

research for a **sustainable**  
**energy development**

imdea **energy** institute

a n n u a l   r e p o r t

**2018**

[www.energy.imdea.org](http://www.energy.imdea.org)

annual report  
2018  
www.energy.imdea.org



**David Serrano**

Director of IMDEA Energy  
Móstoles, August 2019

The major focus of the IMDEA Energy Institute is the development of efficient, cost-competitive and clean energy technologies for contributing to the transition towards a low-carbon energy system. The Scientific Program of IMDEA Energy addresses a number of topics of high relevance, such as energy storage materials and devices, solar energy, sustainable fuels, smart management of electricity demand, energy systems with enhanced efficiency, valorization of CO<sub>2</sub> emissions and techno-economic evaluation of energy systems.

Created by the Regional Government of “Comunidad de Madrid”, IMDEA Energy is an R&D center featured by having a modern and flexible management system. The headquarters of IMDEA Energy are located in a building of new construction in the Technological Park of Móstoles (Madrid), furnished with high efficiency energy systems. These facilities were awarded with the Gold LEED certificate, which is a highly reputed international recognition for buildings with a minimum environmental impact.

Scientific excellence, international visibility and cooperation with industry remain as the main key drivers of the IMDEA Energy activities. The availability of sophisticated lab equipment, as well as of singular pilot plant infrastructures, allows the research activities to be performed on a very high level of excellence and to attract prestigious scientists.

As described in this Annual Report, 2018 has been a highly successful year for IMDEA Energy. Thus, although the overall staff number remained basically stable, both the scientific productivity and the incomes from external sources reached the highest values since the creation of the Institute: 99 scientific indexed publications were contributed, whereas the external funding coming from competitive projects, contracts with companies and personnel grants reached 3.6 M€, which accounts for

a self-funding ratio over 50%. Among the projects and contracts undertaken during 2018 (62 in total), 11 were international projects (mainly of the H2020 EU program) that have been awarded in very competitive calls, as it is the case of the two ERC grants active during 2018 at IMDEA Energy. In addition, 27 personnel grants, funded by third parties, were active along 2018.

Cooperation with industry is an essential element for our institute, aimed to establish solid alliances with companies and to promote innovation and technology transfer. In this way, 21 contracts with companies and 7 industrial projects have been active during 2018. Likewise, 1 new patent was applied and 2 patents were granted in 2018.

The scientific structure of IMDEA Energy comprises eight research units, which includes scientists and technicians with a great variety of backgrounds and specializations like mechanical, electrical, industrial, chemical and materials engineering, physics, biology, chemistry, biochemistry and environmental science, among others. This provides the Institute with a highly qualified and multidisciplinary team of researchers to undertake the study of complex energy systems. In addition to hosting 19 visiting researchers, about 55 B.Sc. and M.Sc. students have collaborated during 2018 in the different research topics of the Institute, whereas 32 PhD theses were under development and 4 were defended. These figures evidence the high relevance given by IMDEA Energy to training activities of young researchers.

These excellent results, together with those of previous years, have positioned IMDEA Energy as a world-class research institute. These achievements must be acknowledged to the IMDEA Energy staff by its outstanding effort, commitment and dedication, as well as to the Regional Government and the Assembly of “Comunidad de Madrid” by its valuable and highly appreciated support.



words from the director...

annual report

# 2018

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imdea energy institute

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# about us

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 energy system.

The IMDEA Energy Institute is committed with having a significant impact on R&D energy themes 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 European levels; such as the European Strategic Energy Technology (SET) Plan with selected targets

for 2020 and 2050; the European Research Framework HORIZON 2020; technology roadmaps of recognized international institutions and associations and implementation agreements of the International Energy Agency.

# Research topics

Production of sustainable fuels

Concentrated solar power

Energy storage

Smart management  
of electricity demand

Energy systems with  
enhanced efficiency

Valorization of CO<sub>2</sub> emissions

Techno-economic evaluation  
of energy systems

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



The building and laboratories of IMDEA Energy Institute are located at the Technological Park of Mostoles, Madrid, on a land with 10,000 m<sup>2</sup>.

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



8 scientific labs

2 pilot plants

office work areas and  
an auditorium





# our structure



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

## RESEARCH UNITS

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

## MANAGEMENT, ADMINISTRATION AND TECHNICAL SUPPORT UNIT

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



## 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  
Professor of the Institute for Environmental Engineering and Energy Economics  
Hamburg University of Technology, Germany

**Mr Rafael van Grieken**  
Vice-president of the Foundation  
Regional Minister of Education and Research  
Comunidad de Madrid, Spain

### REGIONAL ADMINISTRATION REPRESENTATIVES

**Mr. Alejandro Arranz**  
General Director of Research and Innovation  
Comunidad de Madrid, Spain

**Mr. José Manuel Torralba**  
General Director of Universities  
Comunidad de Madrid, Spain

**Mr. Rafael García**  
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 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 Alejaldre**  
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 Computer Sciences Department  
University of Almería, Spain

**Dr. Francisco Gírio**  
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**  
Head Scientist  
Institute of Catalysis and Petrochemistry, CSIC,  
Spain

### EXPERT TRUSTEES

**Dr. José Jacinto Monge**  
Rey Juan Carlos University, 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

**Pending to be appointed**  
Empresarios Agrupados Internacional S.A., Spain

### SECRETARY

**Mr. Alejandro Blázquez**  
Consultalia

## 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**  
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**  
Professor of Renewable Energy Carriers at the ETH Zurich  
and Head of the Solar Technology Laboratory at the Paul  
Scherrer Institute, Switzerland

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

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

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

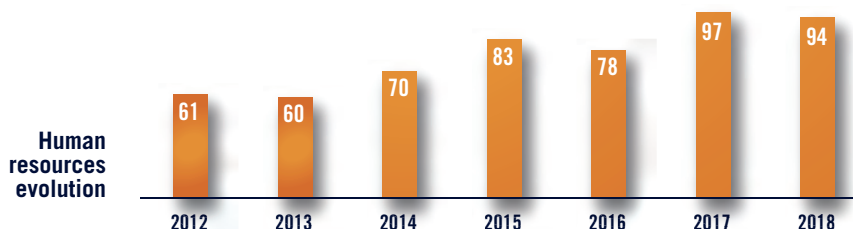
**Dr. José A. Olivares**  
Los Alamos National Laboratory, USA

**Prof. Dr. Gumersindo Feijoo**  
Professor of Chemical Engineering  
Santiago de Compostela University, Spain

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

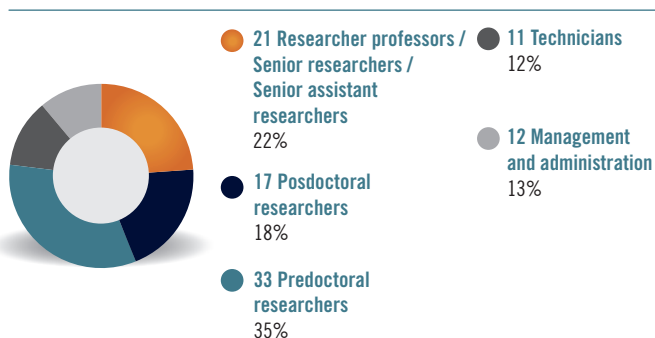
# in figures

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.

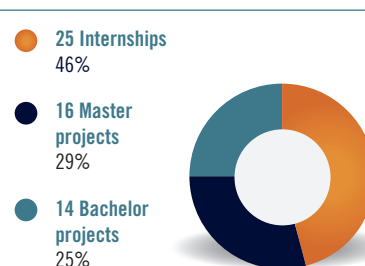


human  
resources

**Human resources distribution by the 31<sup>st</sup> of December of 2018**



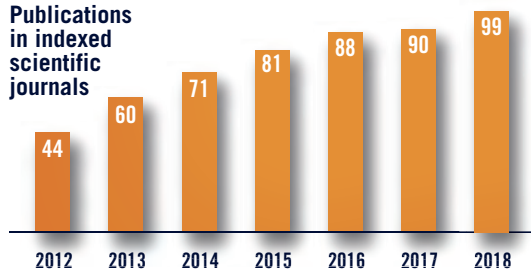
**55 students in connection with the IMDEA Energy Institute in 2018**



**Mobility actions in 2018**

9 Secondments of Imdea Energy researchers  
19 visiting researchers

**Publications in indexed scientific journals**



**2018**

70 congres communications,  
11 invited conferences  
and 26 poster communications.

32 Ph.D. thesis under development  
and 4 Ph. D. thesis defended.

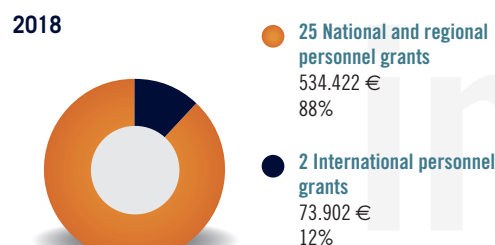
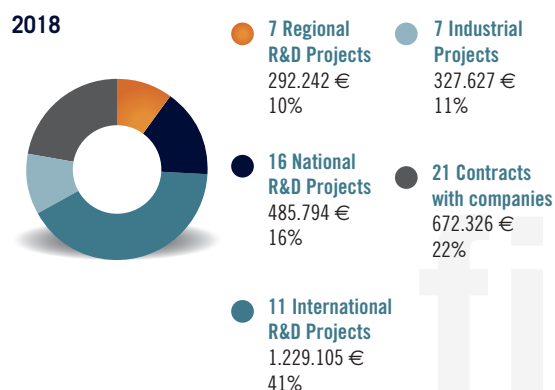
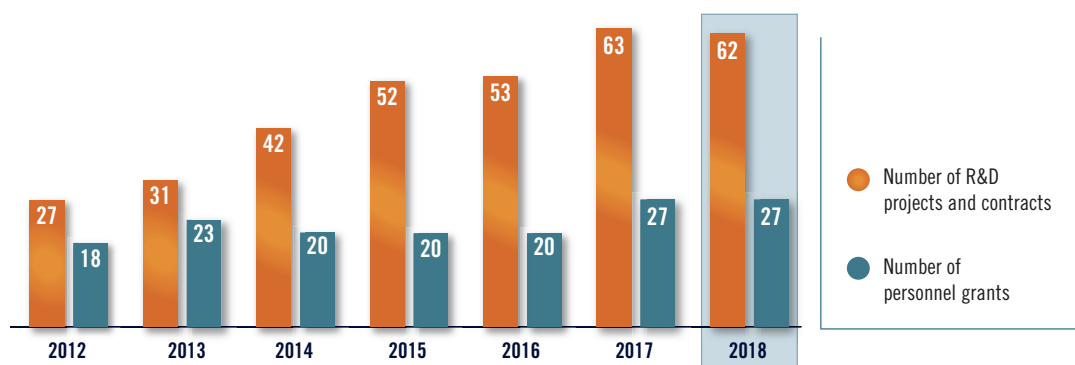
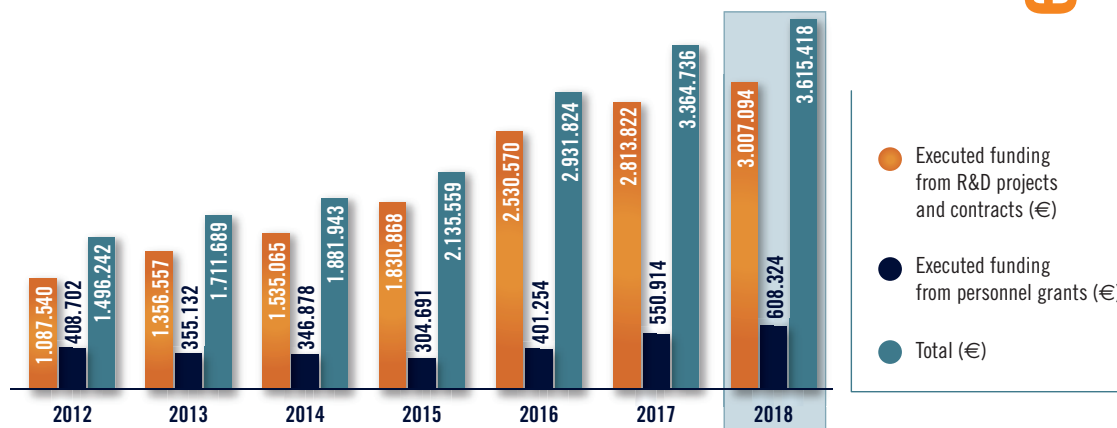
1 new patent applied and  
2 patents granted.

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 2018 the Institute was hosting two Consolidator Grants awarded by the European Research Council with a total budget of 4.5 M€.

# external funding



# cooperation

IMDEA Energy collaborates with universities and research centres worldwide, both within the framework of research projects and for the development of educational programs.

Cooperation with industry in R&D projects 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 agreements with industrial partners and a strong presence in networks and international platforms with participation of companies.

## COOPERATION WITH COMPANIES 2018





During the year 2018, it should be highlighted the celebration of 96 meetings with companies related with the energy sector, covering a wide range of sizes and business areas with an active presence has been maintained, attending events of Associations (Club de la Energía, Madri+d, Madrid Network, enerTIC, AEC, Gasnam, CEOE, Madrid Foro Empresarial, AEBIG), technological platforms (Futured, PTE-EE, M2F, PTFE, PTF4LS, ETIP SNET, FCH-JU, EERAs), seminars, fairs, infodays, conferences, congresses and brokerage events, national and international (Genera and Conama).



## COOPERATION WITH RESEARCH INSTITUTIONS 2018



## COOPERATION WITH UNIVERSITIES 2018



# networking

IMDEA Energy Institute, since its creation, has considered as a relevant activity its 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 2018:

## NATIONAL



## INTERNATIONAL



# 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 supercapacitors.

### Thermal and thermochemical energy storage

- Development of 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.
- Development of 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 CO<sub>2</sub>-free fuels by solar driven thermochemical cycles.
- Solar fuels production by artificial photosynthesis.
- Valorization of plastic wastes.

## Concentrated solar power

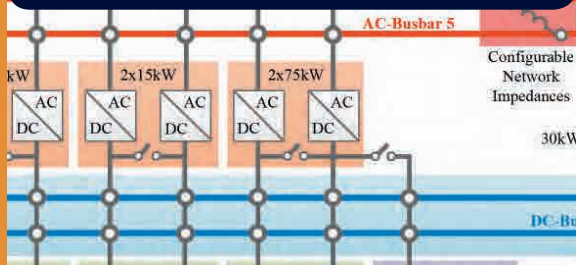


Efficient and dispatchable solar concentrating technologies for power generation, industrial process heat and production of solar fuels and chemicals.

- 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 CO<sub>2</sub> emissions



CO<sub>2</sub> valorization routes by its transformation into high-demand valuable products.

- CO<sub>2</sub> photoreduction for energy storage and fuels production.
- Development of multifunctional materials and solar reactors for photoactivated processes.
- Thermo-catalytic routes for CO<sub>2</sub> 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

- 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.
- Chemical characterization techniques: mass spectrometry, gas/mass chromatography, elemental analysis ICP - OES and CHONS.
- Thermogravimetric analysis (TG-DTA) in oxidising (air), inert (Ar) or reductive (10% H<sub>2</sub>/Ar) atmospheres.
- Properties of solids: textural and chemisorption.
- X-ray diffraction with structural PDF 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, SEM.
- Biotechnological characterisation techniques: GC, HPLC equipped with different columns and detectors (IR, MS, UVVIS, HPAEC-PAD), electrophoresis instrumentation for recombinant DNA technology, protein purification and analysis.



scientific facilities



## Simulation and Modelling Tools

- Aspen Plus for chemical process analysis and optimization.
- 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.
- LabVIEW for data acquisition, process control and calorimetric loops.
- SolidWorks for 3D computer-aided design.
- COMSOL Multiphysics for CFD analysis.
- Tracepro for ray tracing simulation of solar systems.

## Pilot Plants Facilities

**High-flux solar simulators of 7 and 42 kW.** Surface treatment and synthesis of materials. Advanced solar concentration optics. Solar receivers and reactors. Thermal fluids for high temperature applications. Characterisation techniques for high radiation fluxes, high temperatures and simulation tools.

**Smart energy integration lab.** Real-time emulation of AC and DC power networks and microgrids. Development of optimal dispatch algorithms for energy resource management. Stability analysis, power quality and control strategies for microgrids and power electronics converters. Renewable and storage integration to power network.

**Test installation for batteries and electrochemical capacitors** with various assay protocols in DC and AC. Simulation of demand cycles in powers from 0.3 to 30 kW under controlled temperature and humidity.

**Production and conversion of biomass** in open and closed photobioreactors with versatile and flexible configuration. Pyrolysis (thermal or catalytic) on fluidised bed reactor and hydrodeoxygenation on fixed bed reactor.

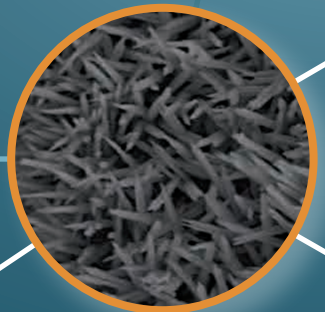
**Solar field consisting of 169 heliostats**, 3 m<sup>2</sup> each, with an experimental platform located on top of a 18 m height tower. This facility allows testing receivers, reactors and materials up to 250 kW thermal power under irradiances above 2500 kW/m<sup>2</sup>.

# research units

**Thermochemical  
Processes Unit**



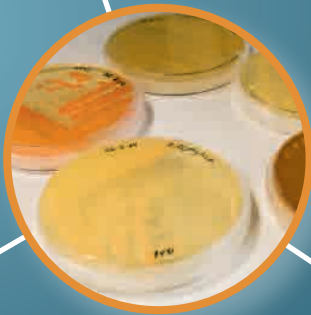
**Electrochemical  
Processes Unit**



**High Temperature  
Processes Unit**

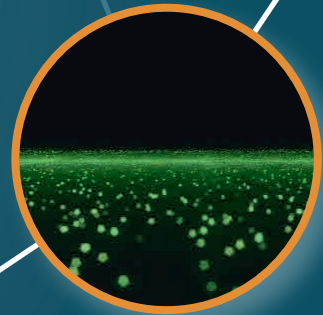






**Biotechnological  
Processes Unit**

**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 M. Coronado**  
Senior Researcher



**Dr. Juan Miguel Moreno**  
Senior Researcher



**Dr. Patricia Pizarro**  
Associated Senior  
Researcher

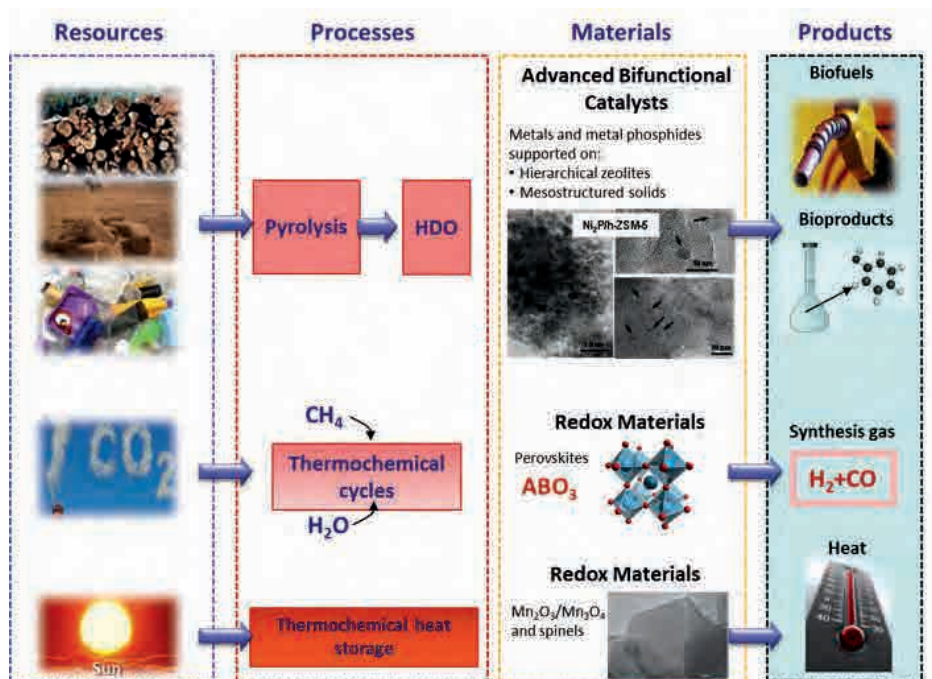


## R&D Objectives

- Development of materials, mainly catalysts, and thermochemical processes for: biomass, CO<sub>2</sub> and wastes valorization to fuels and energy storage.

## Research lines

- Production of advanced fuels and chemical products of new generation by thermochemical conversion (pyrolysis and hydrotreatments) of biomass and plastic wastes.
- Redox materials for the production of solar fuels through decomposition of CO<sub>2</sub> and H<sub>2</sub>O
- and by Chemical Looping Reforming with methane and CO<sub>2</sub>.
- Redox materials for thermochemical heat storage.





## Relevant projects and networking

After the successful completion of CASCATBEL project [FP7-NMP-2013-LARGE-7 (Topic: NMP.2013.1.1-1)] in 2017, coordinated by IMDEA Energy, the research activities of TCPU in 2018 have been mostly developed through the projects CATPLASBIO, RESTOENE2, SOLARKITE, BIOLIGWASTE and PICASSO, which are financially supported by diverse organisations of either national, regional or private nature. The main objective of that projects is the development of more efficient catalysts for the production of advanced biofuels by pyrolysis and Hydrodeoxygenation. CATPLASBIO, RESTOENE2, and

SOLARKITE projects were completed in 2018. BIOLIGWASTE and Picasso are still active in 2019.

In addition, the Thermochemical Processes Unit (TCPU) participates in associations such as the European Energy Research Alliance (EERA) of Bioenergy, the Biobased Industries Joint Undertaken (BBIJU) and the Spanish Platform of Sustainable Chemistry (SUSCHEM). Likewise, the TCPU keeps contact with several universities and research centres in Spain, Europe, South Africa and USA.



## Facilities

### Raw Materials conditioning

- Biomass milling and sieving.
- Oven for biomass drying.

### Synthesis and characterization of catalysts

- Lab equipment for catalysts and materials preparation by different routes such as sol-gel, hydrothermal and co-precipitation.
- Methods for dispersing active phases on porous supports.
- Tubular muffle furnace for thermal treatment under controlled atmosphere.
- Characterization techniques available in IMDEA Energy (gases physisorption, ICP-OES, elemental analysis, TPD-TPR, thermogravimetry, XRD, SEM, Raman, FTIR, among others). Access to techniques at Rey Juan Carlos University (TEM, FEG-SEM, NMR, XRF).

### Lab scale reactors for testing catalytic activity

- Stirred tank high pressure batch reactors ( $P_{\max}$  150 bar).
- High pressure continuous fixed-bed reactor ( $P_{\max}$  50 bar).

- High temperature continuous fixed-bed reactor for testing redox materials ( $T_{\max}$  1500 °C).
- Downdraft fixed-bed pyrolysis reactors.
- Continuous feeding pyrolysis reactor.

### 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.

### Analysis of raw materials and reactions products

- Elemental CHNS-O analysis, Karl Fischer titration, potentiometric titration for carbonyl determination in bio oils.
- Chromatographic analysis: GC-MS, 2 GC (FID, TCD), 2  $\mu$ GC.
- Metal analysis by ICP-OES.
- Thermogravimetric analysis.
- Spectroscopic techniques (FTIR, XRD).

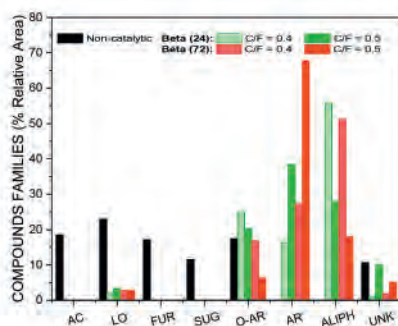




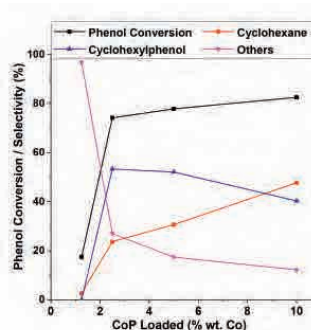
## Scientific activities and results

### Production of advanced fuels and chemical products of new generation by thermochemical conversion (pyrolysis and hydrotreatments) of biomass and plastic wastes

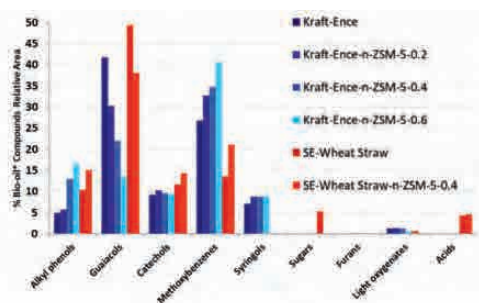
- In the field of catalytic co-pyrolysis of plastic and lignocellulosic wastes, bio-oil\* yields have been maximized (> 40 wt. %), as well as non-oxygenated aromatics (> wt. 70%), by optimization of both the operating conditions and catalyst properties.
- A variety of catalysts and the effect of operating conditions have been evaluated in reactions for the selective synthesis of valuable products (apocynin and cyclohexyl-phenol) using compounds from pyrolysis bio-oils as starting materials.
- Regarding the valorization of lignin wastes by ex-situ catalytic pyrolysis, a variety of operating conditions and pre-treatments have been assessed in the thermal pyrolysis step. Catalysts tested were based on HZSM-5 Zeolite. It is remarkable the high yield of char and the necessity to operate at higher temperatures in the thermal zone when compared with lignocellulose as feedstock. Catalytic bio-oils were very heterogeneous, with less guaiacols but higher amounts of other compound families, such as alkyl-phenols and metoxi-benzenes.
- The experimental work on pressurized pyrolysis (1-10 bar) has been started. It is necessary to implement modifications for better controlling the operation variables (mainly P).
- Experiments on fluidization for the future design of a new reaction system have been performed. This new facility will allow carrying out reactions of ex-situ catalytic pyrolysis and HDO with continuous regeneration of catalysts at lab-intermediate scale.



Catalytic copyrolysis of EU/LDPE blends over HBeta zeolite.



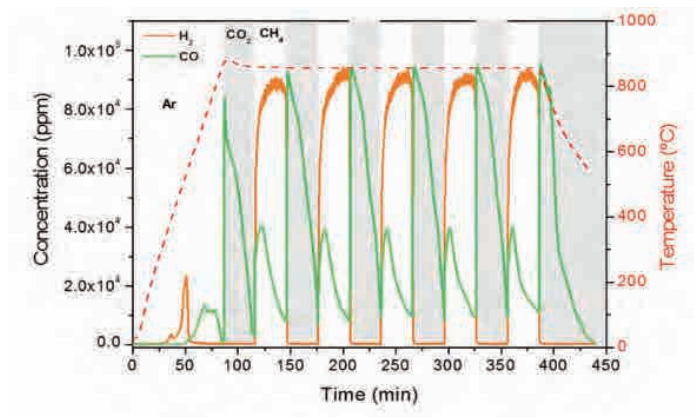
Phenol conversion and selectivity to a cyclohexyl-phenol over HBeta zeolite.



Catalytic pyrolysis of lignin over HZSM-5 zeolite.

## Redox materials for the production of solar fuels through decomposition of CO<sub>2</sub> and H<sub>2</sub>O and by Chemical Looping Reforming with methane and CO<sub>2</sub>

- New compositions of perovskites have been evaluated for the CO + H<sub>2</sub> production by cycles of reduction with CH<sub>4</sub> and oxidation with CO<sub>2</sub>.
- La<sub>0.9</sub>Sr<sub>0.1</sub>FeO<sub>3</sub> shows a remarkable activity and stability during successive redox cycles. Using this material, the syngas yield has been significantly increased by supporting it onto YSZ or by incorporating Ni into its composition.



Redox cycle of La<sub>0.9</sub>Sr<sub>0.1</sub>FeO<sub>3</sub> perovskite.

## Redox materials for thermochemical heat storage

- Different materials for thermochemical heat storage based on spinels of Mn, MMn<sub>2</sub>O<sub>4</sub> (M=Cu, Li) have been produced and characterized, in collaboration with Western Cape University (Cape Town, South Africa).

Sample	Air (pO <sub>2</sub> = 0.21 bars)			
	T <sub>red</sub> (°C)	T <sub>ox</sub> (°C)	ΔT <sub>Hysteresis</sub> (°C)	ΔH <sub>oxi</sub> (kJ/kg)
CuMn <sub>2</sub> O <sub>4</sub>	968	915	53	14 ± 3
LiMn <sub>2</sub> O <sub>4</sub>	946	845	101	36 ± 5



# High Temperature Processes Unit



**Dr. Manuel Romero**  
Research Professor  
Head of the Unit



**Dr. José González-Aguilar**  
Senior Researcher  
Co-head of the Unit



**Salvador Luque**  
Senior Assistant  
Researcher

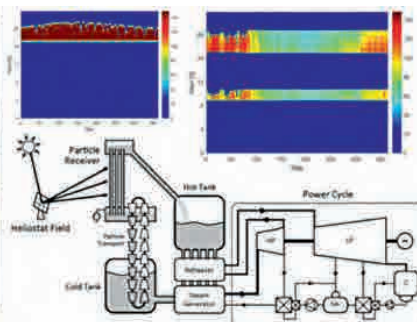


## R&D Objectives

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

## 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.
- Power conversion unit 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 solar flux. In 2018, the HTPU develops its R&D&I activities at local, national and international level. It leads this topic in the Comunidad de Madrid by the regional project ALCCONES (2014-2018) and it is actively contributing to the most recent developments on production of solar fuels (EU H2020 Sun-to-Liquid project), new heat transfer fluids and solar receivers (EU H2020 NEXT-CSP and ES Retos ARROPAR-CEX projects), and solar thermal industrial process heat (EU H2020 INSHIP), and it takes part of the Integrated Research Program STAGE-STE (Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy) that gathers 42 members, all EU research institutions partners of EERA JP-

CSP plus a significant number of additional organizations, including those from non-EU countries. Unique HTPU's facilities allow supporting 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, within Thermal Storage activities and participates in the IEA SolarPACES Task III within the Workgroup on Thermal Storage and Task II on solar thermochemistry as well as in 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.

