ANNUAL ACADEMIC REPORT

Academic Year

2022-2023

IIT
INSTITUTO DE
INVESTIGACIÓN
TECNOLÓGICA

Index

Director's greeting

Dear reader,

This report summarizes the work carried out at the Institute for Research in Technology (IIT) of the ICAI School of Engineering at the Comillas Pontifical University during the last academic year.

The overview presented in the annual report underlines the position we have been able to consolidate, both nationally and internationally, in our chosen areas of research. It showcases the strength of the research teams, who also make an important contribution to our internationally-oriented doctoral programs, and the continuing success of our collaboration with the industrial sector for more than thirty years.

All of the activity described in this report would not have been possible without the work and commitment of all the professionals at the institute: professors, researchers, administrative staff, post-graduate students and representatives of the industrial sector. If the work of the IIT has become an international benchmark in its areas of research, it is without doubt entirely their achievement.

The goal is to build on our success and advance further in our areas of expertise thanks to our continuing commitment and our professionalism. We are convinced that this professionalism will enable us to continue enjoying the confidence of the national and international companies and organizations we collaborate with as well as the ICAI School of Engineering itself, the Comillas Pontifical University, and ICAI Engineers Association. We highly appreciate their valuable support.

We wish to continue earning this confidence by dint of our efforts to produce qualified professionals who are highly sought after by companies in the industrial sector, to encourage applied research which adds to the engineering knowledge base, and to pass on this knowledge so that it may be of use to society.

We are conscious that this is a difficult challenge in the current globalized and interdependent economy with faster an deeper technology change, especially in the energy, transport and telecommunication sectors. We face this challenge with enthusiasm, commitment and optimism. Technology is to play a crucial role in the history of humanity over the upcoming decades and we want to be part of this adventure.

I cordially invite you to get to know us better by reading these pages.

Andrés Ramos Galán

1. Introduction

The Institute for Research in Technology (IIT) is a University Research Institute that belongs to the ICAI School of Engineering of Comillas Pontifical University. Its primary objective is to promote research and postgraduate training in various technological fields through participation in specific projects of interest to the industry and the administration. It is a nonprofit institute that seeks to be flexible and pragmatic in the way they work. Its funding comes mainly from projects contracted with companies and, therefore, meet the social demand proven.

The results of this research are specified in the following products:

• Advanced computer applications, usually developed to customer specifications and used in many different companies, and innovative engineering equipment design.

• Analysis, consulting and technical, statistical, regulatory and econometric studies developed for companies and institutions in various countries.

• Doctoral theses defended at the University and publications in conferences and international journals.

The core of IIT is composed of a group of Professors and Researchers. This group is supplemented by postgraduate researchers as Research Assistants, dedicated to the Institute exclusively. Work teams are formed between both groups for the development of research projects, some of which are made dissertations.

This report covers the period for the academic year 2022 - 2023, from September 1, 2022 to August 31, 2023.

2. Organizational structure

2.1 Management

The management of the IIT during the course 2022 - 2023 has been carried out by the following Professors and Researchers:

- **Chaves Ávila, José Pablo**. Deputy Director for Research Development
- **Cucala García, Asunción Paloma**. Deputy Director for Economic Affairs
- **Lumbreras Sancho, Sara**. Deputy Director for Research Results
- **Ramos Galán, Andrés**. Director

2.2 Council

The members of the Council of IIT during the course 2022 - 2023 were the following ones:

- **Brito Pereira, Paulo**. IEF Representative
- **Chaves Ávila, José Pablo**. Deputy Director for Research Development
- **Cossent Arín, Rafael**. Reseacher Representative
- **Cucala García, Asunción Paloma**. Deputy Director for Economic Affairs
- **Gómez San Román, Tomás**. Reseacher Representative
- **Güitta López, Lucía**. IEF Representative
- **López López, Álvaro Jesús**. Reseacher Representative
- **Lumbreras Sancho, Sara**. Deputy Director for Research Results
- **Ramos Galán, Andrés**. Director
- **Rivier Abbad, Michel**. Reseacher Representative
- **Rodilla Rodríguez, Pablo**. Reseacher Representative
- **Sigrist, Lukas**. Secretary General

2.3 Area coordinators

The coordinators of the eight research areas that group the different activities carried out in the IIT during the course 2022 - 2023 are the following ones:

- **Aracil Fernández, Elisa María**. SMS Coordinator
- **Cantizano González, Alexis**. PCI Coordinator
- **Fernández Rodríguez, Adrián**. ASF Coordinator
- **Latorre Canteli, Jesús María**. SADSE Coordinator
- **Mateo Domingo, Carlos**. REDES Coordinator
- **Olmos Camacho, Luis**. RYE Coordinator
- **Paz Jiménez, Eva**. BIO Coordinator
- **Portela González, José**. ASI Coordinator
- **Rouco Rodríguez, Luis**. MAC Coordinator

2.4 Scientific advisory board

The members of the SAB are the following ones:

- **Andersson, Göran** (Chairman), ETH Zurich, Switzerland
- **Miranda, Vladimiro** (Vice chairman), INESC TEC, Univ. of Porto, Portugal
- **Hobbs, Benjamin F.** (Member), Johns Hopkins University, USA
- **Miyatake, Masafumi** (Member), Sophia University, Japan
- **Neuhoff, Karsten** (Member), DIW Berlin, Technical Univ. Berlin, Germany
- **Wehenkel, Louis** (Member), University of Liège, Belgium

2.5 Academic staff

The permanent staff of IIT consisted of the following Professors and Researchers:

- **Aracil Fernández, Elisa María**. Associate Professor
  Ph.D. in Sustainable Banking. Universidad Rey Juan Carlos de Madrid.
  Degree in Law. Universidad Nacional de Educación a Distancia (UNED).
  Degree in Business Administration. Universidad Complutense de Madrid.
  Areas of interest: Corporate strategy, sustainability, innovation and digitalization, development economics, savings and investment products, sustainable finance, financial markets, stakeholder capitalism.

- **Barrella, Roberto**. Research Assistant Professor
  PhD in Engineering Systems Modelling, Escuela Técnica Superior de Ingeniería (ICAI), Comillas Pontifical University
  Master's Degree Energy Engineering, Renewable Energy. Faculty of Civil and Industrial Engineering, Università degli Studi di Roma La Sapienza
  Bachelor's Degree Energy Engineering. Faculty of Civil and Industrial Engineering, Università degli Studi di Roma La Sapienza
  Areas of interest: Energy poverty, Residential Energy Demand, Energy Efficiency, HVAC systems, Energy Policy, Climate change.

- **Batlle López, Carlos**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Economics and regulation of the electricity industry. Modelling of electricity markets.

- **Bello Morales, Antonio**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas), M.Sc. in Power Systems (Comillas), Mechanical Engineer (Comillas),
  Areas of interest: Risk management support, energy forecasting, energy market modelling, planning of electricity and gas markets, artificial intelligence.

- **Calvo Báscones, Pablo**. Assistant Professor
  Electromechanical Engineer (Comillas). M.Sc. in Industrial Engineering (Comillas)
  Areas of interest: Big data & analytics, intelligent systems, predictive maintenance, process automation, artificial vision & image processing.

- **Campos Fernández, Francisco Alberto**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mathematics Science degree (UCM)
  Areas of interest: Mathematical techniques of operations research. Stochastic optimization. Planning and operation of energy systems. Nash equilibrium. General equilibrium. Optimization under uncertainty. Hydrogen, Gas and Electricity Markets. Cryptology.

- **Castro Ponce, Mario**. Professor
  Ph.D. in Physics Science (UCM)
  Physics Science degree (UCM)
  Areas of interest: Statistical Mechanics, Nonlinear Physics, Theoretical Immunology, Bayesian Statistics and Epidemiology, Forest fires.

- **Centeno Hernáez, Efraim**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Master's Degree in Coaching Psychology (UNED)

Areas of interest: Electric power system operation models. Hydrothermal coordination. Electric power markets.

- **Chaves Ávila, José Pablo**. Research Associate Professor
  Ph.D. in Electrical Engineering (Comillas), Ph.D. in Electrical Engineering (Delft University of Technology - TU Delft, The Netherlands)), Ph.D. in Electrical Engineering (Royal Institute of Technology - KTH, Stockholm, Sweden), Economics (University of Costa Rica), M.Sc. in Electric Power Industry (Comillas), M.Sc. in Network Industries and Digital Economics (University Paris-Sud 11, France)

  Areas of interest: Energy economics, integration of renewable resources and distributed energy resources in the electricity sector, smart grids and regulation of the electricity and other energy sectors.

- **Contreras Bárcena, David**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Computing Engineer (Comillas), Postgraduate in Management Information Systems (Comillas)

  Areas of interest: Wireless Networks. Bluetooth architecture. Information Retrieval Systems. Software development. IoT, Cloud and Big Data. Blockchain.

- **Cossent Arín, Rafael**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)

  Areas of interest: Power system economics and regulation, energy transition, integration of renewable and distributed generation, smart grids, hydrogen and decarbonization.

- **Cuadra García, Fernando de**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)

  Areas of interest: Large-scale modelling, simulation and optimisation problems. Knowledge engineering. Intelligent CAD. Control theory. Power systems. Railways systems. Software engineering and graphical languages for the specification of digital systems.

- **Cucala García, Asunción Paloma**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)

  Areas of interest: Modelling, simulation, design, management and control of railway systems, and their optimisation

- **Dueñas Martínez, Pablo**. Research Assistant Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)

Areas of interest: Mathematical modeling of energy systems, bottom-up decarbonization, energy regulation and policy, energy economics.

- **Echavarren Cerezo, Francisco Miguel**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Modeling, analysis and simulation of power systems.

- **Egido Cortés, Ignacio**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Load-frequency control and voltage control. System modeling and control. Power system stability.

- **Fernández Cardador, Antonio**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Physics Science degree (UCM)
  Areas of interest: Systems modelling, analysis and simulation. Simulation techniques for optimisation and control problems. Design, management and control of railway systems.

- **Fernández Rodríguez, Adrián**. Research Assistant Professor
  Ph.D. in Engineering (Comillas)
  Electrical Engineer (UPM)
  Master's Degree in Research in Engineering Systems Modeling (Comillas)
  Areas of interest: Train simulation, energy efficiency in railway operation and nature inspired optimisation.

- **Frías Marín, Pablo**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Operation and planning of electric power systems. Power economics. Integration of distributed generation in power systems. Advanced electric machines. Electric Vehicles and Sustainable Mobility.

- **García Cerrada, Aurelio**. Professor
  Ph.D. in Electrical and Electronics Engineering (University of Birmingham, U.K.)
  Electrical Engineer (UPM)
  Areas of interest: Power electronics. Control of electrical drives. FACTS. System identification and control.

- **García González, Javier**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (UPC)
  Areas of interest: Decision support models in the electric power industry

- **García González, Pablo**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Control. Power electronics. Power electronics aplied to the electric power systems (FACTS devices, active filters, HVDC, etc.). Electric power systems stability and control.

- **Gerres, Timo**. Research Assistant Professor
  B.Sc. in Business Administration and Engineering (Universität Paderborn) (DE)
  M.Sc. in Systems Engineering, Policy Analysis & Management (Technische Universiteit Delft) (NL)
  Areas of interest: Energy economics, industrial decarbonisation, hydrogen, renewable energy resources, energy sector regulation, environmental policy instruments

- **Gómez San Román, Tomás**. Professor
  Ph.D. in Industrial Engineering (UPM)
  Electrical Engineer (Comillas)
  Areas of interest: Economics and regulation of the energy sector. Planning and operation of transmission and distribution electricity networks. Integration of renewable and distributed energy resources in power systems. Power quality standards and regulation. Electric vehicles. Smart grids.

- **Herraiz Martínez, Francisco Javier**. Assistant Professor
  Engineer and Ph.D. degrees in Telecommunications. Carlos III University of Madrid (Spain)
  Areas of interest: Passive sensors and RFID systems. Electromagnetic metamaterials. Antennas. Microwave circuits.

- **Linares Llamas, Pedro**. Professor
  Ph.D. in Agricultural Economics (UPM)
  Agricultural Engineering degree (UPM)
  Areas of interest: Energy economics. Energy planning models. Integration of renewable energies. Environmental economics. Environmental policy instruments. Multiple criteria decision making.

- **Lobato Miguélez, Enrique**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Analysis, planning, operation and economics in electric power systems.

- **López López, Álvaro Jesús**. Research Associate Professor
  PhD in Engineering (Comillas)
  Electronics degree (Comillas), M.Sc. in Automatics and Electronics (Comillas)
  M.Sc. in Research in Engineering Systems Modeling (Comillas)

Areas of interest: Industry 4.0, Machine Learning, IoT, Railway Power Systems, Railway System Simulation, Dynamic System Control.

- **López Valdés, Francisco José**. Associate Professor
  Mechanical Engineering, Mechanics Universidad de Valladolid (Spain)
  PhD. Mechanical and Aerospace Engineering. University of Virginia (USA)
  Areas of interest: Biomechanics, Injury prevention, biological tissue characterization, injury thresholds, automotive safety

- **Lumbreras Sancho, Sara**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  M.Sc. Systems Modelling (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Decision methods applied to complex problems. ---Tecniques:--- decision under uncertainty, stochastic optimization, Benders' decomposition, risk analysis, heuristics, metaheuristics, genetic algorithms, ordinal optimization. ---Areas of application:--- power systems, planning, network design, transmission expansion planning, wind energy, offshore windfarm design, finance, risk analysis, derivatives.

- **Martín Martínez, Francisco**. Research Assistant Professor
  Electrical Engineer (Comillas)
  Master's degree in Research in Engineering Systems Modeling (Comillas)
  Ph.D. in Industrial Engineering (Comillas)
  Areas of interest: My research focuses on demand flexibility, energy usages, optimization models, and specifically on aggregation and microgrids issues. I am developing studies in electrical systems and the impact of different energy resources. I am also working with digital electronics systems for the control and monitoring of residential consumption.

- **Mastropietro, Paolo**. Research Associate Professor
  Ph.D. in Electrical Engineering (Comillas), Ph.D. in Electrical Engineering (Delft University of Technology - TU Delft, The Netherlands)), Ph.D. in Electrical Engineering (Royal Institute of Technology - KTH, Stockholm, Sweden), M.Sc. in Environmental Engineering (University of Rome Tor Vergata, Italy), Environmental Engineer (University of Rome Tor Vergata, Italy)
  Areas of interest: Power sector regulation; Security of supply; Capacity remuneration mechanisms; regional markets; tariff design and subsidies

- **Matanza Domingo, Javier**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Telecommunications Engineer (Technical University of Valencia)
  Areas of interest: Signal processing. Communication systems. Power Line Communication. Wireless communications.

- **Mateo Domingo, Carlos**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas), Computer Systems Engineer (UNED)
  Areas of interest: Models of electricity distribution networks. Integration of distributed energy resources.

- **Muñoz San Roque, Antonio**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Time series forecasting. Machine learning. Application of Artificial Intelligence techniques to the operation and maintenance of industrial processes. Electricity markets analysis and optimal operation.

- **Nobrega Barroso, Luiz Augusto**. Research Affiliate
  Ph.D. in Power Engineering and Operations Research (Federal University of Rio de Janeiro - UFRJ, Brazil)
  Mathematics Science degree (Universidade Federal do Rio de Janeiro - UFRJ, Brasil)
  Areas of interest: Power system economics. Stochastic optimization. Game theory. Energy policy.

- **Olmos Camacho, Luis**. Senior Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Regulation of the energy sector. Transmission of electricity. Power economics. System identification.

- **Ortega Manjavacas, Álvaro**. Assistant Professor
  Ph.D. in Electrical Engineering. University College Dublin, Ireland.
  Industrial Engineering, Itinerary of Electrical, Electronic and Automation.
  University of Castilla-La Mancha, Spain.
  Areas of interest: Modeling, control and stability of energy storage systems connected to transmission and distribution systems; and frequency estimation, control and stability in low-inertia systems.

- **Palacios Hielscher, Rafael**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mechanical Engineer (Comillas)
  Areas of interest: Advanced data analysis (including vibration analysis, optical handwritten character recognition, image processing, artificial intelligence and data mining). Parallel processing. Thermoelectric applications. Failure detection and maintenance. Aviation safety.

- **Pérez Arriaga, José Ignacio**. Lecturer
  Ph.D. and M.Sc. in Electrical Engineering (Massachusetts Institute of Technology - MIT, U.S.A.), Ph.D. in Industrial Engineering (UPM)
  Electrical Engineer (Comillas)

  Areas of interest: Regulation, economics, planning, operation and control of electric power systems. Sustainability of the energy model. Electricity access in developing countries.

- **Portela González, José**. Associate Professor
  PhD in Engineering (Comillas), Electronics Engineer (Comillas), M.Sc. in Research in Engineering Systems Modeling (Comillas)

  Areas of interest: Functional Data Analysis, Machine Learning, Neural Networks, time series models

- **Ramos Galán, Andrés**. Professor
  Ph.D. in Industrial Engineering (Universidad Politécnica de Madrid)
  Electrical Engineer (Universidad Pontificia Comillas)

  Areas of interest: Development of new algorithms and computer implementation. Modeling of complex systems. Mathematical techniques of operations research and their application to large-scale problems. Large-scale optimization techniques. Stochastic optimization. Benders decomposition. Planning and operation of electric energy systems -models for generation and transmission network planning, generation operation models-. Economy of the electric sector. Computational techniques and analytical methods for planning, operations, and control. Economics, market organization, cost structures, pricing, and risk management. Reliability, uncertainty, and probability, and stochastic system applications. Emerging methods for restructured systems. Generation system resource planning. Transmission system planning. Industry restructuring planning and policy issues.

- **Rivier Abbad, Michel**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)

  Areas of interest: Electric power systems analysis, optimisation, regulation economic, operation and planning. Optimisation techniques.

- **Roch Dupré, David**. Assistant Professor
  Ph.D. (with International Mention) in Engineering Systems Modeling.(Comillas)
  Electromechanical Engineer. (Comillas)
  M.Sc. in Industrial Engineering. (Comillas)
  Official Master's Degree in Research in Engineering Systems Modeling (MRE) (Comillas)

  Areas of interest: Socioeconomic indicators. Longevity Economy. Modeling, simulation, and optimization. Energy efficiency in electrified railway systems.

- **Rodilla Rodríguez, Pablo**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Fundamental and quantitative electricity market modeling. Market design and regulation for wholesale electricity markets. Competition and strategic behavior analysis. Security of supply mechanisms in competitive power systems. Regulatory mechanisms focused on environmental policies

- **Rodríguez Mondéjar, José Antonio**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Communication and control in electric power systems and railway systems.

- **Rodríguez-Morcillo García, Carlos**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas), M.Sc. in Communication Technologies and Systmes (UPM)
  Areas of interest: Embedded systems. Digital systems. Autonomous systems (batteries). HW design. PCB design. PCB manufacturing. Digital communications (wired and wireless). Communication protocols. Programmable logic. Microcontrollers programming.

- **Romero Mora, José Carlos**. Assistant Professor
  PhD in Engineering (Comillas)
  Electrical and Power Systems Engineer (University of Malaga), M.Sc. in Research in Engineering Systems Modeling (Comillas)
  Areas of interest: Energy Sustainability; Fuel Poverty; Energy Transition

- **Rouco Rodríguez, Luis**. Professor
  Ph.D. in Industrial Engineering (UPM)
  Electrical Engineer (UPM)
  Areas of interest: Modelling, simulation, simulation, control and identification of electric power systems

- **Sánchez Fornié, Miguel Ángel**. Research Associate
  Electromechanical Engineer de ICAI (Comillas)
  Nuclear Security Diploma (MIT)
  Areas of interest: Power engineering. Power systems regulation. Power systems planning and operation.
  Power systems asset management. Smart grids. Telecommunications systems and operations. Telecommunications for power systems. Cybersecurity, Big data analysis and artificial intelligence on power systems.

- **Sánchez Martín, Pedro**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Industrial Engineer (Comillas)
  Areas of interest: Transmission and generation electric system modeling. Industrial process planning and scheduling. Work system design. Manufacturing and logistics simulation

- **Sánchez Miralles, Álvaro**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Smart grids. Smart cities. Security systems. Mobile robotics.

- **Sánchez Pérez, Pablo**. Assistant Professor
  Bachelor degree in Computer Science. Universidad Autónoma de Madrid.
  Master's degree in Research and Innovation in Information and Communication Technologies. Universidad Autónoma de Madrid.
  PhD degree in Computer and Telecommunication Engineering. Universidad Autónoma de Madrid.
  Areas of interest: Machine learning, recommender systems, information retrieval.

- **Sánchez Úbeda, Eugenio Francisco**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Machine learning – Forecasting – Data analysis and visualization - Non-linear statistical modeling - Deep learning

- **Sanz Bobi, Miguel Ángel**. Professor
  Ph.D. in Industrial Engineering (UPM)
  Electrical Engineer (UPM)
  Areas of interest: Monitoring and analysis of industrial processes. Modelling and simulation of industrial components performance. Expert systems. Neural networks. Fuzzy logic. Genetic algorithms. Failure detection techniques. Reliability. Predictive maintenance. Image and voice processing.

- **Sigrist, Lukas**. Research Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical and Electronics Engineer (École Plytechnique Fédérale de Lausanne - EPFL, Switzerland)
  Areas of interest: Modeling, analysis and control of electric power systems. Energy Systems Models.

- **Troncia, Matteo**. Research Assistant Professor
  Ph.D. in Industrial Engineering (University of Cagliari), M.Sc. in Electrical Engineering (University of Cagliari), B.Sc. in Electrical Engineering (University of Cagliari)

Areas of interest: Electricity markets, system service markets, energy economics, integration of renewable and distributed energy resources in the electricity sector, smart grids, techno-economic appraisal and cost-benefit analysis for initiatives concerning the electricity sector, power system planning and operation.

- **Valor Martínez, Carmen**. Professor
  Ph.D. in Information Sciences. Universidad Complutense de Madrid.
  Master in Business Administration (MBA). Universidad Carlos III de Madrid.
  MSc Business and Community. University of Bath.
  Areas of interest: Sustainable Consumption. Sustainable brands. Innovation for sustainability. Collaborative consumption. Social Change.

- **Ventosa Rodríguez, Mariano**. Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Operations, planning and economy of electric energy systems. Application of operations research in electric energy markets.

- **Wuebben, Daniel Lewis**. Research Assistant Professor
  Ph.D. Doctor of Philosophy in English. City University of New York. EE.UU.
  Bachelor in English. Hunter College CUNY. EE.UU.
  Areas of interest: Energy Humanities, Science Communication, Ecocriticism, Community Engagement with Smart Grids

2.6 Associated academic staff

The following professors have collaborated with IIT as Associate Researchers:

- **Alfaya Sánchez, David**. Assistant Professor
  PhD in Mathematics . Universidad Autónoma de Madrid (UAM)
  Bachelor Degree in Mathematics. Universidad Autónoma de Madrid (UAM)
  Education, Culture and Sports).
  Computer Science Engineer. Universidad Autónoma de Madrid (UAM)
  Master in Mathematics and Applications . Universidad Autónoma de Madrid (UAM)
  Master in Research and Innovation in Communications and Information Technologies. Universidad Autónoma de Madrid (UAM)
  Areas of interest: Pure and applied mathematics.
  Study of the geometry of moduli spaces (specially moduli of decorated bundles including, among others, Higgs bundles, connections and parabolic structures). Information Retrieval, Information Geometry, Blockchain technologies and interactions between Artificial Intelligence and Mathematics.

- **Arenas Pinilla, Eva María**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mechanical Engineer (Comillas)
  MSc Thermal Power and Fluids Engineering (University of Manchester. Institute of Science and Technology)
  Areas of interest: S-CO2 turbomachinery, hydro-powered pumping, hydraulic turbomachinery, energy poverty

- **Ayala Santamaría, Pablo**. Assistant Professor
  Ph.D. in Industrial Engineering (Comillas, Mechanical Engineer (Comillas), Master's degree in Research in Engineering Systems Modeling (Comillas)
  Areas of interest: CFD, fire modelling, fire protection installation, smoke movement

- **Ballesteros Iglesias, Yolanda**. Associate Professor
  Ph.D. in Chemistry Science (UAM)
  Chemistry Science degree (UAM)
  Areas of interest: Materials. Environment. Biomaterials. Nondetructive testintg (NDT). Adhesives.

- **Boal Martín-Larrauri, Jaime**. Associate Professor
  Ph.D. in Engineering Systems Modeling (Comillas ICAI)
  M.Sc. in Research in Engineering Systems Modeling (Comillas ICAI)
  Electronics Engineer (Comillas ICAI)
  Areas of interest: Energy efficiency and flexibility · Internet of Things (IoT) · Deep learning · Computer vision · Autonomous mobile robots · Topological modeling of the environment · Industry 4.0

- **Cantizano González, Alexis**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mechanical Engineer (Comillas), M.Sc. in Thermal Power and Fluids Engineering (University of Manchester Institute of Science and Technology - UMIST, U.K.), Psychology degree (UNED)
  Areas of interest: Fire Protection Engineering, Fire Dynamics, Computational Fluid Dynamics (CFD), Hydraulic and Thermal Turbomachines

- **Carnicero López, Alberto**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mechanical Engineer (Comillas)
  Areas of interest: Numerical methods in engineering. Railway Catenary. Catenary-pantograph dynamic interaction

- **Cifuentes Quintero, Jenny Alexandra**. Assistant Professor
  Mechatronic Engineering (Universidad Nacional de Colombia).
  Master in Industrial Automation (Universidad Nacional de Colombia).
  Phd in Engineering- Mechanical and Mechatronic Engineering (Universidad Nacional de Colombia).
  Phd in Automation (Institute National des Sciences Appliquées de Lyon-France)
  Areas of interest: Modeling and analysis of dynamical systems, signal processing and pattern recognition using machine learning strategies.

