900 °C and 10 bar.
- Spectroscopy: IR (DRIFT, ATR and VEEMAX), UV-vis-NIR, Raman and fluorescence.
- Thermal diffusivity determination.
- Microscopy: atomic force with next probe, SEM scanning electron and optical.
- Biotechnological characterisation techniques: GC, HPLC equipped with different columns and detectors (IR, MS, UV-VIS, HPAEC-PAD). Electrophoresis instrumentation for recombinant DNA technology, protein purification and analysis.
- Near-ambient pressure (NAP) XPS which allows the in-situ characterisation of photocatalytic processes under illumination at different gas atmospheres and pressures up to 25 mbar.



scientific facilities



Simulation and Modelling Tools

- Aspen Plus for chemical process analysis and optimization.
- SuperPro Designer: simulation of biochemical processes.
- EBSILON Professional for simulation of thermodynamic cycle processes and power plants.
- STEC/TRNSYS for dynamic simulation of solar thermal power plants.
- Simapro 7.2 Professional for life cycle assessment (LCA) and carbon footprinting.
- GaBi Professional and DEA-Solver Pro for sustainability analysis.
- LEAP software for energy planning and thermal fluid dynamics.
- Matlab-Simulink for process simulation and data processing.
- PLECS: simulation of circuits in power electronics.
- LabVIEW for data acquisition, process control and calorimetric loops.
- SolidWorks for computer-aided design.
- COMSOL Multiphysics for CFD analysis.
- Tracepro for ray tracing simulation of solar systems.
- Chemcraft, GAUSSIAN® and VASP® for computational chemistry.
- Digsilent PowerFactory for modelling and simulation of power systems.

Pilot Plants Facilities

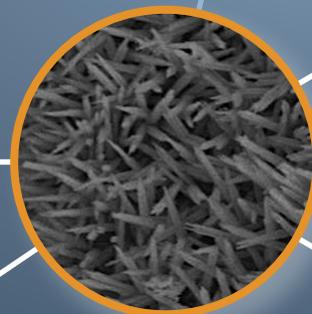
- High Flux Solar Simulator Kiran-42 with an electrical power of 42 kW that with the use of seven 6- kWe short-arc Xenon lamps is able to reach irradiances at the focal point near 4,000 kW/m² and a total power of 12 kW.
- Test bench of batteries for the programming of different test procedures and charge and discharge cycles. It allows analyzing the electrochemical devices performance, cyclability, aging and failure modes.
- Smart Grids Laboratory for the simulation of electrical systems operation, including the integration of renewable energies, storage systems and electric vehicle in order to get an efficient management of the energy resources.
- Pilot plant for the production of advanced biofuels via thermochemical transformations of biomass: catalytic pyrolysis and hydrodeoxygenation.
- Photobioreactors pilot plant which has been designed in order to compare and optimise the most common algae cultivation systems.

Solar Field

- Consisting of 169 heliostats, 3 m² each, with an experimental platform located on top of an 18 m height tower. This facility allows testing receivers, reactors and materials up to 250 kW thermal power under irradiances above 2000 kW/m².

research units

**Thermochemical
Processes Unit**



**Electrochemical
Processes Unit**

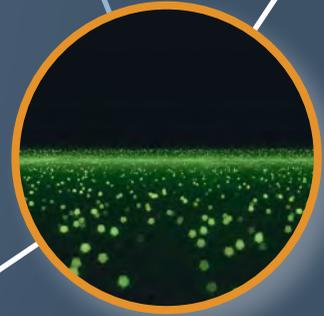


**High Temperature
Processes Unit**



**Biotechnological
Processes Unit**

**System Analysis
Unit**



**Photoactivated
Processes Unit**



**Electrical Systems
Unit**



**Advanced Porous
Materials Unit**



Thermochemical Processes Unit



Prof. Dr. David P. Serrano
Research Professor
Head of the Unit



Dr. Juan Miguel Moreno
Senior Researcher



Dr. Patricia Pizarro
Associated Senior
Researcher



Dr. Javier Feroso
Senior Assistant
Researcher

thermochemical

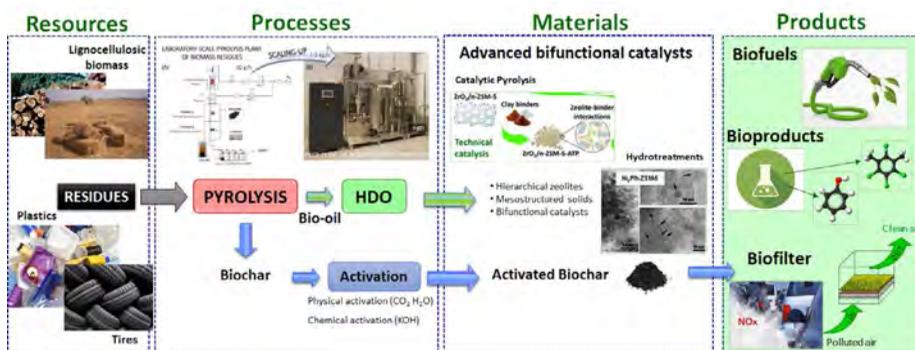


R&D Objectives

- Development of materials (mainly catalysts and redox solids) and thermochemical processes for the valorization of biomass, CO₂ and solid wastes.
- Development of sustainable biofilters from pyrolytic biochars for NOx adsorption.

Research lines

- Development of efficient thermochemical processes for the production of advanced biofuels and valuable chemical compounds from biomass wastes.
- Development of efficient thermochemical processes for the valorization of plastic and other non-renewable organic wastes.
- Valorization of pyrolysis biochars and their application as bio-filters for air decontamination (NOx) in urban environments.



Relevant projects and networking

In 2020 the TCPU has participated in 8 research projects, all of them related with the valorization of different kind of organic wastes (lignocellulose, organic fraction of municipal solid wastes, plastics and tires) into fuels, chemicals and biofilters for NO_x adsorption. The Regional Government of Madrid supports 4 projects: BIOCHARF-ILT (grant to attract young research talent), BIO3 (program for R&D Activity between Research Groups of the Community of Madrid) and 2 industrial doctorates. The national government supports 3 research projects: BIO_LIGWASTE, BIOCASCHEM and REDEFINERY. Finally, the TCPU participates in the H2020 European NONTOX project.

In addition, the Thermochemical Processes Unit (TCPU) participates in associations such as the European Energy Research Alliance (EERA) of Bioenergy, the Spanish Technological Platform of Biomass (BIO-PLAT) and the Spanish Platform of Sustainable Chemistry (SUSCHEM). Likewise, the TCPU keeps contact with several universities and research centres in Spain and Europe. In 2020, the TCPU has maintained a cooperation agreement for mobility actions with the University of Calabria (Italy) and the Federal University of Rio Grande do Norte (Brazil).

Facilities

Raw materials conditioning

- Milling and sieving of biomass, plastics and other residues.
- Oven for feedstocks drying.

Synthesis and characterization of catalysts

- Lab equipment for catalyst and materials preparation by different routes such as sol-gel, hydrothermal and coprecipitation.
- Methods for dispersing active phases on porous supports.
- Tubular muffle furnace for thermal treatment under controlled atmosphere.

Lab scale reactors for testing catalytic activity

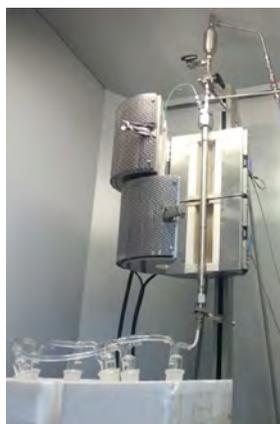
- 2 Stirred tanks high pressure batch reactors (P_{\max} 150 bar).
- 1 High pressure continuous fixed-bed reactor (P_{\max} 50 bar).
- 1 High temperature continuous fixed-bed reactor for testing redox materials (T_{\max} 1500 °C).
- Several downdraft fixed-bed pyrolysis reactors.
- 2 Upward-flow fixed-bed pyrolysis reactors.
- 1 Continuous feeding pyrolysis reactor.
- 1 micro-pyrolyzer with ex-situ catalytic reactor coupled to GC/MS.
- 1 setup for monitoring NO_x adsorption in fixed-bed biofilters.

Pilot scale reactor

- Continuous feeding fluidized bed pyrolysis reactor (max. 1.5 kg/h).
 - Fixed bed continuous flow high pressure reactor (P_{max} 50 bar).
 - Possibility to operate with both fluidized bed and fixed bed reactors connected in series or in independent modes.
- AOD decomposition system.
 - NOx chemiluminescence analyzer.
 - Gas chromatography: 1 GC-MS, 2 GC (FID, TCD), 2 μ GC, Py-GC-MS.
 - Columns and software for PIONA and paraffins GC analysis.
 - Ionic cromatography (IC).
 - Metal analysis by ICP-OES.
 - Thermogravimetric analysis.
 - Spectroscopic techniques (FTIR, XRD).

Analysis of raw materials and reactions products

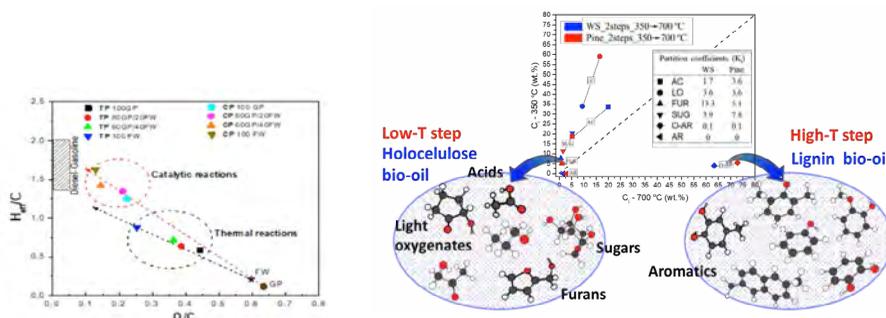
- Elemental CHNS-O analysis, Karl Fischer titration, potentiometric titration for carbonyl determination in bio oil.



Scientific and technical results

Development of efficient thermochemical processes for the production of advanced biofuels and valuable chemical compounds from biomass wastes

- Improvements to the lab-scale pyrolysis set-ups have been carried out that maximize reproducibility and products recovery.
- Reactions for pressurized (up to 10 bar) thermal and catalytic pyrolysis of biomass have been completed, both in inert and H₂ atmosphere. The effect of pressure on the aromatics production has been determined.
- Both thermal and catalytic pyrolysis of Food Waste (FW), either as individual waste or blended with garden pruning (GP) residues, have been carried out. A drastic promotion of aromatics formation is evidenced from FW in the presence of ZSM-5 as catalyst.
- Fractional pyrolysis at subsequent low and high temperatures has been explored for bio-oil speciation into holocellulose and lignin derived compounds.

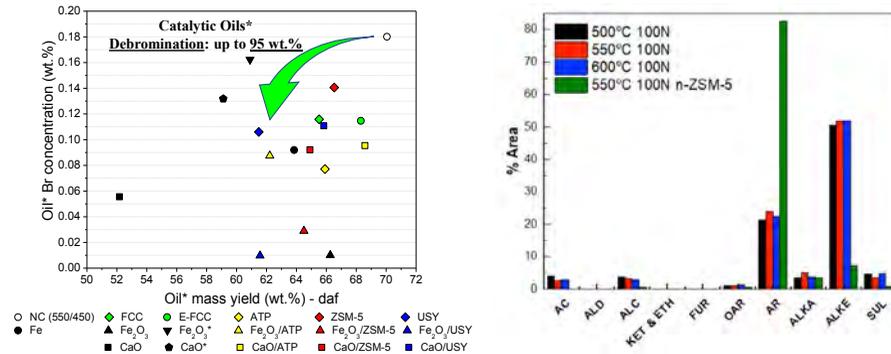


Development of efficient thermochemical processes for the valorization of plastic and other non-renewable organic wastes

- Catalytic pyrolysis of WEEE, with and without pre-treatment at 300 °C, has been carried out using catalysts with different properties. The amount of monoaromatics increases proportionally with the Si/Al ratio and in desilicated zeolites, due to their higher accessibility than the parent zeolite
- As part of the NONTOX Project, catalytic upgrading has been explored to reduce efficiently chlorine and bromine contents (up to 95 wt.% removal) from pyrolysis oil of plastics wastes, including WEEE, ELV, CD&W and residues from CREASOLV®.
- The RESUCAP project has progressed with the scaling-up of the water washing process and adsorption with different types of zeolites, confirming the greater extent of inorganic chlorine removal compared to organic chlorine.

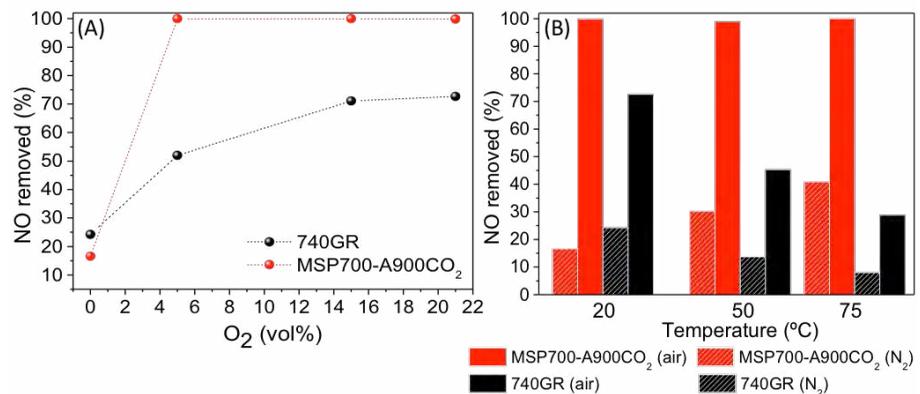


- Thermal and preliminary catalytic pyrolysis of tire wastes has been performed, revealing a high proportion of olefins and aromatics in the oil and a high yield of char.



Valorization of pyrolysis biochars and their application as bio-filters for air decontamination (NO_x) in urban environments

- Biochars have been obtained by slow pyrolysis of lignocellulosic biomass and then activated, physically (CO₂ or steam) at different temperatures (800-900°C), or chemically with KOH (at 700°C) to improve their textural properties.
- The lab-scale facility for NO adsorption tests has been modified and updated with a dilution calibration system and tuned-up.
- Activated carbons produced from MSP700 biochar have shown very promising results as NO_x filters in presence of O₂ in comparison with reference carbon materials.





High Temperature Processes Unit



Dr. José González-Aguilar
Senior Researcher
Head of the Unit



Dr. Manuel Romero
Research Professor

high temperature



R&D Objectives

- Modular, efficient, dispatchable and cost-effective high temperature solar concentrating technologies for production of solar fuels and chemicals, industrial process heat and power generation.

Research lines

- Modular schemes for solar thermal facilities, with high efficiency and dispatchability, and urban integration.
- Solar receivers and reactors (volumetric and particle).
- High-T thermal energy storage (PCM, chemical), materials, modelling and test bed for characterization.
- Solar fuels and chemicals production using metal oxides.
- PCU integration, heat recovery & environmental impact (advanced cycles, water, glint, glare).



Relevant projects and networking

The High Temperature Processes Unit (HTPU) focuses its research on solar thermal technologies with special emphasis on applications involving high temperature and very high concentrated sunlight. In 2020, HTPU maintains its active role as key player in this field in the regional, national and international arena. It currently leads this topic in the Comunidad de Madrid (CM) by the regional research programme ACES2030-CM (2019-2022), which gathers 5 universities (URJC, UPM, UC3M, URJC, and UNED), two public research bodies (CIEMAT and CSIC), one Foundation, 2 associated groups (from UHuelva and ICAI), and 6 industrial entities relevant in the thermosolar and energy sectors (Abengoa Energy, Repsol, Rioglass Solar, Grupo Cobra, Protermosolar, and Empresarios Agrupados). Additionally, HTPU is contributing to the use of solar thermal energy for water and salt recovery from brines in collaboration with SEENSO Renoval.

HTPU is actively involved in the most recent developments on production of solar fuels (through the research agreement between

Synhelion, ETHZ and IMDEA Energy), new heat transfer fluids and solar receivers (EU H2020 NEXT-CSP), and solar thermal industrial process heat (EU H2020 INSHIP). Besides it takes part of the Research Infrastructure Programme Horizon 2020 SFERA III project (Solar Facilities for the European Research Area – Third Phase) that gathers 15 partners from 9 EU member countries. Here HTPU contributes with its unique facilities specially designed to support industrial developments on component for applications in concentrated solar energy. Besides HTPU participates at the European Energy Research Alliance (EERA AISBL) within the Joint Programmes (JP) on Concentrated Solar Power (EERA JP-CSP) and on Energy Storage. In the national arena, HTPU is also involved in the Spanish technological platform on CSP (Solar Concentra) and the Working Group on Energy Storage (GIA), an initiative of the Spanish Ministry of Economy and Competitiveness, and participates in the IEA SolarPACES Task II on solar thermochemistry as well as national and international associations on Solar Energy (ISES).

Facilities

Laboratory for material synthesis and characterization in extreme conditions (high solar irradiance and/or temperature)

- Material synthesis by ball milling and wet-chemical routes.
- Material characterization (1600 °C sintering furnace, thermal diffusivity by laser flash technique, automatic sieve, Chantillon gauge, pHmeters).

- 7 kWe high-flux solar simulator equipped with three-axis positioning system.
- Specific instruments for temperature, radiation flux and gas composition measurements: infrared, CCD and CMOS cameras, radiometers, pyrometers, gas analyzers and micro-chromatograph.
- Vertical solar furnace with three independent heating zones (up to 1500 °C).

Singular facilities for components and prototypes testing

- 42 kWe high-flux solar simulator equipped with a three-axis positioning system with a static load capacity of 250 kg.
- 250 kW solar tower facility composed of 169 heliostats and two testing platforms.

Specific test rigs

- Aerothermal characterization of volumetric absorbers at 1 and 10 kW scale.
- Thermal storage in packed and fluidized beds.
- Outdoor test rig for small heliostats qualification.

Computational design lab for high temperature processes

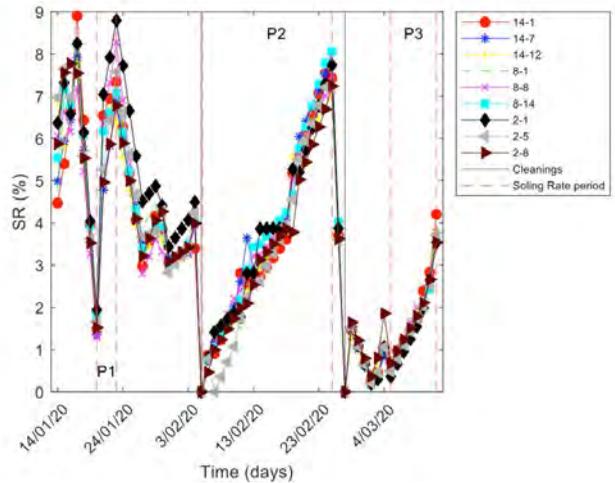
- Workstations.
- Specific software for computer-aided design, computational fluid dynamic modelling, illumination design & optical analysis, data treatment and process control and monitoring, chemical process and power plant design.



Scientific and technical results

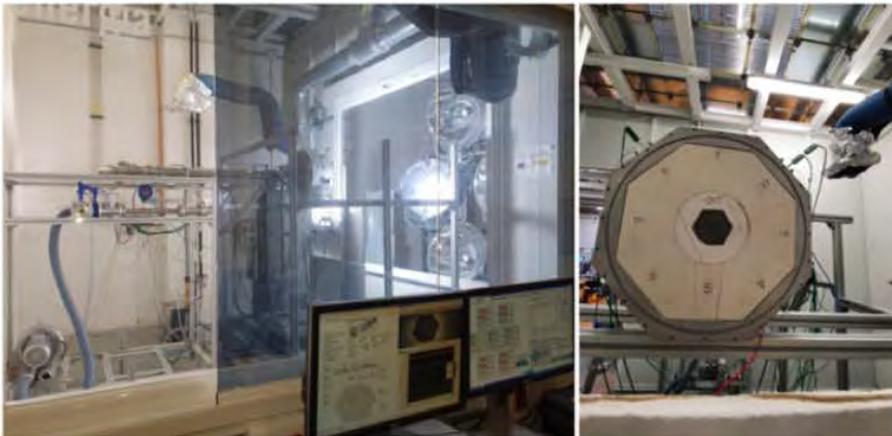
Modular schemes for solar thermal facilities, with high efficiency and dispatchability, and urban integration

- Analysis on soiling in urban areas. It combines daily measurements of the reflectivity on the facets and the soiling characterization (weight, optical and scanning electron microscopy, reflectivity and transmissivity) of small samples.
- Optical-geometric analysis of tilt-roll heliostats. The study identifies and quantifies optical errors due to structural defects in this type of heliostat and allows ranking these errors in order of importance to improve the heliostat performance.
- Continuous development of an improved control system for the solar field that aims at managing the solar field autonomously (without the need for human operator supervision) and in real time.



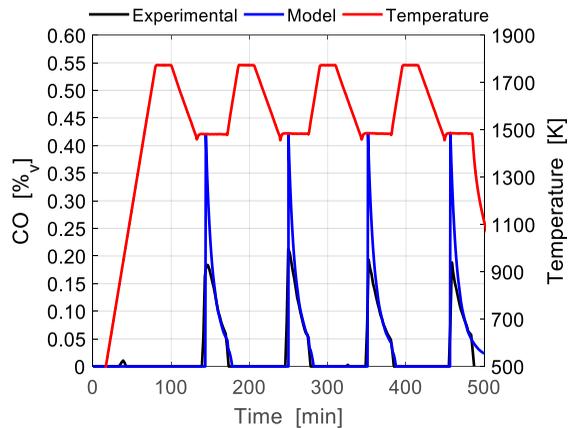
Solar receivers & new heat transfer fluid

- The characterization of metallic atmospheric volumetric absorbers manufactured by 3D printing using the SLM technique has been completed in the 42kWe high flux solar simulator. The performance tests were carried out with operating temperatures and irradiances on the front surface of the absorber up to up to 1,150 °C and 1,000 kW/m², respectively.



Energy storage & solar thermo-chemistry

- Maintenance and adaptation of the solar tower facility to perform methane reforming tests: Installation of a new gas supply area, inspection and painting of the tower structure, and setting up new working and storage zones.
- Continuous thermal decomposition and dry methane reforming in the solar tower facility using a 10kW solar reactor, concentration of 500x, and temperature range between 800 and 1200 °C.
- Thermocatalytic decomposition of water and CO₂ in chemical reactors composed of packed beds of ceria pellets in 10kW vertical furnace and development and validation of numerical models of the reaction.
- Development of materials for thermochemical storage based on perovskites and encapsulated CaO. Testing of iron-doped calcium perovskites. The quantities used (50 g) make it possible to compare reaction progress with respect to that from thermogravimetric analysis and support future prototype designs for thermochemical storage systems.
- Prototype testing for water recovery from brines.



Solar thermal processes integration & environmental impact (advanced cycles, water, glint, glare)

- Dynamic analysis of the annual behaviour of solar thermal power plants based on dense particle suspensions and supercritical CO₂ as working fluids.
- Study on the dynamic behaviour of solar thermal power plants equipped with micro-turbines for electricity production and polygeneration in sites isolated from the grid.
- Analysis of solar energy integration in processes for water recovery and salt extraction from brines.