### 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.

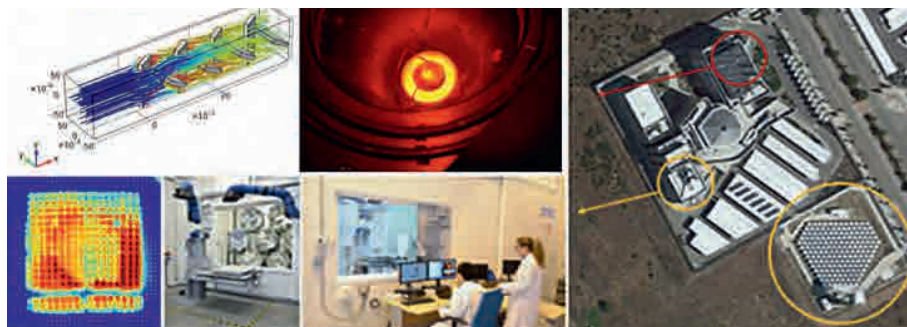
- 250 kW solar tower facility composed of 169 heliostats and two testing platforms.

### Specific test rigs

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

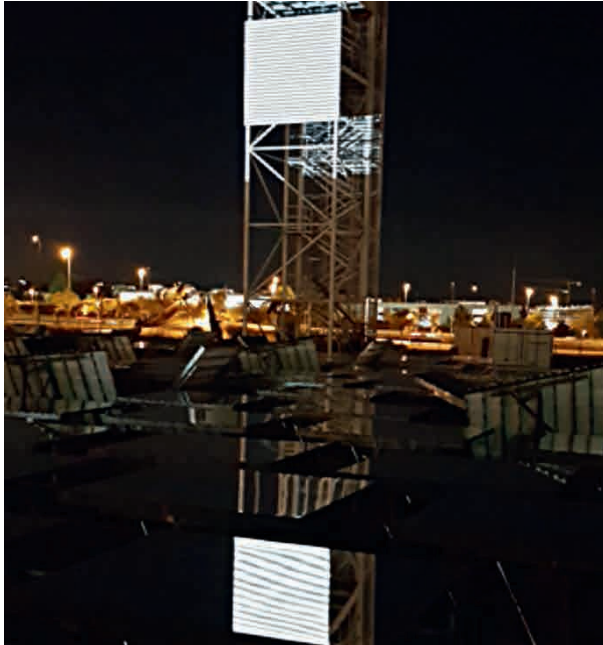
### Computational design lab for high temperature processes

- 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 activities and results

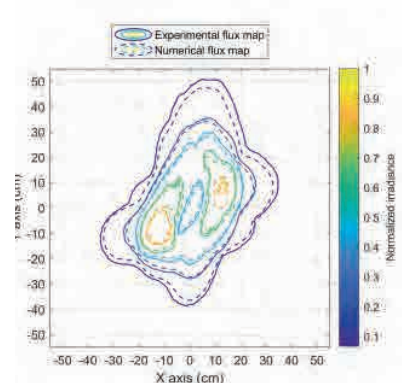
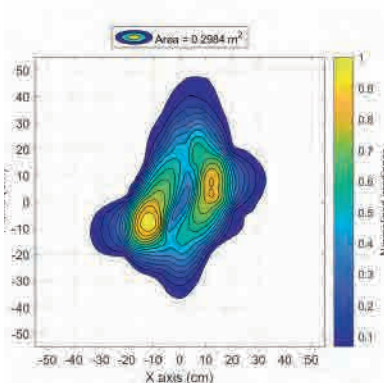
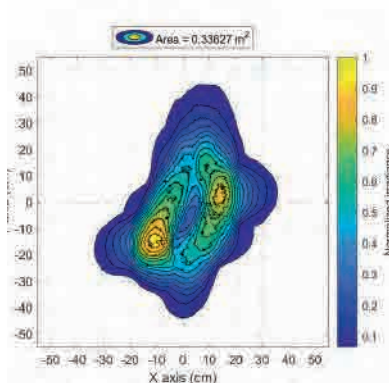
### Innovative modular concepts with minimum environmental impact

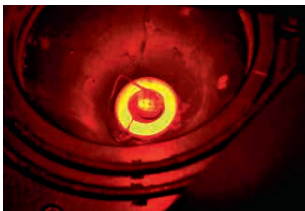


- Carried out a detailed optical characterisation of heliostats by deflectometry of a 250 kW central receiver solar facility for its use in testing at high temperature and very high concentrated solar flux ( $>2,000 \text{ kW/m}^2$ ).
- Developed a customised software for fast optical analysis of heliostats incorporating experimental optical errors.

### Solar receivers & new heat transfer fluid

- Successfully determined the volumetric effects in novel additively manufactured open solar receivers (Selected Laser melting) at kW-scale in the 7kWe-high flux solar simulator.



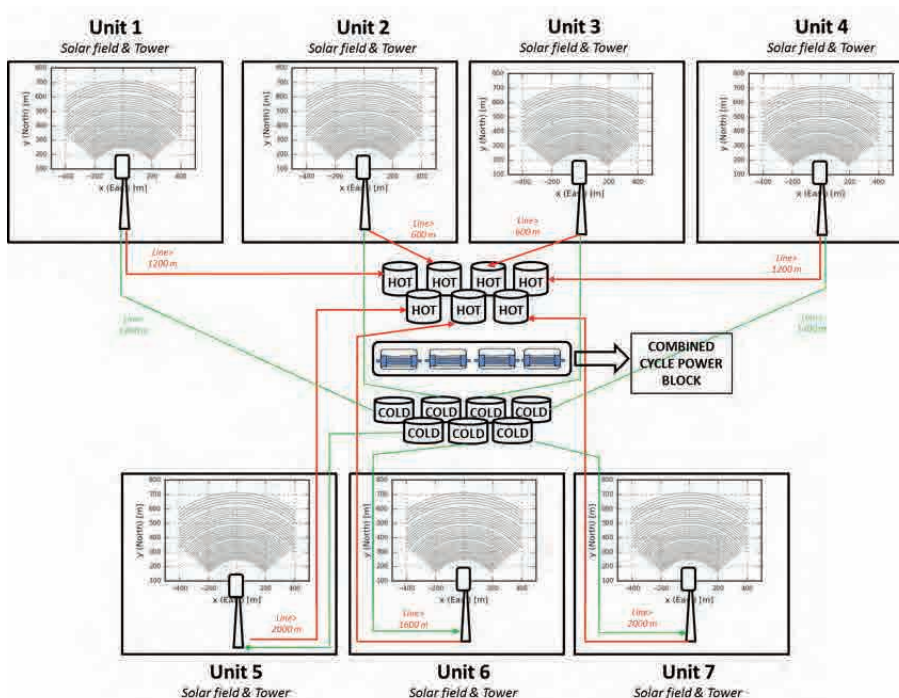


## Energy storage & solar thermo-chemistry

- The operation of a fully integrated 50kW Solar-Thermochemical process for Liquid Hydrocarbon Fuels synthesis under realistic conditions has been achieved.
- Realized the macroencapsulation of sodium chloride and sodium nitrate as phase change materials for thermal energy storage based on sol-gel method.
- Determined the operational conditions in a directly-irradiated solar reactor for solar-driven thermochemical water-splitting by Cerium Oxide.
- Elaborated methodologies for physico-chemical characterization of redox materials for Thermochemical Heat Storage. An international round robin test on enthalpies of perovskites for thermochemical heat storage has been coordinated.
- The synthesis and materials characterization of ceria foams from porous material of vegetable origin has been tested in a high-flux solar simulator.

## High temperature processes integration & environmental impact

- Assessed the performance of concentrated solar power plants based on carbon and hydrogen fuel cells.
- Designed flowsheets of central receiver solar thermal power plants based on dense particle suspensions and supercritical fluids as heat transfer fluids.







# Electrochemical Processes Unit

annual report  
2018



**Dr. Jesús Palma**  
Senior Researcher  
Head of the Unit



**Dr. Rebeca Marcilla**  
Senior Researcher



**Prof. Dr. Marc A. Anderson**  
Scientific Advisor



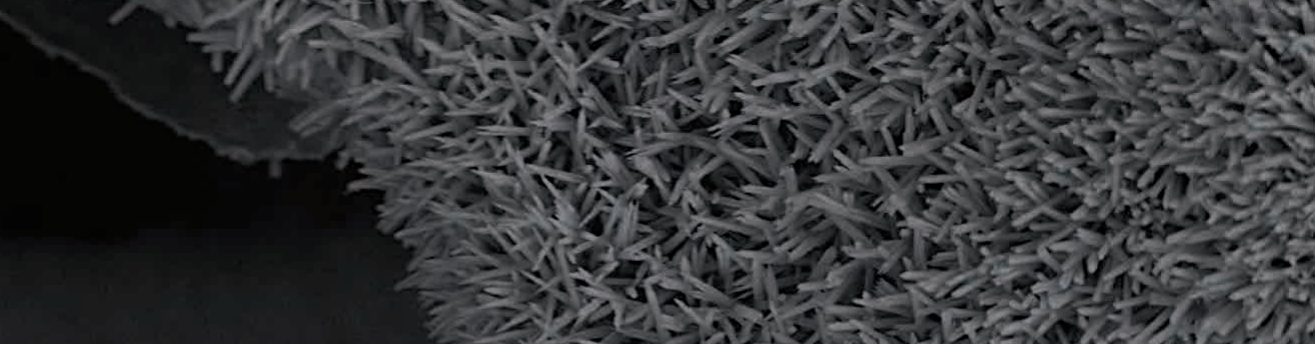
**Dr. Enrique García - Quismondo**  
Senior Assistant  
Researcher



**Dr. Edgar Ventosa**  
Senior Assistant  
Researcher



**Dr. Andreas Mavrantonakis**  
Senior Assistant  
Researcher

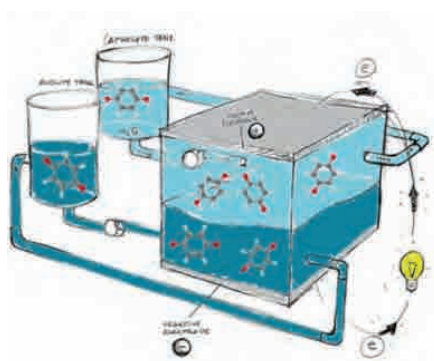


## R&D Objectives

- Electrochemical energy storage to increase the dispatchability of renewable sources and for the electrification of transport.
- Energy-efficient electrochemical devices for energy and environmental applications.

## Research lines

- Electrochemical capacitors
  - Increase energy density by designing new electrodes and formulating advanced electrolytes.
  - Multifunctional devices combining structural and storage capacities.
- Capacitive deionization
  - Energy efficiency in water deionization.
  - Enhanced water recovery, reduction of effluents, brine concentration, ion separation.
- Redox flow batteries
  - Improving vanadium-based redox flow batteries.
  - Organic-based electrolytes for low-cost and sustainable RFBs.
- Increase energy density of aqueous RFBs.
- Membrane-free concepts: immiscible electrolytes and micro-RFBs.
- Metal-air / metal-ion batteries (Zn-air, Al-ion and Li-ion)
  - Electrodes and electrolytes for lower cost and increased performance primary Zn-air batteries.
  - Promote the reversibility of reactions in secondary Al-ion batteries.
  - Structural Li-ion batteries based on reinforced electrodes and solid electrolytes.
- Battery testing
  - Accelerated non-conventional testing.
  - Performance evaluation, aging and life cycle assessments.



## Relevant projects and networking

In 2018 the Electrochemical Processes Unit (ECPU) has participated in 15 research projects ranging from fundamental to industrial research. The regional government of Comunidad de Madrid supports one of them with the R&D collaboration program; two with talent attraction grants; and one more with the industrial doctorates programme. The Spanish Research Agency (AEI) supports three projects that belong to the applied research programme identified as “Retos Colaboracion” and one that belongs to the fundamental research programme, identified as “Retos Investigación”. The European Research Council is funding one Consolidator Grant awarded to Dr. Rebeca Marcilla, senior researcher of the ECPU. Finally, the Unit has been involved in 6 research contracts funded directly by private companies.

The ECPU has expanded its network in 2018, resulting in a greater involvement in Spanish and European organizations. ECPU acted as deputy coordinator of the

Electrochemical Energy Storage subprogramme in the Joint Programme on Energy Storage of the European Energy Research Alliance (EERA). In addition, it is member of the Working Group on Energy Storage of the European Technology and Innovation Platform on Smart Networks for Energy Transition (ETIP-SNET); coordinator of the Electrochemical Storage subgroup of the Working Group on Energy Storage (GIA), created by several Spanish Technological Platforms; coordinator of the working group on New Technologies of the Spanish Association of Batteries and Energy Storage (AEPIBAL) and member of the Spanish network of excellence in Energy and Environmental Applications of Electrochemical Technologies (E3TECH).

In 2018, the ECPU has maintained cooperation agreements for training and mobility actions with foreign universities and research organizations such as Max Planck in Germany; University of Salerno in Italy and University of Malaysia Sarawak.

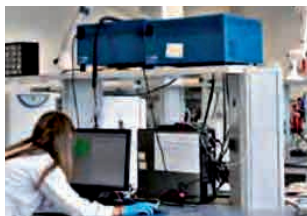
## Facilities

### Synthesis and characterization of electroactive materials

- Light scattering for particle size and Z-potential analysis.
- 1 Glove box for synthesis in controlled atmosphere.
- Slenck line for polymer synthesis.
- Pressurized reactors for hydrothermal synthesis.
- Probes for ultrasonic synthesis.
- Reactors and dialyzers for sol-gel synthesis.





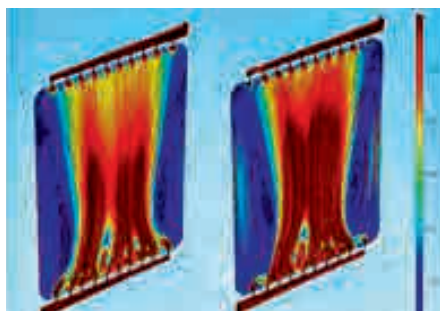
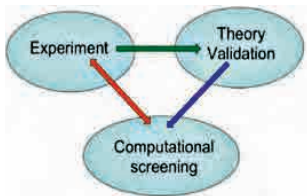


## Components fabrication and characterization

- Ink mixing: 1 ball mill, 1 vacuum and 3 high-shear mixers.
- Ink coating: 2 doctor blade coaters, 2 vacuum driers.
- Ink printing: 1 inkjet printer for micro-electrodes.
- Electrode consolidation: 1 roll press and 2 uniaxial presses.
- Coin cells: 1 puncher and 2 crimpers.
- Pouch sealing: 1 vacuum and 1 heat sealing machine.
- Chemical characterization: ion chromatography and semiautomatic titration.
- Physicochemical characterization: viscosity, density, conductivity, pH and ORP meters.
- Electrochemical characterization: multipotentiostats (50 channels  $\pm 10V - 0.5A$ ); channel boosters 2 x 4A and 1 x 10A; impedance spectroscopy; rotating disk and rotating ring-disk electrodes.
- 1 Glove box for testing in controlled atmosphere.

## Modelling

- Computational chemistry: electronic structure calculations (density functional theory, wave function theory, molecular dynamics), GAUSSIAN ® and VASP ®.
- Computer fluid dynamics: COMSOL Multiphysics ®.
- Matlab-simulink ® for dynamic modelling of batteries.

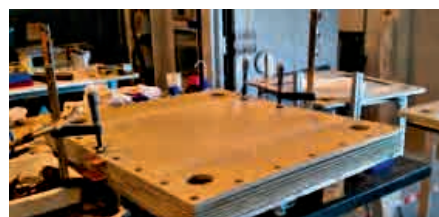
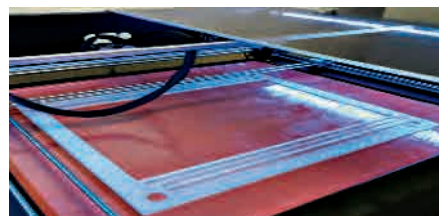


## Prototyping

- 3D design: SolidWorks.
- 3D printers: fused deposition modeling (1 x 4 Litres + 1 x 600 litres ) stereolithography (1 x 1,2 litres).
- CNC micro-milling machine.
- Cell prototypes: coin cells up to 2 cm<sup>2</sup>; pouch cells from 10 to 100 cm<sup>2</sup> electrodes; flow cells (10, 25, 300, 1200 and 2400 cm<sup>2</sup> electrodes) and flow modules up to 20 cells; micro-flow cells; injectable cells.

## Electrochemical devices testing

- Battery cycler: 3 channels x 8 kW, 120V – 200A max.
- Battery cycler: 4 channels x 300 W, 80V – 50A max.
- Cell cyclers: 24 channels x 30 W, 5V – 6A max.
- Cell cyclers: 88 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%H.
- Flow reactor test bed with controlled flow, temperature, pressure and measurement of pH, ORP and conductivity.
- LabView ® programmable control system.

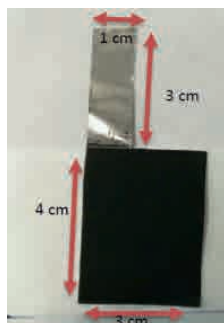
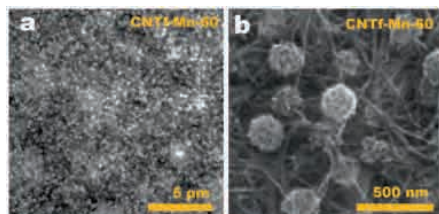
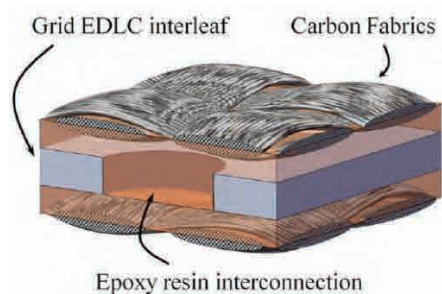




## Scientific activities and results

### Electrochemical capacitors

- Investigated some flexible and structural electrochemical double layer capacitors based on carbon nanotube fibers and solid electrolytes.
- Research has been carried out on pseudo-capacitors made of mixed metal oxides, metal sulfides and their composites with graphene.
- Designed and fabricated several pouch cell prototypes of hybrid supercapacitors with 12 cm<sup>2</sup> electrodes.



### Capacitive deionization (CDI)

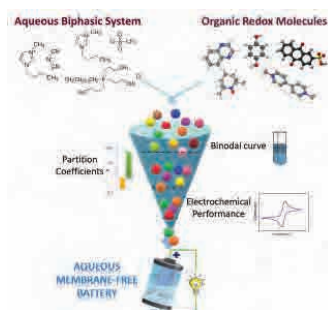
- Development of high deionization capacity electrodes using carbon felts mixed with activated carbons.
- Fabrication of flexible and structural deionization electrodes with carbon nanotube fibers.
- Application of capacitive deionization to treat brines produced as permeates from desalination plants with reverse osmosis. Design, construction and testing of a pilot plan for full size capacitive deionization reactors. The reactor prototype tested involved a stack of 10 cells of 2400 cm<sup>2</sup> electrodes with active mass loadings of 40 mg/cm<sup>2</sup>.



### Redox flow batteries (RFB)

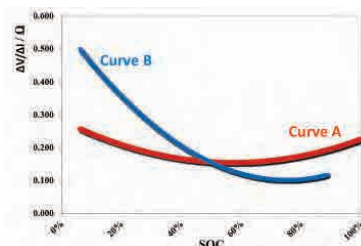
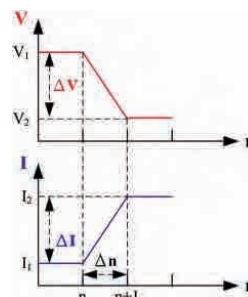
- Explored new and immiscible aqueous electrolytes for membrane-free redox flow batteries.
- Applied microfluidic concepts to produce membrane less redox flow batteries working under ideal laminar flow regime.
- Formulated new electrolytes with organic redox couples in aqueous solvents to reduce the cost and toxicity of the electrolytes, and to build redox flow batteries free of critical materials.
- Studied the possible hybridization of flow and static batteries to increase the energy density of vanadium-free redox flow batteries.

- European Patent application number: EP18382971, Title: "Redox flow battery for energy storage". Date of application: 21/12/2018. Holders: Fundación IMDEA Energía. Inventors: Ventosa, E.; Paez, T.; Palma, J.
- Synthesized and characterized redox-active polymers with potential use as low-cost cathodes for lithium-ion batteries.
- Realized proof of concept of injectable lithium-ion batteries using semi-solid mixtures of electrolytes and electrode active materials. Fabrication and testing of laboratory prototypes.



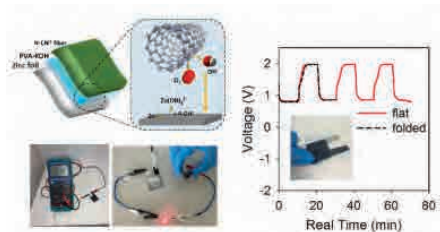
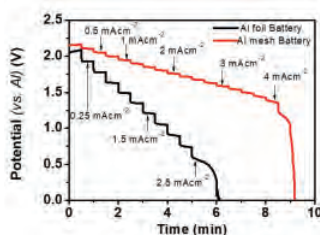
## Battery testing

- Development of new test protocols based on differential impedance measurements to determine the state of health of lithium-ion secondary batteries.



## Metal-air batteries / Metal-ion batteries (Me-air / Me-ion)

- Development of new anode materials for rechargeable aluminum batteries. Design and testing of laboratory prototypes manufactured with 3D printing techniques.
- Research carried out on new concepts to make flexible and rechargeable zinc-air batteries. Fabrication and testing of laboratory prototypes.



- Development of software tools and protocols for accelerated testing and early failure prediction of primary batteries such as zinc-manganese and lithium-manganese.

# Biotechnological Processes Unit



**Dr. Mercedes Ballesteros**  
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Head of the Unit



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Researcher



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**Dr. María José Negro**  
Associated Senior  
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**Dr. Ignacio Ballesteros**  
Associated Senior  
Researcher

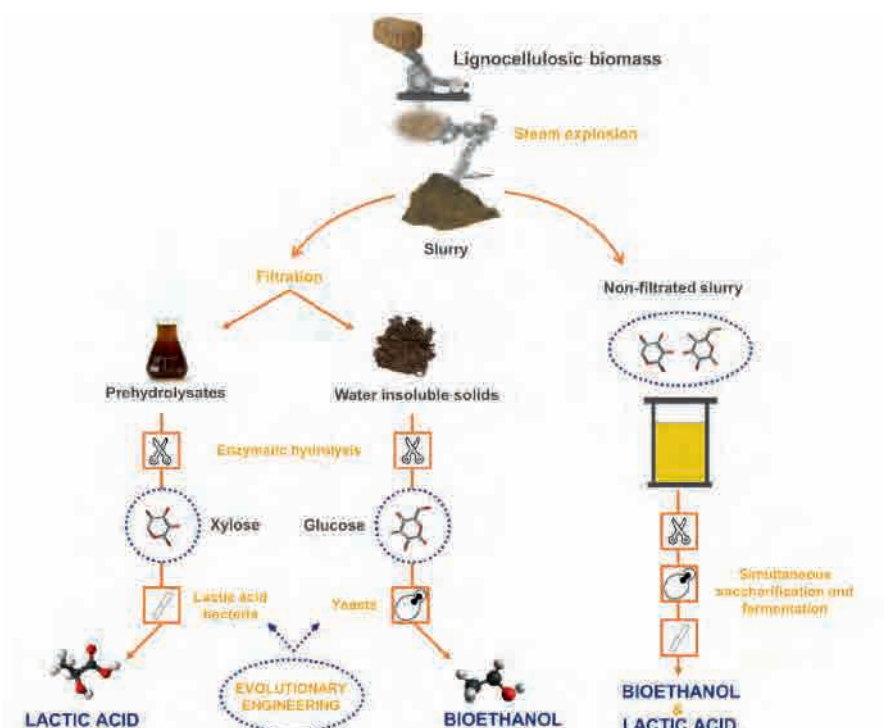


## R&D Objectives

- Development of technologies to produce biofuels and bioproducts via biological processes using biogenic residues and wastes as feedstock.

## Research lines

- Microalgae in upstream processes: microalgae and aerobic bacteria consortia for wastewater treatment.
- Microalgae downstream processes: photosynthetic biomass anaerobic fermentation.
- Microbial oil production from the carboxylic platform (volatile fatty acids).
- Lignocellulose based biofuels and bioproducts.
- Anaerobic fermentation of waste streams for carboxylate and biogas production.





## Relevant projects and networking

The Biotechnological Processes Unit (BTPU) participates in several national and international projects related with the use of photosynthetic microorganisms for wastewater treatment and microalgae biomass valorization by anaerobic digestion. In this sense, BTPU leads the European project EUAL-GAE (2015-2019), supported COST Action of H2020, which involves more than 180 investigators from 27 countries. Also within the microalgae research field, BTPU leads the national project WWAL-GAS (2014-2018) and is involved in MICROALBAC (2015-2018) which is conducted in collaboration with industry. Under WWAL-GAS, the anaerobic microbiome of the sludge used for microalgae digestion has been investigated. Likewise, this biomass has been also studied for the production of alternative bioproducts (volatile fatty acids). Furthermore, the Biotechnology Processes Unit is currently working in the development of tools to improve phototrophic biomass production through the participation in INSPIRA1 project (2014-2018) to determine the feasibility of using *Spirulina* biomass for anaerobic digestion. The unit is also actively involved in BIOGASMENA (2017-2020) (ERANET MED), addressing key technological challenges to foster the development of biogas technology in both the EU and the Mediterranean region.

BTPU is also very active in the valorization of lignocellulosic biomass. In this sense, BTPU is working in yeast and bacteria culture for bioenergy and bioproducts production from lignocellulosic residues. The unit works in LIGNOYEAST (2015-2018) and BIO\_LIG-WASTE (2016-2019) projects related with the production of bioethanol at high substrate loading and lactic acid from lignocellulosic streams.

With regard to alternative waste streams, other than microalgae and lignocellulosic material, in 2018 BTPU has started leading the national project ACMIBIO\_AD (2017-2021) with the objective to produce microbial oils VFAs obtained by anaerobic digestion of agricultural and food residues. Likewise, the unit works with organic matter from urban wastes for biogas production purposes in the framework of WASTE2BIO (2017-2020) (ERANET+ BESTF3).

As a result of the participation in the 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.
- Anaerobic reactors, fermenters and photobioreactors.
- Oven, muffle, balances and centrifuges.

### Chemical analytics lab

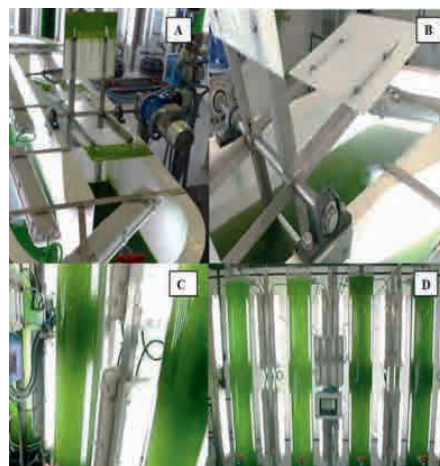
- Gas and liquid chromatographs with different detectors (FID, TCD, DAD, RI).
- Ionic chromatography.
- Equipment for routine analysis; TS/VS, pH, TNK, COD...
- Spectrophotometers: microplate and cuvette type.

### Molecular biology lab

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

### Pilot plants

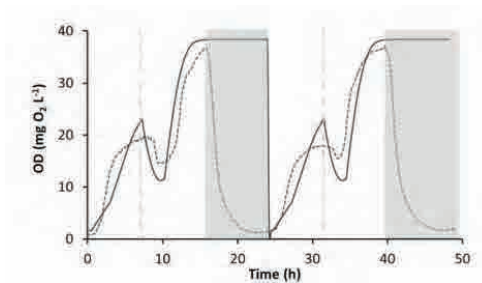
- Bioreactors.
- 3 modules of 4 bubbled columns each (1 m<sup>3</sup> in total).
- 2 open raceways (1 m<sup>3</sup> in total).



## Scientific activities and results

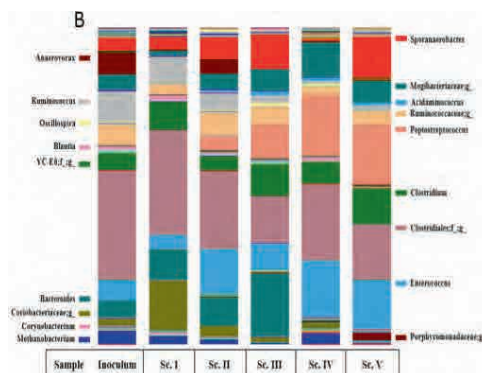
## Microalgae in upstream processes: microalgae and aerobic bacteria consortia for wastewater treatment

- Developed the microbial activity of an algal-bacterial consortium during wastewater treatment based on oxygen evolution.
- Observed that a significant amount of oxygen is consumed by the microalgae itself through endogenous respiration and photorespiration.
- Concluded that the reactor configuration might help overcoming limited efficiency of microalgae-bacteria consortia for wastewater bioremediation technology.



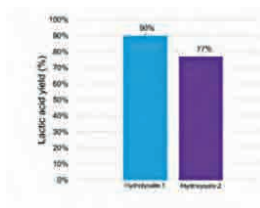
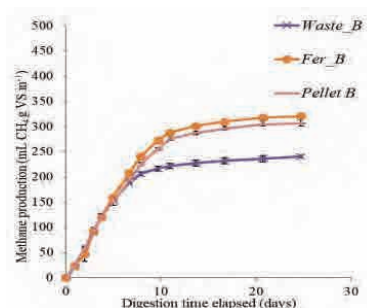
### Microalgae downstream processes: photosynthetic biomass anaerobic fermentation

- Generation of alternative bioproducts (VFAs) as a chemical platform.
- Established the temperature as a determining factor in the anaerobic digestion of photosynthetic biomass.
- Analyzed the effect of anaerobic sludge inoculum on the digestion of microalgae biomass.
- Conducted research on proteins as a key macromolecule for an efficient anaerobic digestion of microalgae biomass.
- Batch and semicontinuous fermentation comparison in terms of VFA production yields and profile.
- Identification of microbial communities in anaerobic microbiome of biodigesters operated to produce VFAs.