- **Cledera Castro, Mª del Mar**. Assistant Professor
  Industrial Engineer. Universidad Politécnica de Madrid.
  Ph.D. in Industrial Engineering. Universidad Pontificia Comillas.
  Areas of interest: Energy and Environment. Materials.

- **Fernández Bernal, Fidel**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Electric Machines and Electric Drives, Electrical Generation, Renewable Generation, Wind Generation.

- **Figuerola-Ferreti Garrigues, Isabel Catalina**. Associate Professor
  Bachelor of Science in Economics. Queen Mary, University of London.
  Master in Economics. London School of Economics.
  PhD in Financial Economics. Queen Mary.University of London.
  Areas of interest: Financial Econometrics, energy markets, commodity markets, Green Finance and ESG investment, risk management volatility and trading strategies.

- **Giannetti, Romano**. Professor
  Ph.D. in Electronics and Computing Engineering (University of Padua, Italy)
  Electronics Engineer (University of Pisa, Italy)
  Areas of interest: Measurement instrumentation and methodology. Biomedical instrumentation. Noise measurements.

- **González Arechavala, Yolanda**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Computing Engineer (UPV-EHU)
  Areas of interest: Software engineering: software development process, programming paradigms, software quality assurance and control, CASE tools. RAMS: standards and analysis. Safety-critical and real time systems. Railway systems. Sustainability assessment of energy generation using LCA. Promotion of STEM vocations in women and provoke a change in trend.

- **Jiménez Octavio, Jesús**. Senior Associate Professor
  PhD Industrial Engineering (Universidad Pontificia Comillas)
  MSc Mechanical Engineering (Universidad Pontificia Comillas)

Areas of interest: Computational mechanics; Biomechanics; Road Safety; Odontology

- **Laloux Dallemagne, Damián**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electrical Engineer (Comillas)
  Areas of interest: Modelling, analysis and control of electric power systems. Sustainable development.

- **López López, Gregorio**. Assistant Professor
  PhD in Telecommunications Engineering. Universidad Carlos III de Madrid.
  Areas of interest: Optimization of M2M communications networks based on analysis and simulation, cybersecurity and data analytics for the IoT, and the use of technology and the Internet.

- **Megía Macías, Ana María**. Assistant Professor
  Doctoral Degree in Science and Technology Applied to Industrial Engineering. Universidad de Castilla - La Mancha.
  Areas of interest: Production, diagnosis and applications of plasmas. --- Techniques: --- Plasmas for ion sources, cold atmospheric plasma, diagnostic tools with temporal resolution. --- Areas of application: --- Ion sources, particle beam medical therapies, surface cleaning and treatment, disinfection, plasma medicine.

- **Mochón Castro, Luis Manuel**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Mechanical Engineer (Comillas)
  Areas of interest: Computacional fluid dynamic. Fluid control. Hydraulic energy. Heat transfer. Olehidraulic systems.

- **Mompó Pavesi, Emanuel Gastón**. Assistant Professor
  Ph.D. Mathematical Engineering, Universidad Carlos III de Madrid.
  M.Sc. Industrial Mathematics, Universidad Carlos III de Madrid.
  M.Sc. on Mathematics Teaching, Universidad Nacional de Educación a Distancia.
  B.Sc. & M.Sc. Mathematics, Universitat de València.
  Areas of interest: Non-linear dynamical systems. Statistical mechanics out of equilibrium. Complex systems.

- **Morales Contreras, Manuel Francisco**. Associate Professor
  Industrial Engineer ICAI, master in Mechanics
  PhD Economics and Business Administration ICADE
  Areas of interest: Sustainability and global supply chain management; lean and efficient operations; process innovation; hospitality and healthcare sectors.

- **Morales Polo, Carlos**. Assistant Professor
  Industrial Engineer.Comillas Pontifical University.
  PhD. Industrial Engineer. Comillas Pontifical University
  Areas of interest: Waste management and treatment. Water technologies. Energy use. Environmental Impact Study through Life Cycle Assesment.

- **Muñoz Frías, José Daniel**. Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Digital systems design. Computer architecture. Motor drives control. Design of embbedded systems for automatic control applications.

- **Paz Jiménez, Eva**. Assistant Professor
  PhD in Engineering (Comillas)
  Industrial Technical Engineering in Industrial Chemistry (UPM), M.Sc. in Production Engineering (UPM)
  Areas of interest: Biomaterials, Bone cements, Composite materials, Nanocomposites, Carbon based nanomaterials, Mechanical Characterisation.

- **Real Romero, Juan Carlos del**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Industrial Engineer (Comillas)
  Areas of interest: Adhesive bonding: adhesives suitable for each application; mechanical characterization of adhesive bonding; durability studies and failure modes; surface treatments to improve durability of the adhesive joints. Composites: preparation of polymer matrix composites reinforced by micro and nanoparticles; mechanical characterization; thermal analysis; applications as coatings; biomedical applications. Carbon based nanomaterials. Nanocomposites

- **Rodríguez Pecharromán, Ramón**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Control systems. Railway electrification. Thermoelectricity.

- **Sáenz Nuño, María Ana**. Assistant Professor
  Ph.D. in Industrial Engineering (Comillas)
  Physics Science degree (UCM)
  Areas of interest: Dimensional metrology.

- **Sánchez Merchante, Luis Francisco**. Assistant Professor
  Telecommunications Engineer (Universidad Politécnica de Madrid)
  Master's degree in Multimedia and Communications (Universidad Carlos III de Madrid)
  PhD in Information Technology (Universidad Tecnológica de Compiègne)

Areas of interest: Advanced analytics on Big Data platforms
Machine Learning
Smart cities

- **Santos Montes, Ana María**. Senior Associate Professor
  Ph.D. in Chemistry Science (UCM)
  Chemistry Science degree (UAM)
  Areas of interest: Development, optimization and validation of chromatographic analytical methods for high-performance liquid chromatography (HPLC) to determine steroids, diuretics and contaminants in urine samples, feed and water. Analysis of the life cycle of crops for biofuels.

- **Zamora Macho, Juan Luis**. Senior Associate Professor
  Ph.D. in Industrial Engineering (Comillas)
  Electronics Engineer (Comillas)
  Areas of interest: Drive control. System identification. Signal processing.

2.7 Pre- and postdoctoral fellows

The Research Assistants (PhD students and post-docs) that developed their activity at the IIT during the academic course 2022 - 2023 were the following ones:

- **Akullo, Grace**. Bachelors in Entrepreneurship and Small Business Management (Makerere University)
  Masters degree in Management and Promotion of Local Development (University of Valencia)
  Masters in Intercultural Communication and Public Service Translation and Interpretation (University of Alcalá de Henares)
- **Alvarez Quispe, Erik Francisco**. Bachelor's Degree in Mechanical and Electrical Engineering. National University of Engineering (Peru).
  Master's Degree in Electrical Engineering. State University of Campinas (Brazil).
- **Asensio Gil, Juan Manuel**. Bachelor's Degree in Industrial Engineering. Universidad Pontificia Comillas.
  Master´s Degree in Engineering for Mobility and Safety. Universidad Pontificia Comillas.
  Master´s Degree in Industrial Engineering. Universidad Pontificia Comillas.
- **Ávila Martínez, Régulo Enrique**. Bachelor Degree in Electrical Engineering. University of Oriente (UDO), Venezuela.
  Master degree in Renewable Energies in Electrical Systems. Carlos III University of Madrid (UC3M), Spain.

- **Baringo Morales, Ana**. B.S. degree in Electrical Engineering and the M.S. degree in Industrial Engineering. Universidad de Castilla-La Mancha.
  Master Degree in Secondary School Teaching, Universidad de Castilla-La Mancha.
  PhD in Science and Technologies Applied to Industrial Engineering, Universidad de Castilla-La Mancha (2016-2020)
- **Bellido López, Francisco Javier**. Degree in Industrial Technologies. Universidad Politécnica de Madrid.
  Master in Industrial Engineering. Universidad Politécnica de Madrid.
  Master in Electrical Engineering. Universidad Politécnica de Madrid.
- **Benítez Domínguez, Álvaro**. Master in Aerospace Engineering. Universidad Carlos III de Madrid.
  Máster de Energías Renovables y Medio Ambiente. Universidad Politécnica de Madrid.
- **Bindu, Shilpa**. Bachelor's degree in Electrical and Electronics Engineering from National Institute of Technology (NIT) - Calicut, India.
  EIT- Innoenergy double Master's degree in Energy for Smart Cities at KTH Royal Institute of Technology Stockholm and Universidad Politécnica de Catalunya (UPC) Barcelona.
- **Blanco Castillo, Manuel**. Bachelor's Degree in Mechanical Engineering. University of Jaén.
  Master's Degree in Industrial Engineering. University of Málaga.
- **Brito Pereira, Paulo**. Degree in Electrical Engineering and Masters Degree in Industrial Engineering (University of Las Palmas of Gran Canaria).
  Masters Degree in the Electric Power Industry (Comillas Pontifical University).
- **Cieslak, Veronika**. Bachelor of Science in Business Administration. Salem International University.
  Bachelor of Arts in International Relations & Diplomacy. Schiller International University.
  Master of Science degree in Human Resource Management. Florida International University.
  Master of European Studies. University of Bonn.
- **Coll Franck, Anne Maren**. Bachelor's Degree in Industrial Technologies Engineering. University Carlos III of Madrid.
  Master's Degree in Industrial Mathematics. University Carlos III of Madrid.
- **Conde Montero, Fernando**. Bachelor's degree in Physics. Universidad Autónoma de Madrid.
  Master's degree in Advanced Mathematics. Universidad de Barcelona.
- **Cubillo LLanes, Diego**. Bachelor's Degree in Engineering for Industrial Technologies. Comillas Pontifical University
  Official Master's Degree in Industrial Engineering. Comillas Pontifical University

- **Diahovchenko, Illia**. M.S. degree in electrical engineering. Sumy State University.
  PhD degree in electrical engineering. National Technical University "Kharkiv Polytechnic Institute"
- **Díaz Pastor, Santos José**. Industrial Engineering. Polytechnic University of Madrid and the Karlsruher Institut für Technologie (KIT.
  Master's Degree in Industrial Engineering and the Master's Degree in the Power Sector. Universidad Pontificia Comillas.
- **Domínguez Barbero, David**. Bachelor's Degree in Computer Engineering, Universidad de Castilla – La Mancha.
  Master's Degree in Artificial Intelligence Research, Menendez Pelayo International University.
- **Domínguez Gago, María**. Industrial Engineer. Universidad Pontificia Comillas.
  Ph.D. in Industrial Engineering. Universidad Pontificia Comillas.
- **Elabbas, Mohamed Abbas Eltahir**. Bachelor of Science in Electrical and Electronic Engineering. University of Khartoum, Sudan.
  Master of Sustainable Energy Technology. Delft University of Technology, The Netherlands.
- **Fernández Palomino, Luis Jesús**. Bachelor in Industrial Technologies Engineering. Universidad Carlos III de Madrid. Master in Industrial Mathematics. Universidad Carlos III de Madrid.
- **Freire Barceló, Teresa**. Degree in Industrial Engineering. Universidad Pontificia Comillas
  Máster in Industrial Engineering. Universidad Pontificia Comillas
- **García Aguilar, Javier**. Master's Degree in Industrial Engineering. Universidad P. Comillas
- **García Cerezo, Álvaro**. Bachelor of Science degree in Electrical Engineering. University of Castilla-La Mancha.
  Master of Science degree in Industrial Engineering. University of Castilla-La Mancha.
  Ph.D. degree in Science and Technologies Applied to the Industrial Engineering. University of Castilla-La Mancha.
- **García Sánchez, Miguel**. Bachelor's degree in Design and Business,VIA University College. Denmark.
  Master's degree in Leadership and Organisation. Malmö University. Sweden.
- **Gesteira Miñarro, Roberto**. BSc. in Telecommunication Engineering (ICAI)
  MSc. in Telecommunication Engineering (ICAI)
  MSc. in Cybersecurity (ICAI)
- **Gómez González, Juan Luis**. Bachelor's degree in Physics. University of Seville.
  Master´s degree in Physics of Complex Systems. University of the Balearic Islands.
- **Gómez Pérez, Jesús David**. Electrical engineer and M.Sc. in electrical engineering. Universidad Tecnológica de Pereira (Colombia)

- **Gómez Sánchez, Stefanía**. Degree in Industrial Engineering. (Escuela Colombiana de Ingeniería Julio Garavito, Colombia)
  Master's Degree in Optimization. (Universidad Autónoma Metropolitana, México)
- **Güitta López, Lucía**. Degree in Electromechanical Engineer (Comillas)
  Master's Degree in Industrial Engineering (Comillas)
  Master in Smart Industry (Comillas)
- **Gutiérrez Guerra, Juan Francisco**. Chemical Engineering Degree. Instituto Tecnológico de Buenos Aires (Argentina).
  M.Sc. in Mechanical Engineering, Energy and Environment. Karlsruher Institut für Technologie (Germany).
  Master in Energy and Environment. Instituto Tecnológico de Buenos Aires (Argentina).
- **Herding, Leslie**. Bachelor of Engineering. Technische Hochschule Köln (Germany).
  Master in Research in Energy Efficiency and Sustainability in Industry, Transport, Construction and Town Planning. UPV/EHU (Bilbao).
- **Herrero Rozas, Luis Alberto**. Degree in Chemical Engineering. Universidad de Cantabria.
  Master's degree in Chemical Engineering. (Universidad de Cantabria (UC) and Universidad del País Vasco (UPV/EHU)
- **Huclin, Sébastien**. Master's degree in Physics (University of Paris-Sud)
- **Insunza Díaz, Eloy Jesús del Gran Poder**. Industrial Engineering Master's Degree. Universidad Politécnica de Madrid.
  Generalist Engineer. École Centrale de Lyon.
  Industrial Technologies Engineering Degree. Universidad Politécnica de Madrid.
- **Lefranc, Léonard**. Master's Degree in General Engineering. École Centrale Paris.
  Master's Degree in Industrial Engineering. Universidad Pontificia Comillas.
  Master's Degree in Business Administration (MBA). Universidad Pontificia Comillas.
- **Lind, Leandro**. B.Sc. in Economics. Federal University of Santa Catarina (Brasil)
  Master in the Electric Power Industry. University Pontificia Comillas (Spain)
  Master in Digital Economics and Network Industries. University Paris-Sud 11 (France)
- **Loras Gimeno, Diego**. B.Sc. in Economics. University of Valencia.
  M.Sc. in Economics and Finance. Barcelona Graduate School of Economics.
  M.A. in Ethics and Democracy. University of Valencia.
- **Mansouri, Seyed Amir**. MSc and PhD degrees in Electrical Engineering. Islamic Azad University. Teherán. (Irán)
- **Martínez Velázquez, Miguel**. Bachelor's Degree in Engineering for Industrial Technologies.Comillas Pontifical University
  MSc in Wind Energy. Technical University of Denmark (DTU)
  Official Master's Degree in Industrial Engineering. Comillas Pontifical University

- **Marulanda García, Geovanny Alberto**. Electrical Engineer, Universidad Tecnológica de Pereira (Colombia)
  Master in Electrical Engineering, Universidad Tecnológica de Pereira (Colombia)
- **Mohammed Nour, Morsy Abdelkader Morsy**.
  Bachelor's degree in Electrical Engineering. Aswan University, Aswan, Egypt.
  Master's degree in Electrical Engineering. Budapest university of Technology and Economics, Budapest, Hungary.
- **Monteagudo Honrubia, Miguel**. Bachelor Degree in Biomedical Engineering (Universitat Politècnica de València)
  MSc in Biomedical Engineering (University of Twente)
- **Montero Guirao, Luis Manuel**. Bachellor's degree in Chemical Engineering from the Universidad de Granada.
  Master's degree in Chemical Engineering from the Universidad de Salamanca.
- **Morell Dameto, Nicolás Mariano**. Bachelor's Degree in Industrial Engineering, Universidad Politécnica de Madrid.
  Master's Degree in Industrial Engineering, Universidad Politécnica de Madrid.
  Master in Electricity Markets, Illinois Intitute of Technology, USA.
- **Moreno, Valeria Karina**. Industrial Engineer . National Technological University (Argentina).
  Master's Degree in Energy Engineering. Polytechnic University of Catalonia (Spain)
- **Navarrete Cruz, Diana María**. Master degree in Data Mining and Business Intelligence (Complutense University of Madrid)
  Industrial Engineering (Universidad del Valle. Colombia)
- **Nemati, Hadi**. B.Sc. degree in Electrical Engineering (Shiraz University)
  M.Sc. degrees in Electrical Engineering (Isfahan University of Technology)
- **Ormeño Mejía, Eliana Carolina**. Bachelor's degree in Electrical Engineering. Escuela Superior Politécnica del Litoral (ESPOL), Guayaquil-Ecuador.
  Master's Degree in Energy Engineering. Universidad Politécnica de Madrid.
  Diploma in Electricity Markets of the Future and its Regulation. Pontificia Universidad Católica of Chile.
- **Paolis Robles, Carlo de**. Bachelor's Degree in Electromechanical Engineering. Comillas Pontifical University.
  Master's Degree in Industrial Engineering. Comillas Pontifical University.
- **Pérez Bravo, Manuel**. Graduado en Ingeniería de Tecnologías Industriales. Universidad de Sevilla
  Máster Universitario en Ingeniería Industrial. Universidad de Sevilla
- **Pérez Sánchez, Jaime**. Degree in Telecommunication Technologies and Services Engineering, by the Universidad Politécnica de Madrid (2013-2018)
  Master's Degree in Telecommunications Engineering, by the Universidad Politécnica de Madrid (2018-2020)
- **Polo Molina, Alejandro**. Master in Big Data & Visual Analytics. Universidad Internacional de La Rioja.
  Master in Big Data & Advanced Analytics. Universidad Pontificia Comillas.
  Degree in Mathematics. Universidad de Granada.

- **Rajabdorri, Mohammad**. Bachelor's degree of Electrical Power Engineering. Shiraz University, Iran.
  Master's in Electrical Power Systems. Shiraz University of Technology, Iran.
- **Rajora, Gopal Lal**. Master in applied Telecommunication & Engineering Management. Polytechnic University of Catalonia
  Master of Science in Finance. University of Siena.
  Bachelor of Technology in Electronics Instrumentation & Control. Rajasthan Technical University.
- **Rico Díez, Olga**. Telecommunication Technologies and Systems Engineering degree. Universidad Politécnica de Madrid.
  Master's degree in Biomedical Engineering. Universidad Politécnica de Madrid.
- **Ríos Ocampo, Miguel Angel**. B.Sc and M.Sc in Electrical Engineering. Technological University of Pereira (UTP).
- **Rodrigo Tobías, Ignacio de**. Bachelor´s Degree in Electromechanical Engineering (Comillas Pontifical University)
  Official Master´s Degree in Industrial Engineering (Comillas Pontifical University)
  Master of Engineering in Mobility and Safety (Comillas Pontifical University)
- **Rodríguez Cuenca, Francisco**. Degree in Software Engineering. Polytechnic University of Madrid.
  Master's degree in Big Data and Advanced Analytics. Comillas Pontifical University.
- **Rodríguez Matas, Antonio Francisco**. Degree in Industrial Engineering (University of Seville)
  Master's Degree in Economics (Complutense University of Madrid)
  Master's Degree in Energy Management (Repsol)
- **Rodríguez Pérez, Néstor**. Universitary Master's Degree in Industrial Engineering - Pontifical University of Comillas, ICAI (2020)
  Master in Smart Grids - Pontifical University of Comillas, ICAI (2020)
  MSc in Smart Grids - University of Strathclyde (2020)
  Bachelor's Degree in Electromechanical Engineering - Pontifical University of Comillas, ICAI (2018)
- **Rodríguez Vilches, Rubén**. Bachelor's Degree in Mechanical Engineering. Universitat Politècnica de València. Master's Degree in Energy Engineering. Universitat Politècnica de Catalunya.
- **Rognini, Davide**. Bachelor's degree in Economics. Universidad de Valladolid.
  Master's degree in International Economics and Development. Universidad Complutense de Madrid.
- **Rosales Perales, Marta**. Degree in Psychology. University of Vic (Spain).
  Master's degree in Consumer Psychology and Marketing. University of Sussex (United Kingdom).
  Master's degree in Marketing, Management, and Communication. Toulouse Business School (France).

- **Ruiz González, Berta**. Bachelor's degree in Mathematics. Universidad Complutense de Madrid.
  Master's degree in Disaster management. Universidad Complutense de Madrid y Universidad Politécnica de Madrid.
- **Ruiz Hernández, Miguel Ángel**. Bachelor´s degree in Industrial Engineering. University Carlos III of Madrid.
  MsC in Industrial Engineering. University of Puerto Rico.
- **Santos Oliveira, Dilayne**. Petroleum Engineer. Federal University of Campina Grande (UFCG/Brazil).
  Master's degree in Energy Engineering. Polytechnic University of Madrid (UPM).
  Master's degree in Oil Reservoirs Simulation and Management. Federal University of Pernambuco (UFPE/ Brazil).
- **Segarra Tamarit, Ignacio**. BSc in Mathematics
  MSc in Banking and Quantitative Finance
- **Serna Zuluaga, Santiago**. Bachellor's degree in Chemichal Engineering. Rey Juan Carlos University.
  Master's degree in Chemichal Engineering. Autonomous University of Madrid and the Rey Juan Carlos University.
- **Sofokleous, Paraskevas**. Bachelor´s degree in Physics (Aristotle University of Thessaloniki, Greece)
  Master´s degree in Nanoscale Engineering (University of Lyon, France)
- **Suárez Porras, Jorge**. Degree in Engineering in Industrial Technologies. Universidad Pontificia Comillas.
  Master's degree in Energy Engineering. Aalborg University (AAU), Denmark.
- **Tomás Martín, Andrés**. University Degree in Communications Electronic Engineering. Complutense University of Madrid.
  Master's Degree in Energy. Complutense University of Madrid.
- **Valarezo Rivera, Orlando Mauricio**. Bachelor's degree in Electrical Engineering (Escuela Superior Politécnica del Litoral - ESPOL)
  Master's degree in Power System and its Automation (Shandong University)
  Master's degree in Computational Engineering and Mathematics (Universitat Rovira i Virgili)
- **Valdano, Manuel**. Mechanical Engineering. Universidad Nacional de Rio Cuarto (Argentina).
- **Valverde Castilla, Gabriel Antonio**. Bachelor of Mathematics. Universidad de Extremadura.
  Bachelor of Statistics and Data Science. Universidad de Extremadura.
  Master's degree in Mathematical Engineering. Universidad Complutense de Madrid.
  Ph.D. in Statistics and Operations Research. Universidad Complutense de Madrid.
- **Verdugo Rojas, Norma Carolina**. Degree in Comercial Engineering. Universidad Técnica Federico Santa María, Valparaiso, Chile.
  Master's degree in Business Administration. Universidad Técnica Federico Santa María, Chile.

- **Vives Torres, Carmen María**. Bachelor's Degree in Engineering for Industrial Technologies. Comillas Pontifical University.
  Official Master's Degree in Industrial Engineering. Comillas Pontifical University.
  Master of Engineering in Mobility and Safety. Comillas Pontifical University.
- **Weldu, Hagos Meresa**. BA Degree in Management. Mekelle University, Meqhele – Tigray.
  Master of Public Policy. KDI School of Public Policy & Management – Korea.
  Master in Electric Power Industry. Universidad Pontificia Comillas, Madrid – Spain.
  Master in Digital Economics & Network Industries. Université Paris Sud-11, Paris – France.
- **Ziegler, David Ulrich**. B.Eng. in Energy Management. Reinhold-Wuerth-Hochschule (Germany)
  M.Eng. in Energy Engineering. Universidad Politécnica de Cataluña (Barcelona)-
  M.Sc. in Electrical Engineering as part of the European master program from EIT (European Institute of Innovation and Technology)

2.8 Services staff

2.8.1 Systems administrator staff

The staff responsible for managing networks and computer systems consists of:

- **Lázaro Martín, Marco Antonio**. Technical Engineer in Management Computing
- **Martín Tena, Julián**. Computer Expert

2.8.2 Administrative staff

The staff that manage the documentation, the general and technical secretariat and the trips consist of:

- **García Lecuona, Paula**. Degree in Hispanic Philology (Universidad Complutense de Madrid)
- **Ghorbal, Bad'r**. B.A. Geology & Earth Sciences - Université Pierre et Marie Curie. France.
  M.S. Earth Sciences. Université Pierre et Marie Curie. France.
  PhD. Geosciences - Geology & Solid Earth Sciences. Vrije University.The Netherlands.
- **Ruiz González-Mateo, Cristina**. Law and Legal Advisor Companies degree (Comillas)
- **Sánchez Alfayate, María Belén**. Social Education Diploma (Universidad Complutense de Madrid)
- **Sánchez Ortega, María Isabel**. Librarianship and Information Science Diploma (University of Granada)

- **Tamudo González, Isabel**. Criminology degree (UEM), Criminology diploma (UCM)

3. Research

3.1 Research areas

The IIT is divided into nine research areas.