Electrochemical Processes Unit



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Head of the Unit



Dr. Rebeca Marcilla
Senior Researcher



Prof. Dr. Marc A. Anderson
Scientific Advisor



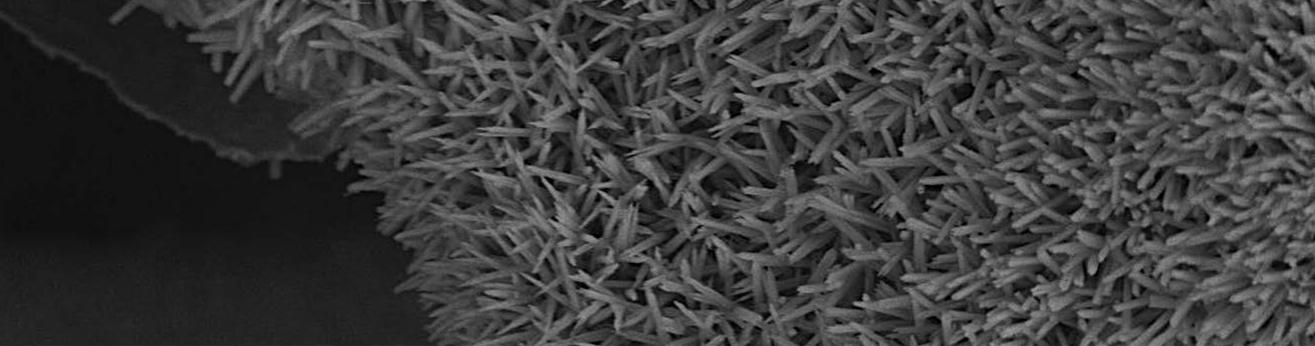
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Senior Assistant
Researcher



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Dr. Andreas Mavrantonakis
Senior Assistant
Researcher

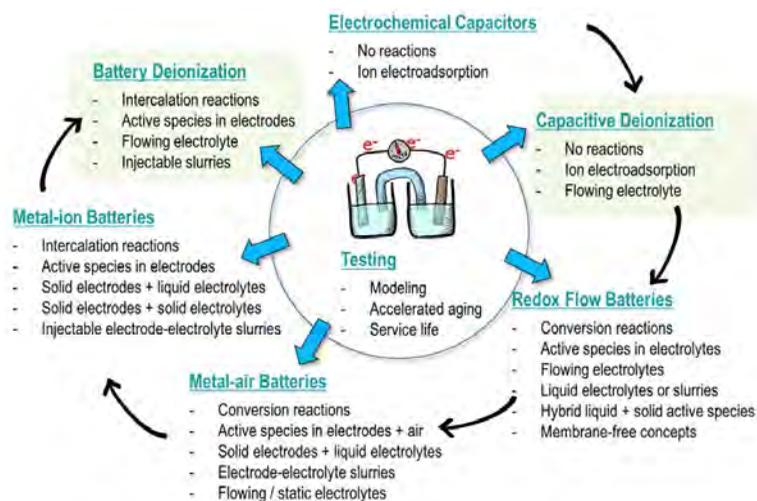


R&D Objectives

- Electrochemical energy storage devices and systems for stationary and transport applications.
- Electrochemical energy-efficient devices and processes for energy and environmental applications.

Research lines

- Development of supercapacitors with improved performance maintaining power density, cycle life and charge-discharge efficiency. Multifunctional capacitors; structural, flexible, or transparent.
- Design and scale-up capacitive deionization processes to produce fresh water from high-salinity natural or waste water. Investigation of faradaic concepts/materials to be applied in water treatment targeting to improve the production of fresh water. Search for faradaic materials for selective ion capture and separation.
- Design and build flow batteries with novel chemistries to improve the technology in two ways: (1) increasing energy density and (2) reducing costs per kWh stored.
- Research on materials and designs to develop rechargeable metal-air batteries.
- Research on materials and components to improve their performance, sustainability and recyclability.
- Establishment of new testing methodologies for batteries, supercapacitors and other electrochemical devices.



Relevant projects and networking

In 2020 the Electrochemical Processes Unit (EPCU) has been involved in 14 research projects. There were 7 direct contracts with companies such as Grupo Antolin, Securitas Direct, Spectrum Brands, Bachman, B5Tec and Zemper. The Regional Government of Madrid has supported 2 grants to attract young research talent and 2 industrial doctorates. The national government supports 2 research projects. Finally, the Unit participates in 3 European projects MFreeB (ERC-Consolidator), Polystorage (ITN-Marie Curie) and NanoBat (NMBP).

Besides, the EPCU has participated in associations such as the European technology

platforms on Smart Grids (ETIP-SNET) and Batteries (Batteries Europe), the Spanish Technology Platform on Energy Storage (BatteryPlat) and the Spanish Association of Battery Makers (AEPIBAL).

Likewise, the EPCU keeps contact with several universities and research centres in Spain and abroad. In 2020, the EPCU has maintained cooperation agreements for mobility actions with the Federal University of Ceará (Brazil), Federal University of Sao Carlos (Brazil), Chalmers University (Sweden) and Wageningen University (Netherlands).

Facilities

Components & cell manufacturing lab

- Light scattering for particle size and Z-potential analysis.
- Glove box for synthesis in controlled atmosphere.
- Schlenk line for polymer synthesis, hydrothermal synthesis, ultrasonic synthesis and sol-gel synthesis.
- Electrode inks manufacturing: grinding, mixing, shaping and consolidating.

Electrochemical characterization lab

- Potentiostats (50 channels) and cell cyclers (166 channels).
- Impedance spectroscopy, rotating ring-disk, quartz crystal microbalance.
- Chemical analyses: ion chromatography and semiautomatic titration.
- Physicochemical characterization: viscosity, density, conductivity, pH and ORP meters.

- Electrochemical characterization: multi-potentiostats (50+ channels); impedance spectroscopy; rotating disk and rotating ring-disk electrodes; electrochemical crystal quartz microbalance.
- 2 Glove boxes for testing in controlled atmosphere.

Modelling facilities

- Workstations (up to 80 nodes).
- Computational chemistry: electronic structure calculations (density functional theory, wave function theory, molecular dynamics), ChemCraft ®, GAUSSIAN ® and VASP ®.
- Computer fluid dynamics: COMSOL Multiphysics ®.
- Dynamic modelling: Matlab-Simulink ®.

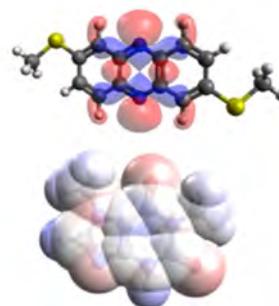
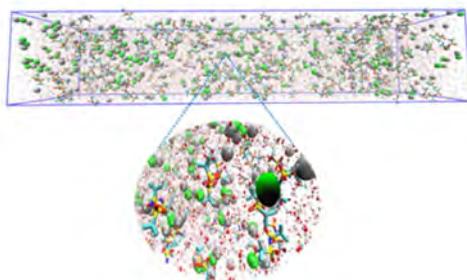
Prototyping facilities

- 3D Design: SolidWorks ®.
- 3D Printers: fused deposition modeling (1 x 4 L + 1 x 600 L).
- CNC micro-milling machine.
- Cell prototypes: coin cells up to 2 cm²; pouch cells from 10 to 100 cm² electrodes; flow cells (10, 25, 300, 1200 and 2400 cm² electrodes) and flow modules up to 20 cells; micro-flow cells; injectable cells.

- Battery cycler: 3 channels x 12 kW, 120V – 200A max.
- Cell cyclers: 48 channels x 30 W, 5V – 6A max.
- Cell cyclers: 112 channels x 0.05 W, 5V – 10mA max.
- 5 Climatic chambers (20, 100, 220, 250 and 4800 L). From -40 to +180°C and 10 to 98%RH.
- Flow reactor test bed with controlled flow, temperature, pressure and measurement of pH, ORP and conductivity.
- LabView ® programmable control system.

Electrochemical devices test lab & pilot plant

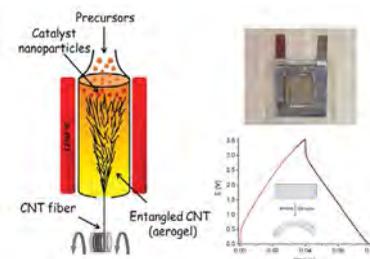
- Test beds with monitoring of flow, level, T, P, pH, ORP, conductivity.



Scientific and technical results

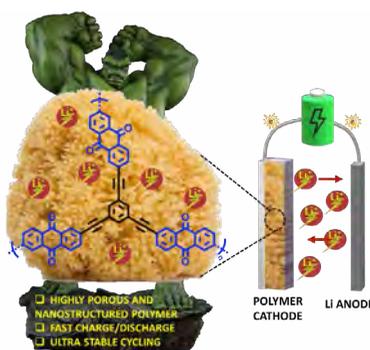
Supercapacitors

- Fabrication of continuous transparent and flexible supercapacitors by depositing a CNT network onto a polymer electrolyte membrane directly from an aerogel of ultra-long CNTs.



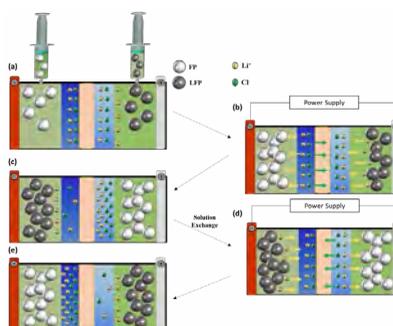
Metal-ion batteries

- Research on redox-active polymers able to behave as cathode or anode in Li-ion, Na-ion, Zn-ion or Al-ion batteries.
- Development of conjugated microporous redox polymers with enhanced electrochemical properties.
- All solid lithium-ion batteries with improved mechanical properties for the automotive sector.
- Synthesis of graphene/ oxide (or sulphide) hybrids by combining electrodeposition and electrophoretic techniques for Li-ion and hybrid supercapacitors.



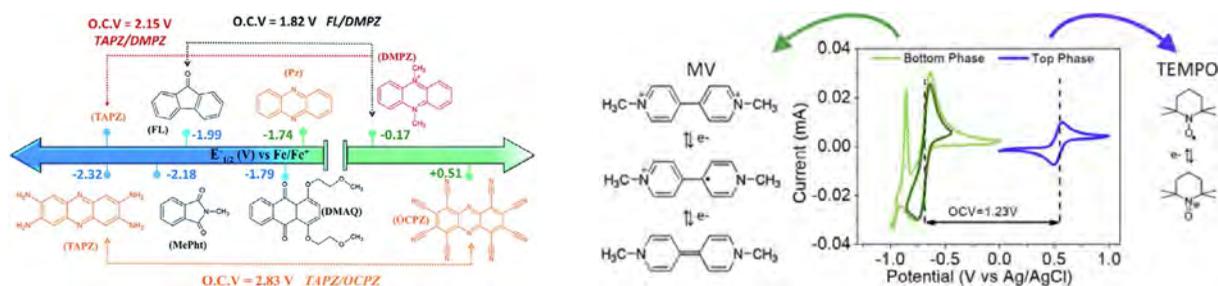
Water deionization

- The concept of water deionization by means of faradaic reactions has been investigated. Different faradaic deionization reactors have been designed, built and tested. A European patent has been filed using this concept applied to lithium and sodium ions.
- A new type of hybrid reactor that combines capacitive deionization and electrochemical oxidation in the same electrode has been proposed. The idea will be further developed in a European project that will start in 2021.



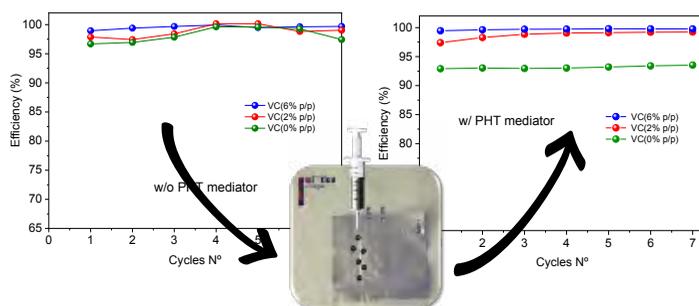
Flow batteries

- Critical aspects of membrane-free aqueous battery based on two immiscible neutral electrolytes.
- Investigations on novel chemistries and reactors that do not require membranes to separate catholyte and anolyte: immiscible phases and microfluidic flow batteries.
- Fluid dynamic modelling of reactor based using these membrane-free approaches. A European patent application has been filed in the design of a flow-through reactor for immiscible membrane free RFBs (EP20382311.7).
- Development of flow batteries with enhanced energy densities making use of solid booster and electrochemical mediators.
- Search for new organic molecules and redox polymers as active species in flow batteries. E.g. New insights into the phenazine-based organic redox flow batteries by using high-throughput DFT modelling.



Battery testing protocols

- Development of new predictive models to assess the state of health and the service life of commercial batteries in emulated realistic environments.
- New methods for accelerated evaluation of the quality of the SEI in commercial Li-ion batteries.





Biotechnological Processes Unit



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Senior Researcher
Head of the Unit



Dr. Elia Tomás
Senior Assistant
Researcher

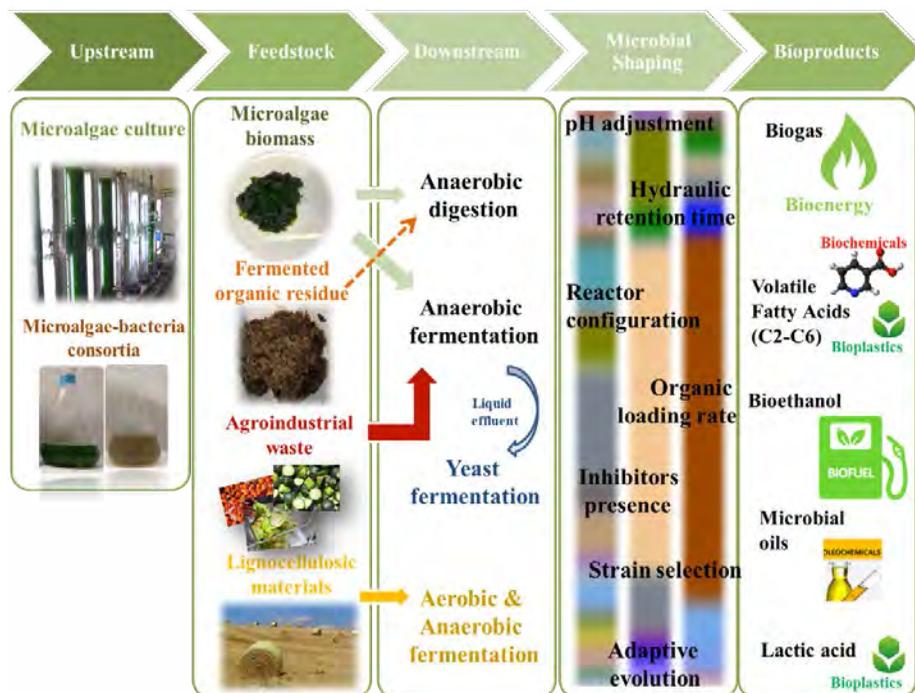


R&D Objectives

- To develop biological processes to produce biofuels and bioproducts from different residual substrates.

Research lines

- Microalgae upstream processes: microalgae and aerobic bacteria consortia for wastewater treatment.
- Microalgae downstream processes: short chain fatty acids (SCFAs) production via anaerobic fermentation.
- Anaerobic fermentation of waste streams for SCFAs and biogas production.
- Microbial oils production from the carboxylic platform (SCFAs).
- Lignocellulose-based biofuels and bioproducts.



Relevant projects and networking

The BTPU has participated in several national and international projects related with the use of different residual streams for the production of alternative compounds (lactic acid, short chain fatty acids and microbial oils) as well as energy products (ethanol and biogas). BTPU has participated in 8 projects, out of which 2 were European (BIOGASMENA, 2017- 2020- ERANET MED and WASTE-2BIO, 2017-2020- ERANET-BESTF3), 4 national (BIO_ LIGWASTE-2016-2020, ACMIBIO-2017-2021, BioPOWER-2GAS-2020, FPI_ACMIBIO-2018-2023) and 1 regional via their services offered in the BIOPEN Lab (ALGATEC-2019-2022). Acknowledging the importance of gaining international visibility and stablishing key collaboration, BTPU is actively participating in several networking COST Actions (Gree-

ning and Euromicroph). In this sense, BTPU leads the European project YEAST-4BIO (2019-2023), supported COST Action of H2020, which involves more than 130 researchers from 34 countries. Also at international level, the Unit participates in RENUWAL (2019-2022), a Latin-American network focused on microalgae cultivated in wastewater. In addition to the Ramón y Cajal fellowship held by the Head of the Unit, BTPU was awarded a second RyC to Dr. Elia Tomás that will be starting in 2021. As a result of the participation in the above mentioned projects, BTPU actively collaborates with leading Research Groups and companies along Europe. Besides, UBTP is member of EERA-Bioenergy, the Biobased Industries Consortia (BIC) and BIOPLAT.





Facilities

Biotechnology and microbiology lab

- Laminar flow hood, PCR cabinet.
- Orbital shakers.
- Cell counter.
- Flow gas meters.
- Anaerobic reactors, fermenters and photobioreactors.
- Oven, muffle, balances and centrifuges.

Chemical analytics lab

- Gas and liquid chromatographs with different detectors (FID, TCD, DAD, RI).
- Ionic chromatography.
- Equipment for routine analysis; TS/VS, pH, TNK, COD...

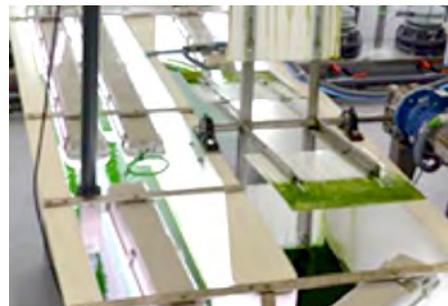
- Spectrophotometers: microplate and cuvette type.

Molecular biology lab

- Polymerase chain reaction: traditional and real-time.
- RNA-ase free cabinet.
- Denaturing gradient gel electrophoresis.
- Agarose electrophoresis.

Pilot plants

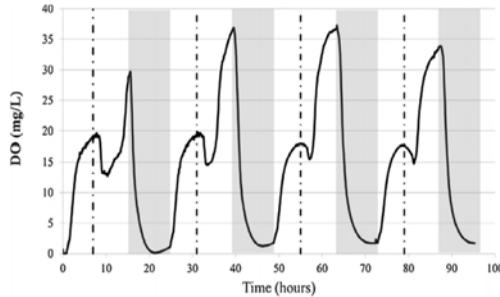
- Bioreactors.
- 3 modules of 4 bubbled columns each (1 m³ in total).
- 2 open raceways (1 m³ in total).



Scientific and technical results

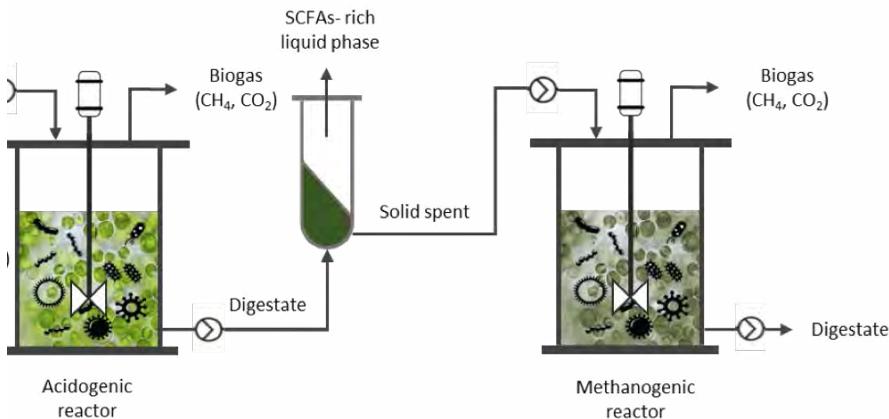
Microalgae in upstream processes: microalgae and aerobic bacteria consortia for wastewater treatment

- The activity determination of an algal-bacterial consortium based on oxygen evolution revealed important aspects of this microbial symbiosis. While bacterial oxygen consumption was limited to a few hours after the addition of wastewater, microalgae not only acted as oxygen producer but events of photorespiration and endogenous respiration processes were detected.
- Out of the two most critical parameters inherent to the digestate for microalgae cultivation, ammonium was identified to be more detrimental than turbidity.



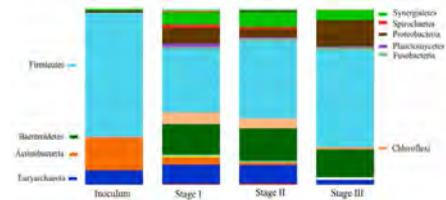
Anaerobic fermentation of waste streams for carboxylate and biogas production

- Non-conventional two stage anaerobic digestion was evidenced to be an effective strategy to increase product portfolio out of one single substrate. This fact is of particular relevance in the context of biorefineries.
- Remarkably high bioconversion yields into SCFA were attained by subjecting agro-food wastes to anaerobic fermentation under mild conditions of temperature. The prevailing carbohydrate-rich nature of these substrates was pointed out to be optimum for this bioprocess. In fact, the developed microbial community exhibited high hydrolytic and acidogenic activities associated to carbohydrates degradation.



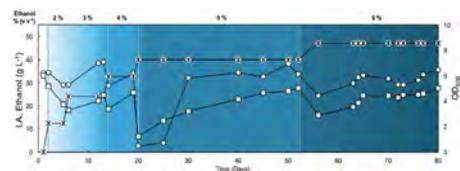
Microalgae downstream processes: SCFAs production via anaerobic fermentation

- When using pretreated microalgae biomass as substrate, the suitability of upflow anaerobic sludge bed (UASB) reactor configuration was demonstrated by reaching high bioprocess efficiency for both, biogas and SCFAs production.
- The organic loading rate could be used to target product output (namely biogas or SCFAs) by shaping the anaerobic microbiome.



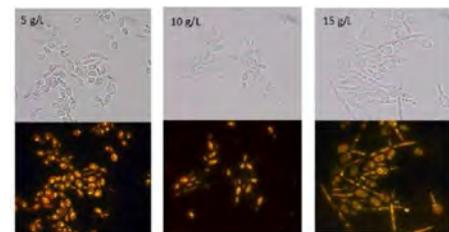
Lignocellulose based biofuels and bioproducts

- The ability of different *Bacillus coagulans* strains to produce lactic acid from sugars mixtures in presence of inhibitory compounds was proven. Furthermore, a reduction in the inhibitors concentration at the end of fermentation was shown, which suggested the presence of biodegradation responses in some of the strains.
- An adaptive laboratory evolution (ALE) process resulted in a *B. coagulans* strain very tolerant to high concentration of ethanol. This new strain could be applied in yeast-bacterial sequential fermentation for bioethanol and lactic acid co-generation.



Microbial oil production from the carboxylic platform (short chain fatty acids)

- The yeast *Y. lipolytica* was able to grow on SCFAs derived from anaerobic fermentation of microalgae biomass at concentration of 17.6 g/L. This is of particular relevance since literature set the inhibitory threshold at significantly lower concentrations.
- *Y. lipolytica* sequentially utilized different types of SCFAs when present in mixtures showing preference for acetic acid coupled to the consumption of long-chain SCFAs.
- The obtained fatty acid profile of lipids, consisting of oleic, palmitic and linoleic acid, were similar to that of vegetable oils commonly used in the chemical industry.