## Anaerobic fermentation of waste streams for carboxylate and biogas production

- Observed that selective residues provided higher methane potentials than non-selective residues.
- Determined that the digestions of a fermented fraction for ethanol production provided at least the same methane production than raw residues.

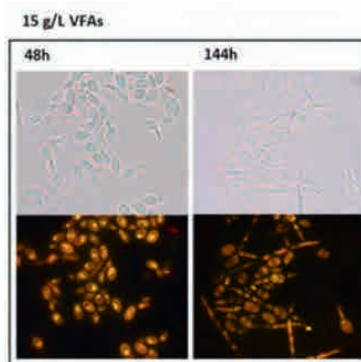


## Lignocellulose based biofuels and bioproducts

- Lactic acid production from lignocellulosic hydrolysates with lactic acid bacteria.
- Enzymatic hydrolysis tests to release monomeric sugars from lignocellulosic hydrolysates.
- Development of an evolutionary engineering approach to obtain lactic acid bacteria highly tolerant to low pH and with improved xylose conversion capacity.
- Bioethanol production from cellulosic fraction of gardening residues.

## Microbial oil production from the carboxylic platform (volatile fatty acids)

- Screening and selection of different oleaginous yeasts for producing high concentrations of lipids.
- Evaluation of oleaginous yeast growth on different concentrations of VFAs: comparison of synthetic mixtures and real digestates.
- Extraction and determination of lipids produced by oleaginous yeasts.







# Electrical Systems Unit

annual report  
2018



**Dr. Milan Prodanovic**  
Senior Researcher  
Head of the Unit

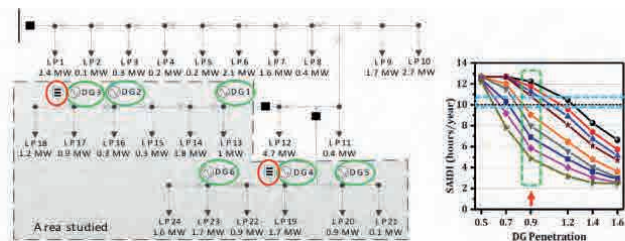


## R&D Objectives

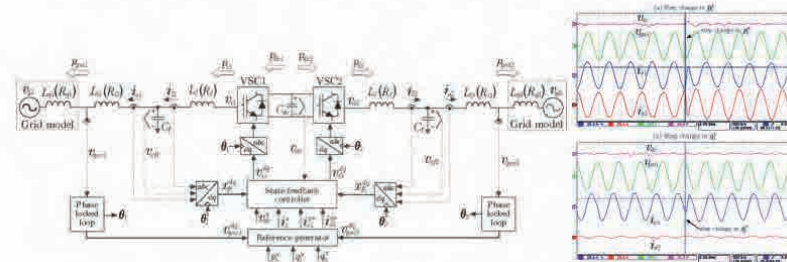
- Improved management, reliability and stability aspects of future electricity networks with high share of renewable and storage technologies. Application of optimisation based algorithms for demand management and renewable integration. Increased energy efficiency in industrial applications.

## Research lines

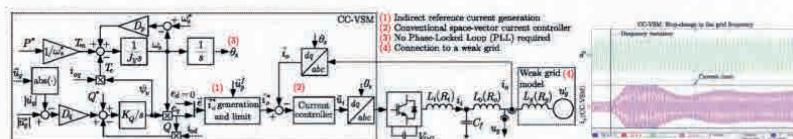
- Renewable and energy storage integration.
- Stability of power networks with high penetration of renewables.
- Reliability of power systems with high share of distributed generation and storage.
- Control of power converters for applications in electricity networks.
- Energy efficiency in systems for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



Energy storage and Distributed Generation technologies contributing to reliability of supply



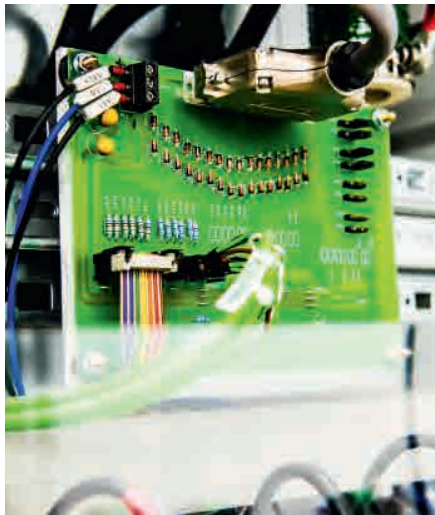
A novel concept of differential and common powers applied to control a Back-to-Back converter



Current limiting functionality applied to Virtual Synchronous Machine

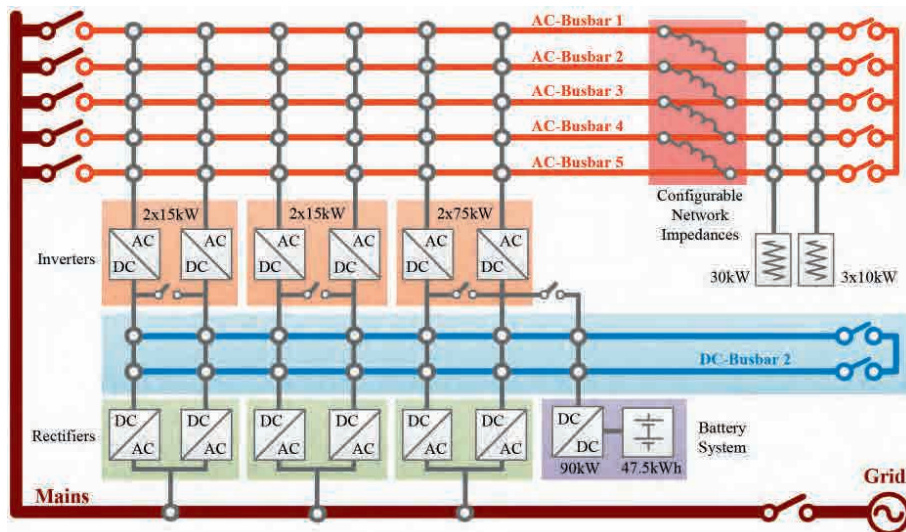
## Relevant projects and networking

In 2018, Electrical Systems Unit (ESU) actively participated in several research and development projects. Principal research activities were performed within the framework of regional project PRICAM (2014-2018) and also within projects EnRed and SinCortes funded by Foundation Iberdrola (2017-2018 and 2018-2019). These projects addressed stability and reliability aspects of renewable and storage integration to power networks as well as control of power electronics interfaces for grid applications. With respect to industrial collaborations, the main projects were LPT (2015-2018) with PVH addressing energy storage integration to power networks, Microgrid-On-Chip (2018-2021) with NORVENTO developing control of battery interfaces for microgrids and EEISVT (2011-) with IMV improving the efficiency of vibration test equipment. Research project RITSE (Reduced Inertia Transient Stability Enhancement, 2019-2020) started in December in collaboration with SuperGrid Institute, Lyon, as the result of a successful application to the competitive research



call Grid 2030 funded by Red Eléctrica de España.

ESU participated in activities of the Spanish Platform for Power Networks (FUTURED) within two workgroups: Power Electronics and Energy Storage. In 2018 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 remotely controllable programmable loads.
- 47.5 kWh battery system.
- 75 kW bidirectional battery interface.
- 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

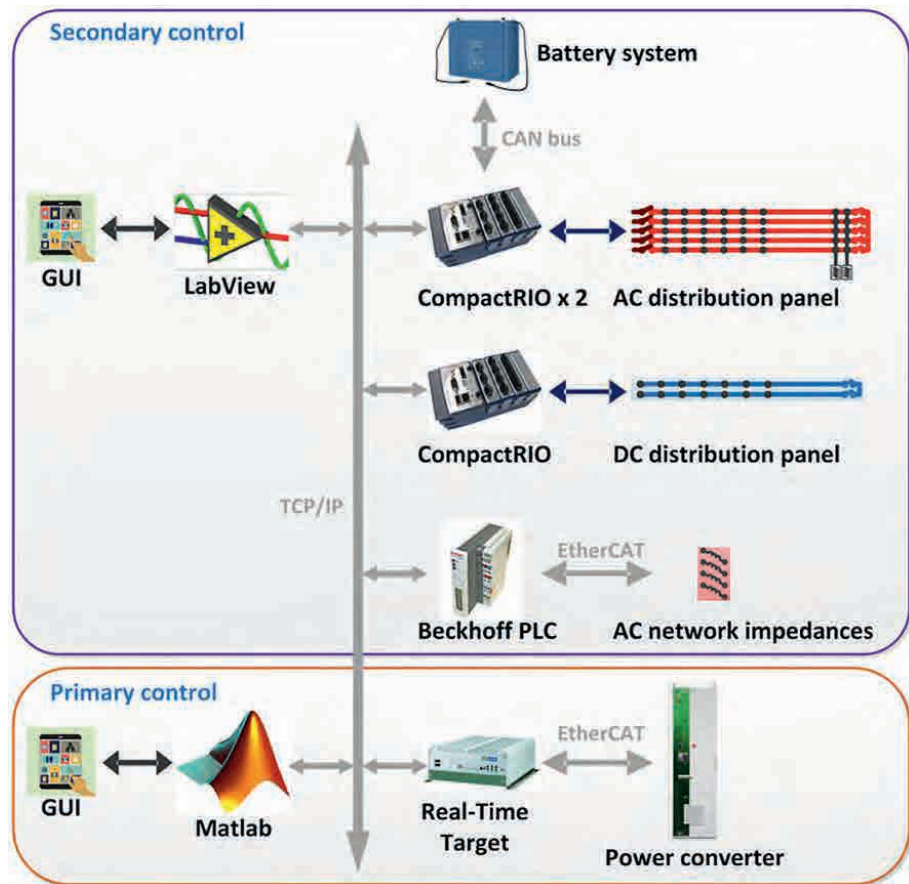
- KNX (Siemens) based technology.
- Sensors and actuators.

### Modelling and simulation tools

- Matlab, PowerWorld, IPSA, PLECS.

### Acquisition and control platforms

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

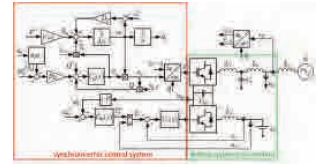




## Scientific activities and results

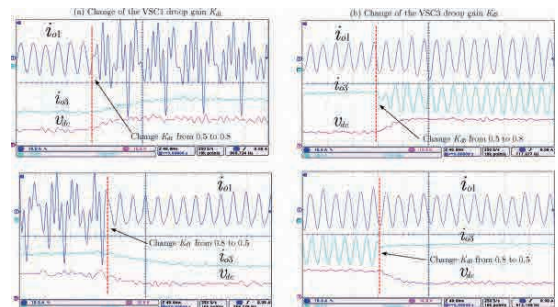
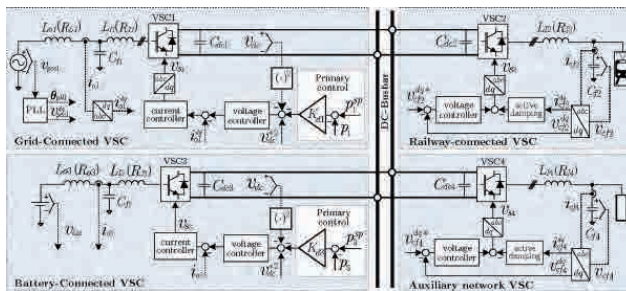
### Renewable and energy storage integration

- Development of advanced converter control techniques for energy storage interfaces for power systems and microgrids.
- Coordinated management of distributed storage applications.
- Applied battery storage integration to railway systems.
- Evaluation of battery technologies for PV grid applications (Li-Ion and flow-batteries).



### Control of power converters for applications in electricity networks

- Analysed advanced control of railway power supply systems.
- Developed novel differential and common power concepts for control of Back-to-Back converters.
- Obtained primary, secondary and tertiary control algorithms for power converters in AC and DC microgrids.
- Improved the power quality in weak power networks.
- Power converter design and control improvements for grid applications (improved noise filtering, damping etc.).



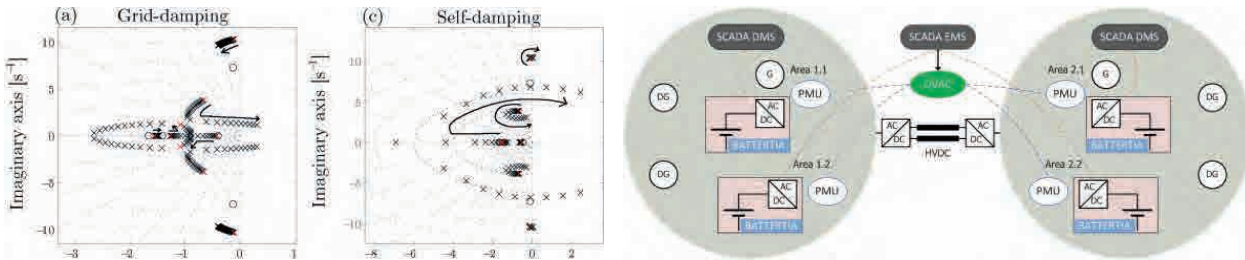
### Energy efficiency in systems for vibration testing

- Development of control boards for switching power amplifiers in vibration system applications.
- Research carried out on control system improvement of switching amplifiers.
- Development and testing of a 20 kW bidirectional isolated industrial power supply.
- Improved management algorithms for Intelligent Shaker Manager.



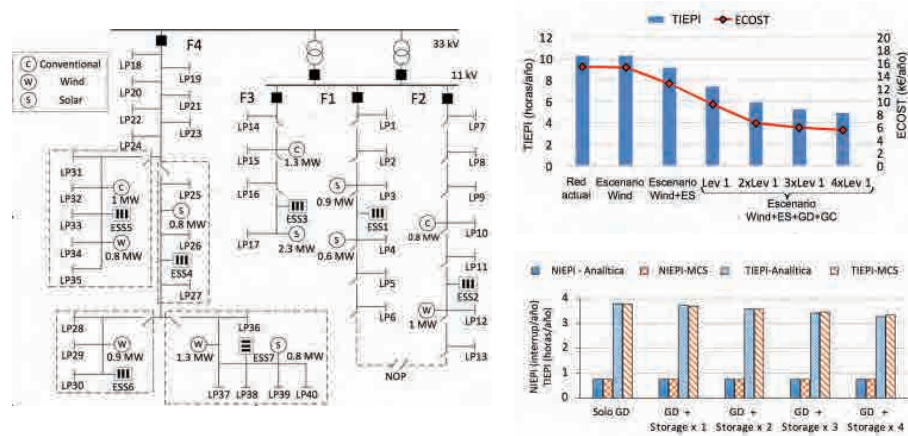
## Stability of power networks with high penetration of renewables

- Modelled the small-signal of AC, DC and hybrid power networks.
- Analysis of transient stability for power networks based on Singular Value Decomposition.
- Assessment of the impact of power converter grid connection on grid stability.
- Development of control of multi-terminal DC networks in power transmission and distribution applications.
- Generation of virtual inertia in HVDC and distribution networks.



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

- Development of analytic methods for reliability assessment of distribution networks and islanded microgrids with high share of renewable and energy storage technologies.
- Reliability assessment of SmartGrids technologies deployed in distribution networks (SNOP, OLTC, DLC, etc.).
- Developed optimisation based sizing tools for renewable and energy storage installations for improving continuity of supply in power networks.
- Estimated the economic benefits produced by operating networks in both grid-connected and islanded modes.



# System Analysis Unit

annual report  
2018



**Dr. Javier Dufour**  
Researcher Professor  
Head of the Unit



**Dr. Diego Iribarren**  
Senior Assistant  
Researcher



**Dr. José Luis Gálvez**  
Senior Assistant  
Researcher



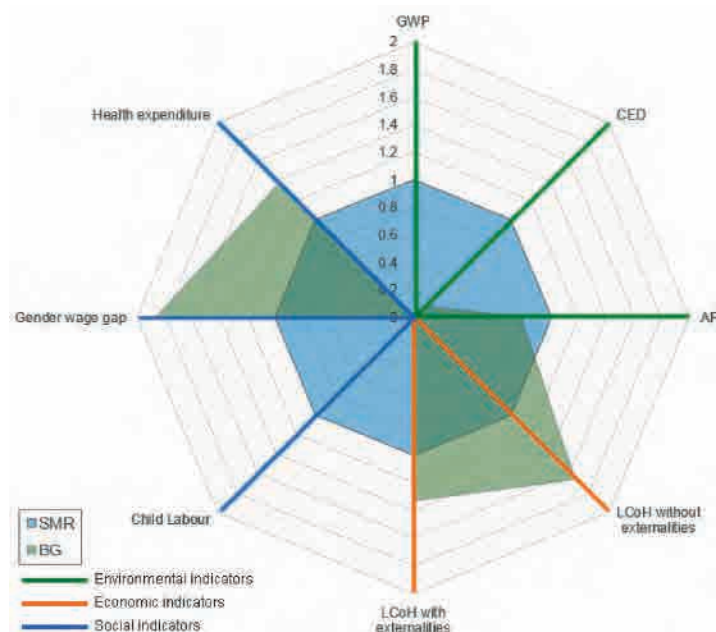


## R&D Objectives

- Sustainability assessment of energy systems; process design, simulation and optimisation; and energy systems modelling for energy planning.

## Research lines

- Life Cycle Assessment of energy systems: environmental LCA, life cycle costing, social life cycle assessment, life cycle sustainability assessment, and multi-criteria decision analysis (LCA + DEA).
- Assessment of the feasibility of energy processes through simulation, thermodynamic analysis (energy and exergy balances), optimisation and techno-economic and environmental evaluation.
- Prospective analysis of energy scenarios: development of energy system models; integration of sustainability indicators and geographic information systems.



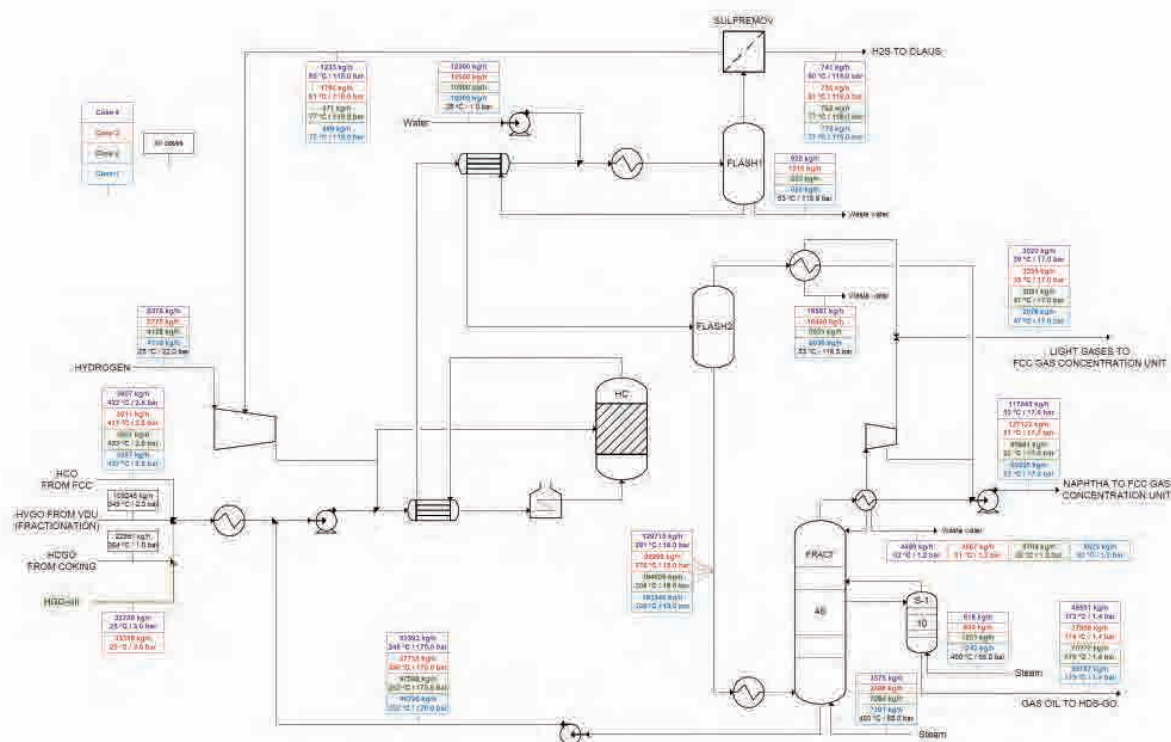


## Relevant projects and networking

In 2018, the Systems Analysis Unit (SAU) has continued its participation in three European projects related to solar fuels (EU H2020 Sun-to-Liquid project), end-of-life strategies for fuel cells and hydrogen technologies (EU FCHJU HyTechCycling project) and the deployment of compressed and liquid natural gas infrastructure for transportation (EU CEF Eco-Gate project). At domestic level, SAU finished the BIO-SUSCAT project, developing scalability criteria and the techno-economic assessment of “building block” compounds obtained from lignocellulosic biomass, and continued working on the PICASO project where the Spanish alternative mobility model is being developed. At the regional level, SAU collaborated in the ResToEne-2

programme, continuing with the roadmapping and sustainability assessment of new processes for the manufacturing of clean transportation fuels from agro-forestry and oily waste. Moreover, SAU has developed nine research contracts with several institutions dealing with process simulation (3), feasibility studies (3), life cycle assessment (2), and energy modelling (1).

Regarding networking, Javier Dufour, head of SAU, has been the Vice-chair of Cross-cutting Research Activities of Hydrogen Europe Research. Likewise, the Unit has been actively involved in the chairmanship of the Spanish Network for Life Cycle Assessment (esLCA).



## Capabilities

### Sustainability assessment of energy systems

- Environmental LCA, carbon footprinting and ecodesign.
- Combined application of LCA and Data Envelopment Analysis for multi-criteria decision analysis.
- Social life cycle assessment, life cycle costing.
- Harmonised LCA and life cycle sustainability assessment.

- Energy and exergy analyses.

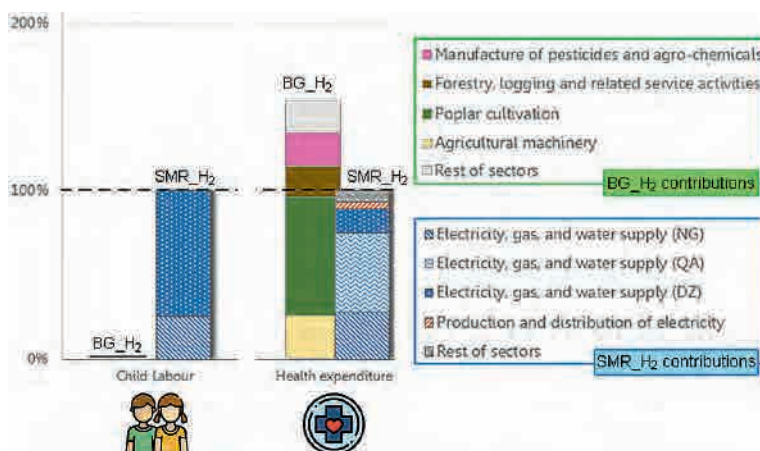
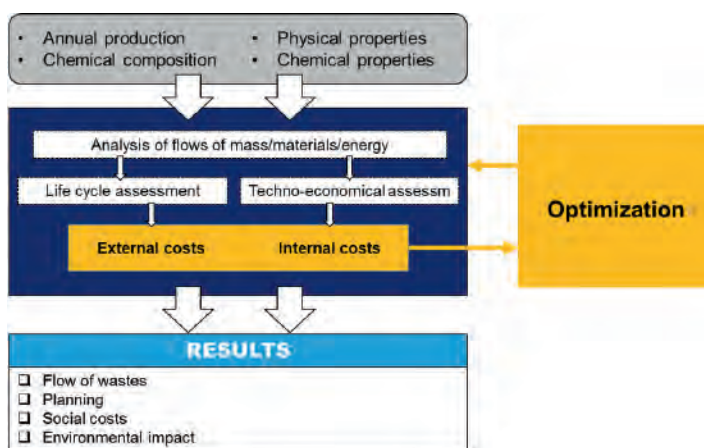
- Conventional economic analysis and externalities.

### Energy planning

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

### Feasibility of energy processes

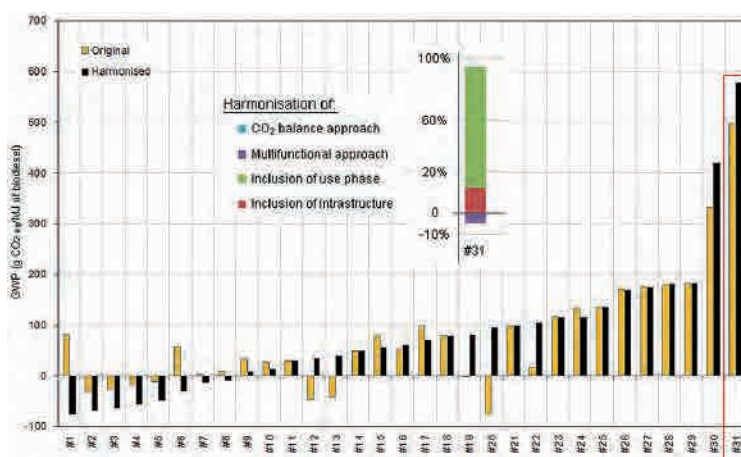
- Process design, simulation and optimization.
- Circular economy energy modelling.



## Scientific activities and results

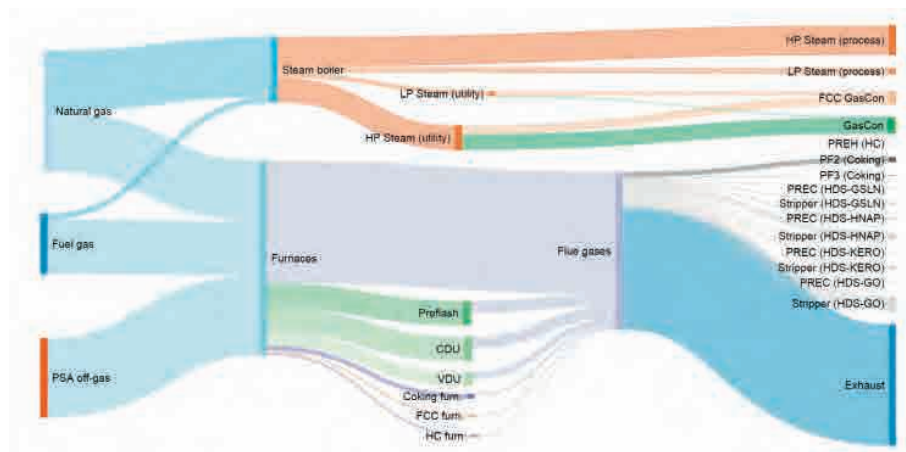
### Sustainability assessment methodology

- Elaborated LC + DEA methods as multi-criteria decision analysis tools in the field of energy systems analysis.
- Development of conventional and harmonised LCA of microalgal-based systems for biofuels production.
- Defined end-of-life strategies for FCH products.
- Assessed the sustainability of several hydrogen production routes.
- Prospective assessment of life-cycle indicators for power generation.



### Feasibility of energy processes

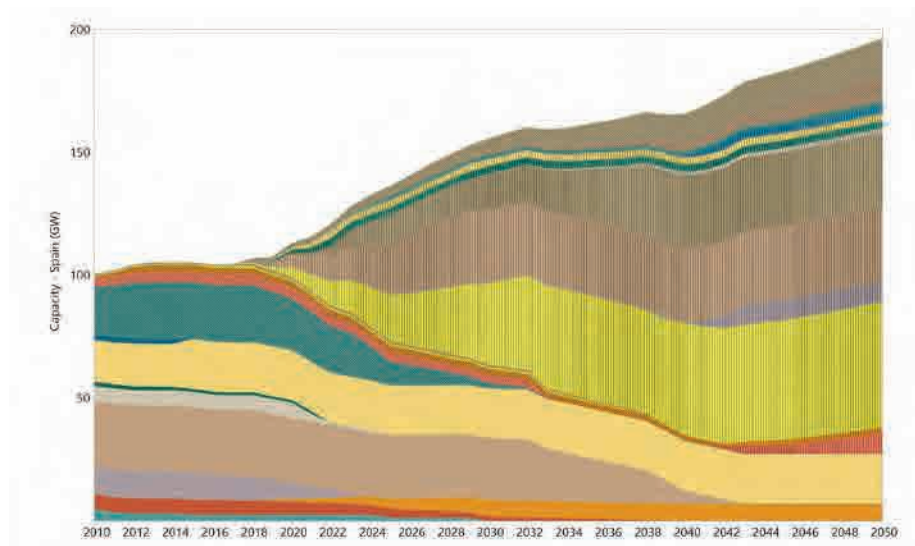
- Carried out scalability analysis of “platform molecules” production processes from biomass.
- Development of hydrothermal treatments models for municipal solid waste, gardening waste, food waste and generic waste.



- Performed the model and simulation of a biomass-oil co-processing refinery.
- Development of the model for the calculation and analysis of life cycle inventories of regional waste management systems.
- Techno-economic assessment of CO<sub>2</sub> capture and utilization alternatives.

## Energy systems modelling

- Realized the roadmapping for new lignocellulosic biofuels.
- Techno-economic assessment of high-value bio-based products.
- Validation and enhancement of the energy systems models of several European cities.
- Carried out the evaluation of energy scenarios in Spain: coal extension; externalities internalisation; and energy security.
- Developed a methodological assessment of the energy-economy decoupling.