3.1.1 Electric Power Systems (MAC)

Area dedicated to the development of computer tools for electrical studies related to such aspects as load flows, stability, transients, frequency-power control, power plant regulators, voltage control, design of systems of electric feeding, protection, harmonics, and the impact of the distributed generation.

Coordinator: Luis Rouco Rodríguez
Web page: https://www.iit.comillas.edu/research-area/mac

3.1.2 Smart and Sustainable Grids (REDES)

The Smartgrids and RES integration Group investigates the challenges of future power systems from a technical, economic and regulatory perspectives. On the one hand, it covers the techno-economic evaluation of the impact of distributed energy resources in distribution networks (such as distributed generation, demand management, electric vehicles and storage). Based on the cost & benefit and scalability & replicability analysis different proposals for standards and regulation are presented. On the other hand, the research in this area also covers the impact of high levels of renewable energy penetration in power systems, and new market and ancillary services designs for their optimal integration.

Coordinator: Carlos Mateo Domingo
Web page: https://www.iit.comillas.edu/research-area/redes

3.1.3 Energy Economics and Regulation (RYE)

Area centred on research into the organization, remuneration and regulation of the power systems (sector structure, market models, economic signals, tariffs and quality of service, etc.).

Coordinator: Luis Olmos Camacho
Web page: https://www.iit.comillas.edu/research-area/rye

3.1.4 Energy Systems Models (SADSE)

Area which goal is to provide assistance in the taking of decisions and in the technical-economic analysis of the generation, transport and distribution systems in the energy sector.

Coordinator: Jesús María Latorre Canteli
Web page: https://www.iit.comillas.edu/research-area/sadse

3.1.5 Fire Safety, Thermal and Fluids Engineering (PCI)

This area is dedicated to mechanical elements design and to running complex simulations using a computer, specially for general mechanical purposes as well as electromagnetism, wind grounds, etc.

Coordinator: Alexis Cantizano González
Web page: https://www.iit.comillas.edu/research-area/adi

3.1.6 Railway Systems (ASF)

This area aims to develop models and other custom-made software tools, safety analysis and quality control, related with different topics of railway systems. These topics include the infrastructure design and management, the power systems planification and operation, as well as the railway traffic planification and operation.

Coordinator: Adrián Fernández Rodríguez
Web page: https://www.iit.comillas.edu/research-area/asf

3.1.7 Intelligent Systems (ASI)

This area deals with the monitoring, diagnosis, reliability and maintenance of industrial processes, and modelling and prediction of industrial and economic systems.

Coordinator: José Portela González
Web page: https://www.iit.comillas.edu/research-area/asi

3.1.8 Bioengineering (BIO)

This group works to develop electronic instrumentation and microprocessors, power electronics, control engineering applications, signal analysis, electronic design, automatization and digital communications.

Coordinator: Eva Paz Jiménez
Web page: https://www.iit.comillas.edu/research-area/geac

3.1.9 Smart Management for Sustainability (SMS)

Coordinator: Elisa María Aracil Fernández
Web page: https://www.iit.comillas.edu/research-area/sms

3.2 Research projects

This section includes all the research projects developed at IIT during this academic year grouped by area and type of funding. A brief description of them and the most relevant data (collaborating institution, dates, staff involved) are also included.

3.2.1 Research and development projects

3.2.1.1 Private funding

- **Modeling and assessment of electrical networks´ requirements for the energy transition in Spain**
  Iberdrola España S.A.U. January 2019 - December 2023. (Michel Rivier Abbad, Tomás Gómez San Román, Rafael Cossent Arín, José Pablo Chaves Ávila, Leslie Herding, Andrés Ramos Galán, Sara Lumbreras Sancho)

  The main objective of the research is to analyze the impact on electricity networks of the connection of new renewable plants on the 2030 horizon under different possible scenarios, and to develop proposals to facilitate the decarbonisation objectives to be achieved in the most efficient possible way.

- **Analysis of the expansion and operation of the Spanish electricity system for a 2030-2050 time horizon**
  Iberdrola España S.A.U. January 2019 - December 2023. (Michel Rivier Abbad, Tomás Gómez San Román, Álvaro Sánchez Miralles, Francisco Martín Martínez, José Pablo Chaves Ávila, Teresa Freire Barceló, Timo Gerres, Andrés Ramos Galán, Sébastien Huclin)

  The main objective of this line of research is to model and analyze possible scenarios of investment and operation of energy resources for the Spanish electricity system in the 2030-2050 horizon. More specifically, the objective is to evaluate the potential and role that each generation, storage and consumption technology can play in the future mix of the electricity system, identifying the factors and scenarios that are most critical for each one of them.

- **Optimal design of ATO driving parameters for Metro de Barcelona to Line 1 for new trains**
  Bombardier European Investments S.L.U. April 2020 - December 2023. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez, Gonzalo Sánchez Contreras)

  The objective of this project is the design and implementation of ATO speed commands in Line 3 of Metro de Barcelona to minimise the energy consumption of new trains in this line. These ATO speed commands are selected and sent to the train by the traffic regulation system in real-time. For each inter-station a set of 4 speed commands are designed, the flat out command and 3 commands parameterized basically by a coast point and a regulation speed.

- **Optimal design of ATO driving parameters for Metro de Barcelona to Line 1 for new trains**
  Bombardier European Investments S.L.U. April 2020 - December 2023. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez, Gonzalo Sánchez Contreras, Fernando Conde Montero)

  The objective of this project is the design and implementation of ATO speed commands in Line 1 of Metro de Barcelona to minimise the energy consumption of new trains in this line. These ATO speed commands are selected and sent to the train by the traffic regulation system in real-time. For each inter-station a set of 4 speed commands are designed, the flat out command and 3 commands parameterized basically by a coast point and a regulation speed.

- **Advanced generator of stochastic scenarios**
  Iberdrola Generación España, S.A.U. April 2020 - March 2023. (Andrés Ramos Galán, Jesús María Latorre Canteli, Jesús David Gómez Pérez)

  In this project a series of stochastic scenarios is obtained, adapted to the Iberian electric system, linked stochastically. Those scenarios allow the generation optimization in the medium term in an uncertain framework, especially by the variability of natural hydro inflows.

Besides, we model the Portuguese electric system, new hybrid hydro power plants, and new energy storage systems.

- **Traceable mechanical and electrical power measurement for efficiency determination of wind turbines**
  Dinnteco Spain S.L. September 2020 - September 2023. (María Ana Sáenz Nuño)

  New technologies for wind turbines are currently assessed in the field, are time-consuming to perform and highly affected by wind conditions. Shortening the time to market for these tests is one way to reduce costs and increase performance for this form of renewable energy. Indoor test benches can rapidly record a wide range of data but require accurate torque and rotational speed measurements which currently lack traceability to national standards and are difficult to make for torque measurements above 1.1 NMm.
  The project assess current methods and develop traceable methodology for torque measurements up to 5 MNm and rotational speeds up to 20 and 1600 revolutions per minute which covers the operational speeds on low-speed and high-speed shafts respectively. Standardised guidelines for traceably determining turbine efficiency on test benches developed along with new efficiency measurement methods for the electrical components of wind turbine nacelles. Project outputs give a better prediction of the energy output of proposed wind parks, provide greater certainty in investments opportunities and help accelerate the transition towards cleaner energy sources.

- **New 100% renewable, flexible and robust energy system for the integration of new generation, grid and demand-side technologies- Network Planning and reconfiguration**
  i-DE Redes Eléctricas Inteligentes, S.A.U. October 2020 - December 2023. (José Pablo Chaves Ávila, Fernando Emilio Postigo Marcos, Tomás Gómez San Román, Orlando Mauricio Valarezo Rivera, Carlos Mateo Domingo, Miguel Ángel Ruiz Hernández, Miguel Martínez Velázquez, Matteo Troncia)

  The main objective of the FLEXENER project is to research new technologies and simulation models in the field of renewable generation, storage systems and flexible demand management and distribution grid operation. The aim is to achieve a 100% renewable and decarbonised energy mix, effectively integrated into the electricity system of the future in a flexible, efficient and safe manner.
  This project supports the FLEXENER project by focusing on the challenges of distribution networks. The specific objective is to develop a series of tasks identified within the FLEXENER project:
  - Distribution grid flexibility solutions.
  - Analysis of requirements and simulations of future scenarios and their impact on the grid in the Iberian Peninsula.
  - Technological research into new markets, flexibility services and system regulation to achieve a 100% renewable energy mix with safe, efficient and clean energy.

- **New 100% renewable, flexible and robust energy system for the integration of new generation, grid and demand-side technologies- Technical studies of networks**
  Iberdrola Generación España, S.A.U. October 2020 - December 2023. (Luis Rouco Rodríguez, Francisco Miguel Echavarren Cerezo, Enrique Lobato Miguélez, Carlo de Paolis Robles)

  This project is part of the FLEXENER project. The main objective of the FLEXENER project is to investigate new technologies and simulation models in the field of renewable generation, storage systems and flexible demand management and operation of the distribution network. A 100% renewable and decarbonised energy mix is sought, effectively integrated into the electrical system of the future in a flexible, efficient and safe way. In this context, this project has been in charge of the assessment of the contribution to the stability of the Spanish mainlad system of the solutions developed in activities A2, A3 and A4.

- **New 100% renewable, flexible and robust energy system for the integration of new generation, grid and demand-side technologies-Technical studies of networks**
  I-DE Redes Eléctricas Inteligentes, S.A. October 2020 - December 2023. (Luis Rouco Rodríguez, Lukas Sigrist, Andrés Tomás Martín)

  This project is part of the FLEXENER project. The main objective of the FLEXENER project is to investigate new technologies and simulation models in the field of renewable generation, storage systems and flexible demand management and operation of the distribution network. A 100% renewable and decarbonised energy mix is sought, effectively integrated into the electrical system of the future in a flexible, efficient and safe way. In this context, this project has been in charge of the assessment of the contribution to the distribution grid to the system stability.

- **FLEXENER: New 100% renewable, flexible and robust energy system for the integration of new technologies in generation, networks and demand - Scenarios**
  Iberdrola Generación España, S.A.U. October 2020 - December 2023. (Michel Rivier Abbad, Tomás Gómez San Román, Álvaro Sánchez Miralles, Francisco Martín Martínez, Andrés Ramos Galán, José Pablo Chaves Ávila, Stefanía Gómez Sánchez, Leslie Herding, Teresa Freire Barceló)

  This project is part of the FLEXENER project. It corresponds to one of the activities of said project. The main objective of the FLEXENER project is to investigate new technologies and simulation models in the field of renewable generation, storage systems and flexible demand management and operation of the distribution network. A 100% renewable and decarbonised energy mix is ??sought, effectively integrated into the electrical system of the future in a flexible, efficient and safe way.
  In this context, this project or activity has been in charge of building future scenarios for 2030 that, based on the resources and technological equipment available at that time, determine an optimal mix of renewable generation

technologies, storage systems and energy management. the demand that allows covering the demand for electricity with sufficient guarantees of supply reliability.

These scenarios have served to feed other activities of the FLEXENER Project that analyze aspects of the detailed electrotechnical behavior of the electrical networks in these conditions to investigate the technical feasibility of the system and explore possible solutions to the technical problems they present.

- **FLEXENER: New 100% renewable, flexible and robust energy system for the integration of new technologies in generation, networks and demand - Market design**

  Iberdrola Generación España, S.A.U. October 2020 - December 2023. (Michel Rivier Abbad, José Pablo Chaves Ávila, Pablo Rodilla Rodríguez, Carlos Batlle López, Paolo Mastropietro, Paulo Brito Pereira, Shilpa Bindu, Matteo Troncia)

  This project is part of the FLEXENER project. It corresponds to one of the activities of said project. The main objective of the FLEXENER project is to investigate new technologies and simulation models in the field of renewable generation, storage systems and flexible demand management and operation of the distribution network. A 100% renewable and decarbonised energy mix is ??sought, effectively integrated into the electrical system of the future in a flexible, efficient and safe way.

  In this context, this project or activity has been in charge of designing configuration options for the electricity market that are adapted to the existence of a 100% renewable electricity system. The general configuration of the market has been analyzed (types of markets involved, their sequence, role of agents, type of agents), focusing in particular on capacity markets and balancing markets. The different options have been analyzed, identifying the advantages and disadvantages for a 100% renewable electricity system.

- **CEVESA: A long term planning model for investment decisions in electricity generation and transportation**

  Institute for Systems and Computer Engineering, Technology and Science (INESC TEC). November 2020 - November 2022. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

  CEVESA is a dynamic model with hourly chronology for planning the expansion of electricity generation in the Spanish and Portuguese electricity systems that considers both the investments made by customers in distributed energy resources from generation and storage (DER) and by generators in conventional plants of thermal generation, renewable and centralized storage (CR). It also represents the Spanish transport sector by including investment decisions in electric vehicles (PEV) and internal combustion motor vehicles (ICEV), taking into account the deployment of infrastructure, fuel and the social and environmental costs of both transport technologies. In turn, CEVESA models investments and hourly operation of hydrogen (H2) production plants in Spain to cover a daily demand for H2 that allows representing a penetration scenario of vehicles powered by H2 (H2EV) or a satisfied H2 demand by renewable generation for other industrial uses. It is also a multizonal model that considers marketsplitting to represent interzonal flows.

- **Flexible and efficient integration of CO2 generation technologies**
  Siemens Gamesa Renewable Energy Innovation & Technology S.L. January 2021 - December 2023. (Luis Rouco Rodríguez, Aurelio García Cerrada, Juan Luis Zamora Macho, Javier García Aguilar, Lukas Sigrist)

  This project will develop "fundamental models" for the design and analysis of wind-based generation technologies. Fundamental models are those derived from more detailed models that capture the most relevant dynamics of systems to be studied so that they can be included in the study of broader systems. These fundamental models will have various degrees of detail according to the purpose they will be intended for.

- **Enable New Occupant Seating Positions**
  Centre Européen d´Etudes de Sécurité et d´Analyse des Risques (CEESAR). March 2021 - June 2024. (Francisco José López Valdés, Jesús Jiménez Octavio, Alberto Carnicero López, Carlos Rodríguez-Morcillo García, Carmen María Vives Torres, Juan Manuel Asensio Gil, Manuel Valdano, Alessandra Porfido)

  The objective of the ENOP project is to generate reference data that can be used in the validation of HBMs and ATDs in new postures such as reclined postures and investigate new injury types, which might be expected in AV. To this end, 15 PMHS sled tests of 15 mid-sized males in five different seating positions is performed (three PMHS tests per condition, no repeat tests on the same PMHS). These seating positions include various degrees of reclined seat back and seat pan inclination angles.

- **Support to deployment of DRE solutions within the Rockefeller Foundation Call for Action and the Integrated Distribution Framework**
  Massachusetts Institute of Technology (MIT), Rockefeller Foundation. May 2021 - January 2023. (Fernando de Cuadra García, Carlos Mateo Domingo, Paolo Mastropietro, Santos José Díaz Pastor, José Ignacio Pérez Arriaga, Andrés González García, Pablo Dueñas Martínez, Varios General Contratado)

  This project is a collaboration between the MITei research team (in which the Comillas-IIT is a relevant partner) and the Rockefeller Foundation (RF) regarding the ongoing collaboration around the Global Commission to End Energy Poverty (GCEEP), and the development of a globally applicable Integrated Distribution Framework (IDF)
  The main areas of action of the project are:
  - Advancing IDF implementation aligned with the Call Action Plan for massive deployment of
  Distributed Renewable Electrification (DRE) solutions
  - Index measuring the progress towards a fully electrified and decarbonized economy for all
  Some of the tasks included in the IIT contributions to the project are:
  - Definition and implementation of computer models to analyse optimal electrification along time, in specific areas (several demand clusters related to the same feeder). Solutions include grid and off-grid options, uncertainty and multiple scenarios.
  - Analysis of the effects and promotion schemes for demand growth: C&I

customers, electric cooking or electric vehicles
- Definition of dynamic scenarios for demand, regulation and business models.
- Analysis of business models, policies, tariffs and subsidies.

- **Optimal design of ATO driving parameters in the branches of Valles Line of FGC**

  Siemens Rail Automation S.A.U. May 2021 - December 2023. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez, Manuel Blanco Castillo)

  The objective of this project is the design and implementation of efficient ATO speed commands in FGC railway line in Tarrasa and Sabadell branches. These ATO speed commands are selected and sent to the train by the traffic regulation system in real-time. The new ATO speed commands must comply with technical, operational and comfort restrictions and will minimise the energy consumption.

- **Training, innovation and development in Metrology**

  Universidad Nacional Educación a Distancia (UNED), FREMAP. May 2021 - July 2023. (María Ana Sáenz Nuño, Mª Rosa Salas Labayen, Mª Victoria Montes Gan, Olga Martín Carrasquilla)

  Projects typically small in duration or budget on metrology, including training, design, innovation for companies, etc.
  Consultancy on gamification and serious games for training applications in Higher Education and Business.

- **Experimental proof-of.concept of electromagnetic selfsensing scaffolds**

  Universidad Pontificia Comillas. September 2021 - December 2023. (Francisco Javier Herraiz Martínez, Javier Matanza Domingo, Yolanda Ballesteros Iglesias, Juan Carlos del Real Romero, Romano Giannetti, José Daniel Muñoz Frías, Miguel Monteagudo Honrubia)

  The main objective of the project is the development of a novel scaffolds technology. These scaffolds are resonant in the GHz band. Thus, they can be interrogated by an electromagnetic signal and used as sensors. Their response signal will be used to control the regeneration of the bone. Moreover, it could be useful for infections detectecion. In order to obtain such an ambitious goal, different novel technologies will be used. In partircular, additive manufacturing techniques and nanomaterials are proposed. Finally, a demonstrator of the whole system will be develop to evaluate the viability of the proposed technology.

- **New functionalities, automation and maintenance DESI and DESIEXT Models 2022**

  Endesa Medios y Sistemas S.L. January 2022 - December 2022. (Enrique Lobato Miguélez)

  New functionalities, automation and maintenance DESI and DESIEXT models 2022

- **Assistance and maintenance of Middle Office models**
  Endesa Medios y Sistemas S.L. January 2022 - December 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao, Varios General Contratado)

  This project between IIT and Endesa focuses on the assistance and maintenance of Middle Office tools VALORE (with its three users LPM, HEPLASE, and SEIE), OMEGA, ACUARIO-VEIMAO, AURIGA, and VALORE-CLOUD.

- **Development of a human like multibody model of a pedestrian**
  Siemens Industry Software NV. January 2022 - December 2022. (Francisco José López Valdés)

  1. Comillas carry out research work in which the behaviour of Madymo pedestrian models are reviewed and analysed against experimental data in order to demonstrate their level of validation. Following the review an improvement plan is made and the models are modified such that the correlation to human response improves. This work is reported to the project manager.
  2. The models' behaviour is validated against existing certification requirements

- **Improvements in Monte Carlo executions**
  Endesa Medios y Sistemas S.L. March 2022 - October 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

  This project focuses on a redesign of the methodology currently used in Monte Carlo simulations.

- **Improving Monte Carlo simulations in OMEGA**
  Endesa Medios y Sistemas S.L. March 2022 - October 2022. (Antonio Bello Morales, Pablo Rodilla Rodríguez, Diana María Navarrete Cruz)

  This project focuses on improving the methodology used in Monte Carlo simulations.

- **Improvements in the optionality of combined cycle power plants**
  Endesa Medios y Sistemas S.L. March 2022 - October 2022. (Antonio Bello Morales, Jenny Alexandra Cifuentes Quintero, Geovanny Alberto Marulanda García, Varios General Contratado, Diana María Navarrete Cruz)

  The objective of the project is to improve the quality of the representation of the optionality of the combined cycle power plants.

- **Improvements in the execution of VALORE: Unification with SEIE and hourly executions**
  Endesa Medios y Sistemas S.L. March 2022 - December 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

  The objective of this project is to improve the quality of forecasts by establishing a unified scheme for the different executions of the LPM and by

implementing a chronological hourly execution mode taking into account temporal couplings.

- **Simulation of the global gas market in the medium term**
  Enel Global Services Srl. April 2022 - November 2022. (Antonio Bello Morales, Pablo Rodilla Rodríguez, Paulo Brito Pereira, Varios General Contratado)
  The aim of this collaboration between IIT and Enel is to develop different improvements in SIMGAS to enable a more realistic representation of the global natural gas market in the medium term.

- **Adaptation of the treatment of outputs considering equiprobable scenarios**
  Endesa Medios y Sistemas S.L. April 2022 - October 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)
  The final objective of the project is to carry out different developments in order to improve the quality of the probabilistic forecasts that are made with VALORE in the Market Analysis Unit.

- **Migration of the GENsol solar scenario generator to the cloud environment**
  Endesa Medios y Sistemas S.L. April 2022 - December 2022. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)
  The primary aim of this project is the migration of the GENsol tool to the cloud environment. Taking as input the information published by the System Operator, this tool uses machine-learning techniques in order to generate solar production scenarios.

- **Development of a deterministic prediction model for residual demand curves in the secondary regulation market**
  Endesa Medios y Sistemas S.L. April 2022 - December 2022. (José Portela González, Antonio Muñoz San Roque, Alberto González Sánchez)
  The objective of the proposed collaboration is the development of a deterministic prediction model for residual demand curves in the secondary regulation market. The model will take into account the effect of existing regulatory regions as well as the adaptation to new regulatory changes.

- **Energy storage system modeling**
  Endesa Medios y Sistemas S.L. May 2022 - November 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Genérico Proyectista Ief)
  The final objective of the project is to carry out different developments in order to improve the quality of the forecasts by including daily storage systems in the simulations executed with VALORE in the Market Analysis Unit.

- **Improvements in the representation of renewable generation assets**
  Endesa Medios y Sistemas S.L. May 2022 - December 2022. (Antonio Bello Morales, Pablo Rodilla Rodríguez, Diana María Navarrete Cruz)

The final objective of the project is to carry out different developments in order to improve the quality of the representation of the renewable assets in Endesa's portfolio.

- **Improvements in the statistical modeling of the demand for natural gas and electricity in Spain, Portugal and France**
  Endesa Medios y Sistemas S.L. June 2022 - September 2022. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)

  The objective of this project is to improve the statistical models of the demand for electricity and natural gas in Spain, Portugal and France.

- **Simulation models of energy generation and consumption to promote changes in consumption habits and improve energy sustainability**
  Aristos Campus Mundus. June 2022 - June 2023. (José Pablo Chaves Ávila, Sara Lumbreras Sancho)

  To advance in energy sustainability, developing tools that promote the integration of renewable energies and favour consumption habits in the interests of greater efficiency. The objectives of the project are:
  1. Techno-economic analysis of the Univ. P. Comillas and Univ. de Deusto installations based on the historical data of these installations.
  2. To develop and validate simulation models of electricity generation and consumption and to disseminate the results through a joint publication in an impact journal.
  3. Apply AI techniques to analyse trends and predict consumption and design strategies to improve consumption habits and improve energy sustainability.
  4. Apply blockchain to energy communities. The results will be used for a joint publication in an impact journal.
  5. Proposal for the improvement of existing facilities based on the results obtained that will allow us to submit a proposal to a national competitive call for proposals.

- **Adaptation of the Montecarlo executions to the use of hydraulic production paths: Phase I**
  Endesa Medios y Sistemas S.L. June 2022 - December 2022. (Antonio Bello Morales, Geovanny Alberto Marulanda García)

  The final objective of the project is to carry out different developments in order to improve the quality of the forecasts by adapting VALORE to a new consideration of hydraulic management and its associated uncertainty in the model.

- **Extension of dry rail dispersion factors Kdry calculation for the on-board ERTMS system configuration**
  Patentes Talgo S.L.U. June 2022 - October 2022. (Adrián Fernández Rodríguez, Asunción Paloma Cucala García, Antonio Fernández Cardador)

  In this project a new software tool is developed for the calculation of the dry rail dispersion factors (Kdry) to be configured in the on-board ERTMS systems. The tool uses Montecarlo method to obtain the variability in the braking curve

as a function of the uncertainty in the application of the different train braking systems.

- **Output management of CODEX optimization model**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Efraim Centeno Hernáez, Luis Jesús Fernández Palomino)

  The final objective of the project is to carry out different developments in order to improve the quality of the long-term forecasts made with CODEX in the changing environment of MIBEL and the European integrated electricity market. This task focuses on aspects such as the electric car, demand management and the energy use of hydrogen.

- **Output management of CODEX optimization model**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Efraim Centeno Hernáez, Luis Jesús Fernández Palomino)

  The final objective of the project is to carry out different developments in order to improve the quality of the long-term forecasts made with CODEX in the changing environment of MIBEL and the European integrated electricity market. The developments of this task aim to improve the representation of the market in contexts with possible schemes different from the current one.