Electrical Systems Unit

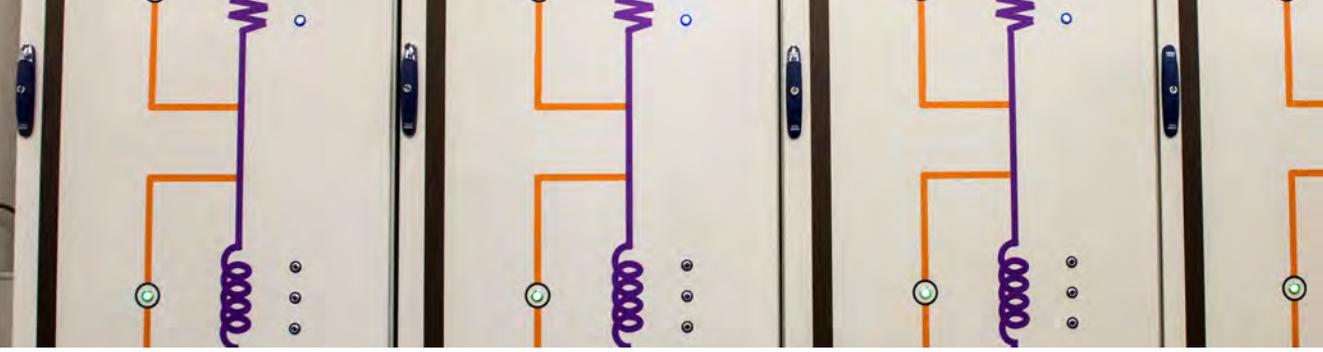


Dr. Milan Prodanovic
Senior Researcher
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Dr. Javier Roldán
Senior Assistant
Researcher

electrical systems

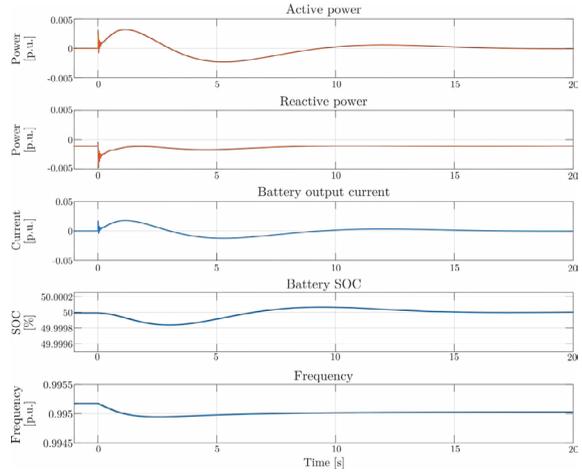
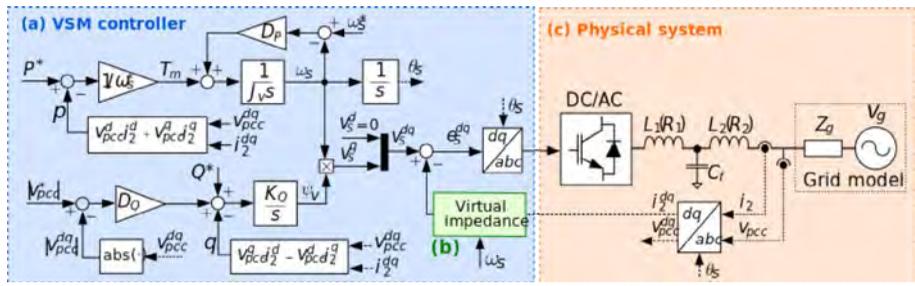


R&D Objectives

- Improved control, reliability and stability aspects of future electricity networks with high share of renewable and storage technologies.
- Optimisation based algorithms for demand management and renewable integration.
- Increased energy efficiency in industrial applications.

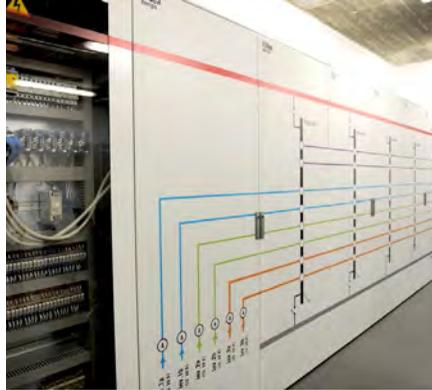
Research lines

- Control of power converters for applications in electricity networks.
- Renewable and energy storage integration.
- Stability of power networks with high penetration of renewables.
- Reliability of power systems with high share of distributed generation and storage.
- Energy efficiency applications.



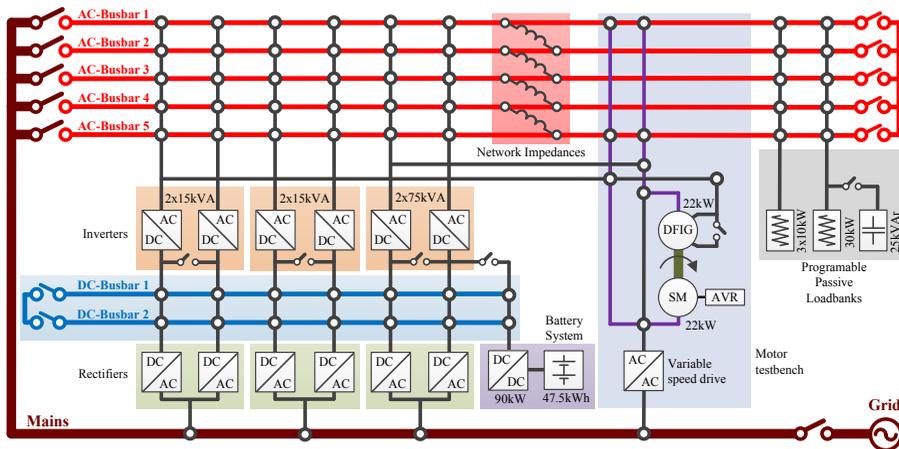
Relevant projects and networking

In 2020, Electrical Systems Unit (ESU) participated in several research and development projects. Principal research activities were performed within the frameworks of regional project PROMINT (2019-2022), European project DRES2MARKET (2020-2023) and project Cooralma funded by Iberdrola Foundation (2019-2020). These projects addressed reliability, stability and flexibility aspects of renewable and storage integration to power networks as well as control of power electronics interfaces in grid applications. Research project RITSE (Reduced Inertia Transient Stability Enhancement, 2019-2020) funded by Red Eléctrica de España was developed in collaboration with SuperGrid Institute, Lyon. There was also a collaboration project with Lithuanian Energy Institute regarding the analysis of power quality in distribution network. With respect to industrial collaborations, the main projects were Microgrid-On-Chip (2018-2021) with NORVENTO developing control of battery interfaces for microgrids, POD4PV with Engie address-



ing power oscillation damping by using PV plants and RECUPERENE and COPOWCO with Genesal and IMV Corporation, respectively, reducing energy consumption.

ESU participated in activities of the Spanish Platform for Power Networks (FUTURED) within two workgroups: Power Electronics and Energy Storage. In 2020 ESU continued its role in the Spanish Platform on ICT applications in Energy Efficiency (EnerTIC) as an associated member.





Facilities

Smart energy integration lab (SEIL)

- 4 x 15 kVA and 2 x 75 kVA converters.
- 2 x 30 kW and 25kVA remotely control-able and programmable loads.
- 47.5 kWh battery system.
- 90 kW bidirectional battery interface.
- 22kW configurable DFIG and synchronous motor-generator testbench.
- Remotely configurable distribution panels for AC and DC networks.
- Configurable network impedances.
- Integrated measurement and SCADA control system.
- Flexible programming platform.

Smart buildings management lab

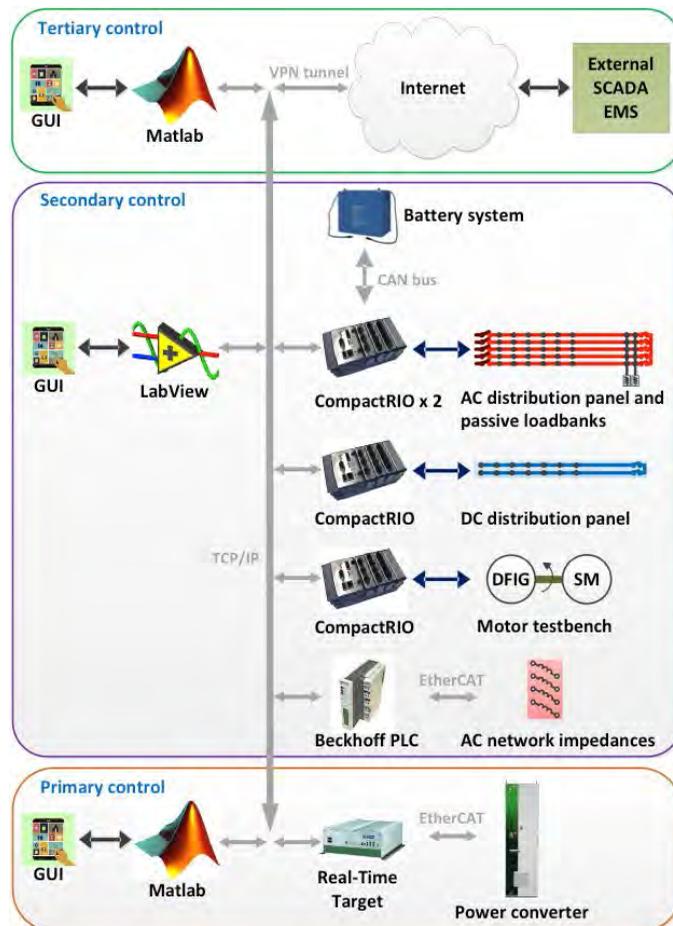
- KNX (Siemens) based technology.
- Sensors and actuators.

Modelling and simulation tools

- Matlab, PowerWorld, IPSA, PLECS, Digsilent PowerFactory.

Acquisition and control platforms

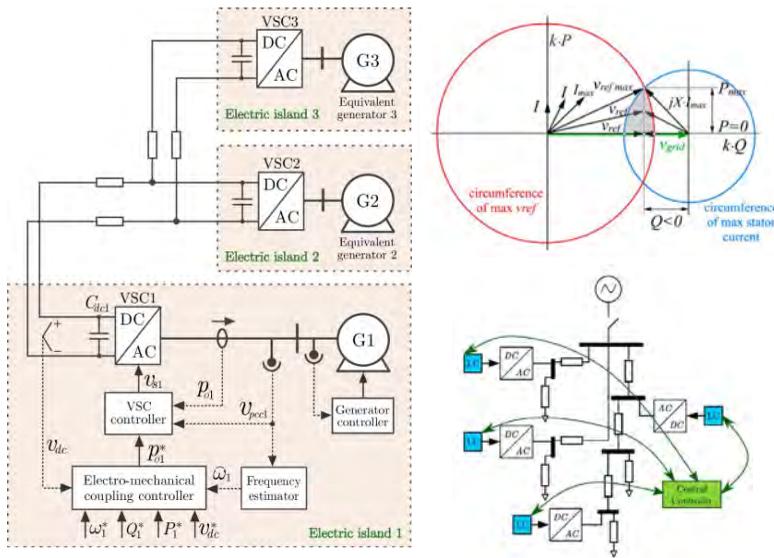
- LabView (NI), Beckhoff, Texas Instruments etc.
- Oscilloscopes, bench power supplies, function generators etc.



Scientific and technical results

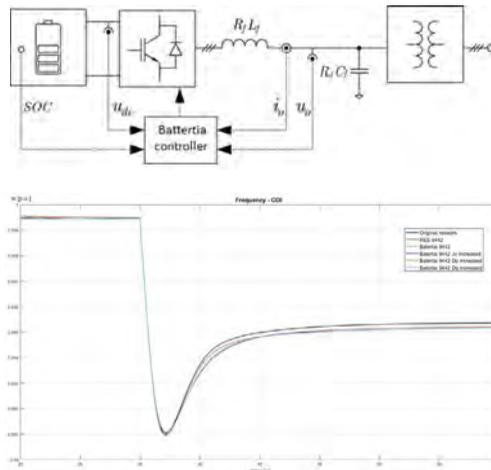
Control of power converters for applications in electricity networks

- Implementation of the “virtual friction” concept for control of HVDC links.
- Implementation of virtual synchronous machine in weak grids.
- Improvement of primary, secondary and tertiary control algorithms for power converters in AC and DC microgrids.
- Improved control of power converters for applications in renewable integration.
- Developed control of multi-terminal DC networks for power transmission and distribution applications.



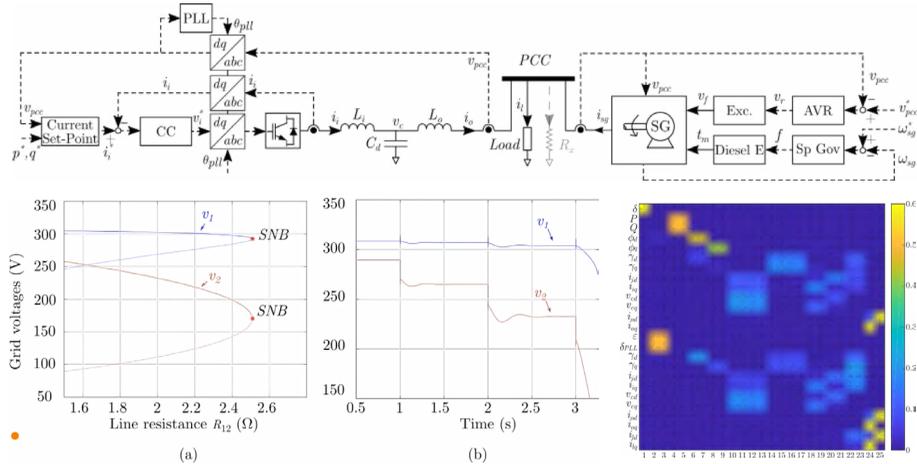
Renewable and energy storage integration

- Development of new control methods for energy storage interfaces in power systems and microgrids.
- Analysed coordinated management of aggregated and distributed storage applications.
- Evaluating battery sizing for inertial services in power systems.



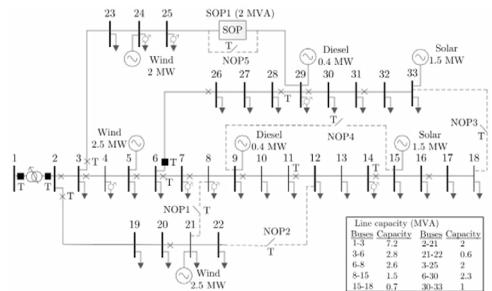
Stability of power networks with high penetration of renewables

- Small-signal modelling of AC, DC and hybrid power networks.
- Analyzed the transient and frequency stability of power networks.
- Evaluated the interaction between power electronic converters, the grid and rotating generators.
- Application of “virtual inertia” in HVDC and distribution networks.
- Applied the bifurcation theory to power systems and microgrids.



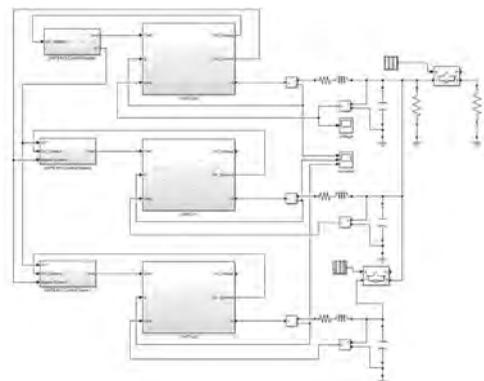
Reliability of power systems with high share of distributed generation and storage

- Evaluated the combined impact of active network management techniques (SNOP, OLTC, DLC, etc.) on network reliability.
- Analyzed the economic benefits produced by operating networks in both grid-connected and islanded modes.



Energy efficiency applications

- Development of control boards for power converters and switching power amplifiers in vibration system applications.
- Control system for a 20 kW bidirectional, isolated and modular industrial power supply.
- Energy saving in generator testing.





System Analysis Unit



Dr. Javier Dufour
Research Professor
Head of the Unit



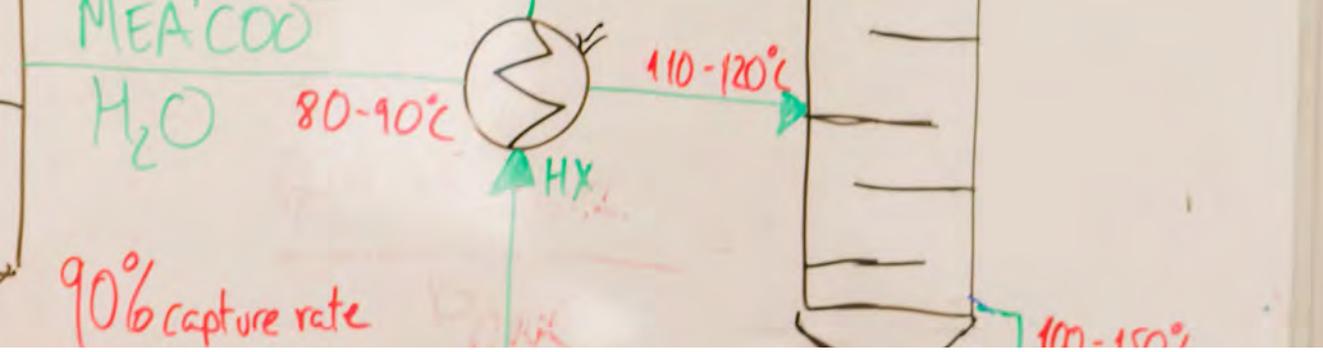
Dr. Diego Iribarren
Senior Researcher



Dr. José Luis Gálvez
Senior Assistant
Researcher



system analysis

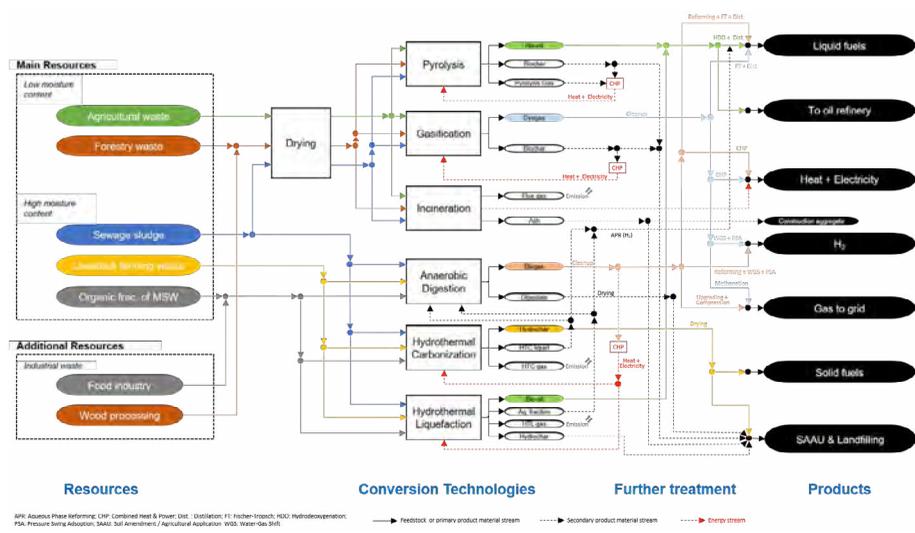


R&D Objectives

- Design, modelling, simulation and optimization of energy systems.
- Sustainability assessment of energy related processes, including environmental, economic and social issues.
- Energy planning.

Research lines

- Biorefineries in the framework of circular economy.
- Production of clean fuels and second-generation biofuels.
- Development of methodologies for the sustainability assessment of energy systems.
- Development of sustainable energy models.
- Sustainability of CO₂ capture and use processes. CO₂ mitigation in the industrial sector.



Relevant projects and networking

In 2020, the Systems Analysis Unit (SAU) has participated in 7 research projects and 7 research contracts. At European level, SAU collaborated in the EU CEF ECO-GATE project about the deployment of compressed and liquid natural gas infrastructure for transportation and started the LIFE SUPERBIODIESEL project, which is focused in the deployment of a supercritical process for the production of biodiesel from waste animal fats. As well, 2 projects funded by the Gulf Organisation for Research and Development of Qatar were kicked off, both of them related to CO₂ mitigation in the construction materials sector.

At domestic level, SAU continued the REDEFINERY project, developing simulation models of thermochemical and biological processes for organic wastes recovery and an integral model for decision-making, including all these processes along with collection procedures to test the application of new technologies and policies from the environmental and economic points of view. SAU also started its participation in the MENTES network, related to energy

planning models. At the regional level, SAU collaborated in the FotoArt programme, studying the scalability of photo-electrocatalytic and photo-catalytic systems.

Regarding the 7 research contracts, it should be highlighted the Metamar contract developed for the Joint Research Centre in Petten about life cycle analyses of the maritime sector. The other contracts were related to CO₂ mitigation (2), technical maturity of hydrogen systems (1), training on systems analysis (2), and end-of-life of batteries (1).

Regarding networking, Javier Dufour was Vice-chair of Cross-cutting Research Activities of Hydrogen Europe Research till July, 2nd and was elected as Deputy Leader of the Cross-Cutting Activities Technical Committee of Hydrogen Europe Research on December, 4th. Diego Iribarren was the chairman of the Spanish Network for Life Cycle Assessment (esLCA).

Capabilities

Sustainability assessment of energy systems

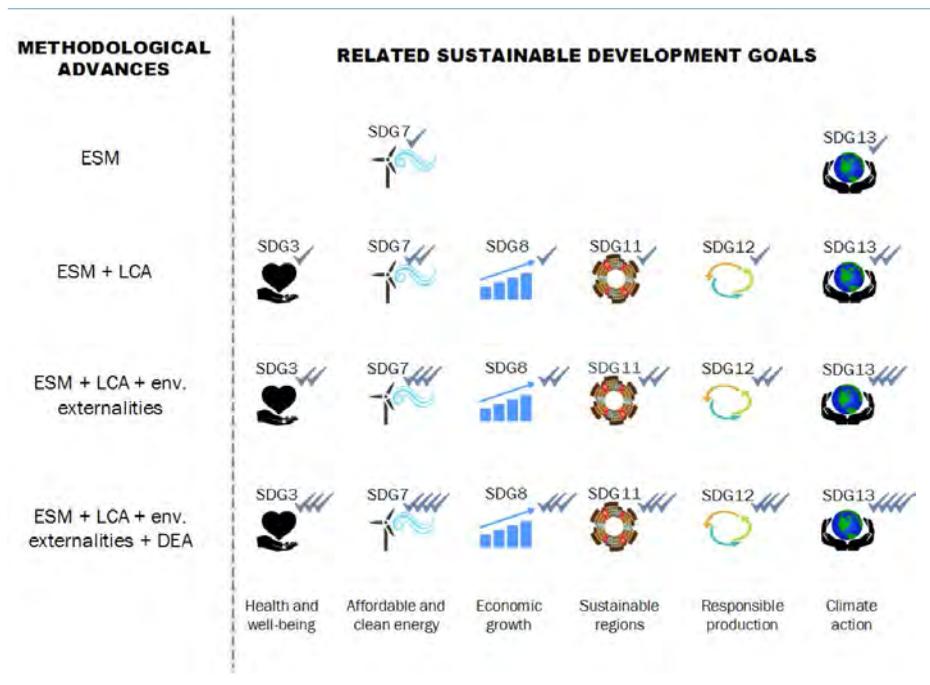
- Environmental LCA, carbon footprinting and eco-design.
- Combined application of LCA and data envelopment analysis for multi-criteria decision analysis.
- Prospective LCA.
- Social life cycle assessment, life cycle costing and eco-efficiency assessment.
- Harmonised LCA and life cycle sustainability assessment.

Feasibility of energy processes

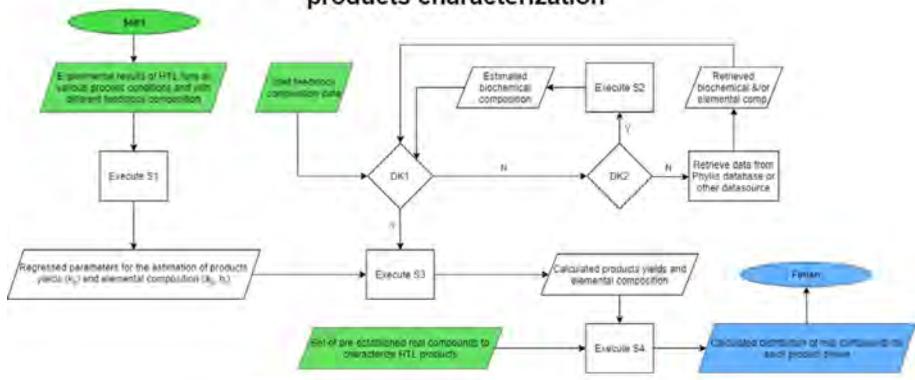
- Process design, simulation and optimization.
- Circular economy energy modelling.
- Energy and exergy analyses.
- Conventional economic analysis and with externalities.

Energy planning

- Development of national and regional energy models (Spain, Region of Madrid).
- Evolution of techno-economic and sustainability indicators in prospective energy scenarios, and demand projection.
- Integration of geographic information systems.