# 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



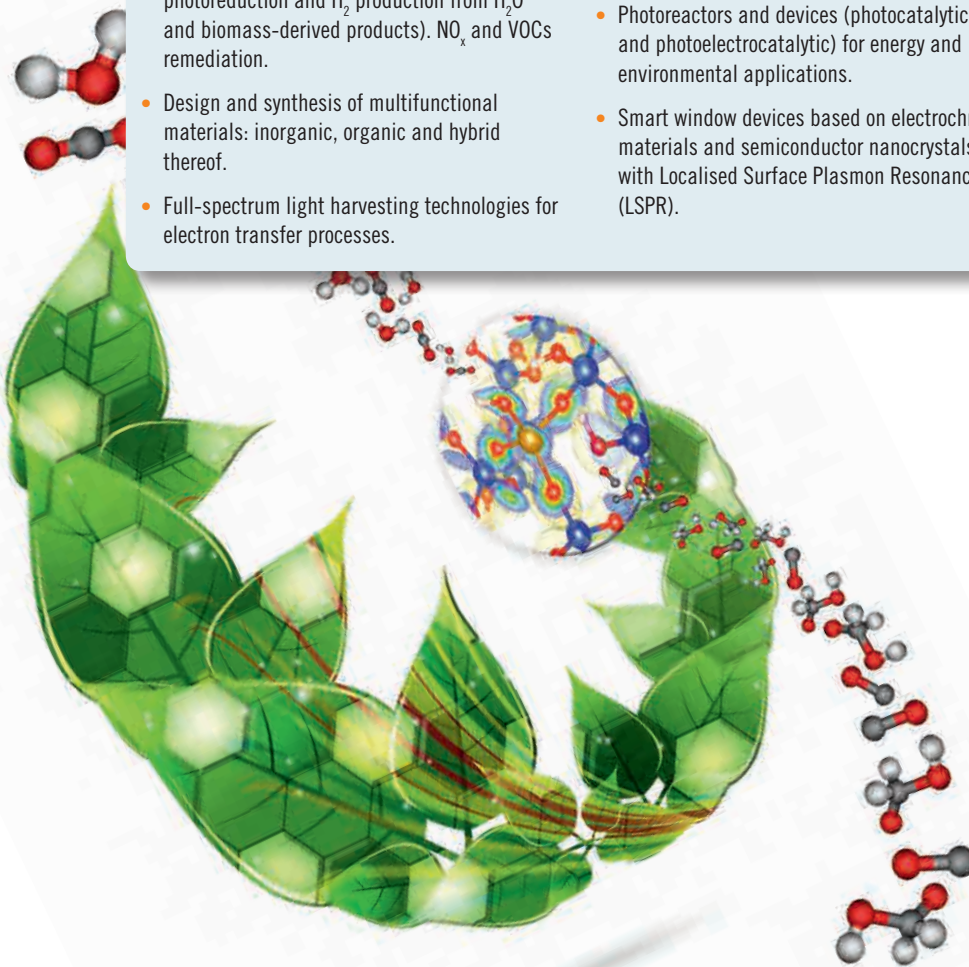
**Dr. Raúl Pérez**  
Senior Assistant  
Researcher

## 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  $\text{CO}_2$  photoreduction and  $\text{H}_2$  production from  $\text{H}_2\text{O}$  and biomass-derived products).  $\text{NO}_x$  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).



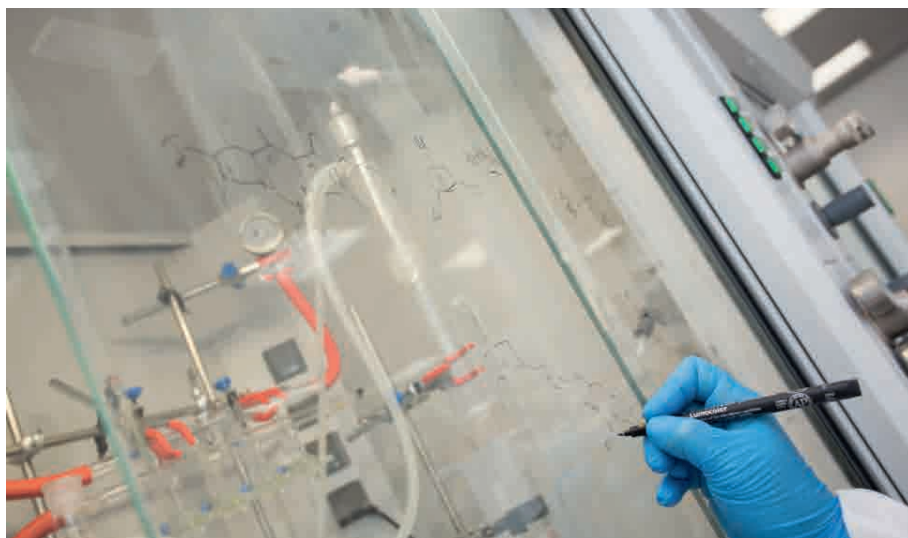
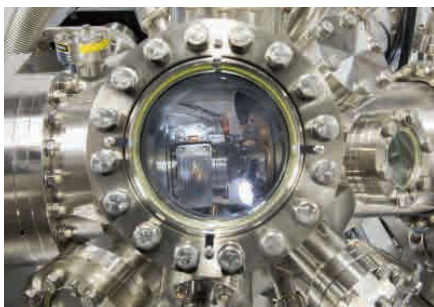
## Relevant projects and networking

In 2018 the Photoactivated Processes Unit (PAPU) has participated in 6 research projects funded at regional, national and european levels. Dr. Víctor A. de la Peña O'Shea, senior researcher and head of the PAPU, has the support of a European project corresponding to the call ERC-2014-CoG (Topic ERC-CoG-2014 - ERC Consolidator Grant) of the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme.

At national level, PAPU is funded and supported through several projects such as Ra-PHUEL (2017-2019) and SOL-PAC (2018-2020) as well as by a Ramon y Cajal Programme project (2015 call) and a Juan de la Cierva Formacion grant (2017 call), all of them related with the design and synthesis of new materials (inorganic semiconductors, conductive polymers and organic-inorganic hybrids) as heterogeneous photocatalysts and photoelectrodes for artificial photosynthesis. In the regional framework, the unit is participating into the MAD2D program (Fundamental Properties and Applications of Graphene and other two-dimensional Materials). Also, at industrial level PAPU holds a project with Mercedes

Company. Besides, PAPU is coordinating the national Excellence Network FOTOFUEL, which promotes synergies and networking of national top research groups devoted to the development of materials and devices for efficient solar fuels production. In addition, PAPU participates in the Spanish CO<sub>2</sub> technological platform (PTECO2) where the head of the Unit coordinates the CO<sub>2</sub> uses working group.

Along 2018 PAPU has been awarded new projects from several research calls such as ART-LEAF, funded by Fundación Ramon Areces, and FOTOART project (Tecnologías 2018 call) funded by regional government of Comunidad de Madrid. These projects are a guarantee to maintain the R&D activity in forthcoming years.





## Facilities

### Synthesis of materials

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

### Materials characterization facilities

- Single-crystal and powder x-ray diffraction equipment with Cu  $\mu$ -focus source.
- Transient absorption spectrophotometer provided with an i-CCD camera and a tuneable laser radiation source (Nd:YAG plus OPO and extended UV).
- Time resolve fluorescence spectrometer.
- Electro- and photoelectrochemical characterization in three and two electrode cell configuration. Cyclic voltammetry, photovoltage, photocurrent and electrochemical impedance spectroscopy (EIS) by potentiostatic and galvanostatic measurements.
- *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 the *in-situ* characterisation of photocatalytic processes under illumination at different gas atmospheres and pressures up to 25 mbar.

### Reactors

- Gas phase reactors and micro-reactors for photocatalytic reduction of CO<sub>2</sub> provided with gas chromatography for product analysis.



- Reactors for photocatalytic H<sub>2</sub> production coupled to in-line gas chromatography for product analysis.
- Photoelectrochemical cells for solar fuels production by water splitting and CO<sub>2</sub> reduction, coupled to potentiostatic measurements and in-line gas chromatography.
- Gas-phase compound parabolic collector solar reactor for CO<sub>2</sub> reduction and H<sub>2</sub> production with solar radiation measurement and chromatographic gas analysis.
- Spectroelectrochemical cells for spectral response and electrochromic response measures.

### Theoretical calculations and modelling

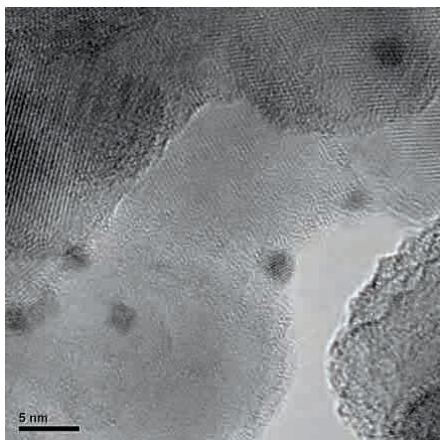
- Workstations.
- Software for chemical modelling.
- Tools for computational fluid dynamics, data treatment and process engineering.



## Scientific activities and results

### Development of novel inorganic photocatalysts

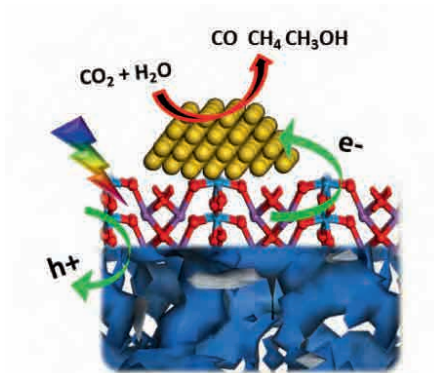
- Band-gap engineering synthesis of UV- and visible-light-absorbing metallates based on group-5 metals and cations with outer shell s-electrons.
- Prepared novel oxide-oxide heterojunctions with improved photocatalytic activity and extended absorption spectrum.
- Controlled deposition of metal nanoparticles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



### Design and synthesis of conjugated porous polymers and its hybrids

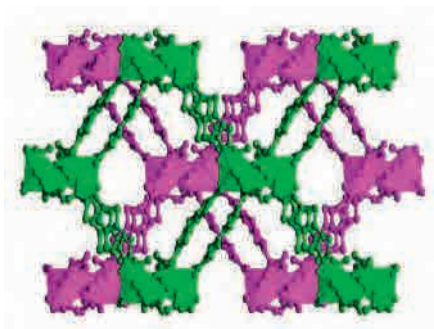
- Design and synthesis of new building blocks: monomers and ligands.
- Synthesis and design of conjugated polymers (linear, hyper-branched and porous networks) based on DTT, Benzodithiophenes and BOPHY moieties.

- Synthesis of conjugated porous polymer nanostructures by miniemulsion and electropolymerization techniques.
- Prepared and characterized hybrid materials based on conjugated porous polymers and inorganic semiconductors.



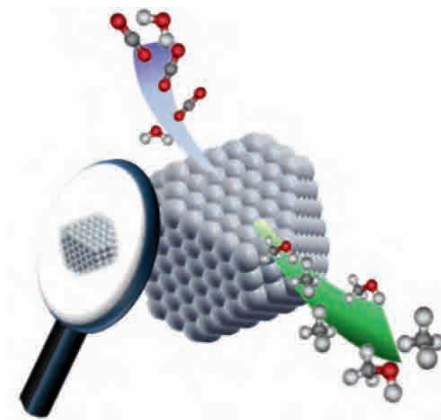
### MOFS

- 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 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 with 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 CO<sub>2</sub> photoreduction with metal nanoparticle co-catalysts.
- H<sub>2</sub> production from biomass derivatives in real matrices.
- Performed scalability studies for CO<sub>2</sub> photoreduction catalysts.
- Preparation of thin films of all the new synthesised materials and evaluation as photoelectrodes in photoelectrochemical cells.



# Advanced Porous Materials Unit

annual report  
2018



**Dr. Patricia Horcajada**  
Senior Researcher  
Head of the Unit

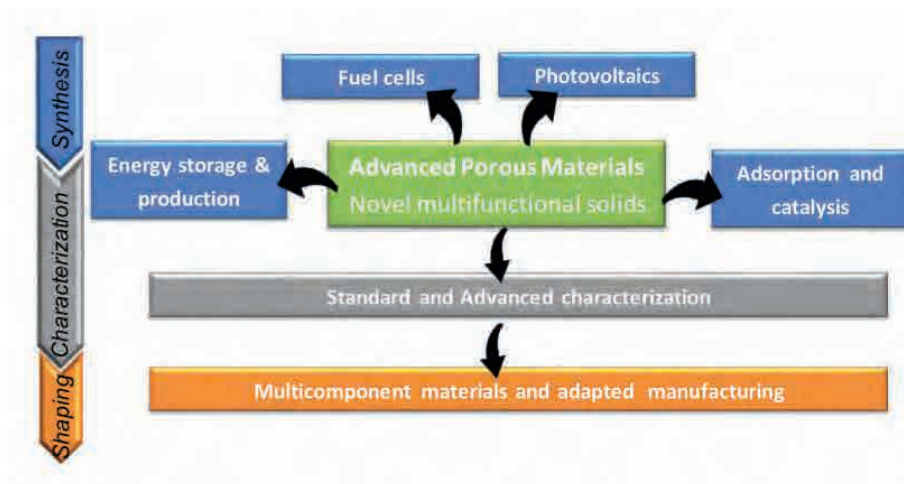


## R&D Objectives

- 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.







## Relevant projects and networking

During 2018 the Advanced Porous Materials Unit (APMU) has been involved in 3 national projects. The project Raphuel (2016-2019), funded by MINECO, focused on the development of new multifunctional materials for CO<sub>2</sub> photoconversion. The project funded by BBVA Leonardo call (2017-2019, PolyMOF) is dedicated to the preparation of new conducting polymer@MOF composites for energy storage. The project funded by Iberdrola Foundation (2017-2018) was aiming to develop electroactive metal@MOF composites for different applications (energy storage, sensing, biomedicine).

Two additional projects have been accepted for starting in 2019. A regional project Madrid-PV2-CM (2019-2022) dealing with the investigation of materials, devices and

technologies for the development of the photovoltaic industry and a Ramón Areces project (2019-2022), which aims to develop fuel cells based on novel composite MOFs. In addition, APMU has been awarded with 5 personal fellowships: 1 national “Ramon y Cajal” and 4 regional grants (2 Junior Postdoctoral Talento, Predoctoral and Technician fellows).

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.

## 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 bag.
- Traditional inorganic synthetic methods: two-layer diffusion, evaporation, high temperature...
- Conventional solvothermal, microwave-assisted, sonochemical and mechanochemical methods, syringe pump techniques.
- High-through put solvothermal reactors.

### Manufacturing

- Supercritical CO<sub>2</sub> extraction system (material purification, adsorption, shaping).
- Press-molding and monoliths.
- Spin-coating (thin films, membranes).

### Characterization

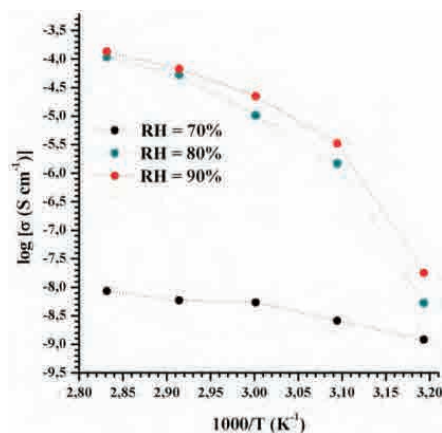
- Standard techniques available at IMDEA Energy (physi- and chemi-sorption, XRD, IR, Raman, UV-Vis, EDX-SEM, TGA, DLS, elemental analysis, ICP, AFM, etc.) and URJC (TEM, FEG-SEM, NMR, etc.).
- High-through put filtration system coupled with multi-sample XRPD.
- *In situ* structural characterization (XRD, 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.
- Permeation chambers.



## Scientific activities and results

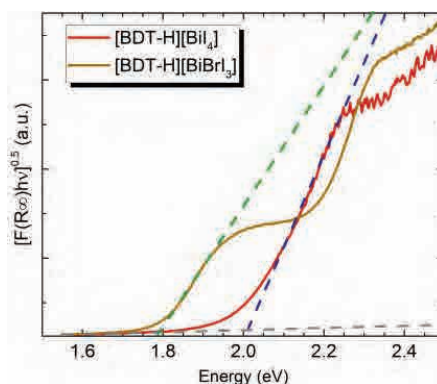
### Proton conducting materials: Fuel cells

- Design and synthesis of a robust proton conducting MOF based on bismuth and a photoactive azobenzene derivative, exhibiting permanent porosity.
- Design and synthesis of new multifunctional MOFs based on the phosphonate ligands. In particular, 2 new porous structures were prepared based on a pyrene derivative and  $\text{Cu}^{2+}$  cations, exhibiting proton conductivity and promising optical properties. Other promising novel structures based on tri (Bi) and tetravalent (Zr) cations have been isolated.
- Insertion of proton conductive species into the porosity of aqueous stable MOFs. A novel lysine@MOF composites has been prepared with proton conductivity and structural stability higher than the starting material.
- Five new MOFs based on environmentally friendly cations (Na, K, Ca) and a dicarboxylate ligand with reversible structural changes upon moisture exposure.



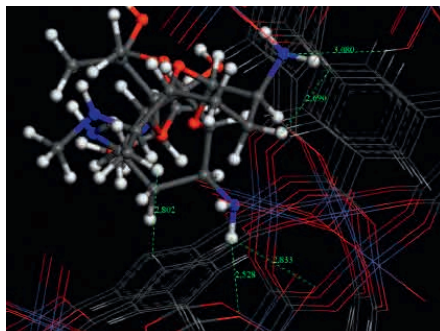
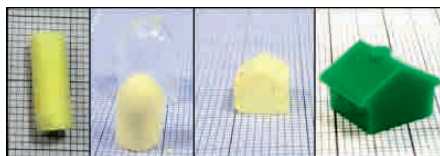
### Semiconducting materials: Photovoltaics

- Design and synthesis of lead-free organic-inorganic materials for mesoporous dye-sensitized solar cells. A series of materials based on organic cations and complex inorganic bismuth-based  $[\text{Bi}_m\text{I}_n]$  anions of controlled dimensionality has been prepared, reaching visible light absorbers with  $E_g = 1.8\text{-}2.2$  eV.
- Application of crystallographic indicators for evaluation of anion-cation interactions. Computational assessment of microscopic parameters, supported by experimental evaluation of bulk and micro/nanoscale textural properties of the new developed materials.



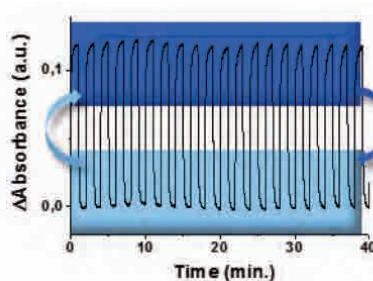
## Adsorbent and catalytic materials

- Development of new heterogeneous catalysts like Cu-imidazolate porous coordination polymers with controlled particle size with a remarkable catalytic activity in the reduction of methylene blue.
- Preparation of shape-tunable centimetric MOF-based monoliths with hierarchical porosity and mechanical robustness.
- Incorporation of active ingredients (AI) in porous MOFs. An in deep-understanding study of the MOF sorption abilities has concluded that MOF/drug hydrophilic/hydrophobic balance together with the structural parameters of the framework strongly affect the adsorption and delivery from MOFs. In addition, a robust MOF has been proposed for the first time as an efficient oral detoxifying agent.
- Development of antimicrobial surfaces for several applications (heat exchange, biocorrosion, medical devices, food industry, transport). Highly antibacterial activity of gentamicin Fe-MOF vector.



## Electroactive materials: Energy storage and production

- Use of a bimetallic (*i.e.*, Co and Fe) MOF as precursor for the preparation of N-doped porous carbons electrocatalysts for rechargeable Zn-air batteries.
- Conducted research on efficient and recyclable production of biodiesel from soybean oil using a lipase@ZIF-67 nanobio-reactor, as an alternative for green energy production via biodiesel transesterification using enzyme-immobilized MOFs.
- Carried out macromolecules nanostructuring using porous electroactive materials based on conducting polymer/MOF composites that exhibit a reversible and cyclable electrochromic switching.
- Obtained the integration of inorganic species into porous materials.





# annex

R&D projects,  
contracts and grants

71

scientific results

90

training and  
dissemination activities

113

annex

## 1. R&D projects, contracts and grants

### 1.1. Regional R&D projects

---

**1. Title/Acronym:** Storage and conversion of concentrated solar power/ALCCONES

**Partners:** IMDEA Energy Institute (Coordinator); URJC; CIEMAT; CSIC; Abengoa Research; SENER Ingeniería y Sistemas; Empresarios Agrupados

**Period:** 2014-2018

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

**IMDEA Energy Institute external funding:** 232.921 €

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**2. Title/Acronym:** Use of agro-forest and oily residues to produce clean transportation fuels/RESTOENE2

**Partners:** ICP-CSIC (Coordinator); CIEMAT; Rey Juan Carlos University; IMDEA Energy Institute; Autonomous University; Abengoa Bioenergía; Repsol; Exide Technologies; Soluciones Catalíticas Ibercat

**Period:** 2014-2018

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

**IMDEA Energy Institute external funding:** 143.399 €

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**3. Title/Acronym:** Fundamental properties and application of graphene and other 2D materials/MAD2D

**Partners:** ICMM-CSIC (Coordinator); IMDEA Energy Institute; IMDEA Nanoscience Institute; IMDEA Materials Institute; Autonomous University; Laboratory-IMDEA Materials; Laboratory-IMDEA Nanoscience; Laboratory-IMDEA Energy; Airbus Operations; Repsol; Bruker; Albufera Energy Storage; Nanoinnova Technologies

**Period:** 2014-2018

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

**IMDEA Energy Institute external funding:** 140.511 €

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**4. Title/Acronym:** Smart grids for the Comunidad de Madrid/PRICAM

**Partners:** Alcalá University (Coordinator); Rey Juan Carlos University; Carlos III University; Pontificia Comillas University; Laboratory-IMDEA Energy; Iberdrola; Indra; Real Academia de Ingeniería; Fuenlabrada University Hospital

**Period:** 2014-2018

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

**IMDEA Energy Institute external funding:** 148.500 €

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**5. Title/Acronym:** Industrial applications of spirulina/INSPIRA1

**Partners:** CIB-CSIC (Coordinator); ICP-CSIC; ICV-CSIC; UAM; UCM; URJC; Laboratory-IMDEA Energy; Bidesma; Micro algae Solutions; Laboratorios Actafarma; Isolux Corsán; Canal de Isabel II; UPM

**Period:** 2014-2018

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

**IMDEA Energy Institute external funding:** 80.000 €

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**6. Title/Acronym:** Design and optimization of a continuous reactor for the catalytic pyrolysis of biomass and the production of high quality bio-oils.

**Partners:** Process Integral Delopment & Tech; IMDEA Energy Institute

**Period:** 2018-2020

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

**IMDEA Energy Institute external funding:** 76.000 €

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**7. Title/Acronym:** Research and study of flow microbatteries for application in photovoltaic microinverters.

**Partners:** Micro Electrochemical Technologies; IMDEA Energy Institute

**Period:** 2018-2020

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

**IMDEA Energy Institute external funding:** 78.000 €

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## 1.2. National R&D projects

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**1. Title/Acronym:** Algal biogas from wastewater bioremediation: seeking for insights on population dynamics and cell wall characteristics/WWAL-GAS

**Partners:** IMDEA Energy Institute (Coordinator); Explotación Agropecuaria Jose Mario Anton Andrés; Bodega Valdehermoso; Aqualia

**Period:** 2014-2018

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. Research Challenges 2013

**IMDEA Energy Institute external funding:** 127.050 €

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**2. Title/Acronym:** Efficient production of solar fuels through the development of new perovskites with redox capacity for thermochemical splitting of CO<sub>2</sub> and H<sub>2</sub>O/SOLARKITE

**Partners:** IMDEA Energy Institute

**Period:** 2015-2018

**Funding Institution/Program:** Ramón Areces Foundation/ XVII Concurso Nacional para la adjudicación de ayudas a la Investigación en Ciencias de la Vida y de la Materia 2014

**IMDEA Energy Institute external funding:** 126.849 €

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**3. Title/Acronym:** Lignocellulosic bioethanol production at high substrate loading: developing yeast tolerant to mechanical stress/LignoYeast

**Partners:** IMDEA Energy Institute (Coordinator); Abengoa Bioenergía; Neol Biosolution; Biopolis

**Period:** 2015-2018

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2014*

**IMDEA Energy Institute external funding:** 174.240 €

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**4. Title/Acronym:** Innovative storage for stationary applications based on aluminum/ALIENA

**Partners:** Albufera Energy Storage (Coordinator); ALEASTUR; GFM; ITMA; IMDEA Energy Institute

**Period:** 2015-2019

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2015*

**IMDEA Energy Institute external funding:** 128.088 €

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**5. Title/Acronym:** Capacitive deionization of brines coming from brackish water reverse osmosis plants/DC-SÓIAS

**Partners:** GS-INIMA (Coordinator); PROINGESA; IMDEA Energy Institute

**Period:** 2015-2018

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2015*

**IMDEA Energy Institute external funding:** 162.480 €

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**6. Title/Acronym:** The total photovoltaic platform – LPT. Project to equip the photovoltaic plants with a platform that allows their maximum level of energy management/LPT

**Partners:** Ingenia Solar Energy (Coordinator); PV Hardware Solutions; Grupo Gransolar; IMDEA Energy Institute; Carlos III University

**Period:** 2015-2019

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2015*

**IMDEA Energy Institute external funding:** 416.900 €

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**7. Title/Acronym:** New strategies for the integration of microalgae-bacteria consortium in small size urban wastewater treatment plants/MICROALBAC

**Partners:** FACSА (Coordinator); IMDEA Energy Institute; CSIC

**Period:** 2015-2019

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2015*

**IMDEA Energy Institute external funding:** 160.926 €

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**8. Title/Acronym:** Multidisciplinary analysis of indirectly-heated particles receivers/reactors for solar applications in extreme conditions/ARROPAR-CEX

**Partners:** IMDEA Energy Institute (Coordinator); CIEMAT; Nanoker Research; Abengoa Research

**Period:** 2016-2019

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2015*

**IMDEA Energy Institute external funding:** 189.970 €

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**9. Title/Acronym:** Innovative materials for application in advanced supercapacitor/MATCAP

**Partners:** IMDEA Energy Institute (Coordinator); CIC Energune; Repsol; Solvionic; AVANZARE Innovacion Tecnologica

**Period:** 2016-2019

**Funding Institution/Program:** Ministry of Economy and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2015*

**IMDEA Energy Institute external funding:** 145.200 €

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**10. Title/Acronym:** New biorefinery concept based on the production of bioethanol and other by-products from pruning waste and gardening residues/BIO\_LIGWASTE

**Partners:** TETma (Coordinator); IMDEA Energy Institute; Centre VERD; CIEMAT

**Period:** 2016-2019

**Funding Institution/Program:** Ministry of Economy, Industry and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Collaboration Challenges 2016*

**IMDEA Energy Institute external funding:** 102.132 €

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**11. Title/Acronym:** CO<sub>2</sub> photoconversion to solar fuels using multifunctional materials/Ra-Phuel

**Partners:** IMDEA Energy Institute (Coordinator); Repsol; Plataforma Tecnológica del CO<sub>2</sub>; Gas Natural Fenosa; Korea Research Institut of Chemical Technology

**Period:** 2016-2019

**Funding Institution/Program:** Ministry of Economy, Industry and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Research Challenges 2016*

**IMDEA Energy Institute external funding:** 223.850 €

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**12. Title/Acronym:** Planning the implementation of alternative fuels in the Spanish energy sector towards a sustainable transport system/PICASO

**Partners:** IMDEA Energy Institute

**Period:** 2017-2019

**Funding Institution/Program:** Ministry of Economy, Industry and Competitiveness/Research, Development and Innovation Oriented Challenges of the Society. *Modality young researchers 2015*

**IMDEA Energy Institute external funding:** 203.280 €

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**13. Title/Acronym:** New challenges in the production of solar fuels/FOTOFUEL-2

**Partners:** IMDEA Energy Institute (Coordinator); ICP-CSIC; Polytechnic University of Valencia; IMDEA Materials Institute; Consorci per a la Construcció, Equipament i Exploració del Laboratori de llum de Síncrotró; Barcelona University; Jaume I University; Fundació Institut de Recerca de l'Energia de Catalunya; ICIQ; PSA

**Period:** 2017-2019

**Funding Institution/Program:** Ministry of Economy, Industry and Competitiveness/Promotion of Scientific and Technical Research Excellence. *Dinamization actions Networks of Excellence 2016*

**IMDEA Energy Institute external funding:** 19.000 €

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**14. Title/Acronym:** Impact of the high penetration of the storage, renewable and other technologies to the stability of distribution networks/EnRed

**Partners:** IMDEA Energy Institute

**Period:** 2017-2018

**Funding Institution/Program:** Fundación Iberdrola España/Call for research funding in energy and environment 2017-2018

**IMDEA Energy Institute external funding:** 20.000 €

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**15. Title/Acronym:** Nano-metallic electroactive objects associated to porous organic metal networks for the chemical storage of energy

**Partners:** IMDEA Energy Institute

**Period:** 2017-2018

**Funding Institution/Program:** Fundación Iberdrola España/Call for energy and environment 2017-2018

**IMDEA Energy Institute external funding:** 20.000 €

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**16. Title/Acronym:** New materials based on porous metal-organic networks and conductive polymers for energy storage/PolyMOF

**Partners:** IMDEA Energy Institute

**Period:** 2017-2019

**Funding Institution/Program:** Fundación BBVA/Becas Leonardo a Investigadores y Creadores Culturales 2017

**IMDEA Energy Institute external funding:** 39.960 €

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**17. Title/Acronym:** Microbial-oils production via anaerobic digestion: bioconversion of volatile fatty acids by oleaginous yeasts/ACMIBIO-DA

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

**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:** 114.950 €

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**18. Title/Acronym:** Solar fuels production in wide-spectrum photoactivated catalytic devices/SOLPAC

**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 €

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**19. Title/Acronym:** Advanced tools for smart distribution network planning to guarantee optimal continuity of supply/SinCortes

**Partners:** IMDEA Energy Institute

**Period:** 2018-2019

**Funding Institution/Program:** Fundación Iberdrola España/Call for energy and environment 2018-2019

**IMDEA Energy Institute external funding:** 20.000 €

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**20. Title/Acronym:** Circular economy perspectives for the management of electric car batteries at their end-of-life/BATTMAN

**Period:** 2018-2019

**Funding Institution/Program:** Fundación Iberdrola España/Call for energy and environment 2018-2019

**IMDEA Energy Institute external funding:** 20.000 €

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**21. Title/Acronym:** Environmental and energy applications of electrochemical technology/Red E3Tech