- **Improvements in the medium- and long-term modeling of the demand for natural gas and electricity in Spain, Portugal and France**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)

  The main objective of the project is to carry out the necessary developments to improve the forecasts generated with MoDEM in the medium-long term, by including the fundamental modeling of certain aspects of demand.

- **Integration of generic dynamic models of conventional generation, loads and RES in the dynamic model of CE grid**
  ENTSO-e. September 2022 - September 2023. (Lukas Sigrist, Illia Diahovchenko, Luis Rouco Rodríguez)

  The aim of the project is the development of methodologies and tools for the integration of generic dynamic models of conventional power generation, loads and RES in a grid model of CE.

- **SIROCO-Offers for the new secondary reserve market in the Spanish and Portuguese electricity systems**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Francisco Alberto Campos Fernández, José Portela González)

  The objective of the project is to design and implement in SIROCO-Offers tool an algorithm for generating offers for the new secondary regulation service in the Spanish and Portuguese peninsular electricity system, in the context of the implementation of the Electricity Balance Directive (EU) 2017/2195.

- **CODEX: Modeling new technologies**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Francisco Alberto Campos Fernández, Luis Alberto Herrero Rozas)

  The objective of this task is the modeling in CODEX of demand management and EV, and to improve the modeling of energy vectors such as hydrogen.

- **CODEX: Adaptation to non-marginalistic markets**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Francisco Alberto Campos Fernández, Luis Alberto Herrero Rozas)

  The objective of this task is to review different alternatives that can be proposed to redefine the functioning of the electricity market and theoretically propose models that can adequately represent them, flexible enough to adapt to different price setting schemes that are proposed with the aim of implementing them in CODEX

- **Design of reliability options for the Spanish electricity market**
  Iberdrola S.A. September 2022 - February 2023. (Paolo Mastropietro, Pablo Rodilla Rodríguez, Michel Rivier Abbad, Carlos Batlle López)

  Reliability options are a kind of reliability product to be traded in a capacity remuneration mechanism that show several benefits in comparison to other products, especially in terms of reduced interference with short-term markets. At a time in which the role of capacity mechanisms is envisioned to grow, several experts signalled reliability options as a potential reference for the European Internal Energy Market. This project presents a comprehensive analysis of all the design elements of reliability options, listing possible alternatives for each of them, taking advantage of the international experiences of those systems that intrduced reliability options in the past (Colombia, ISO New England, Ireland, Italy, and Belgium). The project also assesses the potential interaction the reliability options may have with other measures that are being discussed in the framework of a possible reform of the European electricity market.

- **3D scanning techniques as a tool for monitoring the evolution of venous leg ulcers**
  Universidad Pontificia Comillas. September 2022 - December 2023. (Ana María Megía Macías, Silvia Fernández Villamarín)

  The crossover between engineering and medicine is a field of enormous possibilities. This scientific project is about to change the way we approach the assessment of the evolution of chronic open ulcers. The main objective of this project is to evaluate the ability of typical engineering tools such as photogrammetry to be used to measure the evolution of chronic ulcers. Specifically, this new method is used to evaluate the effectiveness of cold atmospheric plasma treatment compared to traditional methods.
  Photogrammetry, a precise three-dimensional measurement technique, enable researchers to obtain objective data on the surface area, volume and other critical parameters of ulcers. This approach, combined with medical expertise, make it possible to establish essential correlations between treatment and

wound evolution. This multidisciplinary approach demonstrates the synergy between engineering and medicine to address complex medical challenges.
If the results support the efficacy of cold atmospheric plasma treatment, it could represent a significant advance in chronic ulcer care, with the potential to dramatically reduce healing times. Furthermore, this project not only highlights the importance of collaboration between disciplines, but also points to the critical role of precision engineering in medicine, leading the way h

- **Computational analysis of the effectiveness of a cervical airbag for cyclists**
  EVIX FIRM S.L. September 2022 - December 2022. (Francisco José López Valdés, Carmen María Vives Torres)

  Partnership proposal between Comillas ICAI and EVIX FIRM S.L. (EVIX) to analyze the effectiveness of a cervical airbag intended to prevent hyperextension and lateral flexion neck injuries in cyclists

- **Secondary voltage regulator for synchronous generators**
  Bahía Bizkaia Electricidad, S.L. September 2022 - September 2023. (Luis Rouco Rodríguez, Ignacio Egido Cortés, Álvaro Benítez Domínguez)

  This project is aimed ta supplying a licence of the secondary voltage regulator of synchronous generators developed by IIT. In addition, IIT will provide technical assistance for the integration of the regulator in the SCADA of BBE.

- **Critical assessment of the impact of vehicle technical inspections**
  CITA aisbl. November 2022 - December 2022. (Francisco José López Valdés, Luis Francisco Sánchez Merchante)

  The objective of the study is to qualitatively assess the methodologies used in published analyses of the effectiveness of vehicle technical inspections in the reduction of collisions, fatalities and injuries.
  The underlying hypothesis is that existing studies arrive at different estimates of effectiveness due to, at least, one of the following:
  - The data used in the assessment is not detailed enough to detect the effect (lack of detailed enough data)
  - The size of the sample is not large enough to detect the effect (lack of statistical power)
  - The methodology used is not appropriate to detect statistically significant results.

- **Voltage control system of the transmission grid**
  Red Eléctrica de España, S.A.U. November 2022 - November 2023. (Luis Rouco Rodríguez, Enrique Lobato Miguélez, Ignacio Egido Cortés, Álvaro Benítez Domínguez)

  The main objetive of the project is to investigate the feasibility of controlling the voltages of the transmission grid with a tertiary proportional control system implemented at power plant level. In addition, it will be investigated the feasibility of secondary PI control system of pilot buses.

- **Detection of abnomal operation of bus power balance**
  Endesa Generación, S.A. November 2022 - November 2023. (Luis Rouco Rodríguez, Miguel Ángel Sanz Bobi, David Domínguez Barbero, Eloy Jesús del Gran Poder Insunza Díaz)

  This project is aimed at developing a tool for detecting the abnormal operation of bus power balance. Such abnormal operation can arise from measurement transformers and watt meters.

- **Correlation of biometric data with cognitive and emotional states in vehicle interior scenarios and investigation of corrective stimuli and advanced control functions**
  Grupo Antolin Ingeniería S.A.U. December 2022 - October 2024. (Álvaro Jesús López López, Berta Ruiz González)

  The objective of the project is to develop cognitive models specialized in analyzing a series of variables related to the state of health of the occupants of a vehicle.
  The models developed are based on data of a heterogeneous nature that may well have been collected in real scenarios or generated synthetically.

- **ATMOSPHERE. New methodologies for the storage, generation and safety of green hydrogen plants**
  Iberdrola Energía España S.A.U. December 2022 - June 2025. (Andrés Ramos Galán, Jesús María Latorre Canteli, Juan Francisco Gutiérrez Guerra, Pedro Sánchez Martín)

  In the project, a model is developed that determines the optimal sizing of the electrolyzers for the production of green hydrogen for industrial applications, which are hybridized together with hydrogen and electricity storage equipment, and renewable electricity production sources and all of this is connected to the national electricity grid.

Project of the Science and Innovation Missions Program 2022 of the State Program to Catalyze Innovation and Business Leadership of the State Plan for Scientific Research and Innovation 2021-2023 within the framework of the Recovery, Transformation and Resilience Plan financed by the Ministry of Science and Innovation (MIG-20221006)

- **Voltage control system with renewable generation**
  Iberdrola Renovables Energía, S.A.U. December 2022 - February 2023. (Luis Rouco Rodríguez)

This project will determine the capabilities of Iberdrola's power park modules to fulfill the requirements of the draft of the Operational Procedure 7.4 on the voltage control of the transmission grid.

- **CODEX: Improving the renewable generation and the European market modelling**
  Endesa Medios y Sistemas S.L. January 2023 - July 2023. (Francisco Alberto Campos Fernández, Luis Alberto Herrero Rozas)
  The objective of this task is to improve the modeling in CODEX of the European market and specifically the representation of the hydro and nuclear generation, and reducing execution times.

- **Assistance and maintenance of Middle Office models**
  Endesa Medios y Sistemas S.L. January 2023 - December 2023. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)
  This project between IIT and Endesa focuses on the assistance and maintenance of Middle Office tools VALORE (with its three users LPM, HEPLASE, and SEIE), OMEGA, ACUARIO, AURIGA, and VALORE-CLOUD.

- **ENDESA Chair for applications of artificial intelligence to data-driven maintenance**
  Endesa Generación, S.A. January 2023 - December 2026. (Miguel Ángel Sanz Bobi, Antonio Muñoz San Roque, Francisco Javier Bellido López, Eugenio Francisco Sánchez Úbeda)
  The main goal of the Chair is to help ENDESA, in particular, and the energy sector in general, to take advantage of the opportunities offered by Artificial Intelligence by generating knowledge and disseminating it to society. Its main objectives are to investigate and share AI applications in the Maintenance and Management of generation assets to facilitate the energy transition towards a long-term sustainable model following the Sustainable Development Goals.

- **Silver Economy Tracker in Europe**
  Centro de Investigación Ageingnomics. January 2023 - July 2023. (Elisa María Aracil Fernández, David Roch Dupré, Pablo Calvo Báscones)
  This project aims to measure, for all European countries, the advancement and progress of the silver economy using the Silver Economy Tracker methodology, proposed by the research team in previous works.

- **ATMOSPHERE. New methodologies for the storage, generation and safety of green hydrogen plants**
  Innomerics S.L. January 2023 - June 2025. (José Portela González, Alejandro Polo Molina)
  The project consists in the construction of a digital twin of a green hydrogen production plant and its validation with real operation data. IIT contributes in the development of the library of mathematical models representative of the different elements that constitute an industrial green hydrogen production plant

and in the subsequent integration of these models with scientific machine learning algorithms, in order to merge models based on physical equations with operational data using machine learning techniques.
In addition, IIT approaches the definition of the input data for the design of heat networks to take advantage of the waste heat from hydrogen production plants, as well as in their storage format and in the research of the algorithms for the calculation of the necessary models.
Project of the Science and Innovation Missions Program 2022 of the State Program to Catalyze Innovation and Business Leadership of the State Plan for Scientific Research and Innovation 2021-2023 within the framework of the Recovery, Transformation and Resilience Plan financed by the Ministry of Science and Innovation (MIG-202210

- **Specification of the Planning and Rescheduling modules of a TMS for Mass Transit (CBTC)**
  CAF SIGNALLING S.L. February 2023 - February 2025. (Asunción Paloma Cucala García, Antonio Fernández Cardador, Adrián Fernández Rodríguez)

  The objective of this project is the specification of the Planning and Rescheduling modules of a TMS (Traffic Management System) for Mass Transit (CBTC).

- **Excom-Siroco Planning: Adaptation to the new Secondary Regulation Service**
  Endesa Medios y Sistemas S.L. March 2023 - May 2023. (Javier García González, Álvaro García Cerezo)

  The general objective of the project is to make the necessary developments so that the production version of the Excom-Siroco Planning model (ExSp) allows for separate consideration of market revenues from the upward and downward reserves auctions in the optimization process, in order to adapt the tool to the new design of the Secondary Regulation Service.

- **EXCOM: Adjustment of the scheduling of thermal units**
  Endesa Medios y Sistemas S.L. March 2023 - April 2023. (Javier García González)

  The general objective of the project is to carry out the necessary developments to ensure compliance with the minimum up&down time constraints, as well as compliance with the commitment requirements derived from the technical constraint market.

- **Generalisation of sensitivity studies in VALORE**
  Endesa Medios y Sistemas S.L. March 2023 - July 2023. (Antonio Bello Morales, Geovanny Alberto Marulanda García)

  This proposal focuses on implementing a new methodology in the VALORE Monte Carlo tool that allows to calculate price sensitivities with respect to different risk variables.

- **New functionalities, automation and maintenance DESI and DESIEXT Models 2022**
  Endesa Medios y Sistemas S.L. March 2023 - August 2023. (Enrique Lobato Miguélez)
  New functionalities, automation and maintenance DESI model 2023

- **Generalisation of sensitivity studies in OMEGA**
  Endesa Medios y Sistemas S.L. March 2023 - July 2023. (Antonio Bello Morales, Diana María Navarrete Cruz)
  This project aims to implement a new methodology for calculating sensitivities in OMEGA of the gas market price to changes in demand, gas supply costs and gas diversion costs.

- **Improvements in the representation of renewable generation assets**
  Endesa Medios y Sistemas S.L. March 2023 - April 2023. (Antonio Bello Morales, Pablo Rodilla Rodríguez, Paulo Brito Pereira)
  The final objective of the project is to carry out different developments in order to improve the quality of the representation of the renewable assets in Endesa's portfolio.

- **Improvement of demand and renewable production representation**
  Endesa Medios y Sistemas S.L. March 2023 - July 2023. (Efraim Centeno Hernáez, Luis Jesús Fernández Palomino)
  The final objective of the project is to carry out different developments in order to improve the quality of the long-term forecasts that are made with CODEX in the changing environment of MIBEL and the integrated European electricity market. In particular, the improvements during the year 2023 are focused on the updated representation of the profiles of renewable energies, demand and on expanding the representation of the European system.

- **Improvement of european electricity market representation**
  Endesa Medios y Sistemas S.L. March 2023 - December 2023. (Efraim Centeno Hernáez, Luis Jesús Fernández Palomino)
  The final objective of the project is to carry out different developments in order to improve the quality of the long-term forecasts that are made with CODEX in the changing environment of MIBEL and the integrated European electricity market. In particular, the improvements during the year 2023 are focused on the updated representation of the profiles of renewable energies, demand and on expanding the representation of the European system.

- **Design and implementation of an algorithm for power line protection under high penetration of renewables**
  Gas y Electricidad Generación S.A. April 2023 - December 2023. (Antonio Muñoz San Roque, Luis Rouco Rodríguez, Lukas Sigrist, José Portela González)
  The objective of this project is the design and implementation of an algorithm for the protection of power lines in conditions of high penetration of RES.

The proposed algorithm is based on the application of Machine Learning techniques for the detection and classification of faults based on a set of fault scenarios obtained both from real records and through simulation.

- **Energy storage methods in railway systems**
  Union Internationale des Chemins de Fer (UIC), ADIF, Infrabel, Network Rail, RFI. April 2023 - March 2025. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez, María Domínguez Gago)

  The goal of the project is to provide a decision-making tool based on simulation, and guidance to assist infrastructure managers when planning to increase the energy efficiency of railway stations by using the energy regenerated in braking trains by means of Energy Storage Systems located in stations.
  This goal of the project is decomposed into three specific objectives: (1) to study the latest and different technologies in energy storage that could be suitable for this application; (2) to develop a decision software tool based on simulation to analyse the best ESS solution for each station type, based on its consumption and traffic; (3) to develop an IRS (International Railway Solution) draft on the implementation of ESS technologies in railway stations to make them more sustainable.

- **EXLA: Maximum flow rate limitation based on volume for PQV plane representation**
  Endesa Medios y Sistemas S.L. April 2023 - May 2023. (Javier García González)

  The overall objective of the project is to carry out the necessary developments to ensure that the modeling of production curves using the plane approximation guarantees compliance with maximum flow rate limits, as well as to extend this methodology to an additional subsystem to analyze the suitability of extending this approach to the rest of the subsystems.

- **Adaptation of the Montecarlo executions to the use of hydraulic production paths: Phase II**
  Endesa Medios y Sistemas S.L. May 2023 - July 2023. (Antonio Bello Morales, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

  The final objective of the project is to carry out different developments in order to improve the quality of the forecasts by adapting VALORE to a new consideration of hydraulic management and its associated uncertainty in the model.

- **Improvements in VALORE execution: Hourly executions and P48**
  Endesa Medios y Sistemas S.L. May 2023 - December 2023. (Antonio Bello Morales, Luis Manuel Montero Guirao, Geovanny Alberto Marulanda García)

  The purpose of this project is to improve the quality of forecasts made with VALORE by implementing a chronological hourly execution mode that takes into account temporal couplings, reengineering the optimization process associated with P48, and making modeling improvements regarding renewable

energy spills. Additionally, there is a plan to optimize the resources required to size the Cloud containers based on different execution typologies.

- **Improvements in the temporal representation**
  Endesa Medios y Sistemas S.L. May 2023 - December 2023. (Antonio Bello Morales, Pablo Rodilla Rodríguez, Paulo Brito Pereira, Varios General Contratado)

  This project aims first to improve the time representation in ACUARIO and then to address further improvements in asset optionality (thanks to greater detail and granularity) and regulatory aspects to bring them in line with market reality.

- **Migration of the wind scenario generator to the cloud environment**
  Endesa Medios y Sistemas S.L. May 2023 - July 2023. (Antonio Bello Morales, Geovanny Alberto Marulanda García)

  The main objective of this project is the migration of the wind scenario generator to the cloud environment. This tool uses a set of models based on machine learning techniques to make probabilistic predictions of wind power production in the medium term.

- **EXVAL: Change in the time horizon for the hydro setpoints and inclusion of constraints per turbine**
  Endesa Medios y Sistemas S.L. May 2023 - July 2023. (Javier García González)

  The overall goal of the project is to carry out the necessary developments to extend the time horizon in the calculation of water value curves, as well as to include additional constraints by hydraulic groups to obtain more realistic outcomes.

- **Parameter estimation of turbine-governor systems of Lanzarote-Fuerteventura generators**
  Endesa Generación, S.A. June 2023 - October 2023. (Luis Rouco Rodríguez, Lukas Sigrist)

  The objective is to estimate the parameters of the turbine-governor systems of Lanzarote-Fuerteventura generators. A tool for parameter tuning of excitation and turbine-governor system models already developed for Endesa by IIT are used. The parameters of 28 generators are estimated.

- **Development of a multi-axis control system for test machines and systems**
  S.A. Española Ibertest. June 2023 - May 2026. (Juan Luis Zamora Macho, Aurelio García Cerrada)

  The aim of this project is to develop and program an application that automates all the control tasks of an industrial testing machine. The proposed system must allow all kinds of tests, both static and dynamic, whether single-axis or multi-axis. In addition, it must incorporate all the auxiliary functions required to facilitate its commissioning.

- **Improvements in the medium-term probabilistic modeling of the demand for natural gas and electricity in Spain, Portugal and France**
  Endesa Medios y Sistemas S.L. June 2023 - September 2023. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)

  The main objective of the project is to carry out the necessary developments to improve the forecasts generated with MoDEM in the medium term, by including aspects such as self-consumption, cogeneration or gas prices.

- **Review and improvements in the probabilistic modeling of the demand for natural gas and electricity in Spain, Portugal and France**
  Endesa Medios y Sistemas S.L. June 2023 - July 2023. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)

  The objective of this project is to review and improve the probabilistic models for medium-term forecasting of the demand for electricity and natural gas in Spain, Portugal and France.

- **Analysis of the biofidelity of the cervical spine of the PIPER human body model**
  L'Inglesina Baby S.p.A. June 2023 - March 2024. (Francisco José López Valdés, Manuel Valdano)

  The objective of the study is to assess the biofidelity of the cervical spine of the human body model (HBM) PIPER for children around 2 years old.
  The study will:
  - Scale the PIPER HBM to the adequate anthropometry of the individuals with ages 2-4 years old reported in the paper by Ouyang et al. (2005)
  - Isolate the head and neck of the HBM and reproduce the boundary conditions of the test setup described in the aforementioned paper.
  - Compare the response of the scaled PIPER model with the experimental curves reported in the paper.
  - Optimize the values of the material properties of ligaments and intervertebral discs of the HBM so that the response of the model matches the experimental results reported in Ouyang et al. (2005).

- **Improvements in the executions with hourly detail**
  Endesa Medios y Sistemas S.L. July 2023 - December 2023. (Antonio Bello Morales, Luis Manuel Montero Guirao)

  This project is dedicated to enhancing the accuracy of future forecasts by implementing various advancements in VALORE-HEPLASE, specifically focusing on executions with hourly precision.

- **Analysis of the role of pumped-hydro power plants within the framework of the PNIEC in 2030**
  Iberdrola Energía España S.A.U. July 2023 - October 2023. (Andrés Ramos Galán, Pedro Linares Llamas, José Pablo Chaves Ávila, Michel Rivier Abbad, Tomás Gómez San Román)

  Report on the analysis of the role played by pumping within the framework of the 2030 PNIEC draft.

- **CODEX: Improving the renewable generation and the European market modelling**
  Endesa Medios y Sistemas S.L. August 2023 - December 2023. (Francisco Alberto Campos Fernández, Luis Alberto Herrero Rozas)

  The objective of this task is to implement in CODEX alternative methods of representing variables of interest in the long term, among which they are the wind, solar and demand profiles.

3.2.1.2 Public funding

- **Programa Microrredes Inteligentes Comunidad de Madrid**
  Comunidad de Madrid, Fondo Social Europeo, Fondo Europeo de Desarrollo Regional. January 2019 - April 2023. (Aurelio García Cerrada, David Domínguez Barbero, Ramón Rodríguez Pecharromán, Carlos Rodríguez-Morcillo García, Pablo Frías Marín, Jaime Boal Martín-Larrauri, Javier Matanza Domingo, Álvaro Sánchez Miralles, Lukas Sigrist, Francisco Javier Renedo Anglada, Pablo García González, Asunción Paloma Cucala García, Antonio Fernández Cardador, Luis Rouco Rodríguez, Andrés Tomás Martín, Javier García González)

  PROMINT will investigate several aspects of the deployment of smart micro-grids in urban environments: generation, energy recovery, electric vehicles, peer-to-peer communications and machine learning applied to data collection and analysis. Specific objectives are:
  1. Design, simulation, communication architecture evaluation in distributed energy systems working as micro-grids.
  2. Study of hybrid AC-DC urban micro-grids.
  3. Energy recovery and recycling from urban railway systems in urban micro-grids.
  4. Generation management of micro-grids.
  5. Machine learning applied to micro-grids, electric vehicles and energy management.

  Program of R&D activities among Research Groups of “Comunidad de Madrid” in Technology 2018, funding by Comunidad de Madrid and co-funding by European Social Fund and European Regional Development Fund, 2014-2020.

- **Transport and policies for the transition to a low-carbon economy in Spain**
  Ministerio de Ciencia e Innovación (MCI), Agencia Estatal de Investigación (AEI), Fondo Europeo de Desarrollo Regional (FEDER). January 2019 - September 2022. (Pedro Linares Llamas)

The transport sector has become one of the fundamental sectors in fighting against climate change. The great importance of emissions in this sector (responsible for 14% of global greenhouse gas emissions as well as significant emissions of local pollutants) makes it paramount to accelerate the energy transition process. This requires transforming existing mobility policies, among other things, by facilitating the transition from combustion to electric vehicles.
This transformation process must begin both at a local level with new strategies for environmental sustainability and urban mobility as well as at the state and regional level to penalize the use of polluting vehicles, subsidize the acquisition of clean vehicles and implement tax reforms incorporating environmental criteria. These new policies must be approached from different perspectives. Reforms are required to keep pace with the long and short-term transition in the private vehicle market. It is equally important to establish compensatory mechanisms to avoid the distribution of a disproportionately large share of the costs of these policies to certain population groups.
Within this context, this project aims to study the policies required to deal with this transition in Spain in the short-term, both by reforming fuel and vehicle registration taxes as well as promoting energy efficient vehicles. This project is therefore structured in three lines of work that are interrelated but also relatively independent. The first of them, based on the analysis of the current situation of private residential transport in Spain, will analyze the environmental, tax and distributive impacts on Spanish households of the tax reform on fuel and vehicle registration; it will study the impact of modifying tax rates and consider different recycling alternatives of additional income/revenue that could/might compensate the possible regressive effects of the reforms. The second line of work aims to develop a homogeneous database on mobility in Spain that could expand the current energy-environmental models to include the transport sector at a level of detail that would allow us to identify the most efficient policies in the area within the context of a broad energy transition. Last but not least, the third line of work will analyze the capacity of various public policies to promote energy-efficient cars in the Spanish market.
The results of the above-mentioned lines of work may contribute to an informed design and evaluation of foreseeable reforms in public transport policies in Spain, to be undertaken in the coming years, in line with the objectives and proposals put forward by the EU.