Algorithm for the prediction of HTL products characterization



Decision Knobs:
 DK1 Is the biochemical composition of the feedstock known? (Carbohydrates, Proteins, Lipids) + Ash + Moisture
 DK2 Is the elemental composition of the feedstock known?

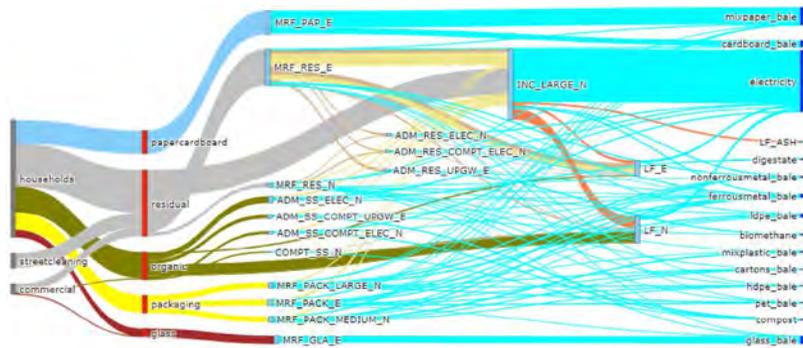
Subroutines:
 S1 Multivariable Linear Regression of HTL products yields and elemental compositions (Ref1)
 S2 Optimization algorithm to adjust biochemical composition from elemental composition (Ref2)
 S3 Calculation of products yields and elemental composition of products
 S4 Optimization algorithm to translate products yields and elemental composition to real chemical compounds (Ref3)

References:
 Ref1 Li, S. et al. Techno-economic uncertainty analysis of wet waste-to-biocrude via hydrothermal liquefaction. *Appl. Energy* 263 (2021), 119340.
 Ref2 Onel, O. et al. Municipal solid waste to liquid transportation fuels - Part I: mathematical modeling of a municipal solid waste gasifier. *Comput. Chem. Eng.* 71 (2014), pp. 536-547.
 Ref3 Brnjakovic, B. et al. Development of an automated method for modeling of bio-crudes originating from distill production processes based on thermochemical conversion. *Appl. Energy* 215 (2018), pp. 670-678.

Scientific and technical results

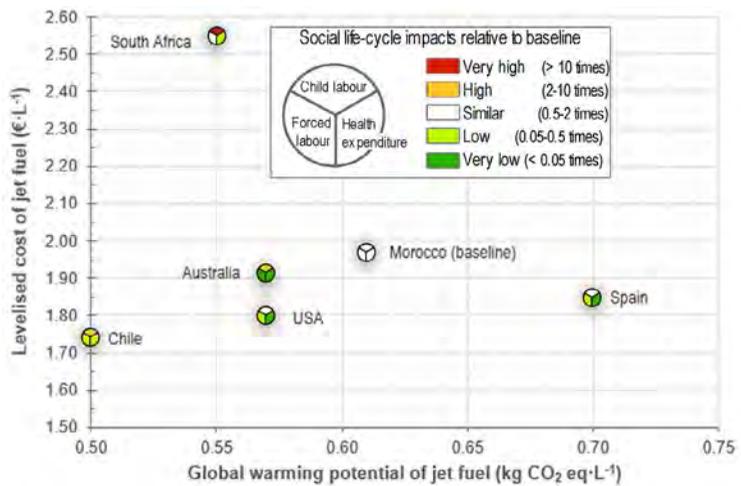
Biorefineries in the framework of circular economy

- Life-cycle environmental consequences of waste-to-energy solutions on the municipal solid waste management system.
- Techno-economic and life cycle assessment of an integrated hydrothermal carbonization and anaerobic digestion system for sewage sludge management.
- Impact of incineration phase-out on municipal solid waste management.



Production of clean fuels and second-generation biofuels

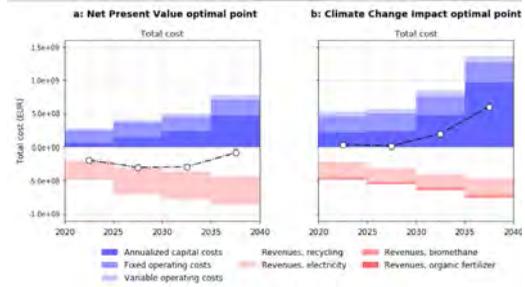
- Modeling, simulation and life-cycle assessment of the use of bio-oil and char in conventional refineries.
- Role of hydrogen in the environmental performance of fuel cell electric vehicles.
- Integrated techno-economic, environmental and social assessment of the solar thermochemical fuel pathway.
- Prospective carbon footprint comparison of hydrogen systems.





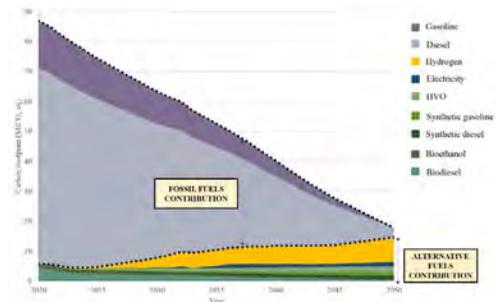
Development of methodologies for the sustainability assessment of energy systems

- Influence of climate change externalities on the sustainability-oriented prioritisation of prospective energy scenarios.
- Thermodynamic, economic and environmental assessment of energy systems including the use of gas from manure fermentation.
- Thermodynamic, economic and environmental assessment of renewable natural gas production systems.
- Modelling and life cycle assessment of end-of-life processes for batteries.
- Protocol for the definition of supply chains in bioelectricity social life cycle assessment.



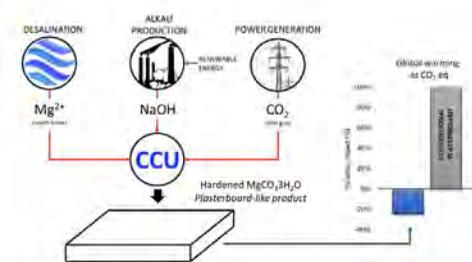
Development of sustainable energy models

- Prospective techno-economic and environmental assessment of a national hydrogen production mix for road transport.
- Spanish long-term production technology mix of alternative fuels for road transport.



Sustainability of CO₂ capture and use processes. CO₂ mitigation in the industrial sector

- Eco-efficiency assessment of calcium sulfoaluminate clinker production.
- Techno-economic assessment of a carbon capture and utilization process for the production of plaster-like construction materials.





Photoactivated Processes Unit



Dr. Victor A. de la Peña
Senior Researcher
Head of the Unit

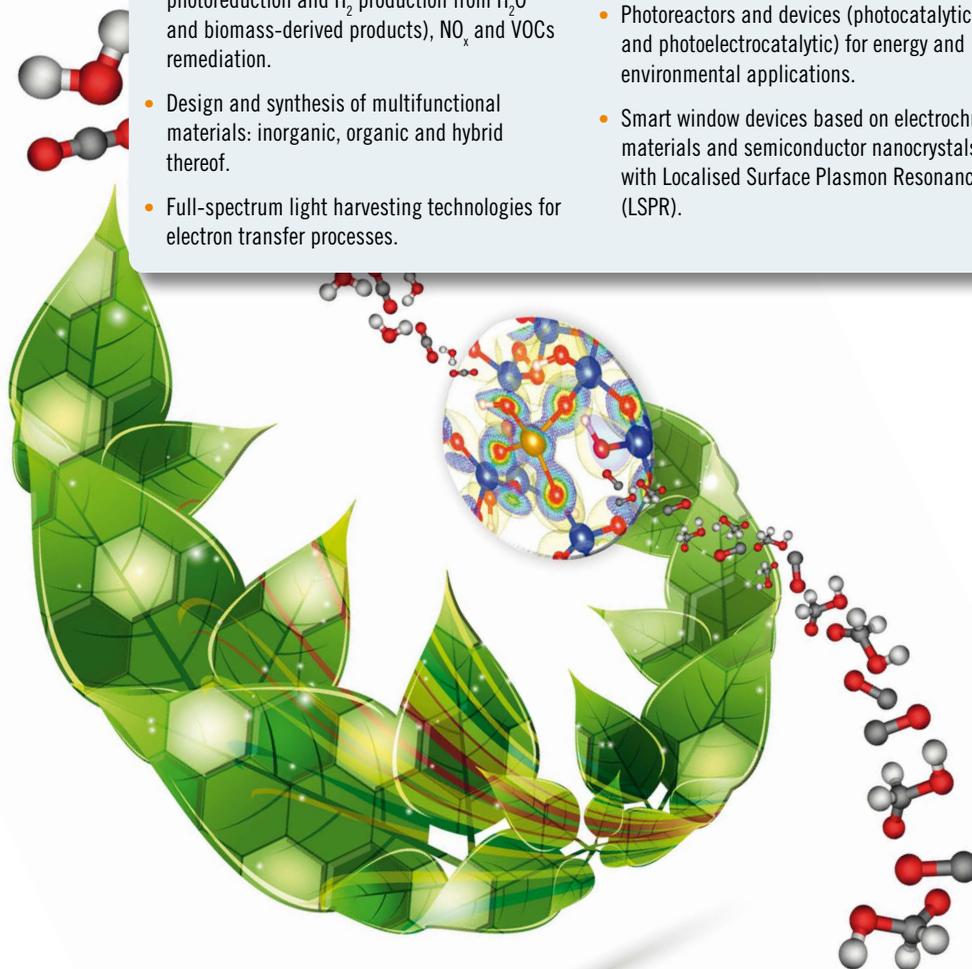


Dr. Marta Liras
Senior Assistant
Researcher



Dr. Fernando Fresno
Senior Assistant
Researcher

photoactivated



R&D Objectives

- Covering the materials, processes and technologies that allow a smart and efficient light harvesting to drive photon-activated processes for energy and environmental applications.

Research lines

- Development of photoactivated processes for energy and environment: solar fuels production by artificial photosynthesis (including CO_2 photoreduction and H_2 production from H_2O and biomass-derived products), NO_x and VOCs remediation.
- Design and synthesis of multifunctional materials: inorganic, organic and hybrid thereof.
- Full-spectrum light harvesting technologies for electron transfer processes.
- Combination of advanced characterisation and theoretical calculation for fundamental studies of reaction mechanisms.
- Photoreactors and devices (photocatalytic and photoelectrocatalytic) for energy and environmental applications.
- Smart window devices based on electrochromic materials and semiconductor nanocrystals with Localised Surface Plasmon Resonance (LSPR).

Relevant projects and networking

In 2020 the Photoactivated Processes Unit (PAPU) has participated in 11 research projects and grants funded at regional, national and European level. Dr. Víctor A. de la Peña O'Shea, senior researcher and head of the PAPU, has the support of a European project, HYMAP, corresponding to the call ERC-2014- Consolidator Grant. During 2020, an ERC-PoC related with the Nanostructuring of Conjugated Porous Polymers, project associated to the previous one, has started. Along 2020 a FET ProActive Project (H2020) coordinated by the PAPU team was funded. In addition, Víctor A. de la Peña O'Shea is the Spanish contact in the SUNRISE project (FET Flagship).

At national level, PAPU is funded and supported through several projects such as Nympha (2020-2023) and SOL-PAC (2018-2020) as well as by a *Ramón y Cajal* Programme project (2015 call), all of them related with the design and synthesis of new materials and systems. In the regional framework, the unit is coordinating the FotoArt program (New Generation of Multifunctional Materials for Artificial Photosynthesis). In addition, PAPU counts with the project Art-Leaf, funded by Fundación Ramón Areces.

Also, at industrial level, PAPU holds a project with the Mercedes company. Besides, PAPU has coordinated the Network FOTO-FUEL and participates in the Spanish CO₂ technological platform (PTECO2) and in the Iberian Photocatalysis Association.



Facilities

Synthesis of materials

- Equipment for organic and polymer synthesis.
- Thermal and microwave ovens and autoclaves.
- Tools for chemical synthesis under controlled atmosphere.
- Ball milling and spin coating.

Materials characterization facilities

- Single-crystal X-ray diffraction equipment with Cu focus source.
- Transient absorption spectrophotometer with an i-CCD camera and a tunable laser radiation source (Nd:YAG plus OPO and extended UV).
- Time resolved fluorescence spectrometer.
- Electro and photoelectrochemical characterisation in three and two electrode cell configurations.
- *In situ* and operando cells for spectroscopic measurements such as FTIR, Raman, XPS, NEXAFS, at laboratory and synchrotron set-ups.
- Near-ambient pressure (NAP) XPS which allows for *in-situ* characterisation of photocatalytic processes.

Reactors

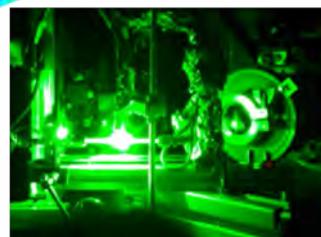
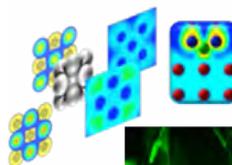
- Gas-phase reactors and micro-reactors for photocatalytic reduction of CO₂ provided with gas chromatography for product analysis.
- Liquid and gas phase reactors for photocatalytic H₂ production.
- Photoelectrochemical cells for solar fuels production by water splitting and CO₂ reduction, coupled to simulated solar light.
- Gas-phase compound parabolic collector solar reactor for CO₂ reduction

and H₂ production with solar radiation measurement.

- Spectroelectrochemical cells for spectral response and electrochromic response measures.

Theoretical calculations and modelling

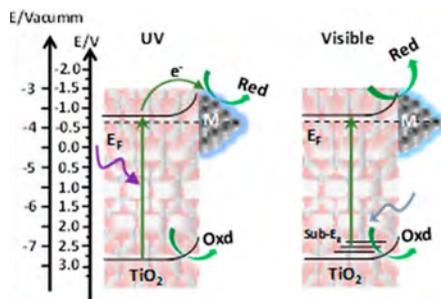
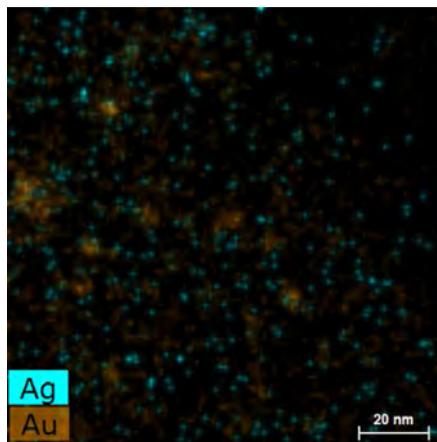
- Work stations and software for chemical modelling.
- Tools for CFD, data treatment and process engineering.



Scientific and technical results

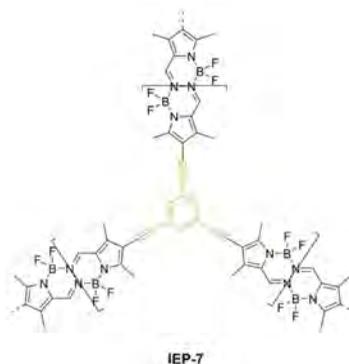
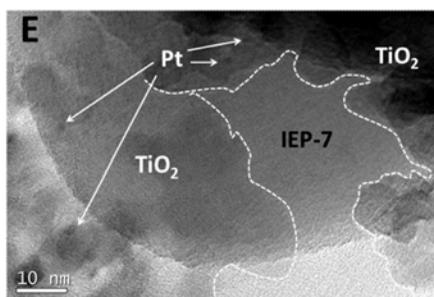
Development of novel inorganic photocatalysts

- Band-gap engineering synthesis of UV- and visible-light-absorbing metallates based on group-5 metals and cations with outer shell s-electrons.
- Prepared novel metal-oxide heterojunctions with improved photocatalytic activity and extended absorption spectrum.
- Controlled deposition of metal nanoparticles as co-catalysts in mono- and bi-metallic catalytic systems.
- Synthesis of colloidal metal oxides nanoparticles as well as doping of them to prepare smart windows.



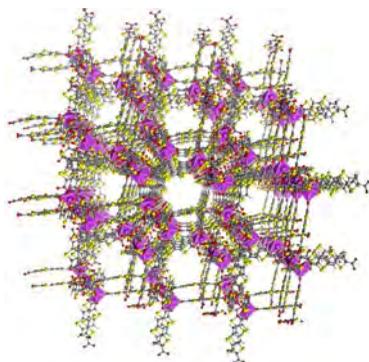
Design and synthesis of conjugated porous polymers and their hybrids

- Design and synthesis of new building blocks: monomers and ligands.
- Synthesis and design of conjugated porous polymers, based on DTT, Benzodithiophenes, truxenes, anthraquinones, BODIPYs, BOPHY and phenylene, moieties.
- Synthesis and design of Covalent Organic Frameworks (COFs) as well as thin films thereof by interfacial synthesis.
- Synthesis of conjugated porous polymer nanostructures by miniemulsion and electropolymerization techniques in order to achieve thin films.
- Prepare and characterize hybrid materials based on conjugated porous polymers and inorganic semiconductors.
- Prepare electron and ions conductive polymer to design dual membranes.



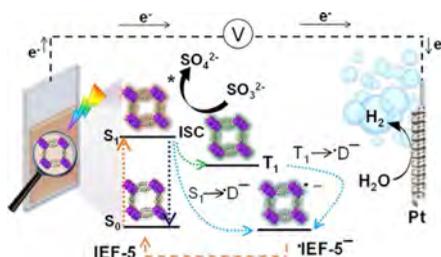
MOFS

- Design and synthesis of novel UV- and visible-light-absorbing building blocks as organic MOF linkers.
- Design and synthesis of MOFs based on group-5 metals.
- Post-functionalization including metal nanoparticles, redox coordination compounds and organic polymers.



Fundamental studies of reaction mechanisms

- Determined the structural, textural and morphological properties of multifunctional materials.
- Optoelectronic characterization by time-resolved optical techniques including transient absorption spectroscopies to correlate these intrinsic properties with the efficiency of the devices for light-driven technologies.



- In-situ characterization under working conditions using vibrational and optical spectroscopies for both laboratory and synchrotron radiation based techniques.
- Ab-initio and QM theoretical calculation.

Process evaluation and scale-up

- Synergistic improvement of solar fuels production using hybrid photocatalysts.
- Implemented tunable selectivity of CO₂ photoreduction with metal nanoparticle co-catalysts.
- H₂ production from biomass derivatives in real matrices.
- Performed scalability studies for CO₂ photoreduction catalysts.
- Preparation of thin films of the new synthesised materials and evaluation as photoelectrodes in photoelectrochemical cells.
- Preparation of thin films and design of smart windows devices.





Advanced Porous Materials Unit



Dr. Patricia Horcajada
Senior Researcher
Head of the Unit



Dr. Yolanda Pérez
Associated Senior Researcher

porous materials

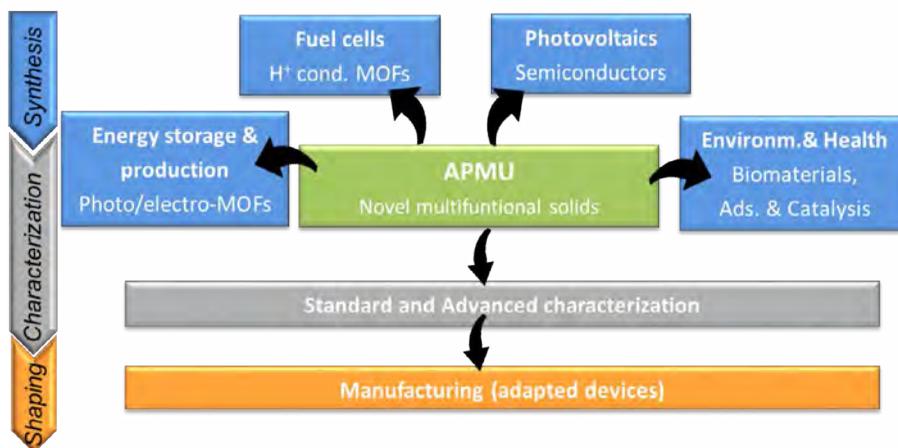


R&D Objectives

- Development of innovative multifunctional solids.
- Full understanding of the structural features for improving and/or adapting the materials properties to specific applications.
- Adapted devices for their final applications (scale-up and shaping).

Research lines

- Proton conducting materials: fuel cells.
- Semiconducting materials: photovoltaics.
- Electroactive materials: energy storage and production.
- Adsorbent and catalytic materials: biomedical applications.
- Adsorbent and catalytic materials: environmental applications.





Relevant projects and networking

During 2020 the Advanced Porous Materials Unit (APMU) has been involved in 2 European, 7 national and 2 regional projects: A European project HeatNMof (H2020-MSCA-ITN-2019) dealing with the development of new nanomedicines based on MOFs and plasmonic and/or magnetic inorganic nanoparticles; a European project C.Cell-MOF (M-ERA.Net) focused on the preparation of new materials for their incorporation as electrodes or electrolytes in fuel cells; a national Maria de Maeztu project, dealing with new concepts for electromobility, solar fuels/photohermal processes and fourth generation fuels; a national industrial collaborative project ESENCE, funded by MINECO, aiming at removing specific contaminants from wastewater; the MOFSEIDON project, funded by MINECO, focused on the preparation of new porous materials for wastewater decontamination; a regional industrial doctorate project CLORATOS, focused to the implementation of different porous materials for the purification of fresh water; two national projects funded by Iberdrola Foundation, Bat-Poro was aim-

ing to develop nanostructured carbons from MOFs for an efficient energy storage, and CESOLMAT developing green 1D perovskites as novel absorbents for solar cells; Ramón Areces project (H+MOF), which aims to develop fuel cells based on novel composite MOFs; a collaboration networking dealing with the development of multifunctional metallodrugs in diagnosis and therapy and a regional Madrid-PV2-CM project dealing with the investigation of materials, devices and technologies for the development of the photovoltaic industry. In addition, during 2020, APMU has enjoyed 5 personal fellowships.

APMU possesses a large frame of collaborations at the national, European and international level that has enhanced mobility actions and collaborative projects. APMU is also involved in the MATERPLAT platform, promoting innovation in advanced materials Spanish system, and in different chemical-related associations (RSEQ, AEBIN, IAAM, etc.).



Facilities

Synthesis

- Best practice organic/inorganic laboratory tools: schlenk lines, ovens, rotatory evaporator, (ultra)centrifuge, climate chamber, thin-layer chromatography (TLC), UV lamp, soxhlet, glove box.
- Traditional inorganic synthetic methods: two-layer diffusion, evaporation, high temperature...
- Conventional solvothermal, microwave-assisted, sonochemical, mechanochemical methods, syringe pump techniques.
- High-through put solvothermal reactors.
- Handling cytotoxic compounds.

Manufacturing

- Supercritical CO₂ extraction system (material purification, adsorption, shaping).
- Press-molding and monoliths.
- Spin-coating, ozone cleaner (thin films, membranes).



Characterization

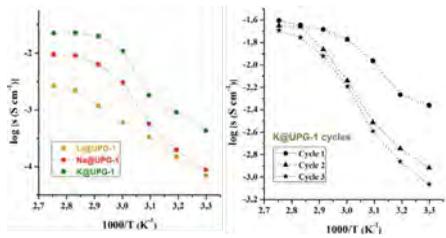
- High-through put filtration system coupled with multi-sample XRPD.
- *In situ* structural characterization (XRD, IR) as a function of temperature, adsorbate and pressure.
- Experimental crystalline structure determination and refinement.
- Chemical, structural, mechanical and colloidal stability tests.
- Computation of properties of periodic structures using state-of-art density functional theory methods (ORCA, Dmol3, CASTEP, VASP codes) and atomistic modelling.
- High performance liquid chromatography (HPLC) coupled with a photodiode array (PDA) detector.
- Ionic chromatography.
- Permeation chambers and cell culture facilities.