**Partners:** Castilla-La Mancha University (Coordinator); Barcelona University; Cantabria University; Alicante University; Polytechnic University of Valencia; Vigo University; Polytechnic University of Cartagena; Valencia University; IMDEA Energy Institute

**Period:**

**Funding Institution/Program:** Ministry of Economy, Industry and Competitiveness/Promotion of Scientific and Technical Research Excellence. *Dinamization actions Networks of Excellence 2017*

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**22. Title/Acronym:** Hybridization of geothermal energy and flow batteries for heating and cooling of zero-energy tertiary use buildings/GeoBATT

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

**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 €

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**23. Title/Acronym:** Battery inverter with integrated controls of power converter and micro-grid/ MICROGRID-ON-CHIP

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

**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:** 92.310 €

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### 1.3. International R&D projects

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**1. Title/Acronym:** Scientific and technological alliance for guaranteeing the European excellence in concentrating solar thermal energy/STAGE-STE

**Partners:** CIEMAT (Coordinator); more than 40 partners, companies, universities, research centres, associations, from all over the world

**Period:** 2014-2018

**Funding Institution/Program:** European Union/FP7. Call identifier: FP7-ENERGY-2013-IRP

**IMDEA Energy Institute external funding:** 472.102 €

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**2. Title/Acronym:** European network for algal-bioproducts/EUALGAE

**Partners:** IMDEA Energy Institute (Coordinator); more than 180 researchers of 113 companies, universities, research centres, associations, from all over the world

**Period:** 2015-2019

**Funding Institution/Program:** European Union/COST actions

**IMDEA Energy Institute external funding:** 62.134 € (estimated)

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**3. Title/Acronym:** Hybrid materials for artificial photosynthesis/HyMap

**Partners:** IMDEA Energy Institute

**Period:** 2015-2020

**Funding Institution/Program:** European Union/ERC-2014-CoG

**IMDEA Energy Institute external funding:** 2.506.738 €

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**4. Title/Acronym:** SUNlight-to-LIQUID: Integrated solar-thermochemical synthesis of liquid hydrocarbon fuels/SUN-to-LIQUID

**Partners:** Bauhaus Luftfahrt (Coordinator); Eidgenoessische Technische Hochschule Zuerich; Deutsches Zentrum für Luft- und Raumfahrt; IMDEA Energy Institute; HyGear Technology and Services; Abengoa Research; ARTTIC

**Period:** 2016-2019

**Funding Institution/Program:** European Union/H2020. Call H2020-LCE-2015-1

**IMDEA Energy Institute external funding:** 936.525 €

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**5. Title/Acronym:** New technologies and strategies for fuel cells and hydrogen technologies in the phase of recycling and dismantling/HYTECHCYCLING

**Partners:** Fundacion para el desarrollo de nuevas tecnologías del hidrógeno en Aragón (Coordinator); Univerza V Ljubljani; IMDEA Energy Institute; Industrias López Soriano; Parco Scientifico e Tecnologico per l'ambiente - Environment Park

**Period:** 2016-2019

**Funding Institution/Program:** European Union/H2020. Call H2020-JTI-FCH-2015-1

**IMDEA Energy Institute external funding:** 89.292 €

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**6. Title/Acronym:** High temperature concentrated solar thermal power plant with particle receiver and direct thermal storage/NEXT-CSP

**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. Call H2020-JTI-FCH-2015-1

**IMDEA Energy Institute external funding:** 199.791 €

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**7. Title/Acronym:** Valorization of urban wastes to new generation of bioethanol/WASTE-2BIO

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

**Period:** 2016-2019

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

**IMDEA Energy Institute external funding:** 42.000 €

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**8. Title/Acronym:** Integrating national research agendas on solar heat for industrial processes/INSHIP

**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; Università 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; Seville University; Cic Energigune; Cranfield University

**Period:** 2017-2020

**Funding Institution/Program:** European Union/H2020. Call H2020-LCE-2016-ERA

**IMDEA Energy Institute external funding:** 10.000 €

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**9. Title/Acronym:** Membrane-free redox flow batteries/MFreeB

**Partners:** IMDEA Energy Institute

**Period:** 2017-2022

**Funding Institution/Program:** European Union/ ERC-2016-CoG

**IMDEA Energy Institute external funding:** 1.998.407 €

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**10. Title/Acronym:** European corridors for natural gas transport efficiency/ECO-GATE

**Partners:** Gas Natural; CETIL Dispensing technology; Fundacion Cidaut; IMDEA Energy; GASNAM; Inversora Melofe; Port Authority of Huelva; SOLTEL IT Solutions; Santiago of Compostela University; 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; REP-SOL; 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; San-José López

**Period:** 2017-2019

**Funding Institution/Program:** European Union/ H2020. Call CEF-Transport-2016-MAP General

**IMDEA Energy Institute external funding:** 20.654 €

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**11. Title/Acronym:** Demonstration of dry fermentation and optimization of biogas technology for rural communities in the MENA region/BIOGASMENA

**Partners:** Hohenheim University (Coordinador); Verona University; 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), Cairo University, 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 €

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#### 1.4. Contracts with companies and other organizations

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

**Company:** IMV Corporation (Japan)

**Period:** 2010-2019

**IMDEA Energy Institute external funding:** 245.021 €

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**2. Title/Acronym:** Development of an organic flow drum based on redox pairs for electric vehicles and stationary storage/BAFO2

**Company:** PV Hardware Solutions/Repsol (Spain)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 346.682 €

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**3. Title/Acronym:** Testing and evaluation of reflective mirror under concentrating solar light exposure

**Company:** XXENTRIA Technology Materials (Taiwan)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 17.500 €

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**4. Title/Acronym:** LCA critical review

**Company:** Solinnen (France)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 2.300 €

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**5. Title/Acronym:** Validation and numerical analysis of components of a desalination device by humidification/dehumidification

**Company:** Seenso Renoval (Spain)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 5.760 €

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**6. Title/Acronym:** Modeling and simulation of the fucus vesiculosus and sugarbeet pulp filter for the treatment of wastewater from galvanizing and zinc-plating processes

**Company:** Hidrolab (Spain)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 2.000 €

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**7. Title/Acronym:** Modeling and simulation of different technologies for the wastewater treatment of São Domingos mine

**Company:** LCW Consult (Portugal)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 3.500 €

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**8. Title/Acronym:** Characterization of materials and determination of their electrochemical properties

**Company:** GNANOMAT (Spain)

**Period:** 2017-2018

**IMDEA Energy Institute external funding:** 37.022 €

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**9. Title/Acronym:** Testing and validation of a system of HDH-AI beds for desalination

**Company:** Seenso Renoval (Spain)

**Period:** 2018

**IMDEA Energy Institute external funding:** 26.117 €

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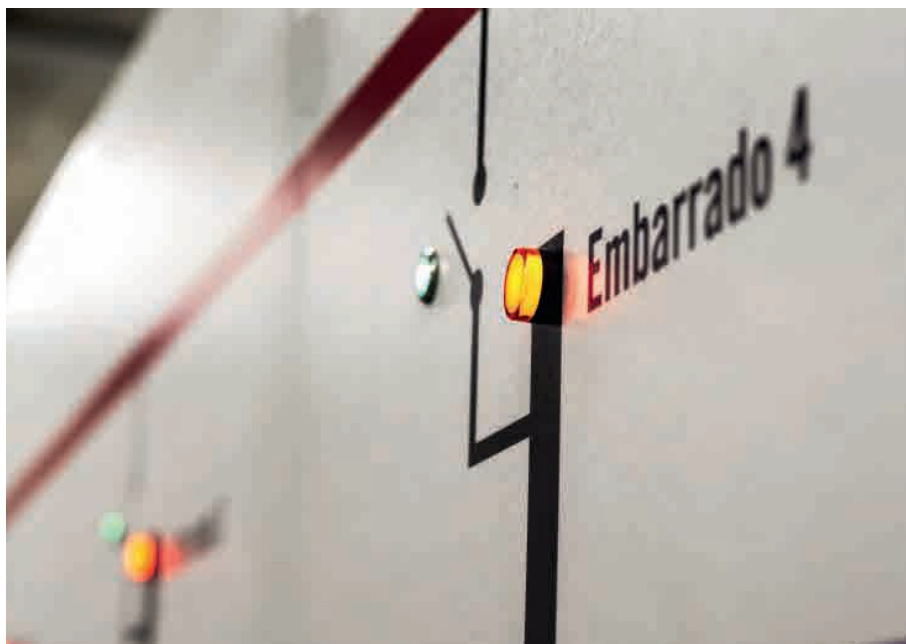
**10. Title/Acronym:** Technical advice for the determination of polluting substances in a paint application process

**Company:** Mercedes Benz España (Spain)

**Period:** 2018-present

**IMDEA Energy Institute external funding:** 10.850 €

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**11. Title/Acronym:** Development of a software tool of a heat recovery system for desalination

**Company:** Seenso Renoval (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 53.500 €

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**12. Title/Acronym:** Analysis of hydrogen production technologies/ANHYPRO

**Company:** WorleyParsons España (Spain)

**Period:** 2018

**IMDEA Energy Institute external funding:** 2.500 €

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**13. Title/Acronym:** In-situ measurement system of concentrated solar flux in solar towers/EFFECTO

**Company:** Cobra Instalaciones y Servicios (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 50.000 €

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**14. Title/Acronym:** In-situ measurement system of concentrated solar flux in solar towers/EFFECTO

**Company:** Egatel (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 50.000 €

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**15. Title/Acronym:** Research on electrochemical technologies for seasonal energy storage/AE3

**Company:** Inversiones Financieras Perseo (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 15.000 €

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**16. Title/Acronym:** Process simulation with professional software licenses/EcoSim

**Institution:** Rey Juan Carlos University (Spain)

**Period:** 2018

**IMDEA Energy Institute external funding:** 4.500 €

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**17. Title/Acronym:** Collaboration in the development of energy models of European towns/MySmartLife

**Institution:** Fundación Tecnalia Research & Innovation (Spain)

**Period:** 2018

**IMDEA Energy Institute external funding:** 11.950 €

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**18. Title/Acronym:** LCA study/WINPOLCA

**Company:** SeoBird/Life (Spain)

**Period:** 2018

**IMDEA Energy Institute external funding:** 3.000 €

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

**Institution:** IMDEA Materials Institute and private company (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 38.500 €

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**20. Title/Acronym:** Testing of primary batteries for wireless devices/TEBAWI

**Company:** Securitas Direct España (Spain)

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 26.900 €

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**21. Title/Acronym:** Techno-economic and environmental assessment of alkaline-based carbon capture and utilization/TEECCU

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

**Period:** 2018-2019

**IMDEA Energy Institute external funding:** 11.500 €

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## 1.5. Researcher grants

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**1. Program:** Contract FPU2014

**Project/Acronym:** Particle reactors for applications in the solar thermochemical

**Period:** 2015-2018

**Funding Institution:** Ministry of Education, Culture and Sports

**IMDEA Energy Institute external funding:** 57.109 €

**Ms. Lucía Arribas**

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**2. Program:** Ramón y Cajal 2014

**Project:** Linking wastewater bioremediation by means of microalgae cultivation and energy production out of this biomass

**Period:** 2016-2020

**Funding Institution:** Ministry of Economy and Competitiveness

**IMDEA Energy Institute external funding:** 168.600 €

**Dr. Cristina González**

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**3. Program: Ramón y Cajal 2014**

Project: Bioapplications of porous materials

Period: 2016-2021

Funding Institution: Ministry of Economy and Competitiveness

IMDEA Energy Institute external funding: 168.600 €

**Dr. Patricia Horcajada**

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**4. Program: IED 2016**

Period: 2016-2018

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 98.684 €

**Dr. Rebeca Marcilla**

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**5. Program: IED 2016**

Period: 2016-2018

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 98.684 €

**Dr. Victor A. de la Peña**

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**6. Program: Ramón y Cajal 2015**

Project: Design and Synthesis of Hybrid Materials for Advances Applications: Solar Fuels Generation

Period: 2017-2021

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 168.600 €

**Dr. Marta Liras**

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**7. Program: Recruitment of young doctors 2016 (Modality 2)**

Period: 2017-2021

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 80.000 €

**Dr. Julio Lado**

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**8. Program: Recruitment of experienced doctors 2016 (Modality 1)**

Project/Acronym: Application of photon up-conversion in photoredox catalysis/APUPCAT

Period: 2017-2021

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 85.557 €

**Dr. Raúl Pérez**

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**9. Program:** Recruitment of research assistants and laboratory technicians 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 45.000 €

**Mr. Carlos Lirio**

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**10. Program:** Recruitment of research assistants and laboratory technicians 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 38.000 €

**Ms. Eva Álvarez**

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**11. Program:** Recruitment of research assistants and laboratory technicians 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 38.000 €

**Mr. Alejandro Aguilar**

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**12. Program:** Recruitment of research assistants and laboratory technicians 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 37.167 €

**Mr. Álvaro Pérez**

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**13. Program:** Call for Predoctoral and Postdoctoral Researchers 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

**Ms. Ana Arenas**

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**14. Program:** Call for Predoctoral and Postdoctoral Researchers 2016

Period: 2017-2019

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 25.000 €

**Mr. Antonio Molina**

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**15. Program:** Contract FPU2016

Project/Acronym: Integración de sistemas de conversión termo-electro-química en centrales termosolares

Period: 2017-2018

Funding Institution: Ministry of Education, Culture and Sports

IMDEA Energy Institute external funding: 13.288 €

**Ms. Elena Díaz**

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**16. Program:** H2020-MSCA-IF-2016

Project/Acronym: Solar Energy Storage PERovskites/SESPer

Period: 2017-2018

Funding Institution: European Union

IMDEA Energy Institute external funding: 67.585 €

**Dr. Emanuela Mastronardo**

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**17. Program:** Contract FPI2016

Project/Acronym: Multidisciplinary analysis of indirectly-heated particles receivers/reactors for solar applications in extreme conditions/ARROPAR-CEX

Period: 2017-2021

Funding Institution: Ministry of Economy, Industry and Competitiveness

IMDEA Energy Institute external funding: 82.000 €

**Mr. Mario Sánchez**

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**18. Program:** H2020-MSCA-IF-2017

Project/Acronym: Sustainability assessment of advanced energy systems: towards new methodological approaches/ SUSADES

Period: 2018-2019

Funding Institution: European Union

IMDEA Energy Institute external funding: 106.326 €

**Dr. Anna Skorek-Osikowska**

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**19. Program:** Recruitment of experienced doctors 2017 (Modality 1)

**Project/Acronym:** Batteries based on semi-solid fluids/BASS

**Period:** 2018-2022

**Funding Institution:** Comunidad de Madrid

**IMDEA Energy Institute external funding:** 110.000 €

**Dr. Edgar Ventosa**

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**20. Program:** Recruitment of experienced doctors 2017 (Modality 1)

**Project/Acronym:** Computer-aided design of functional nanomaterials for energy storage applications/CADFUNES

**Period:** 2018-2022

**Funding Institution:** Comunidad de Madrid

**IMDEA Energy Institute external funding:** 110.000 €

**Dr. Andreas Mavrantakis**

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**21. Program:** Juan de la Cierva-Formación 2016

**Period:** 2018-2019

**Funding Institution:** Ministry of Economy, Industry and Competitiveness

**IMDEA Energy Institute external funding:** 50.000 €

**Dr. Mariam Barawi**

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**22. Program:** Recruitment of young doctors 2017 (Modality 2)

**Period:** 2018-2022

**Funding Institution:** Comunidad de Madrid

**IMDEA Energy Institute external funding:** 80.000 €

**Dr. Sara Rojas**

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**23. Program:** Call for Predoctoral and Postdoctoral Researchers 2017

**Period:** 2018-2020

**Funding Institution:** Comunidad de Madrid

**IMDEA Energy Institute external funding:** 25.000 €

**Mr. Ioan Robert Istrate**

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**24. Program:** Call for Predoctoral and Postdoctoral Researchers 2017

**Period:** 2018-2020

**Funding Institution:** Comunidad de Madrid

**IMDEA Energy Institute external funding:** 25.000 €

**Mr. Alejandro Martínez**

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**25. Program:** Call for Predoctoral and Postdoctoral Researchers 2017

Period: 2018-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 539 €

**Mr. Domingo Olivares**

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**26. Program:** Contract FPI2017

Project/Acronym: CO<sub>2</sub> photoconversion to solar fuels using multifunctional materials/  
Ra-Phuel

Period: 2018-2022

Funding Institution: Ministry of Science, Innovation and Universities

IMDEA Energy Institute external funding: 82.000 €

**Mr. Giacomo Armani**

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**27. Program:** Recruitment of research assistants and laboratory technicians 2017

Period: 2018-2020

Funding Institution: Comunidad de Madrid

IMDEA Energy Institute external funding: 38.000 €

**Ms. Miriam Bravo**

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## 2. Scientific Results

### 2.1. Publications in journals with impact index

1. Alcaide, B.; Almendros, P.; Aragoncillo, C.; Busto, E.; García, C.; Liras, M.; de la Peña-O'Shea, V.A.; García-Sánchez, A.; Stone, H.V. "A facile synthesis of blue luminescent [7] helicene-carbazoles based on gold-catalyzed rearrangement-iodonium migration and suzuki-miyaura benzannulation reactions". *Chemistry-A European Journal*, **2018**, *24*, 7620-7625.
2. Andronesco, C.; Seisel, S.; Wilde, P.; Barwe, S.; Masa, J.; Chen, Y-T.; Ventosa, E.; Schuhmann, W. "Influence of temperature and electrolyte concentration on the structure and catalytic oxygen evolution activity of Nickel-Iron layered double hydroxide". *Chemistry-A European Journal*, **2018**, *24* (52), 13773-13777.
3. Arconada, N.; Arribas, L.; Lucio, B.; González-Aguilar, J.; Romero, M. "Macroencapsulation of sodium chloride as phase change materials for thermal energy storage". *Solar Energy*, **2018**, *167*, 1-9.
4. Arribas, L.; González-Aguilar, J.; Romero, M. "Solar-driven thermochemical water-splitting by cerium oxide: determination of operational conditions in a directly irradiated fixed bed reactor". *Energies*, **2018**, *11* (9), 2451-2465.
5. Barwe, S.; Mei, B.; Masa, J.; Schuhmann, W.; Ventosa, E. "Overcoming cathode poisoning from electrolyte impurities in alkaline electrolysis by means of self-healing electrocatalyst films". *Nano Energy*, **2018**, *53*, 763-768.
6. Barreiro-Vescovo, S.; de Godos, I.; Tomás-Pejó, E.; Ballesteros, M.; González-Fernández, C. "Effect of microalgae storage conditions on methane yields". *Environmental Science and Pollution Research*, **2018**, *25* (14), 14263-14270.
7. Berenguer, A.; Bennett, J.A.; Hunns, J.; Moreno, I.; Coronado, J.M.; Lee, A.F.; Pizarro, P.; Wilson, K.; Serrano, D.P. "Catalytic hydrodeoxygenation of m-cresol over Ni<sub>2</sub>P/hierarchical ZSM-5". *Catalysis Today*, **2018**, *304*, 72-79.
8. Collado, L.; Reynal, A.; Fresno, F.; Barawi, M.; Escudero, C.; Pérez-Diestre, V.; Coronado, J.M.; Serrano, D.P.; Durrant, J.R.; de la Peña-O'Shea, V.A. "Unravelling the effect of charge dynamics at the plasmonic metal/semiconductor interface for CO<sub>2</sub> photoreduction". *Nature Communications*, **2018**, *9* (1), art. no. 4986.
9. Cruz, P.L.; Navas-Anguita, Z.; Iribarren, D.; Dufour, J. "Exergy analysis of hydrogen production via biogas dry reforming". *International Journal of Hydrogen Energy*, **2018**, *43*, 11688-11695.
10. Colzi-Lopes, A.; Valente, A.; Iribarren, D.; González-Fernández, C. "Energy balance and life cycle assessment of a microalgae-based wastewater treatment plant: A focus on alternative biogas uses". *Bioresource Technology*, **2018**, *270*, 138-146.
11. Cubas-Cano, E.; González-Fernández, C.; Ballesteros, M.; Tomás-Pejó, E. "Biotechnological advances in lactic acid production by lactic acid bacteria: lignocellulose as novel substrate". *Biofuels, Bioproducts and Biorefining*, **2018**, *12* (2), 290-303.





12. Das, G.; Benyettou, F.; Sharama, S.K.; Prakasam, T.; Gándara, F.; de la Peña-O'Shea, V.A.; Saleh, N.; Pasricha, R.; Jagannathan, R.; Olson, M.A.; Trabolsi, A. "Covalent organic nanosheets for bioimaging". *Chemical Science*, **2018**, *9* (44), 8382-8387.
13. Díaz, E.; Epstein, M.; Romero, M.; González-Aguilar, J. "Performance assessment of concentrated solar power plants based on carbon and hydrogen fuel cells". *International Journal of Hydrogen Energy*, **2018**, *43* (11), 5852-5862.
14. Escola, J.M.; Serrano, D.P.; Sanz, R.; García, R.A.; Peral, A.; Moreno, I.; Linares, M. "Synthesis of hierarchical beta zeolite with uniform mesopores: effect on its catalytic activity for veratrole acylation", **2018**, *Catalysis Today*, *304*, 89-96.
15. Escalera, A.; Hayes, B.; Prodanovic, M. "A survey of reliability assessment techniques for modern distribution networks". *Renewable and Sustainable Energy Reviews*, **2018**, *91*, 344-357.
16. Feroso, J.; Mašek, O. "Thermochemical decomposition of coffee ground residues by TG-MS: A kinetic study". *Journal of Analytical and Applied Pyrolysis*, **2018**, *130*, 149-255.
17. Fresno, F.; Reñones, P.; Alfonso, E.; Guillén, C.; Trigo, F.; Herrero, J.; Collado, L.; de la Peña O'Shea, V.A. "Influence of surface density on the CO<sub>2</sub> photoreduction activity of a DC magnetron sputtered TiO<sub>2</sub> catalyst". *Applied Catalysis B: Environmental*, **2018**, *224*, 912-918.
18. Fresno, F.; Villar-García, I.J.; Collado, L.; Alfonso-González, E.; Reñones, P.; Barawi, M.; de la Peña O'Shea, V.A. "Mechanistic view of the main current issues in photocatalytic CO<sub>2</sub> reduction". *Journal of Physical Chemistry Letters*, **2018**, *9* (24), 7192-7204 (also the cover of this issue has been awarded).
19. Gálvez-Martos, J.L.; Elhoweris, A.; Morrison, J.; Al-horri, Y. "Conceptual design of a carbon capture and utilisation process based on the reactivity of carbon dioxide with calcium and magnesium rich brines". *Journal of CO<sub>2</sub> utilization*, **2018**, *27*, 161-169.
20. Gálvez-Martos, J.L.; Styles, D.; Schoenberger, H.; Zeschmar-Lahl, B. "Construction and demolition waste best management practice in Europe". *Resources, Conservation and Recycling*, **2018**, *136*, 166-178.
21. García, C.; Liras, M.; de la Peña-O'Shea, V.A.; Pérez-Ruiz, R. "Synchronized biphotonic process triggering C-C coupling catalytic reactions". *Applied Catalysis B-Environmental*, **2018**, *237*, 18-23.
22. García, G.; Dieckhöfer, S.; Schuhmann, W.; Ventosa, E. "Exceeding 6500 cycles for LiFePO<sub>4</sub>/Li metal batteries through understanding pulsed charging protocols". *Journal of Materials Chemistry A*, **2018**, *6* (11), 4746-4751.
23. García-Gusano, D.; Iribarren, D. "Prospective energy security scenarios in Spain: the future role of renewable power generation technologies and climate change implications". *Renewable Energy*, **2018**, *126*, 202-209.
24. García-Gusano, D.; Iribarren, D.; Dufour, J. "Is coal extension a sensible option for energy planning?. A combined energy systems modelling and life cycle assessment approach". *Energy Policy*, **2018**, *114*, 413-421.
25. García-Gusano, D.; Suárez-Botero, J.; Dufour, J. "Long-term modelling and assessment of the energy-economy decoupling in Spain". *Energy*, **2018**, *151*, 455-466.
26. García-Gusano, D.; Istrate, I.R.; Iribarren, D. "Life-cycle consequences of internalising socio-environmental externalities of power generation". *Science of the Total Environment*, **2018**, *612*, 386-391.

- 27.** Giménez-Marqués, M.; Bellido, E.; Berthelot, T.; Simón-Yarza, T.; Hidalgo, T.; Simón-Vázquez, R.; González-Fernández, A.; Ávila, J.; Asensio, M.C.; Gref, R.; Couvreur, P.; Serre, C.; Horcajada, P. "Graftfast surface engineering to improve MOF nanoparticles furtiveness". *Small*, **2018**, *14* (40), art. N° 1801900.
- 28.** González-Fernández, C.; Barreiro-Vescovo, S.; de Godos, I.; Fernández, M.; Zouhayr, A.; Ballesteros, M. "Biochemical methane potential of microalgae biomass using different microbial inocula". *Biotechnology for Biofuels*, **2018**, *11* (1), 184-194.
- 29.** Hanein, T.; Gálvez-Martos, J.L.; Bannerman, M. "Carbon footprint of calcium sulfoaluminate clinker production". *Journal of Cleaner Production*, **2018**, *172*, 2278-2287.
- 30.** Hayes, B.; Gruber, J.K.; Prodanovic, M. "Multi-nodal short-term energy forecasting using smart meter data". *IET Generation, Transmission & Distribution*, **2018**, *12* (12), 2988-2994.
- 31.** Hernando, H.; Feroso, J.; Ochoa-Hernández, C.; Opanasenko, M.; Pizarro, P.; Coronado, J.M.; Čejka, J.; Serrano, D.P. "Performance of MCM-22 zeolite for the catalytic fast-pyrolysis of acid-washed wheat straw". *Catalysis Today*, **2018**, *304*, 30-38.
- 32.** Hernando, H.; Hernández-Giménez, A.M.; Ochoa-Hernández, C.; Bruijninc, P.C.A.; Houben, K.; Baldus, M.; Pizarro, P.; Coronado, J.M.; Feroso, J.; Čejka, J.; Weckhuysen, B.M.; Serrano, D.P. "Engineering the acidity and accessibility of the zeolite ZSM-5 for efficient bio-oil upgrading in catalytic pyrolysis of lignocellulose". *Green Chemistry*, **2018**, *20* (15), 3499-3511.
- 33.** Hlongwa, N.W.; Sastre, D.; Iwuoha, E.; Carrillo, A.J.; Ikpo, C.; Serrano, D.P.; Pizarro, P.; Coronado, J.M. "Exploring the thermochemical heat storage capacity of  $\text{AMn}_2\text{O}_4$  (A = Li or Cu) spinels". *Solid State Ionics*, **2018**, *320*, 316-324.
- 34.** Iglesias, D.; Senokos, E.; Alemán, B.; Cabana, L.; Navío, C.; Marcilla, R.; Prato, M.; Vilatela, J.J.; Marchesan, S. "Gas-phase functionalization of macroscopic carbon nanotube fibers: reaction control and application for flexible supercapacitors". *ACS Applied Materials & Interfaces*, **2018**, *10* (6), 5760-5770.
- 35.** Löffler, T.; Meyer, H.; Savan, A.; Wilde, P.; Garzón Manjón, A.; Chen, Y.-T.; Ventosa, E.; Scheu, C.; Ludwig, A.; Schuhmann, W. "Discovery of a multinary noble metal-free oxygen reduction catalyst". *Advanced Energy Materials*, **2018**, *8* (34), 1802269.
- 36.** López-Calixto, C.G.; Liras, M.; de la Peña-O'Shea, V.A.; Pérez-Ruiz, R. "Synchronized biphotonic process triggering C-C coupling catalytic reactions". *Applied Catalysis B: Environmental*, **2018**, *237*, 18-23.
- 37.** Lubbock, R.J.; Luque, S.; Rosic, B.R. "A new transient high heat flux convection calibration facility for heat transfer gauges in high enthalpy flows". *Journal of Heat Transfer*, **2018**, *140* (4), 041701(1-10).
- 38.** Lucio, B.; de la Fuente, J.L. "Kinetic and chemorheological modelling of the polymerization of 2,4- toluenediisocyanate and ferrocene-functionalized hydroxyl-terminated polybutadiene". *Polymer*, **2018**, *140*, 290-303.



39. Luque, S.; Menéndez, G.; Roccabruna, M.; González-Aguilar, J.; Crema, I.; Romero, M. "Exploiting volumetric effects in novel additively manufactured open solar receivers". *Solar Energy*, **2018**, 174, 342-351.
40. Luque, S.; Santiago, S.; Gómez-García, F.; Romero, M.; González-Aguilar, J. "A new calorimetric facility to investigate radiative-convective heat exchangers for concentrated solar power applications". *International Journal of Energy Research*, **2018**, 42 (3), 966-976.
41. Magdalena, J.A.; Ballesteros, M.; González-Fernández, C. "Efficient anaerobic digestion of microalgae biomass: proteins as a key macromolecule". *Molecules*, **2018**, 23 (5), E1098.
42. Magdalena, J.A.; Tomás-Pejó, E.; Ballesteros, M.; González-Fernández, C. "Volatile fatty acids production from protease pretreated *Chlorella* biomass via anaerobic digestion". *Biotechnology progress*, **2018**, 34 (6), 1363-1369.
43. Martín-Gamboa, M.; Iribarren, D.; Dufour, J. "Environmental impact efficiency of natural gas combined cycle power plants: a combined life cycle assessment and dynamic data envelopment analysis approach. *Science of the Total Environment*, **2018**, 615, 29-37.
44. Muñoz-Torrero, D.; Leung, P.; García-Quismondo, E.; Ventosa, E.; Anderson, M.A.; Palma, J.; Marcilla, R. "Investigation of different anode materials for aluminium rechargeable batteries". *Journal of Power Sources*, **2018**, 374, 77-83.
45. Navalpotro, P.; Anderson, M.A.; Marcilla, R.; Palma, J. "Insights into the energy storage mechanism of hybrid supercapacitors with redox electrolytes by electrochemical impedance spectroscopy". *Electrochimica Acta*, **2018**, 263, 110-117.
46. Navalpotro, P.; Neves, C.M.S.S.; Palma, J.; Freire, M.G.; Coutinho, J.A.P.; Marcilla, R. "Pioneering use of aqueous biphasic systems as membrane-free batteries". *Advanced Science*, **2018**, 5 (10), 1800576.
47. Navalpotro, P.; Sierra, N.; Trujillo, C.; Montes, I.; Palma, J.; Marcilla, R. "Exploring the versatility of membrane-free battery concept using different combinations of immiscible redox electrolytes". *ACS Materials & Interfaces*, **2018**, 10 (48), 41246-41256.
48. Navarro Poupard, M.F.; Polo, E.; Taboada, P.; Arenas-Vivo, A.; Horcajada, P.; Pelaz, B.; del Pino, P. "Aqueous synthesis of copper (II)-imidazolate nanoparticles". *Inorganic Chemistry*, **2018**, 57 (19), 12056-12065.
49. Navarro, R.M.; Guil-López, R.; Fierro, J.L.G.; Mota, N.; Jiménez, S.; Pizarro, P.; Coronado, J.M.; Serrano, D.P. "Catalytic fast pyrolysis of biomass over Mg-Al mixed oxides derived from hydrotalcite-like precursors: influence of Mg/Al ratio". *Journal of Analytical and Applied Pyrolysis*, **2018**, 134, 362-370.
50. Navas-Anguita, Z.; García-Gusano, D.; Iribarren, D. "Prospective life cycle assessment of the increased electricity demand associated with the penetration of electric vehicles in Spain". *Energies*, **2018**, 11 (5), 1185.