Project RTI2018-093692-B-I00 funded by Ministerio de Ciencia e Innovación (MCI), Agencia Estatal de Investigación (AEI) and Fondo Europeo de Desarrollo Regional (FEDER)

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- **IELECTRIX - Indian and European Local Energy CommuniTies for Renewable Integration and the Energy Transition (Horizon 2020. Grant agreement No. 824392)**

  European Commission. May 2019 - October 2022. (Rafael Cossent Arín, Pablo Frías Marín, Carlos Mateo Domingo, Fernando Emilio Postigo Marcos, Nicolás Mariano Morell Dameto, Mauricio Correa Ramírez, Luca De Rosa, Francisco Javier Renedo Anglada, Lukas Sigrist, Leandro Lind, Leslie Herding, Néstor Rodríguez Pérez)

  An increasing role is foreseen in Europe for local energy communities (LECs) to speed up the grid integration of RES. Today, the enabling role of DSOs in support of LECs is hampered by a lack of flexibility when planning cost-efficient LEC connections to their network at MV level, and by a lack of digitalization of the LV networks to make LEC's smart prosumers benefit economically when serving the DSO flexibility needs. Four European DSOs (E.ON, ENEDIS, E.DIS, Güssing Stadtwerke) and an Indian DSO (TATA) have joined with IT-based, innovative product and solution providers, and technology and research centers, to demonstrate the combined roles of innovative functionalities serving the MV and LV networks, when implemented in 5 different regulatory regimes (Austria, France, Hungary, Germany, India- state of Delhi-).
  The joint work of DSOS aims at accelerating scaling up and replication tested by HEDNO (Greece) and E.ON (Sweden). Dissemination towards players of the energy value chain recommends business models, possible regulatory adjustments and deployment roadmaps of the most promising use cases, in support of the implementation of the Clean Energy Package.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824392

- **OPEN_ENTRANCE. Open energy transition analyses for a low-carbon economy (Horizon 2020. Grant agreement No. 835896)**

  European Commission. May 2019 - April 2023. (Luis Olmos Camacho, Sara Lumbreras Sancho, Andrés Ramos Galán, Michel Rivier Abbad, Erik Francisco Alvarez Quispe, Stefanía Gómez Sánchez)

The primary objective of Open ENTRANCE is to contribute to an improved and robust understanding of the transition to a low carbon energy system in Europe by developing, demonstrating and using an Open platform. The platform will be populated with a suite of open 1) integrated modelling tools and a common database including all necessary data for conducting among other scenario building exercises and macro-economic analyses of pathways to a low-carbon energy system at regional, national and pan-European level.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 835896

- **Island system operation with high degree of renewable energy resources (RTI2018-100965-A-I00)**
  MCIN/ AEI/10.13039/501100011033/ "FEDER Una manera de hacer Europa". September 2019 - September 2022. (Lukas Sigrist, Enrique Lobato Miguélez, Mohammad Rajabdorri, Luis Rouco Rodríguez, Francisco Miguel Echavarren Cerezo)

  This projects jointly addresses the operation planing and frequency stability. Both problems are intimately related in island power systems and operation planing taking into account frequency stability and its associated dynamics can lead to stabler and more efficient operation. Real island systems will be used to validate the methods developed.

Grant RTI2018-100965-A-I00 funded by MCIN/AEI/ 10.13039/501100011033 and by "ERDF A way of making Europe".

- **EUniversal - Market enabling interface to unlock flexibility solutions for cost-effective management of smarter distribution grids (Horizon 2020. Grant agreement No. 864334)**
  European Comission. February 2020 - July 2023. (Rafael Cossent Arín, Tomás Gómez San Román, José Pablo Chaves Ávila, Mauricio Correa Ramírez, Nicolás Mariano Morell Dameto, Leslie Herding, Orlando Mauricio Valarezo Rivera, David Ulrich Ziegler, Matteo Troncia, Luca De Rosa, Néstor Rodríguez Pérez, Eliana Carolina Ormeño Mejía)

  The present context shows the potential of electricity grids to lead the energy system transition as long as new solutions deal with the challenges related to flexibility solutions, grid observability and controllability, market mechanisms and interoperability in a holistic way. The new solutions need to cover the technological aspects by linking smart and integrated services and tools for distribution grid with market mechanisms. This architecture will guarantee a significant impact on the environment and society.
  The project consortium accepted this challenge and will develop “EUniversal Project” which will enable the transformation of the electricity grid by resolving existing limitations in the energy system through the introduction of a Universal Market Enabling Interface (UMEI). Through this concept, grids will become capable of accommodating all future scenarios through the active use of grid services, acting as an extensive toolbox of flexibility solutions and innovate market mechanisms.
  The primary goal of EUniversal is to enable the transformation of the energy system into a new multi-energy and multi-consumer concept guaranteeing a sustainable, secure and stable manner of electricity supply by bringing forward an universal, adaptable and modular approach through a Universal Market Enabling Interface (UMEI) to interlink active system management with electricity markets and the provision of flexibility services, taking also into consideration the activation needs and the coordination requirements with both commercial parties and TSOs. To do so, EUniversal will define, develop and validate a set of market-oriented flexibility management services from DER in a real environment, under a large RES integration and high electrification scenario.
  In order to demonstrate the services generated in the development phase of the project, 3 different DEMO sites (located in Portugal (PT), Germany (DE) and Poland (PL)) will be run to validate the project solutions.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 864334

- **Distribution network design of U.S. districts in the URBANopt platform**
  National Renewable Energy Laboratory (NREL), U.S. Department of Energy. February 2020 - December 2022. (Carlos Mateo Domingo, Tomás Gómez San Román, Luca De Rosa)

  The objetive of the URBANopt Grid-Interactive Efficient Building (GEB) Modeling Toolkit, is to model efficient, connected and smart building with a portfolio of interoperable technologies that can adjust demand up or down and shift, store, or dispatch electric load in response to grid and building needs. In this project the U.S. Reference Network Model (RNM-US) is integrated into the URBANopt platform in order to design the distribution network of districts, to be able to analyze the interaction between the buildings and the distribution network, taking into account distributed energy resources.

- **ATTEST. Advanced Tools Towards cost-efficient decarbonisation of future reliable Energy SysTems. (Horizon 2020. Grant agreement No. 864298)**
  European Commission. March 2020 - February 2023. (Miguel Ángel Sanz Bobi, Carlos Mateo Domingo, Pablo Calvo Báscones, Gopal Lal Rajora, Rafael Palacios Hielscher, Rafael Cossent Arín, Eugenio Francisco Sánchez Úbeda, José Portela González, David Domínguez Barbero)

  The objective of the ATTEST project is to develop and operationalize a modular open source toolbox comprising a suite of innovative tools to support TSOs / DSOs operating, maintaining and planning the energy systems of 2030 and beyond in an optimised and coordinated manner, considering technical, economic and environmental aspects. The consortium, from six EU countries, that has been assembled to deliver ATTEST consists of five highly experienced research organisations in the energy systems area, two utilities that manage and operate the transmission system and the distribution system in Croatia, and two industry partners that specialise in the development of advanced ICT solutions and SCADA systems. The development of this broad spectrum of energy-related ICT tools and the utilization of next generation algorithms, demonstrated in a real world environment has not been attempted before. The outputs from the ATTEST project will enable accelerated dissemination, by a wide range of research institutions, within and outside of the project consortium, of the tools that will help TSOs and DSOs to better manage their networks. The demonstration of the results of the project will be valuable for the scientific community and EU energy industry and attest to the relevance of the solutions developed. The ATTEST's ambition is to enable a wide range of users to utilize and test the tools developed in the project, thereby contributing to spread knowledge and experience in the energy systems community in the EU and on a global scale. This will contribute significantly to addressing not only the specific challenges of the call and the Horizon 2020 Energy Work Program, but also those of the EU's Energy Union strategy and the 2020 Climate & Energy package.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864298

- **RC4ALL: Responsible consumption for all**
  Ministerio de Ciencia e Innovación (MCI), Agencia Estatal de Investigación (AEI). May 2020 - December 2023. (Eugenio Francisco Sánchez Úbeda, Antonio Muñoz San Roque, José Portela González, Ignacio Navas Pascual, Francisco Rodríguez Cuenca)

  The main objective of the RC4ALL project (Responsible Consumption for All) is to develop a system that, based on the specific information on consumption per device of a relatively small number of representative customers and complementing it with information from external sources, is capable of generating personalized recommendations that improve the efficiency of consumption for the entire customer base of the company. Machine Learning and Big Data techniques will be used.

  Project Retos- Colaboración RTC2019-007380-3 funded by Ministerio de Ciencia e Innovación (MCI) and Agencia Estatal de Investigación (AEI)

- **Biophysics of immune response: receptors, cells and populations**
  Ministerio de Ciencia e Innovación (MCIN), Agencia Estatal de Investigación (AEI), 10.13039/501100011033. June 2020 - February 2024. (Mario Castro Ponce, Angela Jiménez Casas, Alberto Carnicero López, Miguel García Sánchez)

  The immune response involves multiple stages operating at different spatial and temporal scales. In recent years there has been increasing recognition of the role of physical processes in the effectiveness of the response, starting with the region of physical contact between cells (the so-called immunological synapse). In general, it is not possible to speak of the immune response at a scale but an interaction between scales. On the other hand, although the exact molecular structure of the T cell receptor was discovered in August 2019, this knowledge does not fully determine the immune response as it is a dynamic process out of equilibrium, which requires the use of the traditional tools of statistical physics. The central objective of the project is to quantify through modeling, simulation, and data analysis the role of the biophysical aspects of the immune response operating at different scales, always focusing on the explanation of

experimental data, discrimination between alternative theories and the generation of new hypotheses. To achieve this objective, a study is proposed separating these scales and choosing the methodology that best adapts to their characteristics (large/small concentrations, fluctuations, spatial properties versus well-mixed, etc...) and the available experimental data.
At the molecular level, we will model the cooperation of T-cell receptors (TCR) to determine the dominant mechanism in the amplification of sensitivity by TCR nanoclusters. Combining stochastic models, image analysis and Bayesian inference, we will quantify the dynamics and function of these nanoclusters. This approach will extend to cytokine-activated competition processes.
At the cellular level, we propose the quantitative study of cell deformation at the synapse. In the first phase, we will use an experimental model of a collaborating group (hydrothermal carbon) to validate simulation models based on finite elements and generate effective models of this deformation. In the second phase, we will model the cell membrane using the phase-field method. Finally, we will extend classical models of statistical physics (Smoluchowski model) to study the intracellular dynamics of organelles in viral infections.
At the population level, we will introduce compartmental models that allow us to contrast hypotheses on the maturation dynamics of T lymphocytes in the thymus, with special emphasis on symmetry/asymmetry in the selection of double negative cells, and we will use the models to extract the most parsimonious mechanism from the analysis of experimental data. Following the compartmental models, we will study the role of latency in the severity of HIV infection. The model will be contrasted with experimental data where the role of drugs reversing latency will be analyzed. At all levels, exhaustive use of statistical inference methods will be made, for which the transversal problem of the models' identifiability and new measures of sensitivity and synergy of the models' parameters will be analyzed.
The research team is multidisciplinary (Physics, Mathematics, and Mechanical engineering) and will have a work team made up of biologists, mathematicians and physicists and experimental collaborators who will provide us with empirical data to validate the models.

Grant PID2019-106339GB-I00 funded by
MCIN/AEI/10.13039/501100011033/

- **Development of movement behavior models of complex chronic patients**
  Ministerio de Ciencia e Innovación (MCIN), Agencia Estatal de Investigación (AEI). June 2020 - November 2023. (Eugenio Francisco Sánchez Úbeda, Rafael Palacios Hielscher, Antonio Muñoz San Roque, José Portela González, Carlos Rodríguez-Morcillo García, Alejandro Polo Molina)

  The aim of this project, coordinated with Virgen del Rocío University Hospital (HUVR), is to investigate how the deterioration of mobility may reflect changes in the patient's clinical condition, and its degeneration in the domain of integrated care of complex chronic patient.
  To fulfill this objective, an IoT infrastructure and information system is developed. Based on the collected data on patients mobility, machine learning techniques are applied to create patterns capable of modeling and characterizing movement in the patients in order to explain aspects of the clinical evolution of patients.

  Project PID2019-110747RB-C22/ funded by MCIN/AEI/10.13039/501100011033

- **POSYTYF. Powering system flexibility in the future through RES (Horizon 2020. Grant agreement No. 883985)**
  European Commission. July 2020 - July 2023. (Lukas Sigrist, Luis Rouco Rodríguez, Enrique Lobato Miguélez, Álvaro Ortega Manjavacas, Oluwaseun Enoch Oladimeji, Hadi Nemati, Pedro Sánchez Martín, Luis Jesús Fernández Palomino, Mohammad Rajabdorri, Pablo Rodilla Rodríguez)

  The main objective in the POSYTYF project is to group several RES into a systemic object called Virtual Power Plant (VPP). VPP is a way to aggregate RES sources to form a portfolio of dispatchable/non-dispatchable RES able to optimally internally redispatch resources in case of meteorological and system variations in order to provide sufficient flexibility, reliable power output and grid services.
  The POSYTYF project will provide TSOs, DSOs and generators with knowledge, models and tools for synthesis of VPP controls both for local (production) and grid (ancillary services) objectives. New analysis (stability assessement) and control (centralized vs decentralized concepts) methods will be particularly proposed. Solutions will be immediately implementable in the actual grid and regulatory situation. Realistic (large-scale grids and concrete RES technologies) cases will be treated and full validations – both in simulation and hardware in the loop along with the codes for regulator's implementation will be made available. Proposals for some main problems like stability will be formulated for next generation grids of massive RES penetration and low inertia

systems.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 883985

- **Stability analysis of large power systems with 100% of non-synchronous generators**

  Ministerio de Ciencia e Innovación (MCI). September 2020 - August 2024. (Aurelio García Cerrada, Régulo Enrique Ávila Martínez, Luis Rouco Rodríguez, Francisco Javier Renedo Anglada)

  The future sustainability of the Worlds Energy System (WES) rests on a massive and distributed penetration of renewable energy sources and their substantial increase in the generation mix. This phenomenon is already taking place at an ever-increasing pace (that is bound to speed up in the future) thanks to facilitating technologies such as power electronics. Therefore, conventional synchronous technology will gradually move from its dominant position towards a situation in which coordination with other and newer technologies will be mandatory. In fact, a situation in which the whole electricity demand of certain regions is supplied by electronic converters from renewable energy sources, at least temporarily, is possible or is already occurring. In this new situation there exists the urgent need to rethink current paradigms regarding the control and operation of conventional electric energy systems in order to address future scenarios (lower system inertia, faster dynamics, controller interactions, etc.). The main objective of this project is to provide the in-depth analysis of the control, operation and technology requirements for the newly created breed of electricity networks of low-to-nil conventional generation with increasing numbers of smart components (generators and loads, for example). This type of systems must include (a) alternating current (AC) sub-grids because of the large number of existing AC loads and the necessity of maintaining the compatibility with the conventional grid and (b) direct current (DC) sub-grids where most of the renewable-based generation can be more naturally integrated (see solar energy, for example), energy storage (batteries) can also be easily interfaced and some domestic and industrial loads can be connected (computers and electrical drives, for example). Currently, the operation of hybrid (DC/AC) electric grids is possible thanks to the use of electronic Voltage Source Converters (VSCs, abbreviated). This project will address the following specific topics:
  "Modelling, analysis, control, and quality of electrical grids with low-to-nil conventional generation in order to improve their flexibility thanks to the use of power electronics while similar levels of voltage control, quality and reliability

of supply to those already achieved with conventional systems can be reached."

This project is supported by the Spanish Government through the 2019 edition of its pre-doctoral contract programme with reference number PRE2019-088084

- **MODESC – Platform of innovative models for speeding the energy transition towards a decarbonized economy**
  Ministerio de Ciencia e Innovación (MCIN), Agencia Estatal de Investigación (AEI). September 2020 - December 2023. (Tomás Gómez San Román, Michel Rivier Abbad, José Pablo Chaves Ávila, Andrés Ramos Galán, Pedro Linares Llamas, Leslie Herding, Teresa Freire Barceló)

  The aim of the project is the development of a global platform that integrates innovative energy simulation and impact assessment models that allow speeding the decarbonization of the electricity system including the electrification of the energy demand. Several scenarios in the horizon 2030-2050 are considered.

Grant RTC2019-007315-3 funded by MCIN/AEI

- **RESPONSE. integRatEd Solutions for POsitive eNergy and reSilient CitiEs (Horizon 2020. Grant agreement No. 957751)**
  European Commission. October 2020 - September 2025. (Gregorio López López, Javier Matanza Domingo, Rafael Cossent Arín, José Pablo Chaves Ávila, Tomás Gómez San Román, Carlos Rodríguez-Morcillo García, Néstor Rodríguez Pérez)

  RESPONSE supports the Lighthouse cities of Dijon (FR) and Turku (FI) and their Fellow cities Brussels (BE), Zaragoza (ES), Botosani (RO), Ptolemaida (GR), Gabrovo (BU) and Severodonetsk (UA) to facilitate them deliver positive energy blocks and districts. Through RESPONSE ,the two LHs will achieve a local RES penetration of 11.2 GWh/y, energy savings of 3,090 MWh/y and an emission reduction of 9, 799 tons CO2eq/y within their districts. To achieve this goal, RESPONSE demonstrates 10 Integrated Solutions (ISs), comprising of 86 innovative elements (technologies, tools, methods), that are being monitored with specific impact metrics (KPIs). It attracts the interest of various stakeholders by generating innovative business models enabling the upscale and replication of the solutions forming a validated roadmap for sustainable cities across Europe and beyond. RESPONSE adopts an energy transition strategy, which

includes 5 Transformation Axes (TAs), encompassing the 10 ISs. TA#1 focuses on transforming existing and new building stock into Energy Positive and Smart-ready. TA#2 focuses on the decarbonization of the electricity grid and the district heating/cooling systems, supporting fossil-based regions in transition and the development of energy communities. TA#3 proposes grid flexibility strategies and novel storage systems for optimizing energy flows, maximize self-consumption and reduce grid stress. TA#4 links existing CIPs with apps and other digital infrastructure to enable digitalisation of services and connected city ecosystems, integrating also smart e-Mobility to promote the decarbonisation of the mobility sector. TA#5 offers interdisciplinary citizen engagement and co-creation practices putting citizen at the forefront of shaping the cities they live in and towards the development of each city's 2050 own bold city-vision. Special focus is given to creating resilient and safe cities increasing quality of life and lowering the impacts of climate change.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957751

- **OneNet- One network for Europe (Horizon 2020. Grant agreement No. 957739)**

  European Commission. October 2020 - September 2023. (José Pablo Chaves Ávila, Tomás Gómez San Román, Rafael Cossent Arín, Luis Olmos Camacho, Javier Matanza Domingo, Gregorio López López, Leandro Lind, Orlando Mauricio Valarezo Rivera, Matteo Troncia, Jesús José Fernández García, Miguel Ángel Ruiz Hernández, Shilpa Bindu, David Ulrich Ziegler)

  OneNet addresses the growing needs of TSOs and DSOs to have real-time insight into the operation of
  their networks to work in a closely coordinated way, while unlocking and enabling new flexibility markets in a fair and open way. Goal is to enable a cost-effective, seamless and secure bidirectional power flow to and from network customers as active players while supporting grid operators in their system responsibilities.
  The challenges that OneNet addresses are:
  • The need to unlock markets of flexibility at every level to address all the possible needs of network operators
  • The need to effectively support both TSOs and DSOs system-level operation through providing flexibility for 'frequency balancing' and 'non-frequency' ancillary services among others
  • The need for TSOs and DSOs to secure power supplies in the context of ever-increasing RES penetration, decreasing network outages,

• The need for TSOs and DSOs to gain near real-time insight into the operation of the networks and to can optimise them in near real-time, and
• The need for improved efficiency of grid reinforcements and stabilization of future costs of grid connection.
Comillas is leader of WP10– From OneNet demonstrators to EU wide implementation of coordinated
market schemes and interoperable platforms for standardized system products.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957739

- **RAYUELA. Empowering and educating young people for the internet by playing (Horizon 2020. Grant agreement No. 882828)**
European Commission. October 2020 - October 2023. (Gregorio López López, Mario Castro Ponce, Álvaro Jesús López López, Javier Matanza Domingo, Sara Lumbreras Sancho, Yolanda González Arechavala, Carlos Rodríguez-Morcillo García, Rafael Palacios Hielscher, David Contreras Bárcena, Francisco Javier Herraiz Martínez, Jaime Pérez Sánchez, Luis Francisco Sánchez Merchante, Aarón Gómez Dorado, Gabriel Antonio Valverde Castilla)

The RAYUELA project is a 3-years project beginning in October 2020 with a budget of 5M EUR. The consortium involves 17 partners from 9 countries and is co-ordinated by Universidad Pontificia Comillas. The project brings together experts from different areas of knowledge from all over Europe to develop an interactive story-like game that, on the one side, will allow minors to learn good practices on the use of the Internet and associated technology by playing, and, on the other side, will allow modelling, in a friendly and non-invasive manner, online habits and potential risk profiles related to cybersecurity and cybercriminality, providing Law Enforcement Agencies with scientifically sound foundations to define appropriate policies.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 882828

- **REDREAM. Real consumer engagement through a new user-centric ecosystem development for end-users´assets in a multi-market scenario. (Horizon 2020. Grant agreement No. 957837)**
  European Commission. October 2020 - October 2023. (Álvaro Sánchez Miralles, Francisco Martín Martínez, Miguel Ángel Sanz Bobi, Carmen Valor Martínez, Álvaro Erdozain Vila, Alessandra Porfido, José Carlos Romero Mora, Roberto Barrella, Efraim Centeno Hernáez, Miguel Martín Lopo, Alejandro Rodríguez Gallego, Bad´r Ghorbal, Javier Matanza Domingo, Rubén Rodríguez Vilches, Olga Rico Díez)

  This project not only enables the effective participation of the consumers/prosumers in the energy market, but also drives a profound change turning traditional company's value chain into value generation chain, based on a revolutionary Service Dominant Logic paradigm. The main objective of the REDREAM project is to effectively move the consumer (as a residential, industrial and tertiary consumer) participation to the centre of the energy market through an open and co-creative ecosystem where all stakeholders will actively interact. This ambitious challenge will require the collection of demand response tools and services (energy and non-energy) capable of enabling the capacity for the consumers of participating in the energy market through an improvement of predictability of consumption patterns and consumer behaviour.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957837

- **Graphene-enhanced 3D printed biodegradable scaffolds for bone regeneration (EIN2020-112443)**
  MCIN/AEI /10.13039/501100011033, Unión Europea NextGenerationEU/ PRTR. November 2020 - October 2022. (Eva Paz Jiménez)

  Grant for proposal preparation fot the Horizon Europe Call: ERC Grants (Pillar 1) - Starting Grants (StG).

Grant EIN2020-112443 funded by MCIN/AEI/ 10.13039/501100011033 and by the European Union NextGenerationEU/PRTR.

- **INTMOD: from the mathematical model to the human decision: positioning Spain as a leader in interpretable models**
  MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/ PRTR. November 2020 - October 2022. (Sara Lumbreras Sancho)

  Granted awarded in the 2020 call for "Europe Research" Revitalization Actions for the preparation and presentation of the proposal addressed to the Horizon Europe call: ERC Aids (Pillar 1) - Starting Grants (StG).

Grant EIN2020-112448 funded by MCIN/AEI/ 10.13039/501100011033 and by the European Union NextGenerationEU/PRTR.

- **Implementing network codes**
  Research Council of Norway (RCN), Statkraft, Statnett, Ministry of Petroleum and Energy, Nord Pool. January 2021 - December 2024. (Paolo Mastropietro)

  The project investigates the implementation of European Network Codes and Guidelines'. These are detailed rules on electricity trade intended to improve and harmonize the EU internal energy market. They could have far-reaching consequences for how we use our electricity network, but so far, they have largely escaped scholarly attention. This project asks several fundamental questions: i) how have network codes and guidelines been designed and outlined at the general level? ii) how have they been further specified in various 'terms, conditions and methods' (TCMs) across Europe? iii) how have they actually worked in practice? iv) have they been able to deliver on the fundamental goal of increasing the efficiency of electricity trade within Europe?

- **ECEMF. European Climate and Energy Modelling Forum (Horizon 2020. Grant agreement No. 101022622)**
  European Commission. May 2021 - December 2024. (Sara Lumbreras Sancho, Andrés Ramos Galán, Luis Olmos Camacho, Carlos Mateo Domingo, Dilayne Santos Oliveira, Miguel Martínez Velázquez)

The aim of ECEMF is to provide the knowledge to inform the development of future energy and climate policies at national and European levels. In support of this aim, ECEMF proposes a range of activities to achieve five objectives and meet the four challenges set out in the call text.

ECEMF's programme of events and novel IT-based communications channel will enable researchers to identify and co-develop the most pressing policy-relevant research questions with a range of stakeholders to meet ambitious European energy and climate policy goals, in particular the European Green Deal and the transformation to a climate neutral society.

Answers will be provided by the first inclusive and open full-scale model comparison exercise on achieving climate neutrality in Europe, including from the outset over 20 models and 15 top research groups, to produce a coherent and relevant evidence-base for energy and climate policy impact assessment.

ECEMF's evidence-base will support the development of policy-relevant insights which will be communicated to and discussed with the key decision makers via a range of novel methods, including interactive embeddable visualisation blocks, policy briefs, workshops and high-profile events.

This loop of knowledge co-production stands on two pillars.

First, ECEMF will advance the state-of-the-art of energy and climate modelling by enabling sharing of: input data using open standards, methods for model comparison building on the vast experience of the consortium, scientific software tools such as the IIASA scenario explorer and hands-on training for researchers.