Scientific and technical results

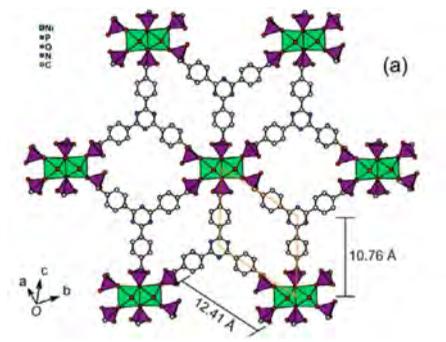
Proton conducting materials: fuel cells

- Designed and synthesized new multi-functional MOFs based on phosphonate ligands.
- Improving the cyclability and ionic conductivity of a robust Zr-MOF via the cationic exchange (Li^+ , Na^+ , K^+) of the labile protons present within the structure.



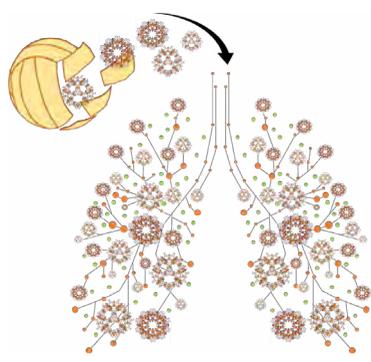
Electroactive materials: energy storage and production

- Obtained a novel MOF (IEF-13) based on a triazine phosphonate derivative and Ni with outstanding thermal and chemical stability, demonstrating a record photocatalytic activity in the water splitting reaction in absence of any co-catalyst.



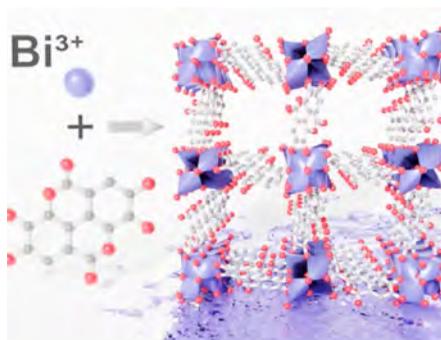
Adsorbent and catalytic materials: biomedical applications

- Evaluated the neurotoxicity of orally administered TiO_2 nanoparticles, concluding on a neurotoxic damage in neurons of the cerebral cortex.
- Pioneering administration of a biosafe formulation of a MOF via a pulmonary route for the administration of drugs (e.g. antituberculosis), reaching the deep lungs.
- Prepared 3 biocompatible MOFs based of the azelaic acid and mono/divalent cations (Na^+ , K^+ , Ca^{2+}) with a remarkable antibacterial activity.
- Developed a biosafe cutaneous formulation based on a MOF and a polymer for the combined delivery of two complementary drugs (nicotinic acid and azelaic acid).

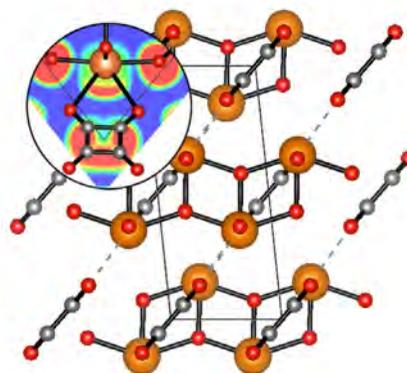


Adsorbent and catalytic materials: environmental applications

- Synthesis of a Bi-MOF based on the natural antioxidant ellagic acid via a fully green method. This biocompatible material allowed the removal of toxic compounds such as SO₂ and H₂S.
- Adapted synthesis of a series of benchmarked porous iron terephthalate MOFs using the microwave route, obtaining the pure phases in a rapid (minutes) and efficient manner (high yields), together with a good control of their crystal size.

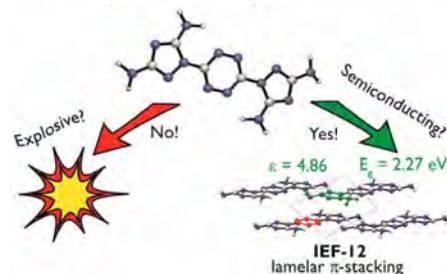


- Prepared a N-rich conjugated heterocyclic compound (N=71 wt %), inert to ignition and mechanically and thermally stable (IEF-12), acting as a non-classically structured organic semiconductor.
- Full characterization of a lead-free hybrid perovskite based on 1D iodobismutate anions and the hydrophobic benzimidazole cation (IEF-4), exhibiting a fully reversible hydration-dehydration transition never reported so far for this type of materials. Its optoelectronic properties together with its exceptional stability under working conditions (temperature and humidity) make this solid a promising absorber material in solar cells.



Semiconducting materials: photovoltaics

- Designed and synthesized a n-type semiconducting Bi-coordination polymer (IEF-3) based on the electroactive squarate ligand, exhibiting a photocurrent response comparable with the inorganic α -Bi₂O₃, but offering the possibility to modulate their optoelectronic properties through ligand substitution.



annex

R&D projects,
contracts and grants

73

scientific results

95

training and
dissemination activities

112

annex



1. R&D projects, contracts and grants

1.1. Regional R&D projects

1. Title/Acronym: Concentrated solar thermal energy in the transport sector and heat and electricity production / ACES2030-CM (S2018/EMT-4319)

Partners: IMDEA Energy Institute (Coordinator); CIEMAT; ICP-CSIC; Carlos III University; UNED, Polytechnic University of Madrid; Rey Juan Carlos University; Lab 327

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Program of R&D activities between research groups in Technology 2018

IMDEA Energy Institute external funding: 251.671 €€

2. Title/Acronym: New generation of multifunctional materials for artificial photosynthesis / FotoArt-CM (S2018/NMT-4367).

Partners: IMDEA Energy Institute (Coordinator); ICMN-CSIC; Autonoma University of Madrid; IMDEA Nanoscience Institute; ICP-CSIC; IMDEA Materials Institute; Lab 369; Lab 150; Lab 442; Lab 433

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Program of R&D activities between research groups in Technology 2018

IMDEA Energy Institute external funding: 303.774 €€

3. Title/Acronym: Smart Microgrids Programme for Community of Madrid / PROMINT-CM (S2018/EMT-4366).

Partners: University of Alcalá (Coordinator); Carlos III University; Pontificia Comillas University of Madrid; IMDEA Energy Institute; Lab 169; Lab 368

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Programa de Actividades de I+D entre Grupos de Investigación de la Comunidad de Madrid en Tecnologías 2018

IMDEA Energy Institute external funding: 169.728 €€

4. Title/Acronym: Materials, devices and technologies for the development of the photovoltaic industry / MADRID-PV2-CM (S2018/EMT-4308)

Partners: Polytechnic University of Madrid (Coordinator); IMDEA Nanoscience Institute; Complutense University of Madrid; INM-CSIC; Lab 270; Lab 439

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Programa de Actividades de I+D entre Grupos de Investigación de la Comunidad de Madrid en Tecnologías 2018

IMDEA Energy Institute external funding: 79.585 €€

5. Title/Acronym: Development of advanced microalgae technologies for a circular economy / ALGATEC-CM (S2018/BAA-4532)

Partners: Rey Juan Carlos University (Coordinator); CIB-CSIC; CIEMAT; Autonoma University of Madrid; Polytechnic University of Madrid; Lab 370

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Programa de Actividades de I+D entre Grupos de Investigación de la Comunidad de Madrid en Tecnologías 2018

IMDEA Energy Institute external funding: 131.000 €€

6. Title/Acronym: Urban bioeconomy: transformation of bio-waste into biofuels and bioproducts of industrial interest / BIOTRES-CM (S2018/EMT-4344)

Partners: Rey Juan Carlos University (Coordinator); ICP-CSIC; Autonoma University of Madrid; CIEMAT; Lab 165; Lab 444

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Programa de Actividades de I+D entre Grupos de Investigación de la Comunidad de Madrid en Tecnologías 2018

IMDEA Energy Institute external funding: 120.433 €€

1.2. National R&D projects

1. Title/Acronym: Microbial-oils production via anaerobic digestion: bioconversion of volatile fatty acids by oleaginous yeasts / ACMIBIO-DA (ENE2017-86864-C2-2-R)

Partners: CIEMAT (Coordinator); IMDEA Energy Institute; Neol Biosolution; BIOPLAT; FIAB

Period: 2018-2021

Funding Institution/Program: Ministry of Economy, Industry and Competitiveness / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2017*

IMDEA Energy Institute external funding: 114.950 € €

2. Title/Acronym: Solar fuels production in wide-spectrum photoactivated catalytic devices / SOLPAC (ENE2017-89170-R)

Partners: IMDEA Energy Institute; Repsol

Period: 2018-2020

Funding Institution/Program: Ministry of Economy, Industry and Competitiveness / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2017*

IMDEA Energy Institute external funding: 217.800 € €





3. Title/Acronym: Fire-Safe Structural Batteries / STRUBAT
Partners: IMDEA Energy Institute; IMDEA Materials Institute
Periodo: 2018-2020
Funding Institution/Program: IMDEA Materials Institute
IMDEA Energy Institute external funding: 49.861 € €

4. Title/Acronym: Environmental and energy applications of electrochemical technology / Red E3Tech (CTQ2017-90659-REDT)
Partners: University of Castilla-La Mancha (Coordinator); Universitat de Barcelona; University of Cantabria; University of Alicante; Polytechnic University of Valencia; University of Vigo; Polytechnic University of Cartagena; University of Valencia; IMDEA Energy Institute
Period: 2018-2021
Funding Institution/Program: Ministry of Economy, Industry and Competitiveness / State Program for Promotion of Scientific and Technical Research Excellence. *Acciones de dinamización "Redes de excelencia" 2017*

5. Title/Acronym: Nanostructured multifunctional membranes for solar fuels production by artificial photosynthesis / Art-LEAF (CIVP19A5951)
Partners: IMDEA Energy Institute
Period: 2019-2022
Funding Institution/Program: Fundación Ramón Areces / XVII Concurso Nacional para la adjudicación de ayudas a la Investigación en Ciencias de la Vida y de la Materia 2018
IMDEA Energy Institute external funding: 126.568 € €

6. Title/Acronym: Novel proton-conducting MOF composites for fuel cell devices / H+MOFs (CIVP19A5950)
Partners: IMDEA Energy Institute
Period: 2019-2022
Funding Institution/Program: Fundación Ramón Areces / XVII Concurso Nacional para la adjudicación de ayudas a la Investigación en Ciencias de la Vida y de la Materia 2018
IMDEA Energy Institute external funding: 126.568 € €

7. Title/Acronym: Injectable batteries of semi-solid electrodes / InBat (RTI2018-099228-A-I00)
Partners: IMDEA Energy Institute
Period: 2019-2021
Funding Institution/Program: Ministry of Science, Innovation and Universities / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2018*

8. Title/Acronym: Computer-aided macromolecular design of redox-active polymers: promising paradigm for sustainable battery research and development / SUSBAT (RTI2018-101049-B-I00)

Partners: IMDEA Energy Institute

Period: 2019-2021

Funding Institution/Program: Ministry of Science, Innovation and Universities / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2018*

IMDEA Energy Institute external funding: 145.200 € €

9. Title/Acronym: Redefining the waste-energy nexus: a new concept of regional refinery for the circular economy / REDEFINERY (RTI2018-097227-B-I00)

Partners: IMDEA Energy Institute

Period: 2019-2021

Funding Institution/Program: Ministry of Science, Innovation and Universities / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2018*

IMDEA Energy Institute external funding: 181.500 € €

10. Title/Acronym: Coordination of distributed storage for improved continuity of supply in distribution networks / CoorAlma

Partners: IMDEA Energy Institute

Period: 2019-2020

Funding Institution/Program: Fundación Iberdrola Spain / Call for research funding in energy and environment 2019-2020

IMDEA Energy Institute external funding: 20.000 € €

11. Title/Acronym: Development of models for the techno-environmental assessment of the recycling of car batteries / SIMBATT

Partners: IMDEA Energy Institute

Period: 2019-2020

Funding Institution/Program: Fundación Iberdrola Spain / Call for research funding in energy and environment 2019-2020

IMDEA Energy Institute external funding: 20.000 € €

12. Title/Acronym: Through efficient solar cells: New environmentally friendly 1D perovskites / CESOLMAT

Partners: IMDEA Energy Institute

Period: 2019-2020

Funding Institution/Program: Fundación Iberdrola Spain / Call for research funding in energy and environment 2019-2020

IMDEA Energy Institute external funding: 20.000 € €

13. Title/Acronym: Ionic systems for energy sustainability / SISE (RED2018-102679-T)
Partners: Universidade da Coruña (Coordinator); Universidade de Santiago de Compostela; Fundación Universidad San Jorge; University of País Vasco; University of Vigo; University of Cantabria; Fundación Tecnalia; University of Murcia; IIAG-CSIC; Universitat Rovira I Virgili; Universitat Jaume I De Castello; Complutense University of Madrid; University of Valencia; Polytechnic University of Cartagena; IMDEA Energy Institute
Period: 2020-2021
Funding Institution/Program: Ministry of Science, Innovation and Universities / State Program for Promotion of Scientific and Technical Research Excellence. *Acciones de dinamización "Redes de excelencia" 2018*

14. Title/Acronym: Concentrating Solar Thermal Systems / SolTerCo (RED2018-102460-E)
Partners: CIEMAT (Coordinator); Carlos III University of Madrid; Universitat Politècnica de Catalunya; Fundación Tekniker; IMDEA Energy Institute; University of Sevilla; CIC Energigune; Fundación CENER-CIEMAT
Period: 2020-2021
Funding Institution/Program: Ministry of Science, Innovation and Universities / State Program for Promotion of Scientific and Technical Research Excellence. *Acciones de dinamización "Redes de excelencia" 2018*

15. Title/Acronym: Combined separation and (photo)degradation of water contaminants using Metal-Organic Framework devices / MOFSEIDON (PID2019-104228RB-I00)
Partners: IMDEA Energy Institute
Period: 2020-2023
Funding Institution/Program: Ministry of Science and Innovation / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2019*
IMDEA Energy Institute external funding: 193.600 € €

16. Title/Acronym: Nano-Structured Hybrid Materials for Solar Fuels Photoelectrocatalytic / NHyMPha (PID2019-106315RB-I00)
Partners: IMDEA Energy Institute
Period: 2020-2023
Funding Institution/Program: Ministry of Science and Innovation / Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2019*
IMDEA Energy Institute external funding: 249.260 € €

17. Title/Acronym: Hydrogen produced in microbial electrolytic cells as an energetic storage system / POWER TO GAS
Partners: IMDEA Energy Institute
Period: 2020-2021
Funding Institution/Program: Fundación Iberdrola Spain / Call for research funding in energy and environment 2020-2021
IMDEA Energy Institute external funding: 10.000 € €

18. Title/Acronym: Nanostructured porous carbons for the electrochemical energy storage / Bat-poro

Partners: IMDEA Energy Institute

Period: 2020-2021

Funding Institution/Program: Fundación Iberdrola Spain / Call for research funding in energy and environment 2020-2021

IMDEA Energy Institute external funding: 20.000 € €

19. Title/Acronym: Unit of Excellence Maria de Maeztu (CEX2019-000931-M)

Partners: IMDEA Energy Institute

Period: 2020-2023

Funding Institution/Program: Ministry of Science and Innovation / “Severo Ochoa Centres of Excellence” and the “María de Maeztu Units of Excellence” 2019

IMDEA Energy Institute external funding: 2.000.000 € €

1.3. Industrial R&D projects

1. Title/Acronym: Design and optimization of a continuous reactor for the catalytic pyrolysis of biomass and the production of high quality bio-oils / DI-PID (IND2017/AMB-7660)

Partners: Process Integral Development & Tech; IMDEA Energy Institute

Period: 2018-2021

Funding Institution/Program: Comunidad de Madrid / Industrial Doctorates 2017

IMDEA Energy Institute external funding: 76.000 € €

2. Title/Acronym: Research and study of flow microbatteries for application in photovoltaic microinverters / MIBAMIN (IND2017/AMB-7719)

Partners: Micro Electrochemical Technologies; IMDEA Energy Institute

Period: 2018-2021

Funding Institution/Program: Comunidad de Madrid / Industrial Doctorates 2017

IMDEA Energy Institute external funding: 78.000 € €

3. Title/Acronym: Advanced fuels and polymers from municipal solid wastes / RESUCAP (IND2018/AMB-9594)

Partners: Repsol; IMDEA Energy Institute

Period: 2019-2022

Funding Institution/Program: Comunidad de Madrid / Industrial Doctorates 2018

IMDEA Energy Institute external funding: 89.000 € €

4. Title/Acronym: Porous materials for the minimization of chlorates in treated waters / CLORATO (IND2019/AMB-17129)

Partners: Canal Isabel II; IMDEA Energy Institute

Period: 2020-2023

Funding Institution/Program: Comunidad de Madrid / Industrial Doctorates 2019

IMDEA Energy Institute external funding: 89.995 € €

5. Title/Acronym: Modeling and reformulation of batteries for emergency lighting devices / BAILEM (IND2019/AMB-17189)

Partners: Electroemper; IMDEA Energy Institute

Period: 2020-2023

Funding Institution/Program: Comunidad de Madrid / Industrial Doctorates 2019

IMDEA Energy Institute external funding: 90.000 € €

6. Title/Acronym: Hybridization of geothermal energy and flow batteries for heating and cooling of zero-energy tertiary use buildings / GeoBATT (RTC-2017-5955-3)

Partners: Sacyr Industrial (Coordinator); PVH Energy Storage; IMDEA Energy Institute; Polytechnic University of Madrid; Carlos III University of Madrid

Period: 2018-2021

Funding Institution/Program: Ministry of Science, Innovation and Universities / Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2017*

IMDEA Energy Institute external funding: 255.476 € €

7. Title/Acronym: Battery inverter with integrated controls of power converter and micro-grid / MICROGRID-ON-CHIP (RTC-2017-6262-3)

Partners: Norvento Energía Distribuída (Coordinator); IMDEA Energy Institute; University of Alcalá.

Period: 2018-2021

Funding Institution/Program: Ministry of Science, Innovation and Universities / Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2017*

IMDEA Energy Institute external funding: 92.097 € €



8. Title/Acronym: New technologies for the removal and in situ detection of emerging contaminants in wastewater / ESENCE (RTC-2019-007254-5)

Partners: Depuración de Aguas del Mediterráneo (Coordinator); IMDEA Energy Institute; Fundación Centro Tecnológico de Investigación Multisectorial

Period: 2020-2023

Funding Institution/Program: Ministry of Science and Innovation / Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2019*

IMDEA Energy Institute external funding: 82.288 € €

1.4. International R&D projects

1. Title/Acronym: Hybrid materials for artificial photosynthesis / HyMap (648319)

Partners: IMDEA Energy Institute

Period: 2015-2022

Funding Institution/Program: European Union / H2020. ERC-2014-CoG

IMDEA Energy Institute external funding: 2.506.738 € €

2. Title/Acronym: High temperature concentrated solar thermal power plant with particle receiver and direct thermal storage / NEXT-CSP (727762)

Partners: CNRS (Coordinator); Électricité de France; Sbp Sonne; IMDEA Energy Institute; Comessa; Whittaker Engineering; European Powder and Process Technology; Katholieke Universiteit Leuven; Institut National polytechnique de Toulouse; Euronovia

Period: 2016-2020

Funding Institution/Program: European Union / H2020-JTI-FCH-2015-1 (FCH-04.1-2015)

IMDEA Energy Institute external funding: 199.791 € €

3. Title/Acronym: "Valorization of urban wastes to new generation of bioethanol / WASTE-2BIO (PCIN-2016-121)

Partners: Imecal (Coordinator); Ciemat; Exergy; Ineuvo Limited; IMDEA Energy Institute

Period: 2016-2020

Funding Institution/Program: Ministry of Economy, Industry and Competitiveness / Cofund ERA-NET BESTF3 joint call/ APCIN 2016

IMDEA Energy Institute external funding: 42.000 € €

4. Title/Acronym: Integrating national research agendas on solar heat for industrial processes / INSHIP (731287)

Partners: Fraunhofer (Coordinator); Ciemat; Aee Intec; Fondazione Bruno Kessler; Universidade de Evora; The Cyprus Institute; Centre for renewable energy sources and saving; ETH Zürich; CEA; Middle East Technical University; EERA Aisbl; CNRS; DLR; ENEA; CNR; Università degli Studi di Palermo, Università degli Studi di Napoli Federico

II; Universita degli Studi di Firenze; Lneg; Associacao do Instituto Superior Tecnico para a Investigacao e Desenvolvimento; Cener-Ciemat; IMDEA Energy Institute; Centro Tecnológico Avanzado de Energías Renovables de Andalucía; Tecnalia; Ik4-tekniker; University of Seville; Cic Energigune; Cranfield University

Period: 2017-2020

Funding Institution/Program: European Union / H2020. Call H2020-LCE-2016-ERA (LCE-33-2016)

IMDEA Energy Institute external funding: 16.601 € €

5. Title/Acronym: Membrane-free redox flow batteries / MFreeB (726217)

Partners: IMDEA Energy Institute

Period: 2017-2022

Funding Institution/Program: European Union / H2020. ERC-2016-CoG

IMDEA Energy Institute external funding: 1.998.407 € €

6. Título/Acrónimo: European corridors for natural gas transport efficiency / ECO-GATE (INEA/CEF/TRAN/M2016/1359344)

Partners: Gas Natural Madrid; CETIL Dispensing technology; Fundacion Cidaut; Instituto IMDEA Energía; GASNAM; Inversora Melofe; Autoridad Portuaria de Huelva; SOLTEL IT Solutions; Universidad de Santiago de Compostela; Port Authority of Gijon; Sociedad Estatal de Correos y Telégrafos; SOULMAN Insightful Thinking; ENAGAS Transporte; ENDESA Energía; MOLGAS Energía; EVARM Innovación; Mantenimiento de instalaciones de gas y servicios auxiliares; REPSOL Comercial de productos petrolíferos; Dourogás Natural- medição e exploração de sistema de gás; GALP Gas Natural; Universidade De tras-os-montes e alto douro; Gas Natural Europe; Ghenova Ingeniería; AUDIGNA.

Period: 2017-2021

Funding Institution/Program: Unión Europea / H2020. CEF-Transport-2016-MAP-General

IMDEA Energy Institute external funding: 20.646 € €

7. Title/Acronym: Demonstration of dry fermentation and optimization of biogas technology for rural communities in the MENA region / BIOGASMENA (PCIN-2017-065)

Partners: University of Hohenheim (Coordinador); University of Verona; Agricultural University of Athens (AUA), Nireas-IWRC (University of Cyprus), EGE University, Université des Sciences et Technologies d'Oran (USTO), Laboratoire de Biotechnologie de L'Environnement (LBE of INRA), IMDEA Energy, Centre de Biotechnologie de Sfax (CBS), University of Cairo, Nenufar, ERM, Talos, Euromarket, FnBB e.V.