51. Neumeier, A.; Sampedro, D.; Majek, M.; de la Peña O'Shea, V.A.; von Wangelin, A.J.; Pérez-Ruiz, R. "Dichromatic photocatalytic substitutions of aryl halides with a small organic dye". *Chemistry - A European Journal*, **2018**, *24* (1), 105-108.
52. O'Mahony, T.; Escardó-Serra, P.; Dufour, J. "Revisiting ISEW valuation approaches: The case of Spain including the costs of energy depletion and of climate change". *Ecological Economics*, **2018**, *144*, 292-303.
53. Patil, N.; Aqil, M.; Aqil, A.; Ouhib, F.; Marcilla, R.; Minoia, A.; Lazzaroni, R.; Jérôme, C.; Detrembleur, C. "Integration of redox-active catechol pendants into poly(ionic liquid) for the design of high-performance lithium-ion battery cathodes". *Chemistry of Materials*, **2018**, *30* (17), 5831-5835.
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55. Peña-Alzola, R.; Roldán-Pérez, J.; Bueno, E.; Huerta, F.; Campos-Gaona, D.; Liserre GAE, M.; Burt, G.M. "Robust active damping in LCL-filter based medium-voltage parallel grid-inverters for wind turbines". *IEEE Transactions on Power Electronics*, **2018**, *33* (12), art. no. 8279469, 10846-10857.
56. Pérez-Ruiz, R.; Molins-Molina, O.; Lence, E.; González-Bello, C.; Miranda, M.A.; Jiménez, M.C. "Photogeneration of quinone methides as latent electrophiles for lysine targeting". *Journal of Organic Chemistry*, **2018**, *83* (21), 13019-13029.
57. Piperopoulos, E.; Fazio, M.; Mastronardo, E. "Synthesis of me doped  $Mg(OH)_2$  materials for thermochemical heat storage". *Nanomaterials*, **2018**, *8* (8), art. no. 573.
58. Přech, J.; Pizarro, P.; Serrano, D.P.; Áejka, J. "From 3D to 2D zeolite catalytic materials". *Chemical Society Reviews*, **2018**, *47* (22), 8263-8306.
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61. Rodríguez, R.; Espada, J.J.; Moreno, J.; Vicente, G.; Bautista, L.F.; Morales, V.; Sánchez-Bayo, A.; Dufour, J. "Environmental analysis of spirulina cultivation and biogas production using experimental and simulation approach". *Renewable Energy*, **2018**, *129*, 724-732.
62. Rojas, S.; Colinet, I.; Cunha, D.; Hidalgo, T.; Salles, F.; Serre, C.; Guillou, N.; Horcajada, P. "Toward understanding drug incorporation and delivery from biocompatible metal-organic frameworks in view of cutaneous administration". *ACS Omega*, **2018**, *3* (3), 2994-3003.
63. Rojas, S.; Baati, T.; Njim, L.; Manchego, L.; Neffati, F.; Abdejelil, N.; Saguem, S.; Serre, C.; Najjar, M.F.; Zakhama, A.; Horcajada, P. "Metal-organic frameworks as efficient oral detoxifying agents". *Journal of American Chemical Society*, **2018**, *140* (30), 9581-9586.
64. Roldán-Pérez, J.; Bueno, E.J.; Peña-Alzola, R.; Rodríguez-Cabero, A. "All-pass-filter-based active damping for VSCs with LCL filters connected to weak grids". *IEEE Transactions on Power Electronics*, **2018**, *33* (11), 9890-9901.



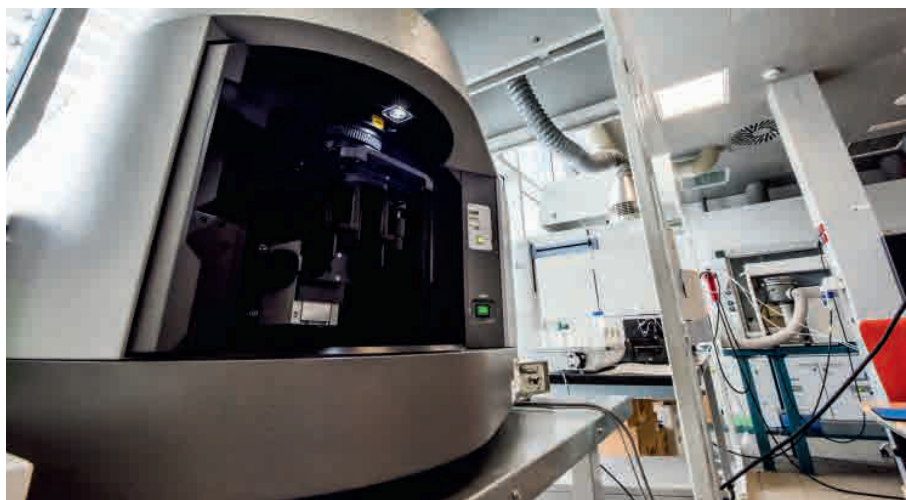
- 65.** Roldán-Pérez, J.; García-Cerrada, A.; Rodríguez-Cabero, A.; Zamora-Macho, J.L. "Comprehensive design and analysis of a state-feedback controller for a dynamic voltage restorer". *Energies*, **2018**, *11* (8), 1972-1997.
- 66.** Roldán-Pérez, J.; Rodríguez-Cabero, A.; Ochoa-Giménez, M.; García-Cerrada, A.; Zamora-Macho, J.L. "Discrete-time resonant controllers design for power conditioning applications". *Electric Power Systems Research*, **2018**, 164, 31-38.
- 67.** Rodríguez, R.; Espada, J.J.; Moreno, J.; Vicente, G.; Bautista, L.F.; Morales, V.; Sánchez-Bayo, A.; Dufour, J. "Environmental analysis of spirulina cultivation and biogas production using experimental and simulation approach". *Renewable Energy*, **2018**, *129*, 724-732.
- 68.** Sánchez, J.S.; Pendashteh, A.; Palma, J.; Anderson, M.A.; Marcilla, R. "Porous NiCoMn ternary metal oxide/graphene nanocomposites for high performance hybrid energy storage device". *Electrochimica Acta*, **2018**, *279*, 44-56.
- 69.** Sánchez, J.S.; Pendashteh, A.; Palma, J.; Anderson, M.A.; Marcilla, R. "Synthesis and application of NiMnO<sub>3</sub>-rGO nanocomposites as electrode materials for hybrid energy storage device". *Applied Surface Science*, **2018**, *460*, 74-83.
- 70.** Sankaranarayanan, T.M.; Kreider, M.; Berenguer, A.; Gutiérrez, S.; Moreno, I.; Pizarro, P.; Coronado, J.M.; Serrano, D.P. "Cross-reactivity of guaiacol and propionic acid blends during hydrodeoxygenation over Ni-supported catalysts". *Fuel*, **2018**, *214*, 187-195.
- 71.** Santos, C.; Lado, J.J.; García-Quismondo, E.; Rodríguez, I.V.; Hospital-Benito, D.; Palma, J.; Anderson, M.A. "Interconnected metal oxide CNT fibre hybrid networks for current collector-free asymmetric capacitive deionization". *Journal of Materials Chemistry A*, **2018**, *6* (23), 10898-10908.
- 72.** Santos, C.; Lado, J.J.; García-Quismondo, E.; Soria, J.; Palma, J.; Anderson, M.A. "Maximizing volumetric removal capacity in capacitive deionization by adjusting electrode thickness and charging mode". *Journal of the Electrochemical Society*, **2018**, *135*, 294-302.
- 73.** Senokos, E.; Ou, Y.; Torres, J.J.; Sket, F.; González, C.; Marcilla, R.; Vilatela, J.J. "Energy storage in structural composites by introducing CNT fiber/polymer electrolyte interleaves". *Scientific Reports*, **2018**, *8*, 3407.
- 74.** Serrano, D.P.; Melero, J.A.; Morales, G.; Iglesias, J.; Pizarro, P. "Progress in the design of zeolite catalysts for biomass conversion into biofuels and bio-based chemicals". *Catalysis Reviews-Science and Engineering*, **2018**, *60* (1), 1-70.
- 75.** Tasbihi, M.; Fresno, F.; Simon, U.; Villar-García, I.J.; Pérez-Dieste, V.; Escudero, C.; de la Peña-O'Shea, V.A. "On the selectivity of CO<sub>2</sub> photoreduction towards CH<sub>4</sub> using Pt/TiO<sub>2</sub> catalysts supported on mesoporous silica". *Applied Catalysis B: Environmental*, **2018**, *239*, 68-76.
- 76.** Tian, H.; Fotidis, I.A.; Mancini, E.; Treu, L.; Mahdy, A.; Ballesteros, M.; González-Fernández, C.; Angelidaki, I. "Acclimation to extremely high ammonia levels in continuous biomethanation process and the associated microbial community dynamics". *Bioresource Technology*, **2018**, *247*, 616-623.
- 77.** Unamuno, X.; Imbuluzqueta, E.; Salles, F.; Horcajada, P.; Blanco-Prieto, M.J. "Biocompatible porous metal-organic framework nanoparticles based on Fe or Zr for gentamicin vectorization". *European Journal of Pharmaceutics and Biopharmaceutics*, **2018**, *132*, 11-18.

- 78.** Valente, A.; Iribarren, D.; Dufour, J. "Harmonising the cumulative energy demand of renewable hydrogen for robust comparative life-cycle studies". *Journal of Cleaner Production*, **2018**, *175*, 384-393.
- 79.** Ventosa, E.; Amendu, O.; Sxhuhmann, W. "Aqueous mixed-cation semi-solid hybrid-flow batteries". *ACS Applied Energy Materials*, *1* (10), 5158-5162.
- 80.** Ventura, M.; Mullaliu, A.; Ciurduc, D.E.; Zappoli, S.; Giuli, G.; Tonti, D.; Enciso, E.; Giorgetti, M. "Thin layer films of copper hexacyanoferrate: structure identification and analytical applications". *Journal of Electroanalytical Chemistry*, **2018**, *827*, 10-20.
- 81.** Vilela, S.M.F.; Babaryk, A.A.; Javalli, R.; Salles, F.; Mosquera, M.E.G.; Elaoud, Z.; Cleuvenbergen, S.V.; Verbiest, T.; Horcajada, P. "A nonlinear optically active bismuth-camphorate coordination polymer". *European Journal of Inorganic Chemistry*, **2018**, *20-21*, 2437-2443.
- 82.** Vilela, S.M.F.; Salcedo-Abraira, P.; Micheron, L.; Solla, E.L.; Yot, P.G.; Horcajada, P. "A robust monolithic metal-organic framework with hierarchical porosity". *Chemical communications*, **2018**, *54* (93), 13088-13091.
- 83.** Wilde, P.; Barwe, S.; Andronescu, C.; Schuhmann, W.; Ventosa, E. "High resolution, binder-free investigation of the intrinsic activity of immobilized NiFe LDH nanoparticles on etched carbon nanoelectrodes". *Nano Research*, **2018**, *11* (11), 6034-6044.
- 84.** Wouters, J.J.; Tejedor-Tejedor, M.I.; Anderson, M.A.; Noguera, D.R. "Performance of  $\text{SiO}_2$ ,  $\text{ZrO}_2$ ,  $\text{TiO}_2$ ,  $\text{Al}_2\text{O}_3$  or  $\text{Fe}_2\text{O}_3$  coatings on Ti electrodes for arsenic (V) detection utilizing electrochemical impedance spectroscopy". *Journal of the Electrochemical Society*, **2018**, *165* (2), B34-B47.
- 85.** Wouters, J.J.; Tejedor-Tejedor, M.I.; Lado, J.J.; Pérez-Roa, R.; Anderson, M.A. "Influence of metal oxide coatings, carbon materials and potentials on ion removal in capacitive deionization". *Journal of The Electrochemical Society*, **2018**, *165* (5), 148-161.
- 86.** Zhu, Y.; Pei, J.; Cao, C.; Zhai, R.; Yang, Y.; Reyes-Belmonte, M.A.; González-Aguilar, J.; Romero, M. "Optimization of solar aided coal-fired power plant layouts using multi-criteria assessment". *Applied Thermal Engineering*, **2018**, *137*, 406-418.

## 2.2. Patents

### 2.2.1. Granted patents

- 1.** Patent: ES2633601, title: "Batería redox con electrolitos inmiscibles". Date of application: 21/03/2016 (OEPM) (Application number: P201630327). Date of grant: 21/06/2018. Holders: Fundación IMDEA Energy. Inventors: Navalpotro, P.; Anderson; M.A.; Palma, J.; Marcilla, R.



**2.** Patent: ES2609600, title: “Material compuesto multifuncional”. Date of application: 10/01/2017 (OEPM) (Application number: P201730017). Date of grant: 08/01/2018. Holders: Fundación IMDEA Energy. Inventors: Vilatela, J.J.; Senokos, E.; Marcilla, R.; Palma, J.

### 2.2.2. Submitted patents

**1.** Application number: EP18382971.2, title: “Redox-flow battery for Energy storage”. Date of application: 21/12/2018 (OEPM). Holders: Fundación IMDEA Energy. Inventors: Ventosa, E.; Pérez, T.; Palma, J.

### 2.3. Books/Chapters of books

**1.** Gálvez-Martos, J.L.; Dufour, J. **2018**. Chapter: Circular economy case studies 14 -17. Book: Políticas locales de clima y energía: teoría y práctica. Ed: INAP (Instituto Nacional de la Administración Pública). ISBN: 978-84-7351-635-8.

**2.** García-Gusano, D.; Iribarren, D.; Dufour, J. **2018**. Chapter: Towards energy self-sufficiency in large metropolitan areas: business opportunities on renewable electricity in Madrid. Book: Renewable energies: business outlook 2050, pp. 17-31. Ed: Springer. ISBN: 978-3-319-45362-0 (Print), 978-3-319-45364-4 (Online).

**3.** Milone, C.; Kato, Y.; Mastronardo, E. **2018**. Chapter: Thermal energy storage with chemical reactions. Book: Green energy and technology, vol. PartF13, pp. 15-32. Ed: Springer Verlag. ISSN: 18653529. DOI: 10.1007/978-3-319-96640-3\_3.

**4.** Singh, G.; Luque, S.; González-Aguilar, J.; Romero, M.; Chandra, L. **2018**. Chapter: Open volumetric air receiver: current status, challenges and innovative solutions. Book: Reference module in materials science and materials engineering. Ed: Elsevier. ISBN: 978-0-12-803581-8.

**5.** Vilela, S.M.F.; Horcajada, P. **2018**. Chapter 14: MOFs as supports of enzymes in biocatalysis. Book: Metal-organic frameworks: applications in separations and catalysis. Ed. Wiley-VCH. Eds: García H.; Navalón S. ISBN: 9783527343133 (Print), 9783527809097 (Online).

### 2.4. Non indexed publications

**1.** Escalera, A.; Prodanovic, M.; Castronuovo, E.D.; Mazuera, J.C. “A comparison of the renewable distributed generation models used in reliability assessment”. 2018 International conference on probabilistic methods applied to power systems, PMAPS 2018-Proceedings, art. no. 8440432. DOI: 10.1109/PMAPS.2018.8440432.

**2.** Escalera, A.; Prodanovic, M.; Castronuovo, E.D. “An analysis of the energy storage for improving the reliability of distribution networks”. Proceedings-2018 IEEE PES innovative smart grid technologies conference Europe, ISGT-Europe 2018. DOI: 10.1109/ISGTEurope.2018.8571768.

**3.** Mancini, T.; Mari, F.; Melatti, I.; Salvo, I.; Tronci, E.; Gruber, J.K.; Hayes, B.; Prodanovic, M.; Elmegaard, L. “Parallel statistical model checking for safety verification in smart grids”. 2018 IEEE International conference on communications, control, and computing technologies for smart grids, SmartGridComm 2018, art. no. 8587416. DOI: 10.1109/SmartGridComm.2018.8587416.

4. Rodríguez-Cabero, A.; Roldán-Pérez, J.; Prodanovic, M. "Small-signal modelling and control design of vscs in multi-terminal railway applications". 2018 IEEE Energy conversion congress and exposition, ECCE 2018, art. no. 8558138, pp. 2222-2227. DOI: 10.1109/ECCE.2018.8558138.
5. Roldán-Pérez, J.; Prodanovic, M.; Rodríguez-Cabero, A.; Guerrero, J.M.; García-Cerrada, A. "Finite-gain-current repetitive controller for synchronverters with harmonic-sharing capabilities". Proceedings of international conference on harmonics and quality of power, ICHQP, vol. 2018-May, pp. 1-6. DOI: 10.1109/ICHQP.2018.8378881.
6. Roldán-Pérez, J.; Ávila-Martínez, R.; Rodríguez-Cabero, A.; Prodanovic, M.; Bueno, E. "LTCL-filter active-damping design considerations for low-switching-frequency grid-tied VSCs". Proceedings: IECON 2018 - 44th Annual conference of the IEEE industrial electronics society, art. no. 8591808, pp. 1315-1320. DOI: 10.1109/IECON.2018.8591808.
7. Roldán-Pérez, J.; Suul, J.A.; D'Arco, S.; Rodríguez-Cabero, A.; Prodanovic, M. "Virtual synchronous machine control of VSC HVDC for power system oscillation damping". Proceedings: IECON 2018 - 44th Annual conference of the IEEE industrial electronics society, art. no. 8591097, pp. 6026-6031. DOI: 10.1109/IECON.2018.8591097.
8. Roldán-Pérez, J.; García-Cerrada, A.; Rodríguez-Cabero, A.; Prodanovic, M. "Phase-matched frequency adaptive repetitive controller for a grid-supporting STATCOM". Proceedings - 2018 IEEE 18th International conference on power electronics and motion control, PEMC 2018, art. no. 8521838, pp. 932-937. DOI: 10.1109/EPEPEMC.2018.8521838.
9. Reyes-Belmonte, M.A.; Díaz, E.; Romero, M.; González-Aguilar, J. "Particles-based thermal energy storage systems for concentrated solar power". SolarPACES2017. AIP Conference Proceedings, vol. 2033, pp. 210013-1/8 (2018). DOI: 10.1063/1.5067215.
10. Reyes-Belmonte, M.A.; Pino, F.J.; Romero, M.; Suarez, C.; González-Aguilar, J.; Guerra, J. "Optimization of an integrated solar combined cycle". SolarPACES2017. AIP conference proceedings, vol. 2033, pp. 210012-1/8 (2018). DOI: 10.1063/1.5067214.
11. Walz, K.A.; Shoemaker, J.B.; Scholes, A.J.; Jiang, H.; Silva, J.M.S.; Sanfilippo, J.; Zeltner, W.A.; Anderson, M.A. "Experimental field trial of self-cleaning solar photovoltaic panels". ASEE Annual conference and exposition, conference proceedings, 2018-June.



## 2.5. PhD Thesis

**1. Title:** Desarrollo de electrolitos redox para su aplicación en nuevos dispositivos electroquímicos de almacenamiento de energía

**Author:** Paula Navalpotro Molina

**Director:** Dr. Rebeca Marcilla and Dr. Jesús Palma

**Venue:** Autonoma University of Madrid, Spain

**Date:** 22 June 2018

**2. Title:** Development of multifunctional flexible and structural supercapacitors based on CNT fibers

**Author:** Evgeny Senokos

**Director:** Dr. Juan José Vilatela (IMDEA Materials) and Dr. Rebeca Marcilla

**Venue:** Polytechnic University of Madrid, Spain

**Date:** 7 September 2018

**3. Title:** Particle reactors for solar thermochemical applications

**Author:** Lucía Arribas Dávila

**Director:** Dr. Manuel Romero

**Venue:** Rey Juan Carlos University, Madrid

**Date:** 16 October 2018

**4. Title:** Modelling, simulation and analysis of the coprocessing of biomass-based feedstocks in crude oil refineries

**Author:** Pedro Luis Cruz Prieto

**Director:** Dr. Javier Dufour

**Venue:** Rey Juan Carlos University, Madrid

**Date:** 30 October 2018

## 2.6. Congress communications

### 2.6.1. Invited lectures

**1. Title:** Engineered-surface metal-organic frameworks (MOFs) as drug nanocarriers for drug nanocarriers

**Author:** Horcajada, P.

**Congress:** 1st Nanomed workshop: novel nanoporous materials for biomedical applications

**Venue:** Alicante, Spain

**Date:** 21-22 March 2018

**Organizer:** NanoMed Project

**2. Title:** Drug vectorization using engineered-surface metal-organic frameworks

**Author:** Horcajada, P.

**Congress:** UK MOF symposium

**Venue:** Southampton, UK

**Date:** 9-10 April 2018

**Organizer:** University of Southampton

**3. Title:** Critical materials and recycling strategies for fuel cells and hydrogen technologies

**Author:** Férriz, A.M.; Zarzuela, M.; Bernad, A.; Fiorot, S.; Dufour, J.; Iribarren, D.; Mori, M.

**Congress:** 22<sup>nd</sup> World hydrogen energy conference (WHEC2018)

**Venue:** Rio de Janeiro, Brazil

**Date:** 17-22 June 2018

**Organizer:**

**4. Title:** Membrane-free battery: a paradigm shift in energy storage

**Author:** Marcilla, R.; Navalpotro, P.; Anderson, M.A.; Palma, J.

**Congress:** XXXIX Reunión del grupo de electroquímica de la real sociedad española de química y III simposio E3 del Mediterráneo (XXXIX GERSEQ & 3<sup>rd</sup> E3-MS)

**Venue:** Madrid, Spain

**Date:** 2-5 July 2018

**Organizer:** Specialized Group in Electrochemistry



**5. Title:** Importance of anodic reaction in reversible aluminium batteries

**Author:** Muñoz-Torrero, D.; García-Quismondo, E.; Ventosa, E.; Anderson, M.A.

**Congress:** XXXIX Reunión del grupo de electroquímica de la real sociedad española de química y III simposio E3 del Mediterráneo (XXXIX GE-RSEQ & 3<sup>rd</sup> E3-MS)

**Venue:** Madrid, Spain

**Date:** 2-5 July 2018

**Organizer:** Specialized Group in Electrochemistry

**6. Title:** Engineered-surface metal-organic frameworks as drug nanocarriers

**Author:** Horcajada, P.

**Congress:** XXVII International materials research congress (IMRC 2018)

**Venue:** Cancún, Mexico

**Date:** 19-24 August 2018

**Organizer:** The Sociedad Mexicana de Materiales (SMM) and the Materials Research Society® (MRS)

**7. Title:** Redes metal-orgánicas porosas en medicina

**Author:** Horcajada, P. (Plenary)

**Congress:** III QuimBioQuim

**Venue:** Albacete, Spain

**Date:** 3-5 October 2018

**Organizer:** University of Castilla La Mancha

**8. Title:** Metal organic frameworks in medicine

**Author:** Horcajada, P. (Plenary)

**Congress:** XVII Encuentro de química inorgánica

**Venue:** Los Andes, Chile

**Date:** 21-24 October 2018

**Organizer:** Sociedad Chilena de Química

**9. Title:** Challenges in biomass pyrolysis and catalytic bio-oil upgrading for the production of advanced biofuels

**Author:** Serrano, D.P.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**10. Title:** Solar-driven thermochemical processes

**Author:** Romero, M.

**Congress:** The Decarbonisation of the energy sector in the mediterranean region and middle east -the role of CSP (CSP4Climate 2018 International Conference)

**Venue:** Nicosia, Cyprus

**Date:** 29 November-1 December 2018

**Organizer:** The Cyprus Institute

**11. Title:** Metal-organic frameworks as novel detoxifying agents

**Author:** Horcajada, P.

**Congress:** 6th International conference on metal organic frameworks & open framework compounds (MOF2018)

**Venue:** Auckland, New Zealand

**Date:** 9-13 December 2018

**Organizer:** The University of Auckland

## 2.6.2. Oral communications

**1. Title:** Volatile fatty acids production via anaerobic digestion from enzymatically pretreated microalgae

**Author:** Magdalena, J.A.; Colzi, A.; Llamas, M.; Ballesteros, M.; González-Fernández, C.

**Congress:** 2<sup>nd</sup> Workshop early career investigators

**Venue:** Thessaloniki, Greece

**Date:** 6 March 2018

**Organizer:** EUALGAE project

**2. Title:** End-of-life of FCH products: a review of the current situation

**Author:** Férriz, A.M.; Dufour, J.; Iribarren, D.; Mori, M.; Fiorot, S.

**Congress:** European hydrogen energy conference 2018 (EHEC2018)

**Venue:** Málaga, Spain

**Date:** 14-16 March 2018

**Organizer:** AeH<sub>2</sub>

**3. Title:** Results from “New recycling technologies applied to FCH products”

**Author:** Valente, A.

**Congress:** HyTechCycling dissemination workshop

**Venue:** Móstoles, Madrid, Spain

**Date:** 20 March 2018

**Organizer:** HyTechCycling project

**4. Title:** Real-time operation of a centralized energy management system for an islanded microgrid

**Author:** Peña-Asensio, A.; Arnalte, S.; Rodríguez-Amenedo, J.L.; García-Plaza, M.; Prodanovic, M.

**Congress:** International Conference on Renewable Energies and Power Quality (ICREPQ'18)

**Venue:** Salamanca, Spain

**Date:** 21-23 March 2018

**Organizer:** Escola Técnica Superior de Enxeñaría

**5. Title:** Antifouling photo-bactericidal combined effect of a Ag@nanoMOF

**Author:** Arenas, A.; Amariei, G.; Aguado, S.; Rosal, R.; Horcajada, P.

**Congress:** 34<sup>th</sup> International congress of the groupe français de zeolites (GFZ2018)

**Venue:** Cabourg, Normandie, France

**Date:** 26-29 March 2018

**Organizer:** The French Group of Zeolites

**6. Title:** Parallel current-controlled synchronverters for voltage and frequency regulation in weak grids

**Author:** Roldán-Pérez, J.; Rodríguez-Cabero, A.; Prodanovic, M.

**Congress:** The 9th International conference on power electronics, machines and drives (PEMD2018)

**Venue:** Liverpool, UK

**Date:** 17-19 April 2018

**Organizer:** IET

**7. Title:** Antifouling photo-bactericidal Combined effect of a Ag@nanoMOF

**Author:** Arenas, A.; Amariei, G.; Aguado, S.; Rosal, R.; Horcajada, P.

**Congress:** 1st European doctoral symposium on metal-organic frameworks (docMOF 2018)

**Venue:** Raitenhaslach, Germany

**Date:** 29 April-2 May 2018

**Organizer:** DEFect NETWORK

**8. Title:** Nanometric MIL-125-NH<sub>2</sub> metal-organic framework as nerve agent antidote carrier

**Author:** Salcedo, P.; Vilela, S.M.F.; Colinet, I.; Salles, F.; de Koning, M.C.; Joosen, M.J.A.; Serre, C.; Horcajada, P.