Second, ECEMF will be established as a long-term, open and welcoming European focal-point for researchers and policy makers with unparalleled international connections to the EMF, JMIP, IAMC and IPCC. Through extensive links to ongoing H2020 projects, research and policy communities & networks ECEMF will reduce fragmentation of the European energy and climate research landscape.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101022622

- **BIO-FlexGen- Highly-efficient and flexible integration of biomass and renewable hydrogen for low-cost combined heat and power generation to the energy system (Horizon 2020. Grant agreement No. 101037085)**
  European Comission. September 2021 - August 2024. (José Pablo Chaves Ávila, Timo Gerres, Paolo Mastropietro, Pablo Rodilla Rodríguez, Paulo Brito Pereira, Javier Matanza Domingo, Gregorio López López, Jesús María Latorre Canteli, Luca De Rosa, Rafael Cossent Arín, Elisa María Aracil Fernández, David Roch Dupré, Shilpa Bindu, Juan Francisco Gutiérrez Guerra)

  BIO-FlexGen aims to significantly increase the efficiency, flexibility and cost effectiveness of renewable energy-based combined heat and power plants (CHP), enabling them to play a key role in integrating fluctuating renewable energy into the energy system, and therefore making a significant contribution to the decarbonisation of the energy system.

  Comillas will contribute to:
  1) the socio and techno-economic evaluation of the of CHP technology under different scenarios and contexts.
  2) analyse the barriers (market, regulatory, business models, etc.) for CHP deployment
  3) contribute to the integration of digitalization strategy.

  This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037085

- **Assisting in Power Africa work. GIS tool for demand forecasting to be used in electrification planning problems**
  OCDE - Organisation de Cooperation et de Development Economiques. September 2021 - September 2022. (Fernando de Cuadra García, Rafael Palacios Hielscher, Carlos Mateo Domingo)

  Research for the development of a Geographic Information System (GIS) tool that can be applied for demand forecasting in Ghana, Senegal, and Uganda to support electrification planning purposes, in terms of defining least-cost pathways to universal electricity access in the aforementioned countries. Model/tool tested by data gathering and running cases in realistic contexts for the countries under study. Capacity building in the use and maintenance of the tool, through cases and seminars/courses.

- **Financial Literacy and Inequalities**
  CaixaBank. February 2022 - November 2022. (Elisa María Aracil Fernández, Elena María Díaz Aguiluz)

  This project analyzes the role of financial education as an element that enhances the positive impacts of financial inclusion in the United Nations' 2030 Agenda, and especially in SDG 10, 'Reduction of inequalities'. The results can serve as a basis to delve into the positive effects that banking promotes on economic and social well-being in the context of developed countries. In particular, the results seek to determine the contribution of financial education in the financial inclusion-reduction of inequality tandem, reinforcing the effect of financial inclusion on the mitigation of inequality. This is significant since advanced countries have high rates of financial inclusion and, at the same time, growing income inequality.

- **Next generation urban rail transport: smart planning and regulation for capacity and energy efficiency [FUTURRAIL]**
  MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/ PRTR. July 2022 - June 2025. (Asunción Paloma Cucala García, Antonio Fernández Cardador, Adrián Fernández Rodríguez, Manuel Blanco Castillo, Fernando Conde Montero)

  The main objective of the FUTURRAIL project is to provide an integrated model to manage transport capacity efficiently in highly demanded urban and metropolitan railway lines, and software tools to implement it. This way, it will be possible to increase the transport capacity in urban railway lines maximizing the usage of the rail infrastructure.
  The project is structured into three main pillars:
  -Planning module: related to infrastructure and new signalling systems.
  -Timetabling and transport demand coverage: related to the generation of efficient timetables.
  -Traffic operation platform: related to traffic operation and regulation of trains in real-time.

Grant CPP2021-008372 funded by MCIN/AEI/ 10.13039/501100011033 and by “European Union NextGenerationEU/PRTR”.

- **eFORT- Establishment of a FramewORk for Transforming current EPES into a more resilient, reliable and secure system all over its value chain (Horizon Europe. Grant agreement No. 101075665)**
  European Commission. September 2022 - August 2026. (Gregorio López López, José Pablo Chaves Ávila, Javier Matanza Domingo, Rafael Palacios Hielscher, Néstor Rodríguez Pérez, Miguel Ángel Sánchez Fornié, Lukas Sigrist)

  Prompted by the need to comply with environmental and societal concerns, Electrical Power and Energy Systems are undergoing an unprecedented transformation, demanding urgent upgrades to make them more reliable, resilient and secure. Modernization of current grids will greatly reduce the frequency and duration of power blackouts, diminish the impact of disruptive events and restore service faster when outages occur, creating broad benefits to society and economy. eFORT approach will enable the further upgrading of the energy grid without affecting the security of supply and increasing their reliability and resiliency against extreme weather events, manmade hazards and equipment failures. eFORT addresses this complex challenge by gathering a consortium of 23 partners, from 10 EU countries, that provides the needed expertise. The project will put in place a set of solutions at the cyber and physical layers for detecting, preventing and mitigating vulnerabilities and threats. Among them, an interoperable Intelligent Platform will set a common foundation for grid characterization and vulnerability overseeing, as well as gather information from smart grid components and apply heavy-duty algorithms, whereas Asset Management developments will strengthen grid infrastructure robustness, which will be empowered by the addressed Digital Technologies. All these elements will be validated in relevant environments coming from 4 demo cases covering the whole grid value chain: (i) a transmission network (The Netherlands); (ii) a remote distribution grid (Italy); (iii) a digital substation in Ukraine; and (iv) a micro-grid in Spain. Moreover, eFORT relies on several horizontal actions aiming at empowering EPES players by establishing a common regulatory and standardisation framework, performing technical and cost-benefit analysis, and evaluating new related business models and replication potential, in the pathway towards a more sustainable energy system.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101075665

- **BeFlex- Boosting Engagement to increase FLEXibility**
  European Commission. September 2022 - August 2026. (José Pablo Chaves Ávila, Carmen Valor Martínez, Javier Matanza Domingo, Tomás Gómez San Román, Pablo Calvo Báscones, Matteo Troncia, Shilpa Bindu, Jesús José Fernández García, Eliana Carolina Ormeño Mejía, Valeria Karina Moreno, Miguel Ángel Ruiz Hernández, Morsy Abdelkader Morsy Mohammed Nour)

  Be-Flex project aims to overcome the existing limitations by demonstrating the implementation of versatile solutions that enable grids to become adaptable to upcoming scenarios, boosting mechanisms that will provide benefits to all actors in the energy market (from market and system operators to final users), giving response to all type of consumers' needs. BeFlex aims at increasing energy system flexibility, enhancing cooperation among DSOs and with TSOs and easing participation of all energy-related actors through the validation and large-scale demonstration of adapted and proven cross-sectoral services, interoperable data exchange platforms for smart grids operation and the creation of required system architecture framework that will enable the creation of new business models providing additional value to meet consumers' needs in compliance with a stable regulatory framework.
  Comillas is in charge of: 1) developing the Regulatory Framework and Proposal for Efficient Flexibility Mechanisms, 2) Define the value proposition and engagement strategies of market actors 3) Guide the project the evaluation, lessons learnt, market uptake of the solutions and scalability of the project.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101075438

- **Counteracting the REduction of Synchronous Inertia in Power Systems (CRESIPS): PID2021-1-125628OB-C21**
  Agencia Estatal de Investigación (AEI). September 2022 - August 2025. (Aurelio García Cerrada, Francisco Miguel Echavarren Cerezo, Fidel Fernández Bernal, Luis Rouco Rodríguez, Enrique Lobato Miguélez, Ignacio Egido Cortés, Álvaro Ortega Manjavacas, Régulo Enrique Ávila Martínez)

  Modern power systems are characterised by (a) a gradual reduction of the number of synchronous generators powered by fossil or nuclear (fully controllable!) fuels; (b) proliferation of fast acting and smart generation units; (c) proliferation of renewable resources, not always fully controllable (wind and solar are two clear examples); and (d) proliferation of smart and robust loads.
  The main objective of the coordinated project (with Comillas [SP1] and Uni. de Alcalá [SP2]) is the comprehensive and holistic analysis and design of modern frequency-control-proving solutions in power systems with a high penetration

of renewable resources with no inertia. First subproject (SP1) will review the concept of inertia in modern power systems and its importance in frequency and angle stability, with special attention to modern technology scenarios. Along these lines, SP1 will firstly review the concept of inertia in grid codes. Secondly, it will review currently used inertia estimation techniques. Since nowadays it seems that frequency does not change uniformly across the power system any more, SP1 will investigate inertia global estimation and estimation at bus level. Thirdly, the project will study algorithms to control variable inertial levels across the power system taking advantage of the flexibility of electronic generation and modern energy storage systems such as batteries or supercapacitors. Finally, SP1 will set up an experimental test rig to validate the most important contributions. The test rig will be integrated in the Electric Machine Laboratory of ICAI School of Engineering (Comillas) where several motor+synchronous generator groups are being prepared to have speed and voltage control. Unlike in SP2, the experimental focus will be placed on a system-wide approach.

Project PID2021-1-125628OB-C21 funded by MCIN/AEI/ 10.13039/501100011033 and by “ERDF a way of building Europe”.

- **HVDC-Wise - HVDC-based grid architectures for reliable and resilient WIdeSprEad hybrid AC/DC transmission systems (Horizon Europe. Grant agreement No. 101075424)**
  European Commission. October 2022 - April 2026. (Lukas Sigrist, Aurelio García Cerrada, Illia Diahovchenko)

  The HVDC-WISE project overall objective is to propose, analyse, design, and validate HVDC-based grid architecture concepts that enable the deployment of reliable and resilient widespread AC/DC transmission grids to achieve the European energy transition. The HVDC-WISE project aims to: a) Propose a set of innovative HVDC-based grid architecture concepts (technological solutions) to harness the full potential of HVDC to increase the R&R of the AC/DC system and reduce the associated threats of HVDC systems, while providing transmission capacity. b) Provide the necessary tools and methodologies to analyse the R&R levels of future AC/DC systems integrating the different HVDC-based grid architecture concepts enabling their selection and design. c) Validate the proposed HVDC-based grid architecture concepts (using the provided tools) implemented on three complementary realistic use cases representing different grid situations in Europe.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101075424

- **DEFINER. Management of flexible electricity demand in markets with very high penetration of renewable energies**
  MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/ PRTR. October 2022 - September 2025. (Andrés Ramos Galán, Pablo Rodilla Rodríguez, Jesús María Latorre Canteli, Paolo Mastropietro, Antonio Bello Morales, Carlos Batlle López, Erik Francisco Alvarez Quispe, Diana María Navarrete Cruz, Pedro Sánchez Martín)

  Study of how flexible demand, with a focus on electricity markets and hydrogen production, is integrated into the electricity market, adequately contributing to flexibility in demand management as a necessary mechanism to maximize the integration of renewables and the reduction of CO2 emissions.

Grant CPP2021-008786 funded by MCIN/AEI/ 10.13039/501100011033 and by "European Union NextGenerationEU/PRTR".

- **AVANHID. Advanced hydraulic generation systems: modeling, control and optimized integration to the energy system**
  MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/ PRTR. October 2022 - September 2025. (Andrés Ramos Galán, Luis Rouco Rodríguez, Jesús María Latorre Canteli, Jesús David Gómez Pérez, Lukas Sigrist, Ignacio Egido Cortés)

  Development of an advanced model of hydraulic simulators that can be validated in the rehabilitation project and improvement of the turbine and pumping capacities that are currently being developed in the Torrejón-Valdecañas complex (Tajo basin). Therefore, these advanced hydraulic generation systems are integrated into Iberdrola's generation portfolio. The optimization of the economic operation of a hydraulic basin and of a generation portfolio requires the development of economic optimization models.

Grant CPP2021-009114 funded by MCIN/AEI/ 10.13039/501100011033 and by “European Union NextGenerationEU/PRTR”.

- **DIAMOND. Delivering the next generation of IAMs for net-zero, sustainable, development (Horizon Europe. Grant agreement No. 101081179)**
  European Commission. December 2022 - November 2026. (Sara Lumbreras Sancho, Luis Olmos Camacho, Andrés Ramos Galán)

  Further development of IAMs and their interface with sectorial models. Development by Comillas of an interface between the power system expansion planning model openTEPES and several IAMs.

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No 101081179

- **OptiREC. Local markets for energy communities: designing efficient markets and assessing the integration from the electricity system perspective**
  Ministerio de Ciencia e Innovación (MCIN). December 2022 - November 2024. (Andrés Ramos Galán, José Pablo Chaves Ávila, Jesús María Latorre Canteli, Matteo Troncia, Seyed Amir Mansouri, Orlando Mauricio Valarezo Rivera, Jesús José Fernández García, Javier García González)

  The project address several of the challenges that limit the effectiveness and proliferation of energy communities. OptiREC develops methods, tools, and solutions for optimal design, operation, and integration into energy systems and energy markets for local energy communities. To ensure effective implementation, energy communities need to be assessed and integrated from several different perspectives. These aspects include the design and internal operation of the energy communities’ participants and assets, aggregation of energy communities and integration into distribution networks, as well as design and participation of local flexibility markets and participation in wholesale markets.

Grant TED2021-131365B-C43 funded by MCIN/AEI/ 10.13039/501100011033 and by “European Union NextGenerationEU/PRTR”

- **Improvement of tools for the analysis of AC/DC hybrid power systems with massive penetration of renewable energy sources and test-case scenarios (TED2021-130610B-C22)**
  Ministerio de Ciencia e Innovación. December 2022 - November 2024. (Aurelio García Cerrada, Francisco Miguel Echavarren Cerezo, Fidel Fernández Bernal, Luis Rouco Rodríguez, Enrique Lobato Miguélez, Ignacio Egido Cortés, Javier García Aguilar)

  Meshed DC grids have been possible for many years but the fantastic development of Voltage Source Converter (VSC) technology has made them practical, now. A hybrid DC-AC grid can make power systems more flexible than conventional AC systems although the specific advantages would strongly depend on the size of the power converters and energy reserves available. More specifically: DC/AC converter stations can support the voltage control in the AC system reducing the risk of voltage instability in the AC grid; DC/AC converter stations can support the AC system with additional damping in case of power oscillations in the AC grid, reducing the risk of angle instability due to poor damping in the AC grid; a DC grid can quickly supply additional power in a controlled manner to an area of the AC grid in case of emergency by extracting it from another area or from internal storage elements, reducing the risk of frequency instability. Noticeably, a DC grid can connect asynchronous AC grids to make a more efficient use of the spinning reserves in both systems.
  The purpose of this subproject is threefold. Firstly, researchers use tools for the analysis and operation of hybrid AC/VSC-based DC system, already developed in previous projects, to investigate all the above advantages and contributions of VSC-based DC grids at system level and, when necessary, extended those tools. Secondly, researchers collaborate with the other subproject to elaborate demonstration cases for the above properties to be tested in a laboratory prototype the other subproject built. The prototype have to be scaled to represent important characteristics of a real power system. Finally, researchers simulate the case studies experimentally verified in characteristic test power systems in the literature (larger size, voltage and power than those of the prototype) to confirm the results obtained. Among others, these simulation cover two specific aspects: (a) the two subprojects collaborate to use similar real-time platforms they are currently equipped with and (b) long term simulation runs are carried out to validate the results from the smart energy management systems investigated by members of the other subproject. A clear understanding of the potential contributions of DC meshed grids to improve the flexibility of AC bulk power systems should help to integrate renewable energy sources (often non-dispatchable) to the generation mix and, consequently, to

the decarbonization of the electricity sector, which could then supply clean electricity to many other industrial sectors.

Grant TED2021-130610B-C22 funded by MCIN/AEI/ 10.13039/501100011033 and by “European Union NextGenerationEU/PRTR”.

- **Rwanda Integrated Clean Cooking Plan- Phase II**

  Sustainable Energy for All (SE4All). January 2023 - December 2023. (Fernando de Cuadra García, Andrés González García, Pablo Dueñas Martínez, José Ignacio Pérez Arriaga, Carlos Mateo Domingo, Rafael Palacios Hielscher, Santos José Díaz Pastor)

  Project for Sustainable Energy for All (SEforALL), towards the development of an Integrated Clean Cooking Plan for Rwanda, supported by geospatial information. Collaboration between the IIT-Comillas and MIT.
  This is the Phase II of the project, devoted to the implementation and development of methods and tools, and the elaboration of some integrated plans (examples).
  The methodology proposed for the preparation of integrated plans will include a large-scale optimization tool, with widespread use of geospatial information, which proposes detailed solutions (at a national level) on infrastructure developments and pricing policies (subsidies), seeking the maximum benefit/cost ratio. The benefits will be social, environmental and health-related, but the model must also include business benefits - as such a large-scale transformation needs to attract investment in a sustainable way. The tool will produce detailed and georeferenced results, to allow the planner to carry out sensitivity analyses with respect to input parameters and constraints.

- **Myoelectric orthoses with implantable electrodes: optimization of bionic reconstruction**

  Instituto de Salud Carlos III. January 2023 - December 2025. (Romano Giannetti, José Daniel Muñoz Frías)

  Peripheral nerve injuries manifest themselves as loss of motor function and loss of sensitivity, which can be very disabling for the patient. Despite the progress made in recent years in reconstructive surgery, the results do not always allow a functional limb. Therefore, myoelectric orthoses (exoskeletons) have been developed to improve the function of the affected limb (also known as bionic reconstruction). Current models are composed of sensors on the skin to communicate muscle contraction to the orthosis, often with a weak and unstable signal for various reasons (movement, sweat, etc.). In addition, the

high cost of these orthoses makes it impossible to use them in national health systems such as the one in our country.
The objective of our project is to improve human-machine communication sensors. To this end, we propose four phases: 1. modification of the current electromyography sensors; 2. encapsulation of the sensor with 3D printing with autologous cells; 3. implantation of these sensors in an animal model; 4. pilot study in patients with these lesions with no other therapeutic alternative. Finally, we propose the development and 3D printing of these orthoses in order to reduce their price.

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- **SEAO2-CDR. Strategies for the evaluation and assessment of ocean-based carbon dioxide removal (Horizon Europe. Grant agreement No. 101081362)**
  European Commission. June 2023 - May 2027. (Pedro Linares Llamas, Timo Gerres, Antonio Francisco Rodríguez Matas)

  Strategies for the Evaluation and Assessment Of Ocean based Carbon Dioxide Removal (SEAO2-CDR) is an ambitious project that develop OCDR beyond current feasibility studies by establishing the mechanisms and frameworks required to support the evaluation and application of archetypal biological, chemical and physical OCDR techniques. Common assessment processes, governance structures and technologies are used to explore system-level interactions between different approaches in order to deliver the insights, tools and guidelines required for the safe and effective implementation of OCDR. These advancements enable SEAO2-CDR to establish the extent to which OCDR can support climate change mitigation and adaptation strategies, and hence the transition to a climate-neutral and resilient society and economy.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101081362

- **Open Modelling toolbox for development of long-term pathways for the energy system in Africa**
  European Commission. July 2023 - June 2026. (Luis Olmos Camacho, Andrés Ramos Galán, Sara Lumbreras Sancho, Mohamed Abbas Eltahir Elabbas, Francisco Labora Gómez)

  OpenMod4Africa aims to develop an Open Energy System Modelling Toolbox (hereinafter referred to as OM4A Toolbox), which is adapted to African needs

and uses based on collaboration between African and European partners. The toolbox provide science-based results to policymakers and local actors, to assist them in analyzing the environmental, social and economic synergies and trade-offs to be achieved in a clean energy transition in African countries, as well as the impact of increasing clean energy generation. The capacity-building program, replication strategy and strong involvement of African academic institutions and other stakeholders guarantees that OpenMod4Africa can help increase African energy modeling competence and establish a network of local experts and users of the open Toolbox in the long term.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101118123

3.2.2 Consultancy and technological support

3.2.2.1 Private funding

- **Study of the electrical interconnection between Bolivia and Brasil**
  Banco Interamericano Desarrollo (BID), Empresa Nacional de Electricidad (ENDE) - Bolivia, Centrales Eléctricas Brasileñas (ELETROBRAS). June 2019 - September 2022. (Luis Olmos Camacho, Andrés Ramos Galán, Michel Rivier Abbad, Jesús María Latorre Canteli, Francisco Miguel Echavarren Cerezo, Francisco Javier Renedo Anglada, Stefanía Gómez Sánchez)

  Technical and economical assessment of the elecrical interconnection between Bolivia and Brasil.

- **Colombia sustainable integrated electrification planning. Grid and off-grid strategies assessment**
  Massachusetts Institute of Technology (MIT), Rockefeller Foundation. July 2021 - September 2022. (Fernando de Cuadra García, Andrés González García, Rafael Palacios Hielscher, Carlos Mateo Domingo, Clara Pérez-Andújar Carretié, Santos José Díaz Pastor, José Ignacio Pérez Arriaga)

  This project is a collaboration between the MITei research team (in which the Comillas-IIT is a relevant partner) and the Rockefeller Foundation (RF) regarding the ongoing collaboration around the Global Commission to End Energy Poverty (GCEEP), and the development of a globally applicable Integrated Distribution Framework (IDF).
  The project aims to extend the electrification planning effort to the whole national territory of Colombia, providing the grounds for the Government to

launch an integrated (comprising grid, mini?grids and individual standalone systems) electrification effort that will lead to the achievement of the Universal Access goal by 2030, including the communities in most isolated areas of the country. This planning strategy will also aim at assessing the main components of an integrated (grid and off?grid) sustainable framework for power supply which will allow the attraction of the necessary investments, the governance of the business?model stakeholders ecosystem, and the regulatory and energy policy provisions which will allow for the long?term supply and its future sustainable evolution.

- **Support to the implementation of the more lights for the Amazon program**
  Inter-American Development Bank (IADB). October 2021 - April 2023. (Rafael Palacios Hielscher, Andrés González García, José Ignacio Pérez Arriaga, Santos José Díaz Pastor, Hagos Meresa Weldu)

  The specific objective of this consultancy is to develop an optimal georeferenced Plan to facilitate universal access to the electricity service, within the framework of the More Lights for the Amazon, to the beneficiaries (consumer units) who must be identified and characterized in remote and isolated areas of the legal Amazon in the States of Amazonas, Acre, Pará and Roraima.
  The products of this consultancy complement the information and analysis carried out by Ministry of Energy and Mines (MME) for the conception, design, and implementation of the More Lights for the Amazon Program. As a result of the consultancy, a georeferenced electrification plan is expected to be prepared, based on GIS information, to facilitate the provision of electricity to remote and isolated communities in the States subject to the consultancy, considering the various options for supplying the electrical service with individual photovoltaic systems or PV mini-grids.

- **ACG-IIT maintenance services**
  Acciona Generación Renovable S.A. January 2022 - December 2023. (Ignacio Egido Cortés, Luis Rouco Rodríguez)

  Acciona participates in the secondary regulation in the Spanish power system. Acciona is using two licenses of AGC-IIT for its two regulation zones. This project covers the AGC-IIT maintenance services

- **Assistance and maintenance of tools CODEX, SIROCO and DESI**
  Endesa Medios y Sistemas S.L. January 2022 - December 2022. (Francisco Alberto Campos Fernández, Efraim Centeno Hernáez, Luis Alberto Herrero Rozas, Enrique Lobato Miguélez, Javier García González, José Portela González)

  Assistance and maintenance of tools CODEX, SIROCO Y DESI developed by IIT for Endesa

- **Electrical studies of integration to the electrical grid of photovoltaic generation facilities with storage**
  Invesyde S.L. January 2022 - June 2023. (Pablo Frías Marín, Miguel Martínez Velázquez)

  The objective of the collaboration is to carry out an analysis of the distributed generation connection in power systems.

- **Development of the universal access to electricity strategy in Bolivia, based on a geo-referenced electricity access plan**
  Inter-American Development Bank (IADB). January 2022 - July 2023. (Rafael Palacios Hielscher, Andrés González García, José Ignacio Pérez Arriaga, Santos José Díaz Pastor, Carlos Mateo Domingo, Fernando de Cuadra García, Varios General Contratado, Hagos Meresa Weldu)

  In this project we are developing the "National Integrated Rural Electrification Plan for Bolivia in 2030" (PINERB 2030), through the optimization of least-cost power supply with grid extension, microgrids, and standalone systems, by using the Reference Electrification Model REM©MIT&IIT-Comillas.
  The technological design analyzes several electrification modes for each individual customer. The analysis includes (1) connection to the existing grid, (2) connection to an independent and isolated mini or microgrid, and (3) small individual standalone systems (DC solar kits and AC systems), considering in detail the techno-economic characteristics of each one of these modes. The decision about the most convenient (least-cost) electrification technology for each customer inside the study area (where there might be a mix of the three electrification modes) requires the analysis of the following topics:
  * For connection to existing network: Topology and design of the existing network, electrical characteristics and cost of network components (cables, transformers), cost and reliability of the energy, tariffs and operational costs, LV and MV regulations.
  * For independent systems: Assets for generation in AC or DC, microgrid regulations and electrical compatibility with existing grid, catalog of components, target reliability of the system, microgrid and stand alone systems' regulations, availability of energy resources (solar, hydraulic, wind, biomass...), cost and legal limitations in the use of diesel fuel for electricity generation.
  * Characteristics of the demand: Types of clients, and electrification modes (demand profile, minimum reliability requirements, quality of service).
  * Geographic characteristics: Topography, Elevation maps, and maps of forbidden areas or areas with a higher implementation or maintenance costs (ex. hills, jungle, or water features).