Period: 2017-2020

Funding Institution/Program: Ministry of Economy, Industry and Competitiveness / ERANETMED 2nd joint call / APCIN 2017

IMDEA Energy Institute external funding: 99.865 € €

8. Title/Acronym: Solar facilities for the european research area - third phase / SFERA-III (823802)

Partners: Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT) (Coordinator); Centre National de la Recherche Scientifique (CNRS); Agenzia Nazionale per le Nuove Tecnologie; L'Energia e lo Sviluppo Economico Sostenibile (ENEA); Deutsches Zentrum für Luft – und Raumfahrt e.V. (DLR); Commissariat à L'Énergie Atomique et aux Énergies Alternatives (CEA); Universidade de Évora; Eidgenössische Technische Hochschule Zürich (ETHZ); Fundación IMDEA Energía; The Cyprus Institute; Fraunhofer Gesellschaft zur Förderung der angewandten Forschung; Laboratorio Nacional de Energia e Geologia I.P. (LNEG); Middle East Technical University; Universidad de Almería; Euronovia; European Solar Thermal Electricity Association (ESTELA)

Period: 2019-2022

Funding Institution/Program: European Union / H2020-INFRAIA-2018-2020 (H2020-INFRAIA-2018-1)

IMDEA Energy Institute external funding: 466.919 € €

9. Title/Acronym: Solar energy for a circular economy / SUNRISE (816336)

Partners: Universiteit Leiden (Coordinator); Commissariat a l energie atomique et aux energies alternatives; Consiglio nazionale delle ricerche; eidgenossische materialprufungs-und forschungsanstalt; Uppsala Universitet; Fundacion IMDEA Energia; Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung; Forschungszentrum Julich; Imperial College of Science Technology and Medicine; Energy materials industrial research initiative aisbl; Siemens Aktiengesellschaft; Turun Yliopisto; Uniwersytet Warszawski; Ustav fyzikalni chemie j. heyrovskeho av cr, v.v.i.; Johnson matthey; Fundacio privada institut catala d'investigacio quimica; Alliance europeenne de recherche dans le domaine de l'energie; Norges teknisk-naturvitenskapelige Universitet NTNU; Universite Catholique de louvain; ENGIE

Period: 2019-2020

Funding Institution/Program: European Union / H2020-FETFLAG-2018-2020 (FETFLAG-01-2018)

IMDEA Energy Institute external funding: 18.381 € €

10. Title/Acronym: Removing hazardous substances to increase recycling rates of WEEE, ELV and CDW plastics / NONTOX (820895)

Partners: Teknologian tutkimuskeskus VTT Oy (Coordinator); Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung; Università degli studi della Campania Luigi Vanvitelli; Relight srl; Fundación IMDEA Energía; AIMPLAS - Asociación de Investigación de Materiales Plásticos y Conexas; Stena Recycling International ab; Galea Polymers sl; Ecodom - Consorzio Italiano per il Recupero e Riciclaggio Elettrodomestici; Norner Research as; Aalto-Korkeakoulusäätiö; Coolrec bv

Period: 2019-2022

Funding Institution/Program: European Union / H2020-SC5-2018-2019-2020 (H2020-SC5-2018-2)

IMDEA Energy Institute external funding: 538.321 € €

11. Title/Acronym: European training network in innovative polymers for next-generation electrochemical energy storage / POLYSTORE (860403)

Partners: Friedrich-Schiller-Universität JENA (Coordinator), Universidad del País Vasco/Euskal Herriko Unibertsitateam; Karlsruher Institut fuer technologie; Uppsala Universitet; Université Catholique de Louvain; Politecnico di Torino; Fundación IMDEA Energía; Lithops; Université de Pau et des Pays de l'Adour; Aalto Korkeakoulusäätiö; Kemijski Institut; Energy Storage Solutions. **Partner Organisations:** Deakin University; Scania CV AB; Toyota Motor Europe; Evonik Creavis GmbH; TCI Europe; CALIXHE; Chemspeed Technologies AG; NETZSCH Gerätebau GmbH; Solvionic; Repsol; University of Ljubljana
Period: 2019-2023

Funding Institution/Program: European Union / H2020-MSCA-ITN-2019 (ETN)
IMDEA Energy Institute external funding: 376.357 € €

12. Title/Acronym: “Non-conventional yeasts for the production of bioproducts / Yeast-4Bio (CA18229)

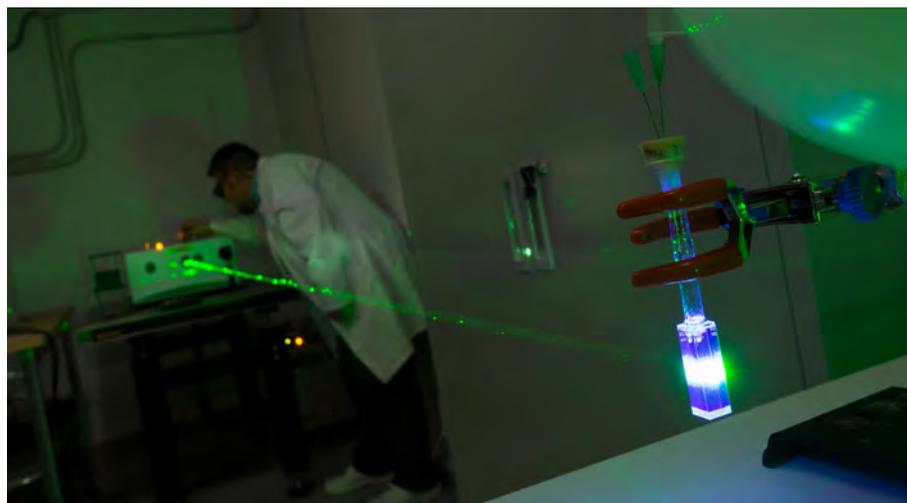
Partners: IMDEA Energy Institute (Coordinator); more than 70 researchers of 50 companies, universities, research centres, associations, from all over the world
Period: 2019-2023

Funding Institution/Program: European Union / COST actions
IMDEA Energy Institute external funding: 80.000 € € (estimated)

13. Title/Acronym: Heating triggered drug release from nanometric inorganic-metal organic framework composites / HeatNMof (860942)

Partners: IMDEA Energy Institute (Coordinator); Universidad de Santiago de Compostela; Centre National de la Recherche Scientifique CNRS; Universiteit Antwerpen; Immaterial Labs Ltd; Institut National des Sciences Appliquées de Toulouse; Universität Hamburg; Fondazione Istituto Italiano di Tecnologia; Nanoscale Biomagnetics; Isern Patentes y Marcas. **Partner Organizations:** Universidad Rey Juan Carlos; Universidad de Zaragoza; University of Cambridge; Université de Nantes; Università degli Studi di Genova; Oncodesign
Period: 2020-2024

Funding Institution/Program: European Union / H2020-MSCA-ITN-2019 (ETN)
IMDEA Energy Institute external funding: 501.810 € €



14. Title/Acronym: GHz nanoscale electrical and dielectric measurements of the solid-electrolyte interface and applications in the battery manufacturing line / NanoBat (861962)

Partners: Keysight Technologies Gmbh (Coordinator); Ruhr-universitaet bochum; Qwed Spolka z Ograniczona Odpowiedzialnoscia; Universitat Linz; Pleione Anonymi Etairia Kainotomon Energeiakon Efarmogon; Eidgenossisches Institut fur Metrologie Metas; AIT Austrian Institute of Technology Gmbh; IMDEA Energy Institute; Technische Universitaet Braunschweig; Kreisel Electric Gmbh & co kg; Centro Ricerche Fiat Scpa; Eurice European Research and Project Office Gmbh

Period: 2020-2023

Funding Institution/Program: European Union / H2020-NMBP-TO-IND-2018-2020 (DT-NMBP-08-2019)

IMDEA Energy Institute external funding: 190.937 € €

15. Title/Acronym: Production of advanced biodiesel from animal wastes using supercritical technologies / LIFE Superbiodiesel (LIFE19 CCM/ES/001189)

Partners: Asociación de Investigación de la Industria del Juguete, Conexas y Afines (AIJU) (Coordinator); Compañía Española de Petróleos; IMDEA Energy Institute; Asociación de Investigación para la Industria del Calzado y Conexas; Agencia Estatal Consejo Superior de Investigaciones Científicas; ORGANOVAC; Universidad de Murcia

Period: 2020-2023

Funding Institution/Program: European Union / H2020. LIFE 2019 - Climate change and mitigation

IMDEA Energy Institute external funding: 57.867 € €

16. Title/Acronym: Technical, business and regulatory approaches to enhance the renewable energy capabilities to take part actively in the electricity and ancillary services markets / DRES2Market (952851)

Partners: Asociación de empresas de energías renovables, APPA (Coordinator); Institute of communication and computer systems; Fronius International; Etaireia Parohis Aeriou Attikis - Elleniki Anonymi Energeias Fysiko Aerio - Elleniki Etaireia Energeias; IMDEA Energy Institute; Gesternova S.A.; Commissariat à l'énergie atomique et aux énergies alternatives; Instytut Energetyki; OMI, Polo Español S.A.; ENEA Operator sp. z o.o.; Deloitte Advisory S.L.; PKP Energetyka; Centre National de la Recherche Scientifique, CNRS; Høgskulen på Vestlandet; Instituto para la diversificación y ahorro de la energía, IDAE

Period: 2020-2023

Funding Institution/Program: European Union / H2020-LC-SC3-2018-2019-2020 (LC-SC3-RES-28-2018-2019-2020)

IMDEA Energy Institute external funding: 332.125 € €

17. Title/Acronym: Manufacture of nanostructured Conjugated Porous Polymers for energy applications / NanoCPPs (899773)

Partners: IMDEA Energy Institute

Period: 2020-2022

Funding Institution/Program: European Union / H2020. ERC-2019-PoC

IMDEA Energy Institute external funding: 150.000 € €

18. Title/Acronym: Novel materials as electrode and electrolyte components in fuel cell technology / C-MOF.cell (PCI2020-111998)

Partners: IMDEA Energy Institute (Coordinator); University of La Laguna; University of Tartu (UT-Estonia); Institut Charles Gerhardt Montpellier (ICGM-France)

Period: 2020-2023

Funding Institution/Program: Ministry of Science and Innovation / M-ERA.NET Call 2019/ PCI 2020

IMDEA Energy Institute external funding: 100.000 € €

1.5. Contracts with companies and other organizations

1. Title/Acronym: Energy efficiency in systems for vibration testing

Company: IMV Corporation (Japan)

Period: 2010-2020

IMDEA Energy Institute external funding: 286.536 € €

2. Title/Acronym: Technical advice for the determination of polluting substances in a paint application process

Company: Mercedes Benz Spain (Spain)

Period: 2018-present

IMDEA Energy Institute external funding: 12.650 € €

3. Title/Acronym: Development and integration of flexible Li-ion batteries into vehicle's components / BATFLEX

Institution: IMDEA Materials Institute and private company (Spain)

Period: 2018-2020

IMDEA Energy Institute external funding: 77.000 € €

4. Title/Acronym: Transient Stability Enhancement / RITSE (Gc2017_P2)

Company: Red Eléctrica de Spain (Spain) / Grid2030 Program

Period: 2019-2020

IMDEA Energy Institute external funding: 183.000 € €

5. Title/Acronym: Testing of batteries for wireless surveillance devices / BAMOWI

Company: Securitas Direct Spain (Spain)

Period: 2019-2022

IMDEA Energy Institute external funding: 59.080 € €

6. Title/Acronym: Heat exchange cooling devices for high temperature electronic systems / DICREAT20

Company: CEDRION (Spain)

Period: 2019-2020

IMDEA Energy Institute external funding: 14.000 € €

7. Title/Acronym: Support on technoeconomic assessment of calcium sulfoaluminate cement production / GORDCSA

Company: GORD-Gulf Organisation for Research & Development (Qatar)

Period: 2019-2020

IMDEA Energy Institute external funding: 7.588 € €

8. Title/Acronym: Updated technological capacities map of Spanish organizations in the area of Energy Storage / CAP-BatteryPlat

Company: AEPIBAL (Spain)

Period: 2019-2020

IMDEA Energy Institute external funding: 4.500 € €

9. Title/Acronym: Organization/leveraging of the work group on technologies within the Spanish technology platform on energy storage / DIN-BatteryPlat

Company: AEPIBAL (Spain)

Period: 2019-2020

IMDEA Energy Institute external funding: 3.500 € €

10. Title/Acronym: Performance analysis of a prototype for the desalination and extraction of high added value products in brine / CI19 SEENSO

Company: SEENSO RENOVAL (Spain) / "Cheque Innovación 2018" Programme

Period: 2019-2020

IMDEA Energy Institute external funding: 75.000 € €

11. Title/Acronym: Assessment of the impact of carbon capture on the energy efficiency and indoor air quality of public buildings / AQUAPUB

Company: EWL-Ecological World for Life Spain (Spain)

Period: 2019-2020

IMDEA Energy Institute external funding: 8.500 € €

12. Title/Acronym: Teaching in an energy course and visit to IMDEA Energy facilities / CuEVa

Company: Sustainable Innovations Europe (Spain)

Period: 2019-2020

IMDEA Energy Institute external funding: 1.500 € €

13. Title/Acronym: Testing of Primary Alkaline Batteries / TestPAB

Company: Spectrum Brands (Spain)

Period: 2020

IMDEA Energy Institute external funding: 1.000 € €

14. Title/Acronym: Services RedLab Biopen

Period: 2020

IMDEA Energy Institute external funding: 500 € €

15. Title/Acronym: Technical review if the state-to-art of the production and transport of hydrogen from fossil fuels, water electrolysis and biomass gasification / H2RIV

Company: RIVADESAR (Spain)

Period: 2020

IMDEA Energy Institute external funding: 10.500 € €

16. Title/Acronym: Solar thermal conversion of CO₂ into valuable nanomaterials (NPRP12S-0322-190433)

Partners: Gulf Organisation for Research and Development QSTP LLC (Coordinator); IMDEA Energy Institute

Period: 2020-2023

IMDEA Energy Institute external funding: 51.108 \$ (45.271 €)

17. Title/Acronym: Development of a low carbon and economically-competitive cement (NPRP12S-0319-190413)

Partners: Gulf Organisation for Research and Development QSTP LLC (Coordinator); IMDEA Energy Institute; Bauhaus Universitat Weimar; Eddymir Ltd.

Period: 2020-2024

IMDEA Energy Institute external funding: 76.873 \$ (68.098 €)

18. Title/Acronym: Experimental demonstration of solar-driven methane conversion to syngas or hydrogen on a solar tower / EFESTO

Company: Synhelion (Switzerland)

Period: 2020-2021

IMDEA Energy Institute external funding: 250.077 €

19. Title/Acronym: Energy recovery in generator set validation testing / RECUPERENE

Company: Generadores Europeos-Genesal (Spain)

Period: 2020

IMDEA Energy Institute external funding: 9.920 €

20. Title/Acronym: Control of power converters in vibration systems / COPOWCO

Company: IMV Corporation (Japan)

Period: 2020

IMDEA Energy Institute external funding: 28.282 €

21. Title/Acronym: Metastudy on LCA analysis applied to the maritime sector / MetaMar

Institution: JRC

Period: 2020

IMDEA Energy Institute external funding: 14.500 €

22. Title/Acronym: Investigation of power quality in the electrical distribution network of "Energijos Skirstymo Operatorius" / PQESO

Institution: Lithuanian Energy Institute (LEI)

Period: 2020-2021

IMDEA Energy Institute external funding: 15.000 €

23. Title/Acronym: Study on reactive power injection with PV plants for power oscillation damping simulation and project report / POD4PV

Company: Solairedirect de Mexico (Mexico)

Period: 2020

IMDEA Energy Institute external funding: 5.280 €



24. Title/Acronym: Investigation of new organic electrolytes with hydroxy-derivatives of phenazine for flow microbatteries / Hidroxi-FEBAT

Company: Aceleradora de Bachman (Spain)

Period: 2020

IMDEA Energy Institute external funding: 25.000 €

25. Title/Acronym: Control of power converters in vibration systems / COPOWC02

Company: IMV Corporation (Japan).

Period: 2020

IMDEA Energy Institute external funding: 23.268 €

26. Title/Acronym: Power oscillation damping by using PV inverters / POD4PV2

Company: Solairedirect de Mexico (Mexico)

Period: 2020

IMDEA Energy Institute external funding: 6.480 €

27. Title/Acronym: Course on Life Cycle Analysis and Ecodesign

Company: Repsol (Spain)

Period: 2020

IMDEA Energy Institute external funding: 4.750 €

28. Title/Acronym: Services RedLab OperandoLab

Period: 2020

IMDEA Energy Institute external funding: 240 €

29. Title/Acronym: Services RedLab TermoCat

Period: 2020-2021

IMDEA Energy Institute external funding: 3.340 €

30. Title/Acronym: Renewable technologies for energy storage based on new photovoltaic-thermal systems / TRANSFER

Company: CEDRIÓN (Spain) / MISIONES CDTI

Period: 2020-2022

IMDEA Energy Institute external funding: 40.000 €

31. Title/Acronym: New generation of waste biomass energy use systems without emissions. Towards carbon negative energy sources / Oe-mision

Company: INGELIA (Spain) / MISIONES CDTI

Period: 2020-2022

IMDEA Energy Institute external funding: 125.040 €

1.6. Researcher grants

1. Program: Ramón y Cajal 2014

Project: Linking wastewater bioremediation by means of microalgae cultivation and energy production out of this biomass (RYC-2014-16823)

Period: 2016-2020

Funding Institution: Ministry of Economy and Competitiveness

IMDEA Energy Institute external funding: 168.600 €(Total: 208.600 €)

Dr. Cristina González

2. Program: Ramón y Cajal 2014

Project: Bioapplications of porous materials (RYC-2014-15039)

Period: 2016-2021

Funding Institution: Ministry of Economy and Competitiveness

IMDEA Energy Institute external funding: 168.600 €(Total: 208.600 €)

Dr. Patricia Horcajada

3. Program: Ramón y Cajal 2015

Project: Design and Synthesis of Hybrid Materials for Advances Applications: Solar Fuels Generation (RYC-2014-15039)

Period: 2017-2021

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 168.600 €(Total: 208.600 €)

Dr. Marta Liras

4. Program: Recruitment of young doctors 2016 (Modality 2) (2016-T2/AMB-1310)

Period: 2017-2021

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 80.000 €

Dr. Julio Lado

5. Program: Contract FPI2016 (BES2016-077031)

Project/Acronym: Multidisciplinary analysis of indirectly-heated particles receivers/reactors for solar applications in extreme conditions / ARROPAR-CEX (ENE2015-71254-C3-1-R)

Period: 2017-2021

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 82.000 €(Total: 88.250 €)

Mr. Mario Sánchez

6. Program: Recruitment of experienced doctors 2017 (Modality 1)
Project/Acronym: Batteries based on semi-solid fluids / BASS (2017-T1/AMB-5190)
Period: 2018-2020
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 59.583 €(Total: 180.732 €)
Dr. Edgar Ventosa

7. Program: Recruitment of experienced doctors 2017 (Modality 1)
Project/Acronym: Computer-aided design of functional nanomaterials for energy storage applications / CADFUNES (2017-T1/AMB-5264)
Period: 2018-2022
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 110.000 €(Total: 306.976 €)
Dr. Andreas Mavrantoukakis

8. Program: Call for Predoctoral and Postdoctoral Researchers 2017 (PEJD-2017-PRE/AMB-4505)
Period: 2018-2020
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 25.000 €
Mr. Ioan Robert Istrate

9. Program: Call for Predoctoral and Postdoctoral Researchers 2017 (PEJD-2017-PRE/AMB-4951)
Period: 2018-2020
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 25.000 €
Mr. Alejandro Martínez

10. Program: Recruitment of research assistants and laboratory technicians 2017 (PEJ-2017-TL/IND-7448)
Period: 2018-2020
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 26.756 €
Ms. Miriam Bravo

11. Program: Recruitment of young doctors 2017 (Modality 2) (2017-T2/IND-5149)
Period: 2018-2020
Funding Institution: Comunidad de Madrid
IMDEA Energy Institute external funding: 49.150 €
Dr. Sara Rojas

12. Program: Contract FPI2017 (BES2017-082749)

Project/Acronym: CO₂ photoconversion to solar fuels using multifunctional materials / Ra-Phuel (ENE2016-79608-C2-1-R)

Period: 2018-2022

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 82.000 €(Total: 88.250 €)

Mr. Giacomo Armani

13. Program: Recruitment of experienced doctors 2018 (Modality 1)

Project/Acronym: Development of biochar-based materials for their application in bio-filters for the treatment of polluted air (nox, vocs) in urban environments / BioCharFilt (2018-T1/AMB-10023)

Period: 2019-2023

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 110.000 €(Total: 310.000 €)

Dr. Javier Feroso

14. Program: Recruitment of young doctors 2018 (Modality 2) (2018-T2/IND-11407)

Period: 2019-2023

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 80.000 €

Dr. Tania Hidalgo

15. Program: Call for Predoctoral and Postdoctoral Researchers 2018 (PEJD-2018-POST/AMB-8688)

Period: 2019-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 35.000 €

Dr Teresa Naranjo

16. Program: Call for Predoctoral and Postdoctoral Researchers 2018 (PEJD-2018-PRE/AMB-9310)

Period: 2019-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

Mr. Pablo Rodríguez

17. Program: Call for Predoctoral and Postdoctoral Researchers 2018 (PEJD-2018-PRE/IND-8666)

Period: 2019-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

Mr. Marcos González





18. Program: Call for Predoctoral and Postdoctoral Researchers 2018 (PEJD-2018-PRE/AMB-8330)

Period: 2019-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

Mr. Julio López

19. Program: Call for Predoctoral and Postdoctoral Researchers 2018 (PEJD-2018-PRE/IND-8674)

Period: 2019-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

Ms. Laura Gómez

20. Program: Recruitment of research assistants and laboratory technicians 2018 (PEJ-2018-TL/AMB-10908)

Period: 2019-2021

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 38.000 €

Ms. Sonia Sevilla

21. Program: Recruitment of research assistants and laboratory technicians 2018 (PEJ-2018-TL/AMB-11661)

Period: 2019-2021

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 33.784 €

Ms. Raquel Martín

22. Program: Recruitment of laboratory technicians 2018 (PEJ2018-004809-A)

Period: 2019-2021

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 35.800 €

Mr. Christian Sánchez

23. Program: Recruitment of laboratory technicians 2018 (PEJ2018-005232-A)

Period: 2019-2021

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 35.800 €

Mr. Gonzalo Castro

24. Program: Recruitment of laboratory technicians 2018 (PEJ2018-004802-A)

Period: 2019-2021

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 35.800 €

Ms. Laura Buceta

25. Program: Recruitment of laboratory technicians 2018 (PEJ2018-004795-A)

Period: 2019-2020

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 319.654 €

Ms. Natalia Joga

26. Program: Recruitment of laboratory technicians 2018 (PEJ2018-004828-A)

Period: 2019-2021

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 35.800 €

Mr. Manuel Ortega

27. Program: Contract FPI2018 (PRE2018-086502)

Project/Acronym: Microbial-oils production via anaerobic digestion: bioconversion of volatile fatty acids by oleaginous yeasts / ACMIBIO-DA (ENE2017-86864-C2-2-R)

Period: 2019-2023

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 82.000 €(88.250 €)

Mr. Sergio Morales

28. Program: Juan de la Cierva-Formación 2018 (FJC2018-037781-I)

Period: 2020-2021

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 50.000 €

Dr. Nagaraj Patil

29. Program: Juan de la Cierva-Incorporación 2018 (IJC2018-038426-I)

Period: 2020-2022

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 87.000 €(Total: 93.000 €)

Dr. Senthilkumar Sirugaloor

30. Program: Recruitment of research assistants and laboratory technicians 2019 (PEJ-2019-AI/AMB-15893)

Period: 2020-2022

Funding Institution: Comunidad de Madrid.