**Congress:** 1st European doctoral symposium on metal-organic frameworks (docMOF 2018)

**Venue:** Raitenhaslach, Germany

**Date:** 29 April-2 May 2018

**Organizer:** DEFect NETWORK

**9. Title:** Novel proton conducting bismuth-based metal-organic framework

**Author:** Vilela, S.M.F.; Devic, T.; Várez, A.; Horcajada, P.

**Congress:** 2018 3rd International conference on energy materials and applications (ICEMA 2018)

**Venue:** Salamanca, Spain

**Date:** 9-11 May 2018

**Organizer:** ICEMA Committees

**10. Title:** Finite-gain-current repetitive controller for synchronverters with harmonic-sharing capabilities

**Author:** Roldán J.; Prodanovic, M.; Rodríguez, A.; Guerrero, J.M.; García, A.

**Congress:** ICHQP 2018

**Venue:** Ljubljana, Slovenia

**Date:** 13-16 May 2018

**Organizer:** IEEE

**11. Title:** Volatile fatty acids production from microalgae biomass via semi-continuous anaerobic digestion

**Author:** Magdalena, J.A.; Colzi, A.; Llamas, M.; Ballesteros, M.; González-Fernández, C.

**Congress:** Young algaeeneers symposium (YAS 2018)

**Venue:** Scotland, UK

**Date:** 16-18 May 2018

**Organizer:** Scottish Association for Marine Science

**12. Title:** Supporting metal phosphides on hierarchical zeolites: structural impact and its correlation with HDO performance

**Author:** Berenguer, A.M.; Ochoa-Hernández, C.; Linares, M.; Moreno, I.; Coronado, J.M.; Serrano, D.P.; Pizarro, P.

**Congress:** Advances in zeolites chemistry and catalysis 2018

**Venue:** Český Krumlov, Czech Republic

**Date:** 21-25 May 2018

**Organizer:** Jiří Čejka

**13. Title:** Enhanced liquid biofuels and aromatics production via catalytic co-pyrolysis of lignocellulose and plastic wastes over hierarchical ZSM-5

**Author:** Jiménez, S.; Peral, A.; Moreno, J.M.; Coronado, J.M.; Pizarro, P.; Serrano, D.P.

**Congress:** Advances in zeolites chemistry and catalysis 2018

**Venue:** Český Krumlov, Czech Republic

**Date:** 21-25 May 2018

**Organizer:** Jiří Čejka

**14. Title:** A novel bismuth-tetracarboxylate MOF as a proton conductor

**Author:** Vilela, S.M.F.; Devic, T.; Várez, A.; Sales, F.; Horcajada, P.

**Congress:** 2<sup>nd</sup> Meeting on porous molecular solids (2nd PoMoS)

**Venue:** Vietri sul Mare, Italy

**Date:** 6-8 June 2018

**Organizer:** University of Salerno

**15. Title:** Valorización de residuos urbanos para la producción de bioetanol y biogás

**Author:** Magdalena, J.A.; Colzi, A.; Ballesteros, M.; González-Fernández, C.

**Congress:** Jornadas de biometanización de RSU 2018

**Venue:** Barcelona, Spain

**Date:** 18-19 June 2018

**Organizer:** University of Barcelona

**16. Title:** Caracterización óptico-energética de heliostatos de pequeñas dimensiones para sistemas solares de muy alta concentración

**Author:** Martínez-Hernández A.; Sánchez M.; Luque S.; González-Aguilar J.; Romero M.

**Congress:** XVI Congreso Ibérico y XII Congreso Iberoamericano de Energía Solar (CIES2018)

**Venue:** Madrid, Spain

**Date:** 20-22 June 2018

**Organizer:** AEDES, UPM/ETSIDI, UIB

**17. Title:** Determinación de estrategias de apunte en un simulador solar de alto flujo

**Author:** Sánchez, M.; González-Aguilar J.; Romero M.

**Congress:** XVI Congreso ibérico y XII congreso iberoamericano de energía solar (CIES2018)

**Venue:** Madrid, Spain

**Date:** 20-22 June 2018

**Organizer:** AEDES, UPM/ETSIDI, UIB

**18. Title:** Producción solar de H<sub>2</sub> con Ni<sub>2</sub>FeO<sub>4</sub> en un lecho fluidizado directamente irradiado

**Author:** Arribas, L.; González-Aguilar J.; Romero M.

**Congress:** XVI Congreso ibérico y XII congreso iberoamericano de energía solar (CIES2018)

**Venue:** Madrid, Spain

**Date:** 20-22 June 2018

**Organizer:** AEDES, UPM/ETSIDI, UIB

**19. Title:** Strategies to design organic moieties as building block for photocatalytic hybrid materials based on conjugated porous polymers

**Author:** Liras, M.; García, C.; García-Sánchez, A.; Reñones, P.; Barawi, M.; Fresno, F.; de la Peña O'Shea, V.A.

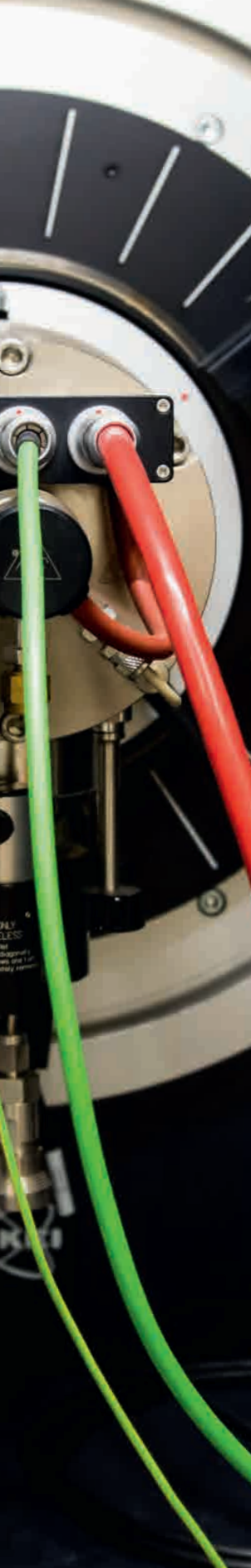
**Congress:** XXVII Reunión bienal de química orgánica (BIQOS2018)

**Venue:** Santiago de Compostela, Spain

**Date:** 20-22 June 2018

**Organizer:** GEQOR





**20. Title:** Synchronized biphotonic processes triggering catalytic reactions

**Author:** García, C.; Liras, M.; de la Peña-O'Shea, V.A.; Pérez-Ruiz, R.

**Congreso:** XXVII Reunión Bienal de Química Orgánica (BIQOS2018)

**Venue:** Santiago de Compostela, Spain

**Date:** 20-22 June 2018

**Organizer:** GEQOR

**21. Title:** Assessing biomass catalytic pyrolysis for the efficient production of advanced biofuels

**Author:** Hernando, H.; Hernández-Jiménez, A.M.; Ochoa-Hernández, C.; Bruijninx, P.C.A.; Houben, K.; Baldus, M.; Pizarro, P.; Coronado, J.M.; Feroso, J.; Weckhuysen, B.M.; ejka, J.; Serrano, D.P.

**Congress:** III Encuentro de jóvenes investigadores de la SECAT

**Venue:** Valencia, Spain

**Date:** 25-27 June 2018

**Organizer:** SECAT

**22. Title:** A Comparison of the renewable distributed generation models used in reliability assessment

**Author:** Escalera, A.; Prodanovic, M.; Castronuovo, E.D.

**Congress:** PMAPS 2018

**Venue:** Boise, USA

**Date:** 25-28 June 2018

**Organizer:** IEEE PES Boise Chapter, Idaho Power, the University of Idaho, Boise State University.

**23. Title:** Multifunctional hybrid materials based on conjugated porous polymer for solar fuel production

**Author:** García-Sánchez, A.; García, C.; Liras, M.; de la Peña-O'Shea, V.A.

**Congress:** Spotlight POLYMAT

**Venue:** San Sebastián, Spain

**Date:** 26-29 June 2018

**Organizer:** POLYMAT and the University of the Basque Country

**24. Title:** In situ x-ray diffraction studies within an operating electrochemical cell: from structural controlled modifications to ion's

**Author:** Santos, C.; Vilatela, J.J.; Marcilla, R.; Pendashteh, A.; Senokos, E.

**Congress:** CARBON 2018

**Venue:** Madrid, Spain

**Date:** 1-6 July 2018

**Organizer:** Spanish Carbon Group

**25. Title:** CNT fibers as multifunctional electrode material for flexible supercapacitors: electrochemical properties, functionalization and application

**Author:** Senokos, E.; Rana, M.; Reguero, V.; Pendashteh, A.; Iglesias, D.; Marchesan, S.; Marcilla, R.; Vilatela, J.J.

**Congress:** CARBON 2018

**Venue:** Madrid, Spain

**Date:** 1-6 July 2018

**Organizer:** Spanish Carbon Group

**26. Title:** Injectable Li-ion batteries

**Author:** Ventosa, E.; Escudero, M.J.; Pérez, D.; Palma, J.

**Congress:** XXXIX Reunión del Grupo de Electroquímica de la Real Sociedad Española de Química y III Simposio E3 del Mediterráneo (XXXIX GE-RSEQ & 3<sup>rd</sup> E3-MS)

**Venue:** Madrid, Spain

**Date:** 2-5 July 2018

**Organizer:** Specialized Group in Electrochemistry

**27. Title:** Control system design for a virtual synchronous machine connected to a weak grid

**Author:** Roldán-Pérez, J.; Rodríguez-Cabero, A.; Prodanovic, M.

**Congress:** Seminario anual de automática, electrónica industrial e instrumentación (SAAEI 2018)

**Venue:** Barcelona, Spain

**Date:** 4-6 July 2018

**Organizer:** Grupo E3PACS-Universitat Politècnica de Catalunya

**28. Title:** Discrete-time resonant controllers design for a dynamic voltage restorer

**Author:** Roldán-Pérez, J.; Rodríguez-Cabero, A.; Ochoa-Giménez, M.; García-Cerrada, A.; Zamora-Macho, J.L.

**Congress:** Seminario anual de automática, electrónica industrial e instrumentación (SAAEI 2018)

**Venue:** Barcelona, Spain

**Date:** 4-6 July 2018

**Organizer:** Grupo E3PACS-Universitat Politècnica de Catalunya

**29. Title:** Stability analysis for weak meshed networks with power electronics based distributed generation

**Author:** Rodríguez-Cabero, A.; Prodanovic, M.

**Congress:** Seminario anual de automática, electrónica industrial e instrumentación (SAAEI 2018)

**Venue:** Barcelona, Spain

**Date:** 4-6 July 2018

**Organizer:** Grupo E3PACS-Universitat Politècnica de Catalunya

**30. Title:** Challenges of the photocatalytic reforming of lignocellulosic bioethanol

**Author:** Fresno, F.; Lirio, C.; Justicia, J.; Tomás, E.; de la Peña-O'Shea, V.A.; Serrano, D.P.; Coronado, J.M.

**Congress:** 4th International symposium on catalysis for clean energy and sustainable chemistry (CCESC2018)

**Venue:** Bilbao, Spain

**Date:** 9-11 July 2018

**Organizer:** Hydrogen Europe Research

**31. Title:** Organic-inorganic hybrid materials based on conjugated porous polymers and their use in artificial photosynthesis

**Author:** Liras, M.; López-Calixto-C.G.; García-Sánchez, A.; Reñones, P.; Alfonso-González, E.; Barawi, M.; Villar, I.J.; Pérez-Ruiz, R.; Fresno, F.; de la Peña-O'Shea, V.A.

**Congress:** 27th PhotolUPAC

**Venue:** Dublin, Ireland

**Date:** 8-13 July 2018

**Organizer:** University College Dublin/UCLA

**32. Title:** Photocatalyzed C-C coupling reactions by vis-to-uv upconversion technology

**Author:** Pérez-Ruiz, R.; López-Calixto-C.G.; Liras, M.; de la Peña-O'Shea, V.A.

**Congress:** 27<sup>th</sup> PhotolUPAC

**Venue:** Dublin, Ireland

**Date:** 8-13 July 2018

**Organizer:** University College Dublin/UCLA

**33. Title:** Life cycle sustainability assessment of hydrogen from biomass gasification: a comparison with conventional hydrogen

**Author:** Valente, A.; Iribarren, D.; Dufour, J.

**Congress:** HYPOTHESIS XIII

**Venue:** Singapore

**Date:** 24-27 July 2018

**Organizer:** NTU Singapore

**34. Title:** Novel end-of-life technologies for fuel cells and hydrogen products

**Author:** Valente, A.; Iribarren, D.; Dufour, J.

**Congress:** HYPOTHESIS XIII

**Venue:** Singapore

**Date:** 24-27 July 2018

**Organizer:** NTU Singapore

**35. Title:** End of life of fuel cells and hydrogen products: from technologies to strategies

**Author:** Valente, A.; Iribarren, D.; Dufour, J.

**Congress:** HYPOTHESIS XIII

**Venue:** Singapore

**Date:** 24-27 July 2018

**Organizer:** NTU Singapore

**36. Title:** Phase-matched frequency adaptive repetitive controller for a grid-supporting STATCOM

**Author:** Roldán-Pérez, J.; García-Cerrada, A.; Rodríguez-Cabero, A.; Prodanovic, M.

**Congress:** 18th International conference on power electronics and motion control (IEEE-PEMC 2018)

**Venue:** Budapest, Hungary

**Date:** 26-30 August 2018

**Organizer:** IEEE



**37. Title:** 3,6-bis-(3,5-diamino-triazolyl-1-yl)-1,2,4,5-tetrazine high dielectric molecular semiconductor for excitonic solar cells

**Author:** Babaryk, A.; Khaynokava, O.A.; Horcajada, P.

**Congress:** 7<sup>th</sup> EuCheMS Chemistry Congress

**Venue:** Liverpool, UK

**Date:** 26-30 August 2018

**Organizer:** EuCheMS

**38. Title:** Defect/doping engineering of CNT fibers as self-standing air cathodes for rechargeable Zn-Air Batteries

**Author:** Pendashteh, A.; Palma, P.; Anderson, M.; Vilatela, J.J.; Marcilla, R.

**Congress:** 69th Annual meeting of the international society of electrochemistry

**Venue:** Bologna, Italy

**Date:** 2-7 September 2018

**Organizer:** ISE

**39. Title:** Highly conductive Nanostructured PEDOT polymer confined into the mesoporous MIL-100(Fe)

**Author:** Salcedo-Abraira, P.; Navalón, S.; Atienzar, P.; Bordet, P.; Salles, F.; Guillou, N.; García, H.; Horcajada, P.

**Congress:** 1er Congreso sobre materiales multifuncionales para jóvenes (MultiMat)

**Venue:** Granada, Spain

**Date:** 3-4 September 2018

**Organizer:** University of Granada

**40. Title:** Drug vectorization using engineered-surface metal-organic frameworks

**Author:** Hidalgo, T.; Giménez-Marques, T.; Simon-Zarza, E.; Bellido, T.; Baati, T.; Rojas, S.; Horcajada, P.

**Congress:** 1er Congreso sobre materiales multifuncionales para jóvenes (MultiMat)

**Venue:** Granada, Spain

**Date:** 3-4 September 2018

**Organizer:** University of Granada

**41. Title:** Mathematical modelling of a membraneless redox flow battery

**Author:** Ruiz-Martin, D.; Moreno-Boza, D.; Vera, M.; Marcilla, R.; Sánchez-Sanz, M.

**Congress:** 12th European fluid mechanics conference (EFMC12)

**Venue:** Vienna, Austria

**Date:** 9-13 September 2018

**Organizer:** Fundació Scito

**42. Title:** Diaminotriazolium halobismuthates as one-dimensional lead free photovoltaic materials  
**Author:** Babaryk, A.; Cuesta, J.; Horcajada, P.  
**Congress:** 7th International Workshop of Layered Materials

**Venue:** Krakow-Tomaszowice, Poland

**Date:** 9-13 September 2018

**Organizer:** Polish Zeolite Association

**43. Title:** Encapsulation of inorganic phase change materials by sol-gel method for thermal energy storage

**Author:** González-Aguilar, J.; Lucio, B.

**Congress:** EuroSun 2018

**Venue:** Rapperswil, Switzerland

**Date:** 10-13 September 2018

**Organizer:** HSR; ISES

**44. Title:** Understanding charge storage mechanism of mixed metal sulfides in alkaline media: NiCoMnS<sub>2</sub> nano-needles case study

**Author:** Sánchez, J.; Pendashteh, A.; Palma, J.; Anderson, M.; Marcilla, R.

**Congress:** 2018 E-MRS fall meeting

**Venue:** Warsaw, Poland

**Date:** 17-20 September 2018

**Organizer:** E-MRS

**45. Title:** Small-Signal modelling and control design of VSCs in multi-terminal railway applications

**Author:** Rodríguez-Cabero, A.; Roldan-Perez, J.; Prodanovic, M.

**Congress:** The 10th Annual IEEE energy conversion congress and exposition (ECCE2018)

**Venue:** Portland, Oregon, USA

**Date:** 23-27 September 2018

**Organizer:** IEEE

**46. Title:** A membrane-free redox flow battery with two immiscible electrolytes

**Author:** Navalpotro, P.; Palma, J.; Anderson, M.A.; Marcilla, R.

**Congress:** ECS and SMEQ joint international meeting (AIMES 2018)

**Venue:** Cancún, Mexico

**Date:** 30 September-4 October 2018

**Organizer:** ECS

**47. Title:** Biowaste-derived carbon electrodes for capacitive deionization

**Author:** Lado, J.J.; Ruotolo, L.A.M.; Zornitta, R.L.

**Congress:** ECS and SMEQ joint international meeting (AIMES 2018)

**Venue:** Cancún, Mexico

**Date:** 30 September-4 October 2018

**Organizer:** ECS

**48. Title:** Application of un-fired closed Brayton cycle with mass flow regulation and particles based thermal energy storage systems for CSP

**Author:** Rovense, F.; Reyes-Belmonte, M.A.; González-Aguilar, J.; Amelio, M.; Bova, S.; Romero, M.

**Congress:** SolarPACES 2018

**Venue:** Casablanca, Morocco

**Date:** 2-5 October 2018

**Organizer:** SolarPACES

**49. Title:** Pre-Commercial scale liquid fuels from concentrated sunlight: an overview on development of a 50 kW solar thermochemical reactor for the SUN-to-LIQUID Project

**Author:** Koepf, E.; Brendelberger, S.; González-Aguilar, J.; Luque, S.; Romero, M.; Steinfeld, A.; Thelen, M.; Zoller, S.

**Congress:** SolarPACES 2018

**Venue:** Casablanca, Morocco

**Date:** 2-5 October 2018

**Organizer:** SolarPACES

**50. Title:** SUN-to-LIQUID: solar fuels from H<sub>2</sub>O, CO<sub>2</sub> and concentrated sunlight

**Author:** Falter, C.; Batteiger, V.; Brendelberger, S.; De Wit, E.; Dufour, J.; Gálvez, J.L.; González-Aguilar, J.; Iribarren, D.; Koepf, E.; Kyrimis, S.; Le Clercq, P.; Liefstink, D.; Luque, S.; Pitz-Paal, R.; Prieto, C.; Rodríguez, A.; Roeb, M.; Romero, M.; Ruiz, F.; Sizmann, A.; Steinfeld, A.; Von Storch, H.; Zoller, S.

**Congress:** SolarPACES 2018

**Venue:** Casablanca, Morocco

**Date:** 2-5 October 2018

**Organizer:** SolarPACES

**51. Title:** Polímeros de coordinación porosos como agentes detoxificantes

**Author:** Rojas, S.; Navarro, J.A.R.; Horcajada, P.

**Congress:** III QuimBioQuim

**Venue:** Albacete, Spain

**Date:** 3-5 October 2018

**Organizer:** University of Castilla La Mancha

**52. Title:** Caracterización fluidodinámica de un receptor de partículas en régimen de lecho fluidizado

**Author:** Sánchez, M.; González-Aguilar, J.; Romero, M.

**Congress:** I Jornada de jóvenes investigadores en ciencia y tecnología químicas de la Universidad de Salamanca

**Venue:** Salamanca, Spain

**Date:** 4-5 October 2018

**Organizer:** University of Salamanca

**53. Title:** Towards laminated lithium-ion batteries with high flexibility and toughness

**Author:** Boaretto, N.; Avvaru, V.; Yusuf, A.; Wang, D.Y.; Etacheri, V.; Palma, J.; Marcilla, R.; Vilatela, J.J.

**Congress:** 55th edition of the annual technical meeting of the society of engineering science (SES 2018)

**Venue:** Madrid, Spain

**Date:** 10-12 October 2018

**Organizer:** SES

**54. Title:** Antifouling photo-bactericidal combined effect of AgNP@nanoMIL-125(Ti)NH<sub>2</sub>

**Author:** Arenas, A.; Horcajada, P.

**Congress:** Brain Wars: the future is in your hands

**Venue:** Madrid, Spain

**Date:** 19 October 2018

**Organizer:** ECS Student Chapter-UCM

**Author:** Barawi, M.; González, A.; Alfonso, E.; García, A.; López-Calixto, C.; Liras, M.; de la Peña-O'Shea, V.A.

**Congress:** nanoGe Fall Meeting 2018

**Venue:** Torremolinos, Spain

**Date:** 22-26 October 2018

**Organizer:** Fundació Scito

**55. Title:** Virtual synchronous machine control of VSC HVDC for power system oscillation damping

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

**Congress:** 44th Annual conference of IEEE industrial electronics society (IECON2018)

**Venue:** Washington DC, USA

**Date:** 21-23 October 2018

**Organizer:** IEEE Industrial Electronics Society

**59. Title:** Solar fuels productions by artificial photosynthesis: from inorganic semiconductors to hybrid multifunctional materials

**Author:** García, A.; Reñones, P.; García, C.; Alfonso, E.; Collado, L.; Perez-Ruiz, R.; Barawi, M.; Villar, I.; Liras, M.; Fresno, F.; de la Peña O'Shea, V.A.

**Congress:** nanoGe Fall Meeting 2018

**Venue:** Torremolinos, Spain

**Date:** 22-26 October 2018

**Organizer:** Fundació Scito

**56. Title:** LTCL-filter active-damping design considerations for low-switching-frequency grid-tied VSCs

**Author:** Roldán-Pérez, J.; Ávila-Martínez, R.; Rodríguez-Cabero, R.; Prodanovic, M.

**Congress:** 44th Annual conference of IEEE industrial electronics society (IECON2018)

**Venue:** Washington DC, USA

**Date:** 21-23 October 2018

**Organizer:** IEEE Industrial Electronics Society

**60. Title:** Characterization of Cu<sub>2-x</sub>Te nanocrystals for photoelectrochemical cells

**Author:** Alonso, E.; Wang, M.; Barawi, M.; De Trizio, L.; Manna, L.; de la Peña-O'Shea, V.A.

**Congress:** nanoGe Fall Meeting 2018

**Venue:** Torremolinos, Spain

**Date:** 22-26 October 2018

**Organizer:** Fundació Scito

**57. Title:** An analysis of the energy storage for improving the reliability of distribution networks

**Author:** Escalera, A.; Prodanovic, M.; Castronuovo, E.D.

**Congress:** 8th IEEE PES innovative smart grid technologies conference Europe 2018 (2018 IEEE PES ISGT)

**Venue:** Sarajevo, Bosnia and Herzegovina

**Date:** 21-25 October 2018

**Organizer:** IEEE

**61. Title:** Recuperación de salmueras con la tecnología de desionización capacitiva

**Author:** Ordóñez, A.; Gutiérrez, B.; Huertas, F.; Palma, J.; Lado, J.J.; García-Quismondo, E.; de Miguel, A.

**Congress:** XII Congreso de la asociación española de desalación y reutilización (AEDyR)

**Venue:** Toledo, Spain

**Date:** 23-25 October 2018

**Organizer:** AEDyR

**58. Title:** Design and development of a multilayer photoelectrode composed of TiO<sub>2</sub> nanocrystals and a new nanostructured conjugate porous polymer with advanced photoelectrochemical properties

**62. Title:** Lactic acid production from hemice-lulosic hydrolysates by Lactobacillus pentosus CECT 4023T in a biorefinery context

**Author:** Cubas-Cano, E.; Ballesteros, M.; González-Fernández, C.; Tomás-Pejó, E.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

Venue: Jaén, Spain

Date: 24-26 October 2018

Organizer: University of Jaén

**63. Title:** Semicontinuous anaerobic digestion of protease pretreated *Chlorella vulgaris* for the production of volatile fatty acids

**Author:** Magdalena, J.A.; Colzi, A.; Llamas, M.; González-Fernández, C.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**64. Title:** *Yarrowia lipolytica* as a promising candidate for the sustainable production of fatty acid-based biofuels from anaerobic digestion effluents

**Author:** Llamas, M.; Tomás-Pejó, E.; González-Fernández, C.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**65. Title:** Ex-situ fast co-pyrolysis of eucalyptus woodchips and low density polyethylene with zeolite and mesoporous

**Author:** Jiménez, S.; Peral, A.; Pizarro, P.; Serrano, D.P.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**66. Title:** Fine chemicals synthesis from bio-oils using zsm-5 zeolites

**Author:** Gutiérrez-Rubio, S.; Moreno, I.; Coronado, J.M.; Serrano, D.P.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**67. Title:** Modelling and assessing the use of biomass feedstock in conventional refineries: a comparative life-cycle study

**Author:** Cruz, P.L.; Iribarren, D.; Dufour, J.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**68. Title:** Parallel statistical model checking for safety verification in smart grids

**Author:** Mancini, T.; Mari, F.; Melatti, I.; Salvo, I.; Tronci, E.; Gruber, J.; Hayes, B.; Prodanovic, M.; Elmegaard, L.

**Congress:** SmartGridComm, IEEE International conference on communications, control, and computing technologies for smart grids

**Venue:** Aalborg, Denmark

**Date:** 29-31 October 2018

**Organizer:** Universidad de Aalborg

**69. Title:** Combined NAP XPS and NAP Core hole clock studies of polymer/TiO<sub>2</sub> hybrids for artificial photosynthesis

**Author:** García-Sánchez, A.; Reñones, P.; Alfonso-González, E.; Barawi, M. Pérez-Ruiz, R.; Fresno, F.; Liras, M.; de la Peña-O'Shea, V.A.; Villar-García, I.J.

**Congress:** 5th Ambient Pressure XPS workshop

**Venue:** Berlín, Germany

**Date:** 12-14 December 2018

**Organizer:** University of Jaén

**70. Title:** Modelado de la Economía Circular para el análisis y la gestión ambiental: residuos sólidos urbanos en Madrid

**Author:** Dufour, J.; Gálvez-Martos, J.L.

**Congress:** FENERCOM. Jornada sobre economía circular

**Venue:** Madrid, Spain

**Date:** 19 December 2018

**Organizer:** Fundación de la Energía de la Comunidad de Madrid

### 2.6.3. Poster communications

**1. Title:** CO<sub>2</sub> reduction over bare and silver-modified niobium-tantalum perovskite photocatalysts

**Author:** Galdón, S.; Fresno, F.; Alfonso, E.; Barawi, M.; Villar-García, I.; Escudero, C.; Pérez-Dieste, V.; Huck-Iriart, C.; de la Peña-O'Shea, V.A.

**Congress:** 10<sup>th</sup> European meeting on solar chemistry and photocatalysis: environmental applications (SPEA10)

**Venue:** Almería, Spain

**Date:** 4-8 June 2018

**Organizer:** University of Almería, PSA

**2. Title:** Influence of post-synthesis modifications of Ti<sub>1-x</sub>Zr<sub>x</sub>O<sub>2</sub> nanocrystallites on the photocatalytic performance for VOC's removal

**Author:** Hernández-Alonso, M.D.; Fresno, F.; de la Peña-O'Shea, V.A.; Soria, J.; Coronado, J.M.

**Congress:** 10<sup>th</sup> European meeting on solar chemistry and photocatalysis: environmental applications (SPEA10)

**Venue:** Almería, Spain

**Date:** 4-8 June 2018

**Organizer:** University of Almería, PSA

**3. Title:** Avances en la producción fotocatalítica de combustibles solares: de los semiconductores inorgánicos a los catalizadores híbridos

**Author:** Fresno, F.; Reñones, P.; García-Sánchez, A.; García, C.; Alfonso, E.; Barawi, M.; Villar-García, I.J.; Pérez-Ruiz, R.; Liras, M.; de la Peña O'Shea, V.A.

**Congress:** 10<sup>th</sup> European meeting on solar chemistry and photocatalysis: environmental applications (SPEA10)

**Venue:** Almería, Spain

**Date:** 4-8 June 2018

**Organizer:** University of Almería, PSA

**4. Title:** Reliability evaluation of grid-connected microgrids with high penetration of renewable distributed energy resources

**Author:** Escalera, A.; Prodanovic, M.; Castronuovo, E.D.

**Congress:** CIRED 2018

**Venue:** Ljubljana, Slovenia

**Date:** 7-8 June 2018

**Organizer:** AIM

**5. Title:** Decarboxylation of stearic acid to long-chain hydrocarbons over Pd/Al-SBA-15 and Pd/H-ZSM-5 catalysts

**Author:** Serrano, D.P.; Escola, J.M.; Briones, L.; Arroyo, M.

**Congress:** XXII Zeolite Forum





**Venue:** Niepołomice, Poland  
**Date:** 19-23 June 2018  
**Organizer:** Polish Zeolite Association

**6. Title:** Catalytic co-pyrolysis of Eucalyptus woodchips and LDPE over nanocrystalline and hierarchical ZSM-5 zeolites  
**Author:** Jiménez-Sánchez, S.; Peral, A.; Pizarro, P.; Serrano, D.P.

**Congress:** XXII Zeolite Forum  
**Venue:** Niepołomice, Poland  
**Date:** 19-23 June 2018  
**Organizer:** Polish Zeolite Association

**7. Title:** Energía solar de concentración para todas las edades  
**Author:** Díaz, E.; Arribas, L.; Luque S.; Reyes-Belmonte, M.A.; Lucio, B.; Sánchez, M.; Martínez, A.; Romero, M.; González-Aguilar, J.

**Congress:** XVI Congreso ibérico y XII congreso iberoamericano de energía solar (CIES2018)  
**Venue:** Madrid, Spain  
**Date:** 20-22 June 2018  
**Organizer:** AEDES, UPM/ETSIDI, UIB

**8. Title:** Simulación numérica del funcionamiento y control de un campo de helióstato para aplicaciones termosolares  
**Author:** Ordoñez de Arce, M.; Martínez-Hernández, A.; Sánchez, M.; Luque, S.; Romero, M.; González-Aguilar, J.

**Congress:** XVI Congreso ibérico y XII congreso iberoamericano de energía solar (CIES2018)  
**Venue:** Madrid, Spain  
**Date:** 20-22 June 2018  
**Organizer:** AEDES, UPM/ETSIDI, UIB

**9. Title:** Design and synthesis of conjugated porous polymers based on BOPHY dye for solar fuels production  
**Author:** García, C.; Liras, M.; Fresno, F.; de la Peña-O'Shea, V.A.