- **Computation of grid access capacity**
  Iberenova Promociones S.A.U. February 2022 - December 2022. (Luis Rouco Rodríguez, Enrique Lobato Miguélez)

  The aim of this project is to update a compute tool for computing the grid acces capacity according to the WSCR criteria incorporating the planning of the transmission grid 2021-2025.

- **Metro Manila Metro Line 4 Transport Capacity Analysis**
  IDOM Consulting, Engineering, Architecture, S.A.U. May 2022 - March 2023. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez, Gonzalo Sánchez Contreras, Manuel Blanco Castillo)

  In this project, an analysis of the transport capacity of Metro Manila Line 4 is carried out, based on information on track infrastructure, train characteristics and the type of signalling.

- **Study of transient recovery voltage of Trillo NPP generator circuit breaker**
  Centrales Nucleares Almaraz Trillo A.I.E. June 2022 - December 2022. (Luis Rouco Rodríguez)

  The aim of the study is to determine the impact of generator shunt capacitors on the transient recovery voltage of Trill NPP genearator circuit breaker.

- **Development of a model for calculating the theoretical energy expenditure on cooling for Spanish households**
  ECODES - Fundación Ecológica y Desarrollo. July 2022 - November 2022. (Roberto Barrella, José Ignacio Linares Hurtado, Eva María Arenas Pinilla, José Carlos Romero Mora)

  The general objective of the project is to develop a model to obtain the thermal expenditure necessary for cooling, i.e. to maintain good comfort in summer in a Spanish home, as a complement to the existing model, which calculates the thermal expenditure for heating and DHW, developed in previous years. In addition, an analysis will be made of the total energy expenditure, including cooling, in Spanish households according to the most representative parameters of these (climate zone, surface area of the dwelling heated in summer, age of the building, etc.).

- **Hydrogen regulation and potential in Europe**
  Ohmium. September 2022 - September 2023. (José Pablo Chaves Ávila)

  This project consists of advising Ohmium on the relevant regulations and potential for hydrogen production in Europe.

- **Studies to adapt Endesa´s AGC to new secondary regulation service**
  Endesa Medios y Sistemas S.L. September 2022 - December 2022. (Luis Rouco Rodríguez, Ignacio Egido Cortés, Ana Baringo Morales)

  The aim of this project is to undertake a number of studies to adapt Endesa's AGC to the new secondary regulation service under the PICASSO platform.

- **Dynamic simulation of power park modules**
  UFD Distribucion Electricidad S.A. September 2022 - December 2022. (Luis Rouco Rodríguez, Enrique Lobato Miguélez, Lukas Sigrist)

  This project is aimed at evaluating the dynamic response of a set of power park modules in the case of the tripping of a transformer at the point of connection to the transmission grid.

- **droneid**
  Grupo TRC. October 2022 - February 2023. (Javier Matanza Domingo, Carlos Rodríguez-Morcillo García, Jaime Boal Martín-Larrauri)

  The project addresses the analysis of radiofrequency signals emitted by commercial drones. The goal of the analysis is to be able to determine the presence of a drone based on its electromagnetic "signature".

- **Assessment of Spanish secondary regulation market**
  Repsol Renovables Servicios, S.A.U. October 2022 - December 2022. (Enrique Lobato Miguélez, Ignacio Egido Cortés, Ana Baringo Morales)

  The project will explore the impact on the quality of secondary regulation caused by the change of hourly to quarter-hour operation of the market.

- **Carbon Contracts for Difference (CCfD) to support the use of sustainable gases in Spain**
  Axpo Iberia SL. October 2022 - January 2023. (Timo Gerres, Pedro Linares Llamas)

  The objective of this study is the economic and regulatory analysis of different CCfD implementation options in a European and national context and to evaluate its impact on the EU ETS. The analysis will not only look at CCfDs as a public support instrument but also as a contractual B2B arrangement in the private sector.

- **Evaluation of express energy retrofits**
  Fundación Naturgy. November 2022 - May 2023. (Roberto Barrella, José Carlos Romero Mora, Efraim Centeno Hernáez)

  This project aims to carry out an objective assessment of the impact on energy poverty of the express energy retrofits carried out by the Naturgy Foundation and the collaborating NGOs within the framework of the Solidarity Fund for Retrofitting. The impact analysis is carried out based on the characteristics of the dwelling and the energy bills before and after the refurbishment, comparing the actual expenditure with the required energy expenditure of the household. The calculation of a hidden energy poverty indicator is also proposed to measure the direct impact of retrofitting on energy vulnerability.

- **Assistance and maintenance of tools CODEX, SIROCO and DESI**
  Endesa Medios y Sistemas S.L. January 2023 - December 2023. (Francisco Alberto Campos Fernández, Efraim Centeno Hernáez, Luis Alberto Herrero Rozas, Enrique Lobato Miguélez, Javier García González, José Portela González)

  Assistance and maintenance of tools CODEX, SIROCO Y DESI developed by IIT for Endesa

- **Comparison of CAPEX and OPEX of H2 transmission and electric power transmission**
  Enagás S.A. January 2023 - January 2023. (Luis Rouco Rodríguez)

This work compares CAPEX and OPEX of H2 transmission and electric power transmission.

- **Analysis of the technical and economic benefits of solar thermal generation in the Spanish peninsular system**
  Asociación Española para la Promoción de la Industria Termosolar (PROTERMOSOLAR). January 2023 - March 2023. (Andrés Ramos Galán, Luis Rouco Rodríguez, Lukas Sigrist)
  Preparation of a set of transparencies showing the advantages of solar thermal generation.

- **Calculation of the capacitors of the series reactors of Picon 220 kV substation**
  Red Eléctrica de España, S.A. January 2023 - May 2023. (Luis Rouco Rodríguez)
  The work is aimed at determining the capacitors to mitigate the transient recovery voltages in Picon-Aceca 220 and Picon-Emperador 220 power lines which will be affected by the series reactors in Picon 220 substation.

- **Migration of the solar scenario generator to the cloud environment**
  Endesa Medios y Sistemas S.L. March 2023 - May 2023. (Eugenio Francisco Sánchez Úbeda, Anne Maren Coll Franck)
  The main objective of this project is the migration of the solar scenario generator to the cloud environment. Taking the information published by the System Operator as input, a set of models based on machine learning techniques are in charge of generating coherent probabilistic predictions for the medium term of solar production.

- **Report on the asynchronous nature of PV plant El Mendalon incorporating synchronous compensators**
  Lantana Desarrollos Renovables S.L. March 2023 - April 2023. (Luis Rouco Rodríguez)
  This report informs of the asynchronous nature of PV plant El Mendalon while incorporating synchronous compensators.

- **Supply of the AGC-IIT and commissioning in the BBE SCADA system**
  Bahía Bizkaia Electricidad, S.L. May 2023 - December 2024. (Ignacio Egido Cortés, Luis Rouco Rodríguez)
  BBE participates in the secondary regulation in the Spanish power system. This project consists in the supply of AGC regulator AGC_SRS-IIT to BBE and the assistance to both BBE and the SCADA provider in its integration in the system.

- **Hydrogen_Use_Cases**
  Keiryo. May 2023 - July 2023. (Rafael Cossent Arín, Pedro Linares Llamas, Timo Gerres, Santiago Serna Zuluaga, Manuel Pérez Bravo)
  The aim of the collaboration is to identify the relevant vertical markets and use cases to use hydrogen as an energy source and feedstock, and to elaborate for the most promising ones detailed market assessment, limiting factors, and

adapted business offers, unlocking limiting factors able to answer customers' needs. The study focuses on the European market, mainly on France, Spain and Portugal.
The contribution of the IIT incldues:
- Regulatory pathway mapping for industrial, transport and energy policy in Spain, and Portugal.
- Perform a techno-economic assessment of the aforementioned hydrogen use cases in order to determine the corresponding TCOO/TVOO for different scenarios or usage envelopes.
- Support and provide feedback on the use case selection and business model definition for the target use cases.

- **Development of the universal access to electricity strategy in Bolivia, based on a geo-referenced electricity access plan**
Inter-American Development Bank (IADB). May 2023 - February 2024. (Rafael Palacios Hielscher, Andrés González García, José Ignacio Pérez Arriaga, Santos José Díaz Pastor, Hagos Meresa Weldu)

The objective of this consultancy is to support the government of Paraguay and ANDE in the development of a national electrification plan as a basis for achieving the goal of universal energy access by 2030.
The project includes the following phases:
1. Development of a georeferenced database in GIS format. This database should include the location of the communities and their buildings, the energy consumption of the communities, the location of existing power lines, access roads, protected areas, identification of the concession areas of the distribution companies, socioeconomic information of the communities, among other relevant information for the development and monitoring of the plan. The database will be prepared using available information to be provided to the consulting firm and data obtained remotely through satellite information or other means of support.
2. Estimation of rural electrification demand at a 2030 horizon (or other proposed by the consulting firm), adequate for the development of the plan.
3. Preparation of the national electrification plan, optimized at the lowest overall cost, and georeferenced that considers the technical and economic feasibility and national technical regulations for grid extensions and off-grid supply systems such as solar mini-grids with storage and photovoltaic home systems. The plan should be based on the estimated energy consumption of the communities. Based on this, and the projected costs of the energy solutions, the plan should size the energy solutions to be implemented to provide access to electricity in the communities, estimate the investment needs of capital costs (CAPEX), operation and maintenance costs (OPEX) and administration costs for the projects. The plan should be based on a global cost optimization to develop an execution and investment plan to achieve universal access by 2030. Finally, scenarios and sensitivities should be developed, estimating the reduction of emissions from the use of renewable technologies and their final results database.
4. Proposal of an investment plan for the execution of the plan (2023-2030), which identifies the investments required and the financing mechanisms to

finance the electrification projects proposed in the plan. The definition of this plan requires analyzing the conditions of economic, technical and environmental sustainability of the proposed business models (grid supply, mini-grids and individual systems), the institutional and regulatory framework and the sources of capital and financing mechanisms used for the development of projects for access to electricity in other countries in the region, as well as in Africa and Asia, and which are relevant to Paraguay.
5. Present a template with the technical specifications for the projects resulting from the national electrification plan.
6. Develop a methodology for updating and monitoring the national electrification plan.
7. Identification and presentation of the risks and mitigation measures identified for the implementation of the national electrification plan.

- **Migration of the residual demand curve prediction model in the day ahead market.to the Cloud environment**
  Endesa Medios y Sistemas S.L. June 2023 - September 2023. (José Portela González, Alejandro Polo Molina)

  The main objective of this project is to migrate the residual demand curve forecasting model in the Spanish day-ahead market to the cloud environment. Taking as inputs different variables of the electricity market, the model applies dimension reduction techniques together with regression models to estimate the curves.

- **Report on the scheduling of the Ricobayo hydroelectric power plant**
  Iberdrola Generación España, S.A.U. June 2023 - June 2023. (Andrés Ramos Galán)

  Report on the medium-term scheduling of the Ricobayo hydroelectric plant.

- **Feasibility of grid connection of Cepsa´s H2 production plants**
  Compañía Española de Petróleos, S.A. (CEPSA). June 2023 - December 2023. (Luis Rouco Rodríguez, Francisco Miguel Echavarren Cerezo, Enrique Lobato Miguélez)

  This collaboration is aimed at investigating the feasibility of grid connection of Cepsa's H2 production plants in Huelva and Algeciras.

- **Biomechanical differences between men and women in frontal impacts**
  Línea Directa. June 2023 - July 2023. (Francisco José López Valdés, Manuel Valdano)

  Biomechanical differences between men and women in frontal impacts

- **Support in the preparation of the application to the call on innovative energy storage systems**
  Glide Energy. June 2023 - October 2023. (Luis Rouco Rodríguez, Andrés Ramos Galán, Francisco Miguel Echavarren Cerezo, Rafael Cossent Arín)

This work is aimed at supporting Glide Energy in the preparation of the application to the call of the Spanish Ministry of Ecological Transition on innovative energy storage systems.

- **Quantitative assessment of Regional Cost Allocation Methods in the West African Power Pool**
  CESI S.p.A. July 2023 - July 2024. (Luis Olmos Camacho, Mohamed Abbas Eltahir Elabbas, Stefanía Gómez Sánchez)
  Application of several methodologies for the computation of electricity transmission tariffs to allocate the cost of the regional transmission grid in the West Africa Power Pool (WAPP). Analysis of the results and derivation of relevant policy conclusions.

- **ACG-IIT installed in Nexus. Maintenance services**
  Nexus Energía S.A. July 2023 - July 2024. (Ignacio Egido Cortés, Luis Rouco Rodríguez)
  Nexus participates in the secondary regulation in the Spanish power system. Nexus is using one license of AGC-IIT for its regulation zone. This project covers the AGC-IIT maintenance services

- **Supply of the AGC-IIT and commissioning in the Nexus SCADA system**
  Nexus Energía, S.A. July 2023 - December 2024. (Ignacio Egido Cortés, Luis Rouco Rodríguez)
  Nexus participates in the secondary regulation in the Spanish power system. This project consists in the supply of AGC regulator AGC_SRS-IIT to Nexus and the assistance to both Nexus and the SCADA provider in its integration in the system.

3.2.2.2 Public funding

- **A method for the settlement of the complementary service of supplying electricity to trains in the ADIF and ADIF high-speed railway systems**
  Administrador de Infraestructuras Ferroviarias (ADIF). June 2020 - November 2022. (Tomás Gómez San Román, José Antonio Rodríguez Mondéjar, Asunción Paloma Cucala García, Antonio Fernández Cardador, Ramón Rodríguez Pecharromán, Álvaro Jesús López López, Adrián Fernández Rodríguez, Carlos Mateo Domingo, Rafael Cossent Arín, Yolanda González Arechavala, Pablo Urosa Sánchez, Manuel Blanco Castillo)
  The aim of the project is to set the regulatory conditions and operational procedures for the settlement of electricity supply to trains belonging to different mobility operators under a context of liberalization of train operators, implementation of on-board energy measurement equipment, and providing energy efficiency signals to the train operators. In addition, the project proposes a remuneration regime for ADIF that acknowledges the efficient incurred costs, providing financial sustainability and economic efficiency signals together with keeping quality of service standards for ADIF as an energy supplier and an infrastructure operator.

- **Protecting children in crashes through the investigation of the material and structural properties of developing tissue (EIN2020-112448)**
  MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/ PRTR. November 2020 - October 2022. (Francisco José López Valdés)

  PROCHILD is a proposal submitted to the EUROPA INVESTIGACION 2020 of the PROGRAMA ESTATAL DE I+D+I ORIENTADA A LOS RETOS SOCIALES. The goal of the proposal is to obtain funding to establish a collaborative network with several Spanish and international institutions to prepare a successful proposal to the European Research Council Consolidator Grants (ERC CoG) call for projects of the program HORIZON EUROPE.
  The ERC CoG proposal will address the global problem of infant injuries due to motor vehicle (MV) crashes. Unintentional injuries, and particularly motor vehicle injuries, are the leading cause of death, serious injury and acquired disability for children and youth between 1 and 14 years of age. In addition, for every fatality, around 18 children are hospitalized and over 400 hundred receive medical treatment. The ultimate goal of the ERC CoG proposal is to eliminate fatal, severe and severely incapacitating injuries caused by road traffic to children and adolescents worldwide. To that end, the specific objective of the proposal is to investigate on the most appropriate constitutive models of developing human musculoskeletal tissue so that detailed finite element models of children are biofidelic and can predict tissue failure. Then, the project will also seek how to implement these models into testing standards and regulations that can be easily adopted by low- and middle- income countries. Indeed, the cost of testing equipment and large testing facilities is a barrier for these countries to implement effective programs to assess the safety of vehicles and vehicle components. But thinking only in the so-called passive safety of children would be to look at one piece of the picture, especially with the advent of more automated cars. This international projection of the results to be obtained within the ERC CoG project is why we consider a need to meet with international experts working on the field of automated vehicles to identify how these features can also help not only in well-established high-income countries, but also in others that are struggling to have a safe and sustainable transport system and cannot afford the toll on young human lives that suboptimal vehicles may impose in their populations. To this end, the current proposal will dedicate funds to establish meetings with those responsible of international testing and regulatory programs such as EuroNCAP and the United Nations.
  As for the scientific contribution of the proposal, the approach of the ERC CoG project to the prevention of pediatric injury is novel because it presents a comprehensive research methodology to analyze changes of tissue mechanical properties with age by linking age to microstructural tissue changes and it is the first robust attempt of developing probabilistic tissue injury criteria based on strain predictions of human FE models. In addition, the proposal will advance existing knowledge on pediatric injuries by approaching them from a multidimensional perspective including not only risk to life but also aspects of disability and treatment costs.
  Thus, PROCHILD also seeks to establish close collaborations with relevant

national research groups such as the School of Medicine of the Universidad San Pablo CEU and the IQS at Universidad Ramon Llull, both well known for their expertise in biomechanical and post-mortem studies and in material testing and characterization.

Grant EIN2020-112448 funded by MCIN/AEI/ 10.13039/501100011033 and by the European Union NextGenerationEU/PRTR.

- **Least cost electrification study and mini-grid portfolio readiness assessment for Pakistan**

  World Bank. June 2021 - September 2023. (Rafael Palacios Hielscher, Andrés González García, José Ignacio Pérez Arriaga, Santos José Díaz Pastor, Hagos Meresa Weldu)

  The Government of Pakistan adopted sustainable development goals (SDGs) in February 2016. As a part of SDGs, the government has targeted universal energy access by 2030. This project aims to analyze both grid extension and off-grid systems as a potential solution for providing energy access to unelectrified population, allowing to electrify 32 million households.
  The World Bank (WB) is supporting Pakistan's energy sector through "Pakistan Sustainable Energy Program" which includes this project to assist the Government in identifying solutions to achieve universal energy access in Pakistan.
  The organizations involved in this project will use the Reference Electrification Model (REM) and the Village Data Analytics (VIDA) for the LCES and mini-grid portfolio assessment respectively. The chosen model and analytical tool have been successfully used for similar activities worldwide.
  The Least-Cost Electrification Study (LCES) shall include:
  (i) Geospatial analysis (grid and off-grid) - The detailed geospatial analysis will consider, based on good practice and international experience, possible least-cost options for electrification, provide a sound strategic basis to implement systematically staged grid extensions and the deployment of off-grid technologies (mini-grids and standalone systems) powered by cost-effective renewable energy solutions where appropriate.
  (ii) Recommendations for implementation – Recommendations on policies, actions and investments needed to achieve the goal of universal electricity access by 2030, including proposed intermediate targets, corresponding investment financing frameworks, an action plan to address the enabling policy and institutional framework, and capacity strengthening initiatives for key sector institutions and agencies involved.
  The Mini-Grid Portfolio Assessment shall support mini-grid pipeline

development to assist the World Bank in conducting its due diligence on a potential mini-grid investment operation and provide useful evidence and data to sector agencies and stakeholders.

- **Licensing and application of a reference network model by a colombian distribution system operator**
  Empresas públicas de Medellín E.S.P. October 2021 - December 2023. (Carlos Mateo Domingo, Fernando de Cuadra García, Tomás Gómez San Román)

  The objective of the project is to license and support EPM in the use of a reference network model, to determine the expansion needs in real distribution networks of Empresas Públicas de Medellín (EPM). The tool provides support in investment decisions in distribution system operators by DSOs, allowing to analyze future demand scenarios, as well as higher penetrations of distributed energy resources.

- **Consulting services for the tariff reform in Slovenia**
  Agencija za Energijo. May 2022 - December 2023. (Tomás Gómez San Román, José Pablo Chaves Ávila, Nicolás Mariano Morell Dameto, Eliana Carolina Ormeño Mejía)

  Consulting services for the study on the Slovenian tariff reform project (preparation of expert opinions, participation in explanatory meetings, participation in public consultation, etc.)

- **Assessment of the emissions reduction potential in the Spanish industrial sectors**
  Ministerio de Industria, Comercio y Turismo. July 2022 - September 2022. (Pedro Linares Llamas, Timo Gerres, Santiago Serna Zuluaga)

  This project assesses the availability in the short and medium term of the different industrial decarbonization technologies according to their readiness; determines the CO2 emissions reduction potential for each sector, related to the European benchmark; and estimates the cost of emissions reduction per ton of CO2, for each sector.

- **Haiti National electrification analysis - Consultancy services for the assessment of electrification options**
  World Bank (WB). August 2022 - November 2023. (Rafael Palacios Hielscher, Andrés González García, José Ignacio Pérez Arriaga, Michel Rivier Abbad, Hagos Meresa Weldu)

  Following the Government of Haiti's request for advisory services, the World Bank appointed Comillas and Waya Energy, with the collaboration of Trama TecnoAmbiental TTA and Castalia, to undertake a National Electrification Analysis (NEA) of Universal Electricity Access Options in Haiti. The objective of the NEA is to provide analysis and insight on various power supply modes options (grid extension, mini grids, standalone systems, meshed grids...) which the World Bank may use to assist in providing advisory services to the Government of Haiti for the preparation of a National Electrification Strategy (NES).

The World Bank is responsible for undertaking the NEA with funding from Policy Dialogue funds and Energy Sector Management Assistance Program (ESMAP). The NEA is designed to help the World Bank to deliver integrated and flexible advisory services to the Government so as to build its capacity to achieve sector development targets.
The scope of work encompasses the following tasks: (a) identify, review and analyze output (e.g., reports, data) of previous efforts supporting electrification planning in the country, several of which have strong synergies with related sectors including water, health, education, ICT; (b) assess the robustness of existing material and highlight gaps, updates or modifications required c) actively support any additional analysis require to develop a geospatial least cost electrification plan and (d) identify potential options and arrangements for scaling up electrification in Haiti in line with national access targets.
This work will produce an analysis of the electricity services and options that could be provided based on the information shared by the Government and other sector stakeholders to assist the World Bank in providing advisory services to the Government. Any further detailed site-specific analysis will be conducted by the designated country agencies if, and when, the decision to undertake electrification projects is made. It is those site-specific analyses, and not the World Bank's NEA, that will determine specific vulnerability, risk and mitigation actions associated with different modes of electricity supply.

- **Energy policies and impact on electricity prices in Spain**
  Fundación Naturgy. January 2023 - April 2023. (Tomás Gómez San Román, Pedro Linares Llamas, José Pablo Chaves Ávila, Roberto Barrella, Nicolás Mariano Morell Dameto)

  This report describes the current context of the decarbonization transition and the high prices situation due to the energy crisis and the war in Ukraine. Energy policies and their impact on both energy costs and regulated costs of the electricity sector in Spain are analyzed. Measures taken to protect vulnerable consumers are also studied. Finally, the emergency measures taken to alleviate the increases in electricity prices are examined.

3.2.3 Services and analysis projects

3.2.3.1 Private funding

- **Implementation and monitoring of the recovery and resilience plan for the green transition**
  Trinomics B.V. December 2021 - February 2023. (Pablo Rodilla Rodríguez, Pedro Linares Llamas, Carlos Batlle López, Rafael Cossent Arín, Paolo Mastropietro, Diana María Navarrete Cruz)

  In the context of the RRP implementation, Spain requested support in particular for the regulatory framework for energy storage and renewable energy. While Spain's plans are ambitious with regard to renewable energy, aiming for climate neutrality by 2050, their current regulation fails to provide the necessary framework to support large-scale RES, storage and hydrogen deployment.

Overall, there is a need to provide clear (price) signals to the market players, and in particular to renewables, energy storage and renewable hydrogen.

- **Technical support for the tools DECA, HADES and MODEM**
  Endesa Medios y Sistemas S.L. January 2022 - December 2022. (Eugenio Francisco Sánchez Úbeda, José Portela González, Javier García González)
  The objective of this project is to provide ENDESA with technical support and maintenance of the tools DECA, MODEM, HADES, EXLA and EXCOM developed by IIT.

- **Support to the Costa Rican ministry of Energy and Environment to develop the National Strategy of Green Hydrogen**
  NTT DATA Europe & Latam Inc. January 2022 - December 2022. (José Pablo Chaves Ávila, Timo Gerres)
  Support to the MINAE of Costa Rica in the development of a National Green Hydrogen Strategy. IIT contributes in the definition of the methodology, analysis of international hydrogen experiences and markets, identification of existing gaps and finally in the elaboration of the Strategy and Action Plan.

- **DICERN_1**
  Universidad Pontificia Comillas. September 2022 - July 2023. (David Roch Dupré)
  This project is a continuation of the DISCERN_1 project and has two main objectives:
  - Design a competency measurement system to evaluate the impact of the "LIDE" training program as well as the relationship between competency training and the use of the tools proposed in the program.
  - Prepare a MOOC and a book associated with the "LIDE" program.

- **FDS simulation of an event for IST**
  Axa Seguros Generales S.A. de Seguros y Reaseguros. October 2022 - November 2022. (Pablo Ayala Santamaría, Alexis Cantizano González)
  The objective of this collaboration is to carry out two numerical simulation using FDS of a fire incident in a wharehouse located at Tomelloso.

- **The decarbonisation of heavy-duty transport in Spain and Portugal**
  Asociación Ibérica de Gas Natural, Hidrógeno y Gas Renovable para la Movilidad (GASNAM). December 2022 - April 2023. (Rafael Cossent Arín, Pedro Linares Llamas, Manuel Pérez Bravo, Santiago Serna Zuluaga)
  The projects aims to carry out a study on "The decarbonisation of heavy-duty transport in Spain and Portugal", including the following elements:
  • Characterization of the current state of the transport sector, particularly land and maritime heavy-duty transport.
  • Evaluation of the penetration of alternative fuels in the heavy-duty transport in Spain and Portugal, including fleets, fuel supply infrastructure, and utilization.