IMDEA Energy Institute external funding: 45.000 €

Mr. Adrián Lago

31. Program: Recruitment of research assistants and laboratory technicians 2019 (PEJ-2019-TL/AMB-14824)

Period: 2020-2022

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 38.000 €

Mr. Amir Jnaini

2. Scientific Results

2.1. Indexed publications (SCOPUS)

1. Alonso-Doncel, M.; Peral, A.; Shamzhy, M.; Čejka, J.; Sanz, R.; Serrano, D.P. "Untangling the role of the organosilane functional groups in the synthesis of hierarchical ZSM-5 zeolite by crystallization of silanized protozeolitic units". *Catalysis Today*, **2020**, *345*, 27-38.
2. Alonso-Doncel, M.; Peral, A.; Shamzhy, M.; Čejka, J.; Sanz, R.; Serrano, D.P. "Fine-tuning hierarchical ZSM-5 zeolite by controlled aggregation of protozeolitic units functionalized with tertiary amine-containing organosilane". *Microporous and Mesoporous Materials*, **2020**, *303*, art. no. 110189.
3. Álvarez-Rodríguez, C.; Martín-Gamboa, M.; Iribarren, D. "Sensitivity of operational and environmental benchmarks of retail stores to decision-makers' preferences through Data Envelopment Analysis". *Science of the Total Environment*, **2020**, *718*, art. no.137330.
4. Álvarez-Rodríguez, C.; Martín-Gamboa, M.; Iribarren, D. "Sustainability-oriented efficiency of retail supply chains: A combination of Life Cycle Assessment and dynamic network Data Envelopment Analysis". *Science of the Total Environment*, **2020**, *705*, art. no.135977.
5. Arenas-Vivo, A.; Ávila, D.; Horcajada, P. "Phase-selective microwave assisted synthesis of iron(III) aminoterephthalate MOFs". *Materials*, **2020**, *13* (6), art. no. 1469.
6. Babaryk, A.A.; Contreras Almengor, O.R.; Cabrero-Antonino, M.; Navalón, S.; García, H.; Horcajada, P. "A semiconducting $\text{Bi}_2\text{O}_2(\text{C}_4\text{O}_4)$ coordination polymer showing a photoelectric response". *Inorganic Chemistry*, **2020**, *6*, 3406-3416.
7. Babaryk, A. A.; Haouas, M.; Khaynakova, O.; Elkaim, E.; Horcajada, P. "Bis-3, 5-Diamino-1, 2, 4-Triazolyl-1, 2, 4, 5-Tetrazine: From Insensitive High Energy Density Materials to Small Molecule Organic Semiconductors". *Crystal Growth & Design*, **2020**, *20* (10), 6510-6518.
8. Barreiro-Vescovo, S.; González-Fernández, C.; Ballesteros, M.; de Godos, I. "Activity determination of an algal-bacterial consortium developed during wastewater treatment based on oxygen evolution". *Journal of Water Process Engineering*, **2020**, *36*, art. no. 101278.
9. Bayón, A.; De La Penã O'Shea, V.A.; Serrano, D.P.; Coronado, J.M. "Exploring the alternative $\text{MnO-Na}_2\text{CO}_3$ thermochemical cycle for water splitting". *Journal of CO_2 Utilization*, **2020**, *42*, art. no. 101264.
10. Boaretto, N.; Rana, M.; Marcilla, R.; Vila-tela, J.J. "Revealing the Mechanism of Electrochemical Lithiation of Carbon Nanotube Fibers". *ACS Applied Energy Materials*, **2020**, *3* (9), 8695-8705.
11. Casas, M.G.; Andía, J.D.; Martos, J.L.G. (2020). ECO2DES: Python Framework for the Eco-Design of Industrial Processes. In: *Computer Aided Chemical Engineering*, *48*, 1987-1992.
12. Castillo-Blas, C.; Romero-Muñiz, I.; Mavrandonakis, A.; Simonelli, L.; Platero-Prats, A.E. "Unravelling the local structure of catalytic Fe-oxo clusters stabilized on the MOF-808 metal organic-framework". *Chemical Communications*, **2020**, *56* (100), 15615-15618.
13. Čejka, J.; Millini, R.; Opanasenko, M.; Serrano, D.P.; Roth, W.J. "Advances and challenges in zeolite synthesis and catalysis". *Catalysis Today*, **2020**, *345*, 2-13.

14. Conceição, R.; Lopes, F.M.; Tavares, A.; Lopes, D. "Soiling effect in second-surface CSP mirror and improved cleaning strategies". *Renewable Energy*, **2020**, *158*, 103-113.
15. Conceição, R.; Vázquez, I.; Fialho, L.; García, D. "Soiling and rainfall effect on PV technology in rural Southern Europe". *Renewable Energy*, **2020**, *156*, 743-747.
16. Cruz, P.L.; Iribarren, D.; Dufour, J. "Modeling, simulation and life-cycle assessment of the use of bio-oil and char in conventional refineries". *Biofuels, Bioproducts and Biorefining*, **2020**, *14* (1), 30-42.
17. Cubas-Cano, E.; González-Fernández, C.; Ballesteros, I.; Tomás-Pejó, E. "Efficient utilization of hydrolysates from steam-exploded gardening residues for lactic acid production by optimization of enzyme addition and pH control". *Waste Management*, **2020**, *107*, 235-243.
18. Cubas-Cano, E.; López-Gómez, J.P.; González-Fernández, C.; Ballesteros, I.; Tomás-Pejó, E. "Towards sequential bioethanol and L-lactic acid co-generation: Improving xylose conversion to L-lactic acid in presence of lignocellulosic ethanol with an evolved *Bacillus coagulans*". *Renewable Energy*, **2020**, *153*, 759-765.
19. Cubas-Cano, E.; Venus, J.; González-Fernández, C.; Tomás-Pejó, E. "Assessment of different *Bacillus coagulans* strains for L-lactic acid production from defined media and gardening hydrolysates: Effect of lignocellulosic inhibitors". *Journal of Biotechnology*, **2020**, *323*, 9-16.
20. Cuellar-Bermúdez, S.P.; Kilimtzidi, E.; Devaere, J.; Goiris, K.; González-Fernández, C.; Wattiez, R.; Muylaert, K. "Harvesting of *Arthrospira platensis* with helicoidal and straight trichomes using filtration and centrifugation". *Separation Science and Technology (Philadelphia)*, **2020**, *55* (13), 2381-2390.
21. De la Cruz, C.; Molina, A.; Patil, N.; Ventosa, E.; Marcilla, R.; Mavrandonakis, A. "New insights into phenazine-based organic redox flow batteries by using high-throughput DFT modeling". *Sustainable Energy & Fuels*, **2020**, *4* (11), 5513-5521.
22. Escalera, A.; Prodanovič, M.; Castronuovo, E.D.; Roldan-Perez, J. "Contribution of active management technologies to the reliability of power distribution networks". *Applied Energy*, **2020**, *267*, art. no. 114919.
23. Esteve-Llorens, X.; Martín-Gamboa, M.; Iribarren, D.; Moreira, M.T.; Feijoo, G.; González-García, S. "Efficiency assessment of diets in the Spanish regions: A multi-criteria cross-cutting approach". *Journal of Cleaner Production*, **2020**, *242*, art. no.118491.
24. Falter, C.; Valente, A.; Habersetter, A.; Iribarren, D.; Dufour, J. "An integrated techno-economic, environmental and social assessment of the solar thermochemical fuel pathway". *Sustainable Energy & Fuels*, **2020**, *4*, 3992-4002.
25. Fernández-Paz, C.; Rojas, S.; Salcedo-Abraira, P.; Simón-Yarza, T.; Remuñán-López, C.; Horcajada, P. "Metal-Organic Framework Microsphere Formulation for Pulmonary Administration". *ACS Applied Materials & Interfaces*, **2020**, *12* (23), 25676-25682.
26. Frankforter, K.J.; Tejedor-Tejedor, M.I.; Anderson, M.A.; Janhns, T.M. "Investigation of hybrid battery/ultracapacitor electrode customization for energy storage applications with different energy and power requirements using HPPC cycling". *IEEE Transactions on Industry Applications*, **2020**, *56* (2), 1714-1728.
27. Gallastegui, A.; Minudri, D.; Casado, N.; Goujon, N.; Ruipérez, F.; Patil, N.; Detrembleur, C.; Marcilla, R.; Mecerreyes, D. "Proton trap effect on catechol-pyridine redox polymer nanoparticles as organic electrodes for lithium batteries". *Sustainable Energy & Fuels*, **2020**, *4*, 3934-3942.

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31. García-Muñoz, P.; Fresno, F.; de la Peña O'Shea, V.A.; Keller, N. "Ferrite materials for photoassisted environmental and solar fuels applications". *Topics in Current Chemistry*, **2020**, *378* (1), art. no. 6.
32. García-Muñoz, P.; Fresno, F.; Ivanez, J.; Robert, D.; Keller, N. "Activity enhancement pathways in LaFeO₃@TiO₂ heterojunction photocatalysts for visible and solar light driven degradation of myclobutanil pesticide in water". *Journal of Hazardous Materials*, **2020**, *400*, art. no. 123099.
33. García-Muñoz, P.; Fresno, F.; Lefevre, C.; Robert, D.; Keller, N. "Synergy effect between photocatalysis and heterogeneous photo-Fenton catalysis on Ti-doped LaFeO₃ perovskite for high efficiency light-assisted water treatment". *Catalysis Science and Technology*, **2020**, *10* (5), 1299-1310.
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37. García-Sánchez, A.; Gómez-Mendoza, M.; Barawi, M.; Villar-Garcia, I.J.; Liras, M.; Gándara, F.; de la Peña O'Shea, V.A. "Fundamental insights into photoelectrocatalytic hydrogen production with a hole-transport bismuth metal-organic framework". *Journal of the American Chemical Society*, **2020**, *142* (1), 318-326.
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42. Greses, S.; Tomás-Pejó, E.; González-Fernández, C. "Agroindustrial waste as a resource for volatile fatty acids production via anaerobic fermentation". *Bioresource Technology*, **2020**, *297*, art. no. 122486.
43. Grissa, I.; El-Ghoul, J.; El Mir, L.; Ben Cheikh, H.; Horcajada, P. "In deep evaluation of the neurotoxicity of orally administered TiO₂ nanoparticles". *Brain Research Bulletin*, **2020**, *155*, 119-128.
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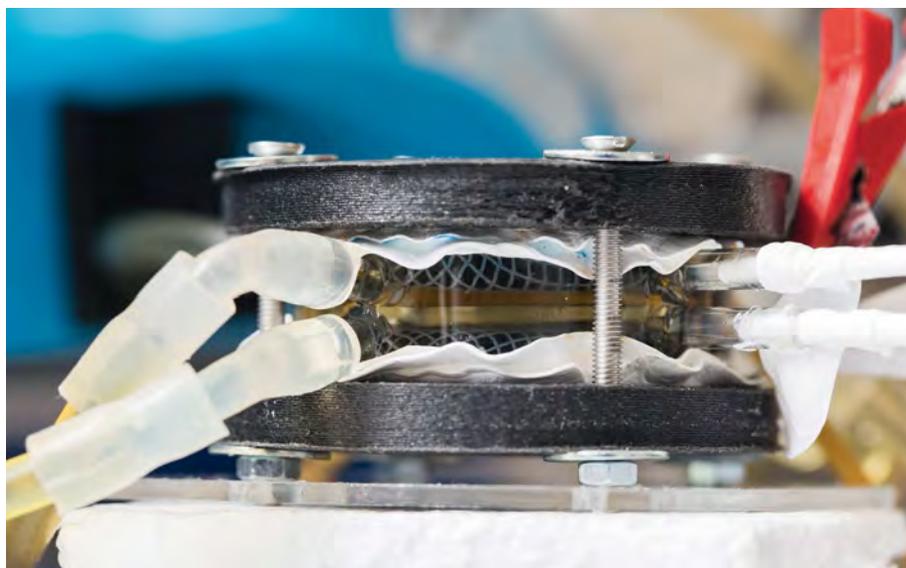
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- 117.** Yang, Z.; Oropeza, F.E.; Zhang, K.H.L. “P-block metal-based (Sn, In, Bi, Pb) electrocatalysts for selective reduction of CO₂ to formate”. *APL Materials*, **2020**, *8* (6), art. no. 060901.



2.2. Intellectual property

2.2.1. Patents

Submitted patents

1. Application number: EP20382772.0, title: "Recyclable Electrode". Date of application: 31/08/2020 (OEPM). Holders: Fundación IMDEA Energía. Inventors: Lado, J.; Ventosa, E.; Pérez, D.; García-Quismondo, E.; Palma, J. de Sevilla, Fundación CENER, Mesurex S.L.U., Cobra Instalaciones y Servicios, S.A., Egatel, S.L., Fundación IMDEA Energía.
2. Application number: P202030682, title: "Dispositivo y procedimiento de radiometría para la medida de irradiancia solar". Date of application: 02/07/2020 (OEPM). Holders: Universidad
3. Application number: EP20382311.7, title: "Redox flow battery". Date of application: 17/04/2020 (OEPM). Holders: Fundación IMDEA Energía. Inventors: Montes, I.; Marcilla, R.; Palma, J.; Ventosa, E.; Vera, M.; Sánchez, M.

2.3. Books/chapters of books/other publications

1. Dufour, J.; Marín, F. and others. (2020). Tecnología e innovación: palancas para la transición energética en Spain. Ed. Club Español de la Energía.
2. Dufour, J.; Orellana, J.; Vizcaíno, A.; Peral, A.; Potenciano, N.; García, J.M. (2020). "Gestión de la eficiencia energética en el sector terciario y la Administración pública". Ed. AENOR. ISBN 978-84-17891-10-7 [hardcover]; 978-84-17891-14-5 [ebook].
3. Gálvez-Martos, J.L.; Istrate, I.R. (2020). "Construction and demolition waste management". In: Advances in Construction and Demolition Waste Recycling. Ed: Elsevier. ISBN: 978-0-12-819055-5.
4. "Producción optimizada de baterías y pruebas a nanoescala: Lanzamiento del proyecto europeo NanoBat". Journal: Energética XXI, nº 196, pp 73. May 2020.
5. Morán, D. P.; Prodanovic, M.; Roldán-Pérez, J.; Medrano, G.; Ausín A.; Marrero, J. A. (2020). "MICROGRID-ON-CHIP. Estabilidad de microrredes con baterías y generadores convencionales". In: Libro de Comunicaciones VII CONGRESS SMART GRIDS. Ed: Grupo Tecma Red S.L. ISBN: 9798581946923.
6. Navas, Z; Iribarren, D. "Apoyo a la planificación nacional del mix de producción de combustibles para el transporte por carretera". Journal: Energética XXI, nº 200, pp 116-117. October 2020.
7. Zarei, M. E.; Prodanovic, M.; Roldan-Pérez, J.; Medrano, G.; Ausín, A. (2020). "Control de sistemas de almacenamiento de energía basados en baterías para microrredes". In: Libro de Comunicaciones VII CONGRESS SMART GRIDS. Ed: Grupo Tecma Red S.L. ISBN: 9798581946923.





2.4. PhD Thesis defended

1. Title: Advances in life cycle sustainability assessment of hydrogen energy systems

Author: Antonio Valente

Director: Dr. Javier Dufour, Dr. Diego Iribarren

Venue: Rey Juan Carlos University, Spain

Date: 27 February 2020

2. Title: Control of power electronics interfaces for safeguarding stability of future power networks

Author: Alberto Rodríguez Cabero

Director: Dr. Milan Prodanovic, Dr. Javier Roldán

Venue: Online, Alcalá de Henares University, Spain

Date: 13 May 2020

3. Title: Diseño y caracterización de perovskitas para la producción eficiente de combustibles solares mediante ciclos termoquímicos redox

Author: Daniel Sastre Quemada

Director: Dr. Juan Coronado, Dra. Patricia Pizarro

Venue: Online, Rey Juan Carlos University, Spain

Date: 14 May 2020

4. Title: Digestión anaerobia de microalgas para la producción de ácidos grasos volátiles

Author: José A. Magdalena

Director: Dr. Cristina González

Venue: Online, Complutense University of Madrid, Spain

Date: 5 June 2020

5. Title: Diseño de nuevas rutas catalíticas para la valorización de bio-oils de pirólisis de biomasa mediante la producción de biocombustibles y compuestos de alto valor añadido

Author: Santiago Gutiérrez

Director: Dr. Juan Coronado, Dra. Inés Moreno

Venue: Online, Rey Juan Carlos University, Spain

Date: 17 Julio 2020

6. Title: Development and Optimization of Rechargeable Batteries based on Aluminium

Author: David Muñoz-Torrero

Director: Dr. Edgar Ventosa, Dra. Rebeca Marcilla

Venue: Online, Autónoma Universiti of Madrid Madrid, Spain

Date: 10 September 2020

2.5. Congress communications

2.5.1. Invited lectures

1. Title: New Insights into Phenazine-based Redox Flow Batteries by using High-Throughput Density Functional Theory Modelling

Author: Andreas Mavrantakis

Congress: Meetings of the group "Multiscale Modeling in Batteries" of University of Uppsala

Venue: Webinar

Date: 11 June 2020

Organizer: University of Uppsala

2. Title: Biomedical and environmental interest of Metal-Organic Frameworks

Author: Patricia Horcajada

Congress: International School of Chemistry - Chemistry for everyday life web edition

Venue: Online

Date: 01-06 September 2020

Organizer: ICCOM; Istituto di Chimica dei Composti Organometallici

3. Title: Redox Flow Batteries**Author:** Jesús Palma**Congress:** I Jornadas de Difusión Científica “La tecnología electroquímica al servicio de la Sociedad: aplicaciones en medio ambiente y energía”**Venue:** Online**Date:** 26-27 October 2020**Organizer:** Red de Excelencia E3TECH**4. Title:** SUPERCONDENSADORES: Dispositivos de alta potencia**Author:** Rebeca Marcilla**Congress:** I Jornadas de Difusión Científica “La tecnología electroquímica al servicio de la Sociedad: aplicaciones en medio ambiente y energía”**Venue:** Online**Date:** 26-27 October 2020**Organizer:** Red de Excelencia E3TECH**5. Title:** Metal organic frameworks: from synthesis to applications**Author:** Patricia Horcajada**Congress:** JIQ-RSEQ Webinar MERCK**Venue:** Online**Date:** 19 November 2020**Organizer:** RSEQ**6. Title:** Towards zero waste microalgae biorefinery: short-chain fatty acids and methane production**Author:** González-Fernández, C.; Llamas M.; Greses, S.; Tomás-Pejó, E.**Congress:** AlgaEurope 2020**Venue:** Online**Date:** 1-4 December 2020**Organizer:** EABA; DLG BENELUX**2.5.2. Oral communications****1. Title:** Planificación de la implementación de combustibles alternativos en el sector energético español para un transporte sostenible (PICASO)**Author:** Navas-Angueta, Z.; García-Gusano, D.; Dufour, J.; Iribarren, D.**Congress:** XV Congress de la Asociación Española para la Economía Energética**Venue:** Toledo, Spain**Date:** 29-31 January 2020**Organizer:** Asociación Española para la Economía Energética**2. Title:** Evolutionary engineering of *Lactobacillus pentosus* improves lactic acid productivity from xylose-rich media at low pH**Author:** Cubas-Cano, E.; Tomás-Pejó, E.**Congress:** 1st Open Cost Action CA18113 Conference (EuroMicroPH)**Venue:** Lisboa, Portugal**Date:** 12-14 February 2020**Organizer:** EuroMicroPH COST Action CA18113**3. Title:** Enlarging the scope of conventional life-cycle inventories using supply chain management for Social Life Cycle Assessment**Author:** Martín-Gamboa, M.; Iribarren, D.; Arroja, L.; Dias, A.C.**Congress:** SETAC Europe 30th Annual Meeting**Venue:** Online**Date:** 3-7 May 2020**Organizer:** SETAC**4. Title:** Robust sustainability assessment of hydrogen: a comparative life-cycle study**Author:** Valente, A.; Iribarren, D.; Dufour, J.**Congress:** HYPOTHESIS XV**Venue:** Online**Date:** 3-5 June 2020**Organizer:** UCL**5. Title:** Techno-economic assessment of a hydrothermal liquefaction process for energy recovery from food waste**Author:** Medina, E.; Miranda, P.; Gálvez-Martos, J.L.; Dufour, J.**Congress:** 30th European Symposium of Computer Aided Process Engineering (ESCAPE30)**Venue:** Online**Date:** 31 August-2 September 2020**Organizer:** AIDIC**6. Title:** Facile synthesis of an Agnanocluster@MOF composite and its superior visible-photocatalytic activity in continuous flow

Author: Rojas, S.; Arenas-Vivo, A.; Ocaña, I.; Torres, A.; Liras, M.; Salles, F.; Ávila, D.; Horcajada, P.

Congress: AEBIN Photochemistry School 2020

Venue: Online

Date: 07-09 September 2020

Organizer: Donostia International Physics Center

7. Title: Electricity Network Constraint Management using Individualised Demand Aware Price Policies

Author: Melatti, I.; Alimguzhin, V.; Mari, F.; Prodanovic, M.; Hayes, B.

Congress: 2nd Workshop on Artificial Intelligence and fOrmal VERification, Logic, Automata, and sYnthesis (OVERLAY 2020)

Venue: Online

Date: 25 September 2020

Organizer: OVERLAY

8. Title: Hybrid Organic-Inorganic Photoanodes Based on Conjugated Porous Polymers Prepared by Electropolymerization

Author: Alfonso, E.; López-Calixto, C. G.; García, D.; Gómez-Mendoza, M.; Oropeza, F. E.; Liras, M.; Barawi, M.; de la Peña O'Shea, V. A.

Congress: nanoGe Fall Meeting 2020

Venue: Online

Date: 20-23 October 2020

Organizer: Fundació Scito

9. Title: Coupling of Islanded Grids by Multi-Terminal HVDC Grids for Oscillation Damping and Inertia Sharing

Author: Rodríguez-Cabero, A.; Roldán-Pérez, J.; Prodanovic, M.; Are Suul, J.; D'arco, S.

Congress: Energy Conversion Congress and Exposition (ECCE 2020)

Venue: Detroit (Michigan) (USA)

Date: 11-15 October 2020

Organizer: IEEE

10. Title: Desarrollo de baterías de flujo sin membrana utilizando electrolitos inmiscibles

Author: Navalpotro, P.; de la Cruz, C.; Ibáñez, S. E.; Senthilkumar, T.; Mavrantanakis, A.; Marcilla, R.

Congress: V Workshop de la Red #E3TECH sobre "Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica"

Venue: Online

Date: 26-29 October 2020

Organizer: Red de Excelencia E3TECH

11. Title: Escalado de procesos electroquímicos: Del almacenamiento de energía al tratamiento de agua

Author: Lado, J. J.; García-Quismondo, E.; Palma, J.; Anderson, M.

Congress: V Workshop de la Red #E3TECH sobre "Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica"

Venue: Online

Date: 26-29 October 2020

Organizer: Red de Excelencia E3TECH

12. Title: Diseño y análisis de un campo solar para un sistema de generación basado en turbina de gas

Author: Rovense, F.; Falcón, B.; Romero, M.; Hinojosa, J.; González-Aguilar, J.

Congress: CIES2020-XVII Congresso Ibérico e XIII Congresso Ibero-americano de Energia Solar, 2020

Venue: Online

Date: 3-5 November 2020

Organizadores: Laboratório Nacional de Energia e Geologia (LNEG) and Asociación Española de Energía Solar (AEDES)

13. Title: Deriva intrínseca en heliostatos

Author: Martínez-Hernández, A., Bravo, I., Romero, M., González-Aguilar, J.

Congress: CIES2020-XVII Congresso Ibérico e XIII Congresso Ibero-americano de Energia Solar.

Venue: Online

Date: 3-5 November 2020

Organizadores: Laboratório Nacional de Energia e Geologia (LNEG) and Asociación Española de Energía Solar (AEDES)

14. Title: Análise do comportamento de lentes em vidro de sílica perante a utilização de radiação solar concentrada

Author: De Almeida, G., Guerra Rosa, L., Pereira, J.C.G., Bravo Gonzalo, I., Franco, P., Fernandes, J.C., González-Aguilar, J.

Congress: CIES2020-XVII Congresso Ibérico e XIII Congresso Ibero-americano de Energia Solar
Venue: Online

Date: 3-5 November 2020

Organizadores: Laboratório Nacional de Energia e Geologia (LNEG) y Asociación Española de Energía Solar (AEDES)

15. Title: Effect of Temperature gradients on Continuous Hydrogen Production

Author: Sánchez-Redero, M., González-Aguilar, J., Romero, M.

Congress: 1st Forum of Young Researchers in Energy & Environment

Venue: Online

Date: 12 November 2020

Organizadores: University of Messina

16. Title: Optimization of microalgae growth in dry anaerobic digestate for nutrient recovery

Author: Greses, S., Tomás-Pejó, E., González-Fernández, C.

Congress: Online Conference on Biogas Production and Digestate Valorisation from Wastes

Venue: Online

Date: 17-18 November 2020

Organizadores: IMDEA Energy

17. Title: Valorization of agroindustrial wastes into bioproducts and bioenergy via two-stage fermentation process

Author: Díez, A., Greses, S., Tomás-Pejó, E., González-Fernández, C.