**Congress:** XXVII Reunión bienal de química orgánica (BIQOS2018)  
**Venue:** Santiago de Compostela, Spain  
**Date:** 20-22 June 2018  
**Organizer:** GEQOR

**10. Title:** Estudio comparativo del efecto del gas reductor en la producción de gas de síntesis mediante ciclos termoquímicos redox utilizando perovskitas LSMA

**Author:** Sastre, D.; Serrano, D.P.; Pizarro, P.; Coronado, J.M.  
**Congress:** III Encuentro de jóvenes investigadores de la SECAT  
**Venue:** Valencia, Spain  
**Date:** 25-27 June 2018  
**Organizer:** SECAT

**11. Title:** Influencia de las interacciones moleculares en la hidroxidroxigenación de mezclas de guayacol y ácido acético sobre Ni<sub>2</sub>P/ZSM-5

**Author:** Gutiérrez-Rubio, S.; Moreno, I.; Pizarro, P.; Coronado, J.M.; Serrano, D.P.  
**Congress:** III Encuentro de jóvenes investigadores de la SECAT  
**Venue:** Valencia, Spain  
**Date:** 25-27 June 2018  
**Organizer:** SECAT



**12. Title:** Performance of K-ZSM-5 zeolites in lignocellulose catalytic pyrolysis

**Author:** López-Renau, L.M.; Gómez-Pozuelo, G.; Hernando, H.; Botas, J.A.; Serrano, D.P.

**Congress:** EFCATS SCHOOL on CATALYSIS 2018

**Venue:** Liblece, Czech Republic

**Date:** 25-29 June 2018

**Organizer:** Jiří Čejka

**13. Title:** Hybrid materials composed of nanostructured Conjugated Porous Polymers and TiO<sub>2</sub> for Enhanced hydrogen evolution in Photoelectrochemical Cells

**Author:** Barawi, M.; González, A.; Alfonso, E.; García, A.; López-Calixto, C.G.; Liras, M.; de la Peña-O'Shea, V.A.

**Congress:** XXXIX Reunión del grupo de electroquímica de la real sociedad española de química y III simposio E3 del Mediterráneo (XXXIX GERSEQ & 3rd E3-MS)

**Venue:** Madrid, Spain

**Date:** 2-5 July 2018

**Organizer:** Specialized Group in Electrochemistry

**14. Title:** Modelo comportamental de bajo coste de la impedancia de entrada de inversores trifásicos para el análisis de estabilidad de sistemas de distribución en corriente continua

**Author:** Sanz, M.; Caballero, A.; Huerta, F.; Lázaro, A.; Sánchez, S.; Tedeschi, E.; D'Arco, S.; Roldán-Pérez, J.

**Congress:** Seminario anual de automática, electrónica industrial e instrumentación (SAAEI 2018)

**Venue:** Barcelona, Spain

**Date:** 4-6 July 2018

**Organizer:** Grupo E3PACS-Universitat Politècnica de Catalunya

**15. Title:** Design and synthesis of tunable conjugated porous polymers and behavior as photocatalysts in hydrogen production

**Author:** López-Calixto, C.G.; Liras, M.; Fresno, F.; de la Peña-O'Shea, V.A.

**Congress:** 27<sup>th</sup> PhotolUPAC

**Venue:** Dublín, Irland

**Date:** 8-13 July 2018

**Organizer:** University College Dublin/UCLA

**16. Title:** Feasibility of one-pot Transformation routes of biomass-derived hexoses into chemicals

**Author:** Gálvez, J.L.; Lirio, C.; Dufour, J.

**Congress:** 4th International symposium on catalysis for clean energy and sustainable chemistry (CCESC2018)

**Venue:** Bilbao, Spain

**Date:** 9-11 July 2018

**Organizer:** Hydrogen Europe Research

**17. Title:** Antifouling photo-bactericidal combined effect of a Ag@nanoMOF

**Author:** Arenas-Vivo, A.; Amariei, G.; Aguado, S.; Rosal, R.; Horcajada, P.

**Congress:** XXVII International materials research congress (IMRC 2018)

**Venue:** Cancún, Mexico

**Date:** 19-24 August 2018

**Organizer:** The Sociedad Mexicana de Materiales (SMM) and the Materials Research Society® (MRS)

**18. Title:** Nanometric MIL-125-NH<sub>2</sub> metal-organic framework as nerve agent antidote carrier

**Author:** Vilela, S.M.F.; Salcedo-Abraira, P.; Colinet, I.; Salles, F.; de Koning, M.C.; Joosen, M.J.A.; Serre, C.; Horcajada, P.

**Congress:** XXVII International materials research congress (IMRC 2018)

**Venue:** Cancún, Mexico

**Date:** 19-24 August 2018

**Organizer:** The Sociedad Mexicana de Materiales (SMM) and the Materials Research Society® (MRS).

**19. Title:** Sulfur polyconjugated organic ligands as building blocks in photoactive Metal-Organic Frameworks

**Author:** García-Sánchez, A.; Liras, M.; Barawi, M.; Fresno, F.; Gutiérrez-Puebla, E.; Monge, A.; Gándala, F.; de la Peña-O'Shea, V.A.

**Congress:** 31<sup>st</sup> European crystallographic meeting (ECM31 2018)

**Venue:** Oviedo, Spain

**Date:** 22-27 August 2018

**Organizer:** European Crystallographic Association

**20. Title:** MnO<sub>2</sub> on CNT fibers for high-performance ionic liquid-based supercapacitors

**Author:** Pendashteh, A.; Senokos, E.; Palma, J.; Anderson, M.; Vilatela, J.J.; Marcilla, R.

**Congress:** 69th Annual Meeting of the International Society of Electrochemistry

**Venue:** Bologna, Italy

**Date:** 2-7 September 2018

**Organizer:** ISE

**21. Title:** Metal-organic frameworks as detoxifying agents

**Author:** Rojas, S.; Guillou, N.; Navarro, J.A.R.; Horcajada, P.

**Congress:** 1er Congreso sobre materiales multifuncionales para jóvenes (MultiMat)

**Venue:** Granada, Spain

**Date:** 3-4 September 2018

**Organizer:** University of Granada

**22. Title:** Photocatalyzed reactions by photon upconversion based on triplet-triplet annihilation

**Author:** Pérez-Ruiz, R.; López-Calixto, C.G.; Liras, M.; de la Peña-O'Shea, V.A.

**Congress:** VI Brazil-Spain workshop on organic chemistry (BSWOC 2018)

**Venue:** Oviedo, Spain

**Date:** 1-3 October 2018

**Organizer:** University of Oviedo

**23. Title:** Round robin test on enthalpies of redox materials for thermochemical heat storage: perovskites

**Author:** Lucio, B.; Bayon, A.; Olivares, R.; Navarro, M.E.; Ding, Y.; Senneca, O.; Tregambi, C.; Lanchi, M.; Sau, S.; Vidal, J.; González-Aguilar, J.

**Congress:** SolarPACES 2018

**Venue:** Casablanca, Morocco

**Date:** 2-5 October 2018

**Organizer:** SolarPACES

**24. Title:** Development of small low-cost heliostats for ultra-modular high flux solar fields

**Author:** Luque, S.; Martínez, A.; González-Aguilar, J.; Romero, M.

**Congress:** SolarPACES 2018

**Venue:** Casablanca, Morocco

**Date:** 2-5 October 2018

**Organizer:** SolarPACES

**25. Title:** Technoeconomic assessment of sustainable transformation routes of lignocellulose

**Author:** Gálvez, J.L.; Lirio, C.; Dufour, J.

**Congress:** 4th Iberoamerican congress on biorefineries (4-CIAB)

**Venue:** Jaén, Spain

**Date:** 24-26 October 2018

**Organizer:** University of Jaén

**26. Title:** Metal-organic frameworks based on polyconjugated organic ligands for photocatalytic applications

**Author:** de la Peña-O'Shea, V.A.

**Congress:** 6th International conference on metal organic frameworks & open framework compounds (MOF2018)

**Venue:** Auckland, New Zealand

**Date:** 9-13 December 2018

**Organizer:** The University of Auckland



### 3. Training and dissemination activities

#### 3.1. Mobility actions

IMDEA Energy researchers

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##### 1. Javier Roldán

Stay at: SINTEF Energy Research-Trondheim, Norway

Period: 3 months, 2018

Funding Institution: Ministry of Education, Culture and Sports

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##### 2. Raúl Pérez

Stay at: Politechnic University of Valencia, Spain

Period: 4 months, 2018

Funding Institution: IMDEA Energy Institute

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##### 3. Héctor Hernando

Stay at: Utrecht University- Utrecht, Netherlands

Period: 3 months, 2018

Funding Institution: IMDEA Energy Institute and Rey Juan Carlos University

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##### 4. Juan Coronado

Stay at: Northwestern University -Evanston-Illinois, United States of America

Period: 4 months, 2018

Funding Institution: Ministry of Education, Culture and Sports

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##### 5. Mercedes Llamas

Stay at: Patras University - Patras, Greece

Period: 3 months, 2018

Funding Institution: COST Association (EUALGAE project)

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#### 6. José A. Magdalena

Stay at: Delf University - Delf, Netherlands

Period: 3 months, 2018

Funding Institution: COST Association (EUALGAE project)

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#### 7. Sergio Vilela

Stay at: Centre National de la Recherche Scientifique-CNRS-ICGM-Motpellier, France

Period: 3 months, 2018

Funding Institution: Ministry of Education, Culture and Sports

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#### 8. Patricia Reñones

Stay at: Heriot Watt University-Edimburg, United Kindom

Period: 3 months, 2018

Funding Institution: IMDEA Energy Institute

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#### 9. Jaime Sánchez

Stay at: Max Plank-Fritz Haber Institute- Berlin, Germany.

Period: 3 months, 2018

Funding Institution: IMDEA Energy Institute

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### Visiting Researchers

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#### 1. Marzia Scolastico, ERASMUS Student

Origin institution: University of Naples Federico II, Italy

Host Unit: High Temperature Processes Unit

Period: 5 months, 2018

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#### 2. Vincenzo Senatore, ERASMUS Student

Origin institution: University of Salerno, Italy

Host Unit: Electrochemical Porcesses Unit

Period: 5 months, 2018

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#### 3. Adlane Tahar

Origin institution: Research Centre in Analytical Chemistry and Physics (CRAPC), Algeria

Host Unit: Photoactivated Processes Unit

Period: 2 months, 2018

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#### 4. Luis Miguel López

Origin institution: Rey Juan Carlos University, Madrid

Host Unit: Thermochemical Processes Unit

Period: 12 months, 2018

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#### **5. Sara Rojas**

Origin institution: Institute Lavoisier, France

Host Unit: Advanced Porous Materials Unit

Period: 8 months, 2018

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#### **6. Silvia Quaresma**

Origin institution: High Technical Institute of Lisbon, Portugal

Host Unit: Advanced Porous Materials Unit

Period: 1 month, 2018

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#### **7. Seyed Dariush Teherzade**

Origin institution: University of Teherán, Iran

Host Unit: Advanced Porous Materials Unit

Period: 9 months, 2018

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#### **8. Nidia Libia Torres García**

Origin institution: Michoacan University of San Nicolás Hidalgo, México

Host Unit: Photoactivated Processes Unit

Period: 11 months, 2018

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#### **9. Clara López Aguado**

Origin institution: Rey Juan Carlos University, Madrid

Host Unit: Systems Analysis Unit

Period: 1 month, 2018

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#### **10. Miguel García Casas**

Origin institution: Rey Juan Carlos University, Madrid

Host Unit: Systems Analysis Unit

Period: 7 months, 2018

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#### **11. Guadalupe Diocelina Toledo**

Origin institution: Autonoma University of the State of Morelos, México

Host Unit: Systems Analysis Unit

Period: 3 months, 2018

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#### **12. Vanesa Celis Arias**

Origin institution: Autónoma Metropolitan University of Azcapotzalco, México

Host Unit: Advanced Porous Materials Unit

Period: 3 months, 2018

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**13. Marco Smeltink**

Origin institution: Hygear Technology and Services, BV, Belgium

Host Unit: High Temperature Processes Unit

Period: 18 months, 2018

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**14. Dick Liefink**

Origin institution: Hygear Technology and Services, BV, Belgium

Host Unit: High Temperature Processes Unit

Period: 18 months, 2018

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**15. Claudia Miyiseth Valverde**

Origin institution: Rey Juan Carlos University, Madrid

Host Unit: Thermochemical Processes Unit

Period: 6 months, 2018

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**16. Laura García Pina**

Origin institution: Rey Juan Carlos University, Madrid

Host Unit: Thermochemical Processes Unit

Period: 6 months, 2018

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**17. Tim Schlichting**

Origin institution: Deutsches Zentrum für Luft und Raumfahrt, Germany

Host Unit: High Temperature Processes Unit

Period: 5 days, 2018

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### 18. Moussa Dicko

Origin institution: Université Paris 13, France

Host Unit: Systems Analysis Unit

Period: 12 days, 2018

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### 19. Alberto Quintero

Origin institution: B5tec, Spain

Host Unit: Electrochemical Processes Unit

Period: 15 months (3 months, 2018 and 12 months 2019)

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## 3.2. Organization of scientific events

**1.** EXILUM 2018 Keys to the success of public lighting

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 15 February 2018

Organizer: Federación de Municipios de Madrid/ City Council of Móstoles/IMDEA Energy

**2.** HyTechCycling dissemination Workshop

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 20 March 2018

Organizer: HyTechCycling project

**3.** Workshop: Uses and transformation of CO<sub>2</sub>: from the laboratory to the company

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 25 June 2018

Organizer: URJC/IMDEA Energy/PTECO<sub>2</sub>

**4.** Workshop: SUN-to-LIQUID: Production of solar fuels for road transport, aviation and shipping: technology development and market uptake

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 10-11 October 2018

Organizer: Sun-to-Liquid consortium

**5.** ETIP SNET Western Region Workshop

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 22-23 November 2018

Organizer: ETIP SNET, Futured, Circe, IMDEA Energy

**6.** 7th Annual Workshop of Young Researchers of IMDEA Energy Institute

Venue: IMDEA Energy Institute, Madrid, Spain

Date: 13-14 December 2018

Organizer: IMDEA Energy

## 3.3. Internal seminars

**1. Oral Presentation:** Energy management strategies for smart buildings

Speaker: Dr. Milan Prodanovic (IMDEA Energy)

Date: 26 January 2018

**2. Oral Presentation:** Water-energy nexus: The role of emerging technologies in sustainable development

Speaker: Dr. July Lado (IMDEA Energy)

Date: 26 January 2018

**3. Oral Presentation:** Contributions to steel industry, nanocomposites and aerospace applications

Speaker: Dr. Beatriz Lucio (IMDEA Energy)

Date: 23 February 2018

- 4. Oral Presentation:** Decoupling energy and power in non-flowable batteries  
**Speaker:** Teresa Pérez (IMDEA Energy)  
**Date:** 23 February 2018
- 5. Lecture:** Molecular processes in intercalation and redox flow batteries  
**Speaker:** Prof. Ulrich Stimming (Newcastle University, UK)  
**Date:** 6 March 2018
- 6. Oral Presentation:** How computational modeling can rationalise and guide experiments  
**Speaker:** Dr. Andreas Mavrantoukakis (IMDEA Energy)  
**Date:** 23 March 2018
- 7. Oral Presentation:** Photoelectrochemical study of semiconductor thin films for artificial photosynthesis  
**Speaker:** Elena Alfonso (IMDEA Energy)  
**Date:** 23 March 2018
- 8. Lecture:** Procesos relacionados con la conversión electrocatalítica de la energía investigados in situ mediante espectroscopía de rayos X blandos generados por radiación de sincrotrón  
**Speaker:** Dr. Juan J. Velasco Vélez (Fritz-Haber-Institute of the Max-Planck-Society, Berlin, Germany)  
**Date:** 20 April 2018
- 9. Oral Presentation:** Integrated approach of anaerobic digestion process towards producing biogas and biobased chemical building blocks with zero waste  
**Speaker:** Dr. Alexandre Colzi (IMDEA Energy)  
**Date:** 27 April 2018
- 10. Oral Presentation:** Association of active species to Metal-Organic Frameworks  
**Speaker:** Ana Arenas (IMDEA Energy)  
**Date:** 27 April 2018
- 11. Oral Presentation:** New materials for lithium batteries  
**Speaker:** Dr. Nicola Boaretto (IMDEA Energy)  
**Date:** 25 May 2018
- 12. Oral Presentation:** Planning a sustainable road transport system for Spain  
**Speaker:** Zaira Navas (IMDEA Energy)  
**Date:** 25 May 2018
- 13. Oral Presentation:** Environmental assessment of strategies for the circular economy  
**Speaker:** Dr. Jose Luis Gálvez (IMDEA Energy)  
**Date:** 22 June 2018
- 14. Oral Presentation:** Electroactive porous multifunctional materials  
**Speaker:** Pablo Salcedo (IMDEA Energy)  
**Date:** 22 June 2018
- 15. Lecture:** Low-cost materials for energy storage and conversion  
**Speaker:** Dr. Ana Belén Jorge Sobrido (Queen Mary University of London)  
**Date:** 5 July 2018
- 16. Oral Presentation:** Redox active polymers for sustainable energy storage  
**Speaker:** Dr. Nagaraj Patil (IMDEA Energy)  
**Date:** 21 September 2018
- 17. Oral Presentation:** Bioplastics from residues: Improving lactic acid production from hemicellulose by process optimization and experimental evolution  
**Speaker:** Enrique Cubas (IMDEA Energy)  
**Date:** 21 September 2018
- 18. Oral Presentation:** Metal-Organic Frameworks in biomedical and environmental applications  
**Speaker:** Dr. Sara Rojas (IMDEA Energy)  
**Date:** 26 October 2018
- 19. Oral Presentation:** Volatile fatty acids production from microalgae biomass  
**Speaker:** José A. Magdalena (IMDEA Energy)  
**Date:** 26 October 2018
- 20. Oral Presentation:** Conjugated Microporous Polymer (CMP) for energy storage  
**Speaker:** Antonio Molina (IMDEA Energy)  
**Date:** 29 November 2018

### 3.4. Participation in science dissemination activities

**1.** Open day in the IMDEA Institutes led by female scientists

**Participants:** Rebeca Marcilla, Elia Tomás, Marta Liras

**Activity:** Guided tour in IMDEA Energy

**Venue:** IMDEA Energy Institute, Madrid, Spain

**Date:** 7 February 2018

**Organizer:** Madri+d Foundation

**2.** Meeting between women scientists and high school students of educational centers in Madrid

**Participants:** Patricia Horcajada

**Venue:** IMDEA Energy Institute, Madrid, Spain

**Date:** 8 February 2018

**Organizer:** Madri+d Foundation

**3.** Jornadas con Ciencia en la Escuela

**Participants:** Elena Díaz, Antonio Valente, Carmen García, David Muñoz

**Activity:** “Motor Stirling: ¿Te atreves a hacer funcionar un motor sin combustible?” y “Baterías y medios conductores: Cómo un electrón y un limón pueden iluminar un hogar”

**Venue:** Circulo de Bellas Artes de Madrid, Spain

**Date:** 6-7 March 2018

**Organizer:** El Círculo de Bellas Artes, FUHEM, FECYT, SM, Fundación José Ramón Otero and Consejería de Educación e Investigación

**4.** GENERA 2018

Brokerage Event

**Speaker:** Marín, F.

**Venue:** IFEMA, Madrid, Spain

**Date:** 13 June 2018

**Organizer:** Madri+d Foundation

**5.** European researchers' night 2018

**Activity:** ¡Energizing the future!

**Venue:** IMDEA Energy Institute, Madrid, Spain

**Date:** 28 September 2018

**Organizer:** IMDEA Energy

**6.** Science Week of Comunidad de Madrid (2018)

**Activity:** Sustainability for the world of energy

**Venue:** IMDEA Energy Institute, Madrid, Spain

**Date:** 12-15 November 2018

**Organizer:** IMDEA Energy

### 3.5. Training activities

**1.** Lucero, Sandra

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Support activities for the advanced biofuel production line.

**Supervisor:** Dr. Juan Miguel Moreno, TCPU

**Period:** January-March 2018

**2.** Viggiano, Donato

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Chemical recycling of plastics from electronic equipment (WEEE: Waste Electrical and Electronic Equipment) by thermochemical processes.

**Supervisor:** Dr. Juan Miguel Moreno, TCPU

**Period:** March-August 2018

**3.** Escudero, Maria Jesus

BSc in Civil Engineering, Polytechnic University of Madrid

**Internship work:** Development and improvement of aluminum ion batteries.

**Supervisor:** Dr. Edgar Ventosa, ECPU

**Period:** March-May 2018

**4.** Paradelo, Ainoa

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Development of rechargeable batteries based on aluminum.

**Supervisor:** David Muñoz-Torrero, ECPU

**Period:** March-June 2018



**5. González, Cristina**

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Identification of substances susceptible to contaminate the process of applying automotive painting using spectroscopic techniques and chromatographies.

**Supervisor:** Dr. Fernando Fresno, PAPU

**Period:** April-June 2018

**6. González, Carlos**

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Numerical modeling of solar concentration optical systems by simulation tools by ray tracing. Technical support in the assembly and commissioning of experimental devices and in hydrogen production tests using thermochemical cycles.

**Supervisor:** Dr. José González, HTPU

**Period:** July-August 2018

**7. García, Elena**

BSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Experimental research work on the thermocatalytic residue recovery line through pyrolysis processes.

**Supervisor:** Dr. Juan Miguel Moreno, TCPU

**Period:** September-October 2018

**8. San Segundo, Noelia**

MSc in Chemical Engineering, Rey Juan Carlos University

**Internship work:** Experimental research work on the thermocatalytic residue recovery line through pyrolysis processes.

**Supervisor:** Dr. Juan Miguel Moreno, TCPU

**Period:** November 2018-February 2019

**9. García, Laura**

MSc in Engineering, Complutense University of Madrid

**Internship work:** Develop “next-generation” high-performance organic batteries-based on redox-active polymers (RAPs), by following four

key criteria: safe, sustainable, smart and stable (4S).

**Supervisor:** Dr. Nagaraj Patil, ECPU

**Period:** November 2018-February 2019

**10. Torres, María José**

MSc in Engineering, Complutense University of Madrid

**Internship work:** Development and optimization of electrochemical energy storage devices based on aluminum; specifically, injectable aluminum-ion batteries.

**Supervisor:** David Muñoz-Torrero/ Dr. Edgar Ventosa, ECPU

**Period:** November 2018-January 2019

**11. Paredes, Guillermo**

Professional Training, IES- Salesianos de Atocha

**Internship work:** Support tasks in the High Temperature Processes Unit

**Supervisor:** Dr. José González, HTPU

**Period:** April-June 2018

**12. Martínez, Iñigo**

Professional Training, IES- Salesianos de Atocha

**Internship work:** Support tasks in the Photoactivated Processes Unit

**Supervisor:** Dr. Víctor de la Peña, PAPU

**Period:** April-June 2018

**13. Menendez, Stalin Leonardo**

Professional Training, IES-Benjamin Rua

**Internship work:** Support tasks in the Electrical Systems Unit

**Supervisor:** Adriana Torres, UELSU

**Period:** March-June 2018

**14. Castilla, Roberto**

Professional Training, IES- Palomeras Vallecas

**Internship work:** Support tasks in the Electrochemical Processes Unit

**Supervisor:** Guzman García, ECPU

**Period:** March-June 2018

**15. Berlanas, Ismael**

Professional Training, IES- Lope de Vega

Internship work: Support tasks in the Electrochemical Processes Unit

Supervisor: Ignacio Almonacid, ECPU

Period: April-June 2018

**16. Rodríguez, Ariadna**

Professional Training, IES- Lope de Vega

Internship work: Support tasks in the Thermochemical Processes Unit

Supervisor: Dr. Juan Miguel Moreno, TCPU

Period: April-June 2018

**17. Carrascosa, Guillermo**

Professional Training, IES- Lope de Vega

Internship work: Support tasks in the Thermochemical Processes Unit

Supervisor: Guzman García, ECPU

Period: September-December 2018

**18. Navarrete, Sandra**

Professional Training, IES- Lope de Vega

Internship work: Support tasks in the Thermochemical Processes Unit

Supervisor: Dr. Juan Miguel Moreno, TCPU

Period: September -December 2018

**19. Vázquez, Inés**

BSc in Chemical Engineering – Industrial Organization Engineering, Rey Juan Carlos University

Project title: Análisis de la escalabilidad de alternativas de producción de biocombustibles a partir de cultivos microalgas (Industrial Organization Engineering). Análisis tecnoeconómico de procesos de producción de biocombustibles a partir de microalgas (Chemical Engineering).

Supervisor: Dr. Javier Dufour, SAU

Date of defense: February and March 2018

**20. Suarez, Jasson**

BSc in Industrial Organization Engineering, Rey Juan Carlos University

Project title: Estudio prospectivo del parque automovilístico español.

Supervisor: Dr. Diego García, SAU

Date of defense: March 2018

**21. Martín, María Isabel**

BSc in Chemical Engineering and Environmental Engineering, Rey Juan Carlos University

Project title: Integración del proceso Sabatier en una planta de obtención de biogás

Supervisor: Dr. Javier Dufour, SAU

Date of defense: July 2018

**22. Ayuso, Lucas**

BSc in Electromechanical Engineering-Electronic Itinerary, Pontificia of Comillas University

Project title: Estudio de la estrategia de control  $df/dt$  para convertidores conectados a la red eléctrica

Supervisor: Dr. Javier Roldan, ELSU

Date of defense: September 2018

**23. Hornillos, Gonzalo**

BSc in Electrical Engineering, Pontificia of Comillas University

Project title: Optimización de redes de media tensión con SNOP

Supervisor: D. Alberto Escalera Blasco/ D. Alberto Rodríguez Cabero, ELSU

Date of defense: August 2018

**24. Escudero, Maria Jesus**

BSc in Civil Engineering, Politechnical University of Madrid

Project title: Estudio y desarrollo de baterías inyectables para almacenamiento estacionario.

Supervisor: Dr. Edgar Ventosa, ECPU

Date of defense: July 2018

**25. Almenara, Jesús**

BSc in Mechanical Engineering, Carlos III University of Madrid

Project title: Mechanical and electrochemical characterization of an LFP-CNT deformable composite electrode

Supervisor: Dr. Nicola Boaretto, ECPU

Date of defense: October 2018

**26. Martínez, Mathias**

MSc in Environmental Engineering and Sustainable Energy, Universidad Rovira y Virgili

**Project title:** Carbon footprint and economic analysis of Calcium Sulfoaluminate clinkers

**Supervisor:** Dr. José Luis Gálvez, SAU

**Date of defense:** January 2018

**27. González, Adrián**

MSc in Electronic and Application Systems, Carlos III University of Madrid

**Project title:** Diseño y análisis de una máquina síncrona virtual controlada en corriente para redes débiles

**Supervisor:** Dr. Javier Roldan, ELSU

**Date of defense:** September 2018

**28. Rodríguez, Pablo**

MSc in Electronic and Application Systems, Carlos III University of Madrid

**Project title:** Almacenamiento de energía como herramienta fundamental para estabilizar redes eléctricas

**Supervisor:** Dr. Milan Prodanovic, ELSU

**Date of defense:** September 2018

**29. Romero, Lucas**

MSc in Renewable Energies in Electrical Systems, Carlos III University of Madrid

**Project title:** Estabilidad transitoria en redes eléctricas con alta penetración de fuentes renovables y poca inercia del sistema

**Supervisor:** Dr. Milan Prodanovic, ELSU

**Date of defense:** September 2018

**30. Nizamian, Dustin**

MSc in Energy Science and Technology, ETHZ

**Project title:** On-Sun commissioning of a 50 kW solar reactor for thermochemical H<sub>2</sub>O & CO<sub>2</sub> splitting

**Supervisor:** Dr. Manuel Romero, HTPU

**Date of defense:** December 2018

**31. Molinero, Javier**

MSc in Renewable and Environmental Energies, Polytechnic University of Madrid-ETSIDI

**Project title:** Desarrollo y puesta en marcha de una técnica de caracterización de superficies especulares para sistemas de concentración solar

**Supervisor:** Dr. José González, HTPU

**Date of defense:** September 2018

**32. Fernández, Alejandro**

MSc in Renewable Energies in Electrical Systems, Carlos III University of Madrid

**Project title:** Nuevos modelos de almacenamiento de energía para la operación óptima de redes de distribución

**Supervisor:** D. Alberto Escalera, ELSU

**Date of defense:** September 2018

**33. Segovia, Rodrigo**

MSc in Renewable Energies in Electrical Systems, Carlos III University of Madrid

**Project title:** Continuidad del suministro en redes de distribución inteligentes con generación distribuida controlable y gestión Activa de la demanda

**Supervisor:** D. Alberto Escalera, ELSU

**Date of defense:** September 2018

**34. Justicia, Jessica**

MSc in Chemical Engineering, Rey Juan Carlos University

**Project title:** Producción de hidrógeno mediante procesos de fotorreformado

**Supervisor:** Dr. Fernando Fresno, PAPU

**Date of defense:** December 2018

**35. Iglesias, Sirma**

MSc in Energy and Fuels for the Future, Autónoma University of Madrid

**Project title:** Desarrollo de nuevos sistemas redox basados en óxidos mixtos de manganesos y metales alcalinos para procesos de almacenamiento termoquímico de energía

**Supervisor:** Dr. Juan Coronado, TCPU

**Date of defense:** June 2018

### 36. S  n  , Hector

MSc in Microbiology and Parasitology, Complutense University of Madrid

**Project title:** Ingenier  a evolutiva como estrategia de mejora del proceso de producci  n de   cido l  ctico a partir de lignocelulosa con *Lactobacillus pentosus* CECT 4023T

**Supervisor:** Dra. Elia Tom  s, BTPU

**Date of defense:** July 2018

### 37. Gonz  lez, Alberto

MSc in Energy and Fuels for the Future, Aut  noma University of Madrid

**Project title:** Nuevos fotoelectrodos h  bridos basados en TiO<sub>2</sub> y pol  meros porosos conjugados nanoestructurados para la producci  n de combustibles solares

**Supervisors:** Drs. Marta Liras and Mariam Barawi, PAPU

**Date of defense:** June 2018

### 38. Gonz  lez, Miguel

MSc in Energy and Fuels for the Future, Aut  noma University of Madrid

**Project title:** Estudio de espectroscop  a fotoelectr  nica de fotocatalizadores h  bridos para fotos  ntesis artificial

**Supervisor:** Dr. Ignacio Villar, PAPU

**Date of defense:** June 2018

### 39. Guachamin, Jos   Rafael

MSc in Energy and Fuels for the Future, Aut  noma University of Madrid

**Project title:** Water-Energy Nexus: Effect of water composition in the energy efficiency of capacitive deionization

**Supervisors:** Drs. Jesus Palma and Julio Lado, ECPU

**Date of defense:** September 2018





Comunidad  
de Madrid

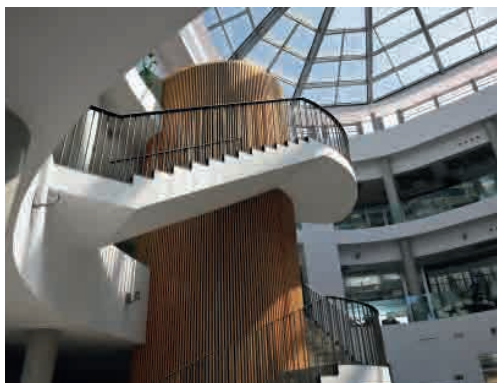


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annual report

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