Congress: Online Conference on Biogas Production and Digestate Valorisation from Wastes

Venue: Online

Date: 17-18 November 2020

Organizadores: IMDEA Energy

18. Title: WASTE2BIO project: Valorisation of urban wastes to new generation of bioethanol (*Flash talk*)

Author: Latorre, M., Coll, C., Oliva, J. M., Moreno, D., González-Fernández, C., Greses, S., Bains, N., Schols, E.

Congress: Online Conference on Biogas Production and Digestate Valorisation from Wastes

Venue: Online

Date: 17-18 November 2020

Organizadores: IMDEA Energy

19. Title: Ion conductive Zr-phosphonate UPG-1 materials: strategies to enhance their conductivity

Author: Salcedo-Abraira, P.; Vilela, S.M.F.; Gómez-Peña, A.; Trens, P.; Várez, A.; Salles, F.; Horcajada, P.

Congress: Brain Wars: The future is in your hands

Venue: Online

Date: 27 November 2020

Organizer: Madrid UCM Student Chapter (ECS) and RSEQ-STM

20. Title: Can Solar Energy Generate Fuels?

Author: Alonso, E.; Barawi, M.; De la Peña-O'Shea, V.A.

Congress: Brain Wars: The future is in your hands

Venue: Online

Date: 27 November 2020

Organizer: Madrid UCM Student Chapter (ECS) and RSEQ-STM

21. Title: Electrochemical Energy Storage and Water Deionization Technologies: An example of the Water-Energy Nexus

Author: Palma, J.; Lado, J.J.; García-Quismondo, E.; Almonacid, I.; García, G.; Anderson, M.A.

Congress: International 3rd WaterEnergyNEXUS Conference (WEN 2020)

Venue: Online

Date: 1-5 December 2020

Organizer: University of Sfax (Tunisia), Sanitary Environmental Engineering Division (SEED) of the University of Salerno (Italy), Advanced Institute of Water Industry at Kyungpook National University (Korea) and The Energy and Resources Institute, TERI (India)

22. Title: Graphite Felt 3D Electrodes: From Energy Storage to Water Desalination
Author: Lado, J.J.; Cartolano, V.; García-Quismondo, E.; Palma, J.; García, G.; Almonacid, I.
Congress: International 3rd WaterEnergyNEXUS Conference (WEN 2020)
Venue: Online
Date: 1-5 December 2020
Organizer: University of Sfax (Tunisia), Sanitary Environmental Engineering Division (SEED) of the University of Salerno (Italy), Advanced Institute of Water Industry at Kyungpook National University (Korea) and The Energy and Resources Institute, TERI (India)

23. Title: Nuevas Redes Metal-Orgánicas y composites: síntesis y aplicaciones
Author: Salcedo-Abraira, P.; Devic, T.; Ávila, D.; Horcajada, P.
Congress: V Simposio Anual Química Avanzada UCM
Venue: Online
Date: 14-15 December 2020
Organizer: UCM

2.5.3. Poster communications

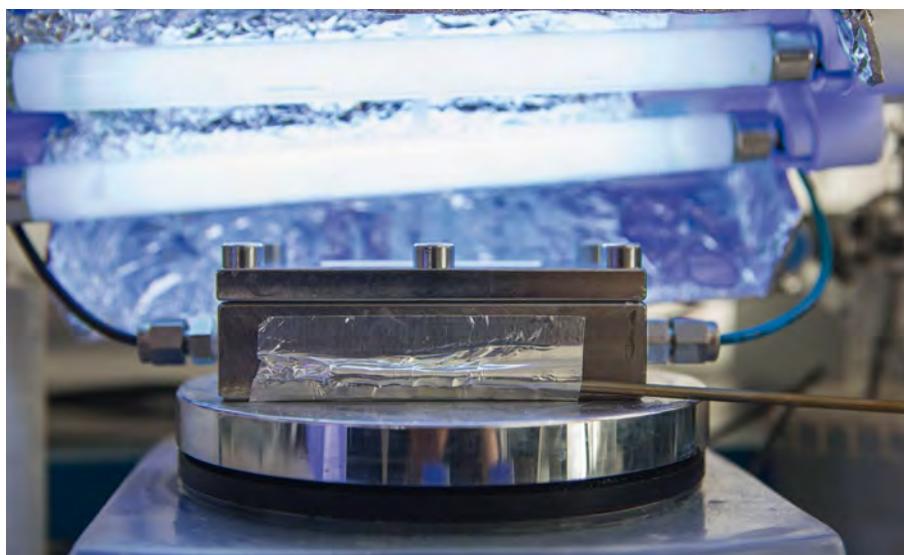
1. Title: Metal-Organic Frameworks as Detoxifying Agents
Author: Rojas, S.; Horcajada, P.
Congress: XIII Spanish-Portuguese Conference on Controlled Drug Delivery
Venue: Santiago de Compostela, Spain

Date: 22-24 January 2020
Organizer: SPLC-CRS

2. Title: Biocompatible iron(III) carboxylate Metal-Organic Frameworks as promising RNA nanocarriers
Author: Hidalgo, T.; Rojas, S.; Alonso-Nocelo, M.; Bouzo, B.L.; Reimondez-Troitiño, S.; Abuin-Redondo, C.; de la Fuente, M.; Horcajada, P.
Congress: XIII Spanish-Portuguese Conference on Controlled Drug Delivery
Venue: Santiago de Compostela, Spain
Date: 22-24 January 2020
Organizer: SPLC-CRS

3. Title: Efficient production of lactic acid from gardening residues: importance of pH control for the resistance of inhibitory compounds
Author: Cubas-Cano, E.; Tomás Pejón, E.
Congress: 1st Open Cost Action CA18113 Conference (EuroMicropH)
Venue: Lisboa, Portugal
Date: 12-14 February 2020
Organizer: EuroMicropH COST Action CA18113

4. Title: A new micro-nanoMOF platform for pulmonary drug delivery
Author: Remuñán-López, C.; Fernández-Paz, C.; Salcedo-Abraira, P.; Rojas, S.; Simón-Yarza, T.; Horcajada, P.
Congress: International Conference on Aerogels for Biomedical and Environmental Applications (AERoGELS)
Venue: Santiago de Compostela, Spain



Date: 18-20 February 2020

Organizer: AERoGELS COST Action CA18125

Awarded with the best poster prize

5. Title: Comparative life cycle assessment of hydrogen-fuelled passenger cars

Author: Candelaresi, D.; Valente, A.; Iribarren, D.; Dufour, J.; Spazzafumo, G.

Congress: HYPOTHESIS XV

Venue: Online

Date: 3-5 June 2020

Organizer: UCL

6. Title: New Insights into Phenazine-based Redox Flow Batteries by using High-Throughput DFT Modelling

Author: De la Cruz, C.; Mavrantoukakis, A.; Marcilla, R.

Congress: EMMC-eSSENCE 2020 – “Multiscale modelling of materials and molecules in complex systems”

Venue: Online

Date: 8 June 2020

Organizer: EMMC

7. Title: Soiling Effect in a Central Receiver Solar Plant under Real Outdoor Conditions

Author: Conceição, R.; Martínez, A.; Bravo, I.; González-Aguilar, J.; Romero, M.

Congress: EuroSun 2020

Venue: Online

Date: 1-3 September 2020

Organizer: ISES

8. Title: Performance Analysis of an Unfired Solar Closed Brayton Cycle: A Case

Author: Rovense, F.; Falcón, B.; Romero, M.; Hinojosa, J.; González-Aguilar, J.

Congress: EuroSun 2020

Venue: Online

Date: 1-3 September 2020

Organizer: ISES

9. Title: Intrinsic drift in off-axis solar-tracking systems

Author: Martínez, A.; Bravo, I.; Romero, M.; González-Aguilar, J.

Congress: SolarPACES2020

Venue: Online

Date: 28 September-02 October 2020

Organizer: SolarPACES

10. Title: Reflectance Loss due to Soiling Effect on Solar Tower Heliostat Field

Author: Conceição, R.; González-Aguilar, J.; Romero, M.

Congress: SolarPACES2020

Venue: Online

Date: 28 September-02 October 2020

Organizer: SolarPACES

11. Title: Influence of PLL Parameters on Small-Signal Stability of Microgrids with Synchronous Generators

Author: Morán, D. P.; Roldán-Pérez, J.; Prodanovic, M.; García-Cerrada, A.

Congress: Energy Conversion Congress and Exposition (ECCE 2020)

Venue: Detroit, Michigan (Online)

Date: 11-15 October 2020

Organizer: IEEE

12. Title: Bifurcation Analysis of Converter-Dominated Electrical Distribution Systems

Author: Moutevelis, D.; Roldan-Perez, J.; Prodanovic, M.; Sanchez-Acevedo, S.

Congress: Energy Conversion Congress and Exposition (ECCE 2020)

Venue: Detroit, Michigan (Online)

Date: 11-15 October 2020

Organizer: IEEE

13. Title: Stable lead-free hybrid perovskite based on iodobismuthates

Author: Babaryk, A. A.; Pérez, Y.; Martín, A.; Mosquera, M.; Antolín, E.; Horcajada, P.

Congress: nanoGe Fall Meeting 2020

Venue: Online

Date: 20-23 October 2020

Organizer: Fundació Scito

14. Title: Electrolitos concentrados de gel polimérico para baterías de litio metálico de 4 V

Author: Ciurduc, D. E.; Boaretto, N.; Fernández, J. P.; Marcilla, R.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

15. Title: Desarrollo de polímeros conjugados porosos para aplicación en baterías
Author: Grieco, R.; Patil, N.; Liras, M.; Marcilla, R.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

16. Title: Baterías de flujo de Zn sin membrana basadas en electrolitos inmiscibles
Author: Senthilkumar, S. T.; Patil, N.; de la Cuz, C.; Navalpotro, P.; Ibáñez, S. E.; Marcilla, R.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

17. Title: Modelización y reformulación de baterías para dispositivos de iluminación de emergencia
Author: Medina, J.; García-Quismondo, E.; Rubio, F.; Palma, J.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

18. Title: GEOBATT–hibridación de energía geotérmica y baterías de flujo para calentamiento/enfriamiento de edificios con bajo consumo energético
Author: Berling, S.; García-Quismondo, E.; Palma, J.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online

Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

19. Title: Limitación del estado de carga de baterías de flujo redox sin membrana debido a las reacciones de autodescarga
Author: Ibáñez, S. E.; Navalpotro, P.; Sirugaloor, S.; Marcilla, R.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

20. Title: Microfluidica aplicada a baterías de flujo redox: una tecnología disruptiva sin membrana
Author: Oraá, B.; Quintero, A. E.; Bernaldo de Quirós, A.; Palma, J.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

21. Title: Química computacional, fenacinas y electroquímica aplicadas a baterías de flujo redox
Author: De la Cruz, C.; Marcilla, R.; Mavrantakis, A.

Congress: V Workshop de la Red #E3TECH sobre “Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica”

Venue: Online
Date: 26-29 October 2020
Organizer: Red de Excelencia E3TECH

22. Title: Novel Hybrid Organic-Inorganic Photoelectrodes for Hydrogen Evolution Reaction
Author: Alonso, E.; García-López, C.; García, D.; Gómez, M.; Oropeza, F.E.; Barawi, M.; De la Peña-O’Shea, V.A.

Congress: Catalight Young Scientist Symposium

Venue: Online
Date: 10-26 November 2020
Organizer: SFB/TRR 234 Catalight

3. Training and dissemination activities

3.1. Mobility actions

IMDEA Energy Researchers

1. Stay at Technische Universität Berlin, Alemania

Period: 1 month, 2020

Funding Institution: IMDEA Energy Institute

D. Alba García Sánchez

Visiting Researchers

1. V Andrea Bomenuto

Origin institution: University of Naples, Federico II, Italy

Host Unit: High Temperature Processes Unit

Period: 3 months, 2020

2. Dimitrios Mitrogiannis

Origin Institution: Agricultural University of Athens

Host Unit: Biotechnological Processes Unit

Period: 2 months, 2020

3. Jessica Miranda Abreu Freire

Origin Institution: Federal University of Ceara

Host Unit: Electrochemical Processes Unit

Period: 10 months, 2020

4. Alessia Marino

Origin Institution: Rey Juan Carlos University-University of Calabria

Host Unit: Electrochemical Processes Unit

Period: 3 months, 2020

5. Farouk Zaoui

Origin Institution: Autonomous University of Madrid-University of Orán

Host Unit: Photoactivated Processes Unit

Period: 1 month, 2020

6. Sergio Carrasco-Garrido

Origin Institution: Rey Juan Carlos University - Stay within the framework of GOT TALENT Project

Host Unit: Advanced Porous Materials Unit

Period: 19 months, (5 months in 2020, 12 months in 2021 and 2 months in 2022)





7. Francesco Rovense

Origin Institution: Rey Juan Carlos University - Stay within the framework of GOT TALENT Project

Host Unit: High Temperature Processes Unit

Period: 21 months, (5 months in 2020, 12 months in 2021 and 4 months in 2022)

8. Inés Barras García

Origin Institution: Rey Juan Carlos University

Host Unit: High Temperature Processes Unit

Period: 24 months, (11 months in 2020, 12 months in 2021 and 1 month in 2022)

9. Marta Ventosa Rosquelles

Origin Institution: Catalan Institute of Chemical Research (ICIQ)

Host Unit: Photoactivated Processes Unit

Period: 3 days 2020

10. Mario Zuber

Origin Institution: Swiss Federal Institute of Technology, Zurich (ETH), Zurich

Host Unit: High Temperature Processes Unit

Period: 5 months, 2020

11. Moritz Patriarca

Origin Institution: Swiss Federal Institute of Technology, Zurich (ETH), Zurich

Host Unit: High Temperature Processes Unit

Period: 5 months, 2020

12. Emmanuela Mastronardo

Origin Institution: Board of Scientific Researchers (CSIC)

Host Unit: High Temperature Processes Unit

Period: 1 month, 2020

13. Khaoula Ben Hnich

Origin Institution: National Engineering School of Gabes, Túnez

Host Unit: System Analysis Unit

Period: 3 months, 2020

14. Alba García Sánchez

Origin Institution: Board of Scientific Researchers Institute of Materials Science of Madrid -ICMM

Host Unit: Photoactivated Processes Unit

Period: 10 months, (6 months in 2020 and 4 months in 2021)

15. Vanesa Muñoz

Origin Institution: Carlos III University of Madrid

Host Unit: Electrochemical Processes Unit

Period: 3 months, 2020

16. Luis Guerra Rosa

Origin Institution: University of Lisbon- Higher Technical Institute (IST Lisbon)

Host Unit: High Temperature Processes Unit

Period: 15 days, 2020

17. Jaime Sánchez Sánchez

Origin Institution: Chalmers University of Technology

Host Unit: Electrochemical Processes Unit

Period: 12 months, (3 months in 2020 and 9 months in 2021)

18. Hugo Gattuso

Origin Institution: University of Alcalá de Henares

Host Unit: Photoactivated Processes Unit

Period: 24 months, (2 months in 2020, 12 months in 2021 and 10 months in 2022)

19. Laura Collado

Origin Institution: Rey Juan Carlos University

Host Unit: Photoactivated Processes Unit

Period: 12 months, (9 months in 2020 and three months in 2021)

3.2. Organization of scientific events

1. Webinar “Instrumentos y políticas ambientales para productos en el contexto Europeo”

Venue: Móstoles, Madrid, Spain (Online)

Date: 16 November 2020

Organizer: IMDEA Energy (SAU)

3. SFERA-III/ACES2030 Joint Workshop (ONLINE) on MST-Materials for Solar Thermochemistry

Venue: Móstoles, Madrid, Spain (Online)

Date: 10 Diciembre 2020

Organizer: IMDEA Energy (HTPU)

2. Online Conference on Biogas Production and Digestate Valorisation from Wastes (Proyecto BIOGAS MENA)

Venue: Móstoles, Madrid, Spain (Online)

Date: 17-18 November 2020

Organizer: IMDEA Energy (BTPU)

4. 9th Annual Workshop of Young Researchers of IMDEA Energy

Venue: Móstoles, Madrid, Spain (Online)

Date: 16 December 2020

Organizer: IMDEA Energy



3.3. Internal seminars

1. Exploring the charge transfer efficiency in OER (photo)electrodes by X-ray photoelectron spectroscopy
Speaker: Dr. Freddy Oropeza (IMDEA Energy)
Date: 31 Enero 2020
2. Stability Assessment of Hybrid Microgrids: Interaction between Power Converters and Diesel Generators
Speaker: Diana Morán (IMDEA Energy)
3. A sustainable rechargeable seawater battery
Speaker: Dr. S. T. Senthilkumar (IMDEA Energy)
Date: 21 Febrero 2020
4. From municipal solid waste to advanced fuels and polymers (RESUCAP)
Speaker: Aitor Romero (Repsol)
Date: 21 Febrero 2020

3.4. Participation in science dissemination activities

1. GENERA 2020 Fair
Venue: IFEMA, Madrid, Spain
Date: 5-7 February 2020
Organizer: IFEMA
Activity: La energía, clave para la sostenibilidad
Venue: IMDEA Energy Institute, Madrid, Spain (Online)
Date: 4-6 November 2020
Organizer: IMDEA Energy Institute, Fundación para el conocimiento madri+d
2. International Day of Women and Girls in Science
Activity: La Energía de las Mujeres
Venue: IMDEA Energy Institute, Madrid, Spain
Date: 11 February 2020
Organizer: IMDEA Energy Institute, Fundación para el conocimiento madri+d
3. Madrid Fair for Science and Innovation
4. European researchers' night 2020
Activity: Energía limpia para salvar el planeta
Venue: IMDEA Energy Institute, Madrid, Spain (Online)
Date: 27 November 2020
Organizer: IMDEA Energy Institute, Fundación para el conocimiento madri+d

3.5. Training activities

1. Alejandro Carretero Aguado
Professional Training, IES-Benjamin Rúa
Internship: Technical support tasks
Supervisor: Dr. Milan Prodanovic, ELSU
Period: September-December 2020
2. Andrés Gordo Padilla
Professional Training, IES-Lope de Vega
Internship: Technical support tasks
Supervisor: Dra. Marta Arroyo, Central Laboratories.
Period: September-December 2020
3. Miguel Garcia Corpas
Professional Training, IES-Lope de Vega
Internship: Technical support tasks
Supervisor: Dra. Marta Liras, PAPU
Period: September-December 2020
4. Sergio Rodriguez
Professional Training, IES-La Paloma
Internship: Technical support tasks
Supervisor: Dra. Marta Liras, PAPU
Period: September-December 2020

- 5. Pablo Suárez Mesa**
Professional Training, IES Palomeras Vallecas
Internship: Technical support tasks
Supervisor: Dra. Marta Liras, PAPU
Period: October 2020-March 2021
- 6. Jorge Díez Jaén**
B. Sc In Chemical Engineering, Universidad Rey Juan Carlos
Internship: The internship was carried out in the framework of the MFreeB project on membrane-free flow batteries
Supervisor: Dr. Edgar Ventosa, ECPU
Period: February-March 2020
- 7. Paloma Galindo Arauz**
B. Sc In Energy Engineering, Universidad Rey Juan Carlos, Spain
Internship: Support to the execution of techno-economic analysis
Supervisor: Dr. José Luis Gálvez Martos, SAU
Period: February-August 2020
- 8. Marta González Cebolla**
M. Sc Chemical Engineering Universidad Autónoma de Madrid and Universidad Rey Juan Carlos
Internship: Synthesis in combinatorial chemistry, using multiple solvothermal conditions to obtain crystalline structures
Supervisor: Giacomo Armani, APMU
Period: March-September 2020
- 9. María Sanz Navarro**
M. Sc Chemical Engineering Autonomous University of Madrid and Rey Juan Carlos University
Internship: Application of the Pyr-GC/MS technique to the study of the valorization of plastic and lignocellulosic wastes by pyrolysis
Supervisor: Dr. Juan Miguel Moreno, TCPU
Period: March-April 2020
- 10. Alvaro Gonzalez Bernardo**
M. Sc Chemical Engineering Universidad Autónoma de Madrid and Universidad Rey Juan Carlos
Internship: Support tasks in the research line of thermal and catalytic pyrolysis of organic wastes of different origins
Supervisor: Dra. Inés Moreno García, TCPU
Period: November 2020-January 2021
- 11. Javier Rocha Acevedo**
M. Sc Chemical Engineering Universidad Autónoma de Madrid and Universidad Rey Juan Carlos
Internship: Support tasks in the research line of thermal and catalytic pyrolysis of plastic waste
Supervisor: Dr. Héctor Hernando Marcos, TCPU
Period: November 2020- January 2021
- 12. Marcos Calle Calle**
B Sc. in Materials Engineering, Complutense University of Madrid
Project Title: New MOFs based on electroactive ligands
Supervisor: Dra. Patricia Horcajada/Pablo Salcedo, APMU
Date of defense: June, 2020
- 13. Roberto Espí Gutiérrez**
Bsc. In Electronic Engineering, UPM - ETSIDI (Escuela Técnica Superior de Ingeniería y Diseño Industrial)
Project Title: Electrochemical impedance study
Supervisor: Ignacio Almonacid, ECPU
Date of defense: September, 2020
- 14. Sandra Álvarez Conde**
Msc. In Industrial Engineering, Universidad Rey Juan Carlos, Spain
Project Title: Development of predictive methods for the estimation of the lifetime of lithium-ion batteries
Supervisor: Dr. Jesús Palma, ECPU
Date of defense: July, 2020
- 15. Cristina Irastorza Santori**
Msc. In Industrial Engineering, Universidad Rey Juan Carlos, Spain
Project Title: Development of recyclable batteries for environmental applications
Supervisor: Dr. Edgar Ventosa/ Dr. Julio J. Lado, ECPU
Date of defense: July, 2020
- 16. Álvaro Bañegil Díaz**
Msc. In Industrial Engineering, Universidad Rey Juan Carlos, Spain
Project Title: distributed storage as a tool for the control of electrical distribution grids
Supervisor: Dr. Milan Prodanovic, ELSU
Date of defense: October, 2020



17. Bárbara San Román Martínez

Msc. in Master in Microbiology and Parasitology, Universidad Complutense de Madrid

Project Title: Valorization of wastes by anaerobic fermentation

Supervisor: Dra. Cristina González/Dra. Silvia Greses, BTPU

Date of defense: September, 2020

18. Javier Trobo Navarro

Msc. in Industrial Engineering, Universidad Rey Juan Carlos, Spain

Project Title: Development of a model for the evaluation of costs and emissions of municipal solid waste collection

Supervisor: Dr. Javier Dufour, SAU

Date of defense: October, 2020

19. Jorge Galindo Fernández,

Msc. In Industrial Engineering, Universidad Rey Juan Carlos, Spain

Project Title: Prediction of sulfur dioxide emissions in the production of alternative cement formulations

Supervisor: Dr. José Luis Gálvez, SAU

Date of defense: October, 2020

20. Manuel Del Barrio Jimeno

Msc. in Energies and Fuels for the Future, Universidad Autónoma de Madrid

Project Title: Towards more efficient solar cells: new environmentally compatible 1D perovskites

Supervisor: Dra. Patricia Horcajada/Marcos González, APMU

Date of defense: July, 2020

21. Ángel David Romero Hernández

Msc. in Master in Electrical Systems, Universidad Carlos III

Project Title: Reduced order modeling of power electronics converters

Supervisor: Dr. Javier Roldán, ELSU

Date of defense: September, 2020

22. Alejandro Moreno

Msc In Electronic Systems Engineering and Applications, Universidad Carlos III

Project Title: Study for the sizing of batteries as inertial backup of electrical grids with renewable energies

Supervisor: Dr. Milan Prodanovic, ELSU

Date of defense: October, 2020

23. Daniel Niño Sánchez

Msc. In Electrical Systems, Universidad Carlos III

Project Title: Stability analysis of hybrid microgrids

Supervisor: Dr. Javier Roldán, ELSU

Date of defense: September, 2020

24. Irene Leal Romero

Msc. in Renewable Energies in Electrical Systems, Universidad Carlos III, Spain

Project Title: Distributed storage as a control tool for electrical distribution networks. application to microgrids

Supervisor: Dr. Milan Prodanovic, ELSU

Date of defense: October, 2020



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