• Status of projects for the production of biomethane and hydrogen, particularly those aimed at supplying land and martime transport demand.
• Identification and evaluation of recent regulatory developments relevant to the objectives of the study, and analysis of compliance with energy policy objectives.
• Carry out a comparison between the situation in Spain and Portugal and the leading European countries in production and use of renewable gases for transport.

- **Technical support for the tools DECA, HADES and MODEM**
  Endesa Medios y Sistemas S.L. January 2023 - December 2023. (Eugenio Francisco Sánchez Úbeda, José Portela González, Javier García González)

  The objective of this project is to provide ENDESA with technical support and maintenance of the tools DECA, MODEM, HADES, EXLA and EXCOM developed by IIT.

- **Academic coordination in the preparation of the study «The impact of energy poverty on the social vulnerability of the population attended by the Spanish Red Cross in the context of the inflationary crisis»**
  Cruz Roja Española. January 2023 - December 2023. (Roberto Barrella, Sebastián Mora Rosado, José Carlos Romero Mora, Efraim Centeno Hernáez)

  The main objective of this applied research project is to analyse the different situations and dimensions of energy poverty experienced by the population assisted by the Spanish Red Cross in the context of the inflationary crisis we are experiencing in Spain and the rest of Europe.
  The research and academic coordination carried out offers an analysis of the attended population based on the characteristics that are most relevant in the context of energy poverty: socio-demographic data, efficiency and housing conditions, economic, occupational and school situation of household members, risk of poverty and/or social exclusion (AROPE), objective and subjective dimensions of energy poverty, family strategies to combat energy poverty and its risks, consequences and degree of social protection.
  The project is based on the coordination and cooperation of/with the parties involved for the realisation of the study with a double quantitative/qualitative approach.

- **Prospects for industrial transformation towards a green economy**
  Fundación Naturgy. February 2023 - May 2023. (Pedro Linares Llamas, Timo Gerres)

  This report characterizes the situation of the national industry in the European context, differentiating between different sectors according to their energy consumption and emission intensity. Starting from the state of the industrial sector, the main challenges of the industrial transition towards an emissions-neutral society in the year 2050 are identified. The analysis of these challenges focuses on the different regulatory options for industrial policy at a national and European level. Based on the results, the opportunities and risks for the Spanish industry are identified.

- **Simulation using FDS of an event in Vallada**
  Investigation Service Technologies (IST). February 2023 - October 2023. (Pablo Ayala Santamaría)

  The objective of this collaboration is to carry out two numerical simulation using FDS of a fire incident in a wharehouse located at Vallada.

- **Statistical analysis of data from the study «The impact of energy poverty on the social vulnerability of the population attended by the Spanish Red Cross in the context of the inflationary crisis»**
  Cruz Roja Española (CRE). May 2023 - September 2023. (Roberto Barrella, José Carlos Romero Mora)

  The main objective of the project is to carry out a statistical analysis of the data from the study "The impact of energy poverty on the social vulnerability of the population attended by the Spanish Red Cross in the context of the inflationary crisis". This objective can be broken down into three sub-objectives:
  1. Preparation of the database provided by the Spanish Red Cross for the study and preliminary descriptive analysis.
  2. Obtaining the main aggregated energy poverty indicators and the AROPE indicator for the sample of households.
  3. Factor analysis and disaggregated study of the sample to identify the determinants of energy poverty in the households attended by the Spanish Red Cross in the context of the inflationary crisis.
  The statistical analysis takes into account the following elements (among others): socio-demographic data, education, origin, income, employment, housing, and the variables that make up the AROPE.

- **Digitilization of electrical distribution networks: indicators and investments**
  Fundación Naturgy. May 2023 - November 2023. (Rafael Cossent Arín, Tomás Gómez San Román, José Pablo Chaves Ávila, Gregorio López López, Javier Matanza Domingo, Miguel Ángel Sánchez Fornié, Carlos Mateo Domingo, Néstor Rodríguez Pérez)

  The objective of the proposed collaboration is to develop a report on "Digitalization of electrical distribution networks: indicators and investments". This report is a continuation of the first report published in September 2021, which delves into the following aspects:
  - Indicators to measure how digitized the networks are and establish the correspondence between the service provided (performance) and the degree of digitization.
  - Current trends in investments in network digitilization and the most relevant innovation projects in the European and Spanish context, identifying the main challenges for their deployment.

- **Briefing about the EU green hydrogen strategy in Africa assessed from the perspective of PCD and sustainable development in partner countries**
  Trans European Policy Studies Association aisbl (TEPSA). July 2023 - September 2023. (Timo Gerres, Rafael Cossent Arín)

In line with the European Union (EU) 's goal to achieve climate neutrality by 2050, the European Commission introduced a new external energy strategy as part of the REPowerEU plan in April 2022. The strategy focuses on preferred partnerships with potential exporting countries to ensure a stable supply of renewable energy imports and enable 10 million tons of renewable hydrogen imports annually by 2030.
The Briefing evaluates the strategy's alignment with Policy Coherence for Development by assessing its support for African partner countries to achieve their Sustainable Development Goals (SDGs), analysing partnership agreements with Namibia and Egypt, as well as considering Africa's energy transition status and uncertainties in the global renewable hydrogen trade.

3.2.3.2 Public funding

- **EDucation for DIgitalisation of Energy. Sector Skills Alliances for implementing a new strategic approach ("Blueprint") to sectoral cooperation on skills**
  Education, Audiovisual and Culture Executive Agency. January 2020 - December 2023. (Fernando de Cuadra García, Carlos Mateo Domingo, Miguel Ángel Sánchez Fornié, Álvaro Jesús López López, Juan Carlos del Real Romero, Pablo García González, María Belén Sánchez Alfayate)

  The EDDIE project aims at creating a Sector Skills Alliance (SSA) by bringing together all the relevant stakeholders in the energy value chain such as industry, education
  and training providers, European organisations, recruiters, social partners and public authorities. The main objective of this SSA is to develop a long-driven Blueprint for the
  digitalisation of the European energy sector to enable the matching between the current and future demand of skills necessary for the digitalisation of the energy sector and
  the supply of improved Vocational Education and Training (VET) systems and beyond.

3.3 Publications

3.3.1 Books

- E. Aracil, I. Sancak, *"Essential concepts of sustainable finance".* Editors: Aracil Fernández, Elisa María; Sancak, Ibrahim. Publisher: Routledge, part of the Taylor & Francis Group. ISBN: 978-1-032-31687-1. July 2023.

3.3.2 Chapters in books

- E. Aracil, I. Sancak, *"Sustainable finance a multidimensional and multi actor framework".* Chapter in the book "Essential concepts of sustainable finance". Editors: Aracil Fernández, Elisa María; Sancak, Ibrahim. Publisher: Routledge, part of the Taylor & Francis Group. Pp. 1-6. ISBN: 978-1-032-31687-1. July 2023.

- C. Batlle, P. Mastropietro, P. Rodilla, I.J. Pérez-Arriaga, *"Resource adequacy in decarbonizing power systems: Lessons learned from both sides of the Atlantic".* Chapter in the book "Capacity mechanisms in the EU energy market: Law, policy, and economics". Editors: Hancher, L.; et al., . Publisher: Oxford University Press. Pp. 123-143. ISBN: 978-0-19-284980-9. October 2022.

- T. Gerres, J.P. Chaves, F. Martín, M. Rivier, A. Sánchez, T. Gómez, *"Guiding the transition: design challenges in decarbonising electricity markets".* Chapter in the book "Handbook on the economics of renewable energy". Editors: del Río González, Pablo; Ragwitz, Mario. Publisher: Edward Elgar Publishing. Pp. 179-205. ISBN: 978-180037-901-5. July 2023.

- P. Linares, J.C. Romero, *"Definición reconciliación desde la ecología".* Chapter in the book "Reconciliación transdisciplinar". Editors: Martínez-Gayol Fernández, Nurya. Publisher: Tirant Humanidades. Pp. 119-133. ISBN: 978-84-18970-19-1. December 2022.

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- J.C. del Real-Romero, S. López de Armentia, E. Paz, H. Handwerker, F. Debor, *"Biomedical adhesives: qualification, specification, quality control, and risk mitigation".* Chapter in the book "Advances in structural adhesive bonding". Editors: Dillard, David A. Publisher: Elsevier Ltd.. Pp. 877-908. ISBN: 978-0-323-91214-3. June 2023.

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3.3.3 Publications in journals

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- A. Baringo, L. Baringo, J.M. Arroyo, *"Robust virtual power plant investment planning",* Sustainable Energy, Grids and Networks, vol. 35, pp. 101105-1-101105-12. ISSN: 2352-4677. July 2023/September 2023.

- R. Barrella, *"Abordando la pobreza energética de manera integrada. Una caracterización interdisciplinar de los hogares vulnerables españoles y propuesta para implementar soluciones técnicas y regulatorias viables",* Papeles de Energía, nº. 21, pp. 53-89. ISSN: 2445-2726. June 2023.

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- G.L. Rajora, P. Calvo-Báscones, C. Mateo, M.A. Sanz-Bobi, R. Palacios, M. Bolfek, D. Vrbicic Tendera, H. Keko, *"Application of machine learning techniques for asset management and proactive analysis in power systems"*, Communication in International Conference on Power System Technology - POWERCON 2022. Kuala Lumpur (Malaysia). 12-14 September 2022.

- A. Rodrigues de Oliveira, V. Navega, J. Villar, J.P. Tomé Saraiva, F.A. Campos, *"Hybridization of CEVESA MIBEL market model based on market outcomes"*, Communication in 18th International Conference on the European Energy Market - EEM22. Ljubljana (Slovenia). 13-15 September 2022.

- J.M. Asensio-Gil, R. Lancashire, E.J. Dijkstra, A. Carnicero, F.J. López-Valdés, *"Development of a multibody 50th percentile model for Euro NCAP's Pedestrian Test Protocol"*, Communication in International Research Council on Biomechanics of Injury - IRCOBI Europe 2022. Porto (Portugal). 14-16 September 2022.

- M. Valdano, J.M. Asensio-Gil, J.R. Jiménez-Octavio, M. Cabello-Reyes, R. Vasserot-Tolmos, F.J. López-Valdés, *"Parametric analysis of the effect of CRS seatback angle in dummy measurements in frontal impacts"*, Communication in International Research Council on Biomechanics of Injury - IRCOBI Europe 2022. Porto (Portugal). 14-16 September 2022.

- M. Castro, M. García-Sánchez, J. Faro, *"BCR-antigen catch bond behavior"*, Communication in 12th European Conference on Mathematical and Theoretical Biology - ECMTB 2022. Heidelberg (Germany). 19-23 September 2022.

- M. García-Sánchez, M. Castro, J. Faro, *"The rotational diffusion of B-cell receptor vs antibody paratopes differentially affects their antigen binding kinetics"*, Poster in 12th European Conference on Mathematical and Theoretical Biology - ECMTB 2022. Heidelberg (Germany). 19-23 September 2022.

- P. Brito-Pereira, P. Rodilla, P. Mastropietro, L.A. Barroso, C. Batlle, *"Efficient de-rating in modern capacity mechanisms and the interdepence with reliability metrics"*, Communication in 17th IAEE European Energy Conference. Athens (Greece). 21-24 September 2022.

- E. Bernabéu Martínez, S. Moltó, M. Sáenz, T. Belenguer, C. García-Izquierdo, M. N. Medina, D. Campo Maldonado, *"Quantum Pascal: propuestas límite y fundamentación cuántica"*, Paper in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- R.M. Lorente-Pedreille, M.A. Sebastián, M. Sáenz, M. N. Medina, *"Contribuciones de incertidumbre de interés en la magnitud de par de torsión de aplicación en el sector eólico"*, Poster in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- S. Moltó, T. Belenguer, M. Sáenz, C. García-Izquierdo, E. Bernabéu Martínez, *"Diseño óptico de un patrón cuántico de presión basado en la medida del índice de refracción de un gas"*, Poster in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- M. Sáenz, D. Campo Maldonado, M.R. Salas Labayen, M.V. Montes Gan, N. López Salas, O. Martín Carrasquilla, A. López-Pintor, G. Pedraza Carballo, *"Metodologías innovadoras para la difusión en metrología. Escape room virtuales sobre metrología legal y sistema internacional de unidades. Indicadores para el seguimiento de los proyectos"*, Poster in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- M. Sáenz, R. Giannetti, N. Pérez Mallada, *"Iniciación a la metrología. Experiencia docente en el diseño curricular de una asignatura transversal basada en la práctica para la transmisión de conocimientos metrológicos en distintas áreas de la formación universitaria"*, Paper in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- M. Sáenz, C. Sánchez-Blaya, A. Sáez-Serrano, T.E. Fernández-Vicente, *"Laboratorio de Metrología de la Salud en el CEM"*, Paper in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- A. Sáez-Serrano, M. Sáenz, C. Sánchez-Blaya, T.E. Fernández-Vicente, *"Etapas en el desarrollo de la metrología sanitaria en España"*, Poster in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- M.A. Sebastián, M. Sáenz, E. M. Rubio, *"Análisis de contenidos metrológicos en las normas españolas para el sector de la automoción CETA (1947 a 1975)"*, Paper in 7º Congreso Español de Metrología. Ávila (Spain). 27-29 September 2022.

- D.P. Morán-Río, J. Roldán-Pérez, M. Prodanovic, A. García-Cerrada, *"Small-signal analysis of a microgrid with secondary control including the dynamics of primary control and communication delays"*, Communication in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- H. Nemati, L. Sigrist, L. Rouco, P. Sánchez, A. Ortega, *"Addressing unfeasibilities of energy storage systems participating in energy and reserve markets"*, Communication in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- O. Oladimeji, L. Sigrist, A. Ortega, *"Guaranteeing the provision of primary frequency control services by distributed generation"*, Communication in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- M. Oluic, M.A. Antolín Liñán, B. Berggren, M. Ghandhari, L. Rouco, *"Detection and properties of voltage impasse regions in the presence of nonlinear static loads"*, Communication in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- N. Rodríguez Pérez, J. Matanza, G. López, V. Stojanovic, *"Scalability evaluation of a Modbus TCP control and monitoring system for Distributed Energy Resources"*, Communication in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- M. Troncia, *"Local markets for energy communities: designing efficient markets and assessing the integration from the electricity system perspective"*, Paper in IEEE PES International Conference on Innovative Smart Grid Technologies Europe - ISGT Europe 2022. Novi Sad (Serbia). 10-12 October 2022.

- F.J. López-Valdés, E. Sánchez, K. Bhalla, D. Bose, M. Seguí-Gómez, J.R. Crandall, *"Influence of certification in the impact response of motorcycle helmets: a multi-country study"*, Communication in 66th AAAM Annual Scientific Conference - AAAM 2022. Portland (United States of America). 11-14 October 2022.

- S. Moltó, M. Sáenz, E. Bernabéu Martínez, M. N. Medina, *"Uncertainty in mechanical deformation of a Fabry-Perot cavity due to pressure: towards best mechanical configuration"*, Communication in World Congress of the International Measurement Confederation - IMEKO 24th TC3 -14th TC5 - 6th TC16 - 5th TC22. Cavtat (Croatia). 11-13 October 2022.

- S. Moltó, M. Sáenz, C. García-Izquierdo, E. Bernabéu Martínez, *"A parametric methodology for the assigment of pressure values versus refractive measurement"*, Communication in World Congress of the International Measurement Confederation - IMEKO 24th TC3 -14th TC5 - 6th TC16 - 5th TC22. Cavtat (Croatia). 11-13 October 2022.

- L.F. S. Merchante, C.M. de Argila, F.J. López-Valdés, *"A pilot analysis of crash severity of electric passenger cars in Spain (2016-2020)"*, Communication in 66th AAAM Annual Scientific Conference - AAAM 2022. Portland (United States of America). 11-14 October 2022.

- M. Valdano, J.R. Jiménez-Octavio, F.J. López-Valdés, B. Pipkorn, *"Evaluation of serious occupant injuries using a deterministic and probabilistic method in frontal crashes"*, Communication in 66th AAAM Annual Scientific Conference - AAAM 2022. Portland (United States of America). 11-14 October 2022.

- L. Herding, J.P. Chaves, S. Bañales, R. Cossent, M. Rivier, T. Gómez, *"Do network investment costs outweigh the benefits of integrating high shares of renewable generation into electricity networks?"*, Poster in 9th International Conference on Integration of Renewable and Distributed Energy Resources - IRED 2022. Adelaide (Australia). 24-26 October 2022.

- M. Troncia, J.P. Chaves, M. Valarezo, L. Lind, R. Cossent, *"Flexibility markets for voltage control in transmission and distribution grids: quantitative assessment of a realistic case study"*, Poster in 9th International Conference on Integration of Renewable and Distributed Energy Resources - IRED 2022. Adelaide (Australia). 24-26 October 2022.

- P. Riaza, S. Dorado, J.R. Jiménez-Octavio, A. Arias, *"Supervivencia del diente endodonciado ¿son los datos experimentales de los estudios biomecánicos trasladables a una situación clínica real?"*, Poster in 42º Congreso Nacional de Endodoncia - AEDE 2022. Zaragoza (Spain). 27-29 October 2022.

- T. Gerres, J.P. Chaves, P. Linares, *"The impact of industrial policymaking on the economics of low-emission technologies: the TRANSid model"*, Communication in 17th Conference on Sustainable Development of Energy, Water and Environment Systems - SWEDES 2022. Paphos (Cyprus). 06-10 November 2022.

- G. Marulanda, J. Cifuentes, A. Bello, J. Reneses, *"Short-term wind power forecasting by a long short term memory ensemble approach"*, Communication in 13th International Renewable Energy Congress - IREC 2022. Hammamet (Tunisia). 13-15 December 2022.

- C. Álvarez-Romero, J.A. Rivas-González, C. Jiménez-de-Juan, A. Polo-Molina, E.F. Sánchez-Úbeda, C. Rodríguez-Morcillo, R. Palacios, J. Portela, A. Muñoz, C.L. Parra-Calderón, C. Hernández-Quiles, *"Evaluación de la movilidad de pacientes crónicos complejos mediante dispositivos de seguimiento para su valoración pronóstica"*, Poster in XIX IBiS Researchers Forum. Seville (Spain). 15-16 March 2023.

- J. Suárez Porras, D.I. Stroe, A. Sangwongwanich, *"State-of-energy balancing control with cascaded H-bridge for second-life batteries"*, Paper in IEEE Applied Power Electronics Conference and Exposition - APEC 2023. Orlando (United States of America). 19-23 March 2023.

- C. Álvarez-Romero, C. Jiménez-de-Juan, A. Polo-Molina, E.F. Sánchez-Úbeda, C. Rodríguez-Morcillo, R. Palacios, J. Portela, C. Hernández-Quiles, *"Evaluación de la movilidad de pacientes crónicos complejos mediante dispositivos de seguimiento para su valoración pronóstica"*, Communication in XXVI Congreso Nacional de Informática de la Salud - Inforsalud 2023. Madrid (Spain). 21-23 March 2023.

- M. Tangi, S. Ruggeri, M. Troncia, A. Amaranto, *"A multi-objective approach to design integrated multi-energy systems for efficient and sustainable decarbonization at the regional level"*, Communication in EGU General Assembly - EGU23. Vienna (Austria). 23-28 April 2023.

- M.A. Rios-Ocampo, I. Segarra, R. Barrella, *"Explainable artificial intelligence (xai) for energy poverty analysis: a spanish case of study"*, Communication in 8th Meeting on Energy and Environmental Economics - ME3. Aveiro (Portugal). 08 May 2023.

- M. Monteagudo Honrubia, F.J. Herraiz-Martínez, J. Matanza, *"Automatic classification and permittivity estimation of glycerin solutions using a dielectric resonator sensor and machine learning techniques"*, Communication in IEEE International Instrumentation and Measurement Technology Conference - I2MTC 2023. Kuala Lumpur (Malaysia). 22-25 May 2023.

- L. Montero, A. Bello, J. Reneses, *"Analyzing the computational burden of global-linking balance equations in the medium-term unit commitment problem"*, Communication in IEEE PES Generation Transmission and Distribution Conference - 2023 IEEE PES GT&D. Istanbul (Turkey). 22-25 May 2023.

- R. Barrella, *"Energy burden in a time of crisis: analysing the evolution of electricity bills in Spanish households"*, Communication in XVIII Congreso de la Asociación Española para la Economía Energética. Castellon de la Plana (Spain). 24-26 May 2023.

- T. Gerres, P. Linares, *"The economics of fossil decarbonisation in industrial processes for a targeted policy design"*, Communication in XVIII Congreso de la Asociación Española para la Economía Energética. Castellon de la Plana (Spain). 24-26 May 2023.

- L. Sigrist, *"Frequency stability constrained unit commitment in isolated power system with high penetration of renewables energy sources"*, Paper in 21st International Conference on Renewable Energy and Power Quality - ICREPQ'23. Madrid (Spain). 24-26 May 2023.

- S. Bindu, L. Olmos, J.P. Chaves, *"Integrating the central-dispatch markets into the European balancing platforms: main lessons learnt and challenges"*, Communication in 19th International Conference on the European Energy Market - EEM23. Lappeenranta (Finland). 06-08 June 2023.

- S. Bindu, M. Troncia, J.P. Chaves, A. Sanjab, *"Bid forwarding as a way to connect sequential markets: opportunities and barriers"*, Communication in 19th International Conference on the European Energy Market - EEM23. Lappeenranta (Finland). 06-08 June 2023.

- J.F. Gutiérrez, T. Gerres, S. Serna, J.P. Chaves, *"Exploring the synergies of biomass-based top-cycle CHP plants with hydrogen for industrial applications"*, Communication in 19th International Conference on the European Energy Market - EEM23. Lappeenranta (Finland). 06-08 June 2023.

- D.P. Morán-Río, J. Roldán-Pérez, M. Prodanovic, A. García-Cerrada, *"Enabling the seamless coordination and synchronization of microgrids using batteries"*, Communication in 23rd IEEE International Conference on Environment and Electrical Engineering - EEEIC 2023. Madrid (Spain). 06-09 June 2023.

- A. Rodrigues de Oliveira, J. Villar, J.P. Tomé Saraiva, F.A. Campos, *"Improved hybridization of CEVESA MIBEL market model based on real market data"*, Paper in 19th International Conference on the European Energy Market - EEM23. Lappeenranta (Finland). 06-08 June 2023.

- M. Usman, B. Mohandes, F. Capitanescu, A. G. Madureira, M. Bolfek, Z. Matisic, F.J. Soares, N. S. Fonseca, H. S. Teixeira, C. Mateo, *"Scalable uncertainty aware ancillary services procurement tool for active distribution systems"*, Communication in 27th International Conference and Exhibition on Electricity Distribution - CIRED 2023. Rome (Italy). 12-15 June 2023.

- O. Oladimeji, L. Sigrist, A. Ortega, B. Marinescu, V. Thomas, *"Real-time operation of dynamic virtual power plants: integrating re-dispatch optimization with the dynamic DVPP model"*, Communication in 21st European Control Conference - ECC2023. Bucharest (Romania). 13-16 June 2023.

- M. Brenner-Fliesser, M. Avanzini, M. Bonsfills, C.E. Borges, D. Abi Ghanem, V. Ivanova, M. Hortamani, M. Miletic, A. Mink, J. Mwasaru, F.J. Sainz de Salces, J. Slacik, P. Tobin, C. Valor, *"A framework for measuring stakeholder engagement in energy transitions projects"*, Communication in 11th Sustainable Places Conference - SP 2023. Madrid (Spain). 14-16 June 2023.

- J.A. Font, J. Jarauta Gastelu, R. Gesteira Miñarro, R. Palacios, G. López, *"Threat models for vulnerability analysis of IoT devices for manipulation of demand attacks"*, Communication in VIII Jornadas Nacionales de Investigación en Ciberseguridad - JNIC 2023. Vigo (Spain). 21-23 June 2023.

- V. García Fernández, N. Rodríguez Pérez, R. Gesteira Miñarro, J. Matanza, R. Palacios, G. López, *"Dynamic risk assessment tool for customer IoT infrastructures for smart grids"*, Communication in VIII Jornadas Nacionales de Investigación en Ciberseguridad - JNIC 2023. Vigo (Spain). 21-23 June 2023.

- R. Gesteira Miñarro, G. López, R. Palacios, *"Ingeniería inversa sobre protocolos de radiofrecuencia para sistemas Remote Keyless Entry"*, Communication in VIII Jornadas Nacionales de Investigación en Ciberseguridad - JNIC 2023. Vigo (Spain). 21-23 June 2023.

- A. Pérez-Sánchez, R. Palacios, *"Evaluation of local security event management system vs. standard antivirus software"*, Communication in VIII Jornadas Nacionales de Investigación en Ciberseguridad - JNIC 2023. Vigo (Spain). 21-23 June 2023.

- F.M. Echavarren, L. Rouco, A. Benítez Domínguez, L. Sigrist, *"Power flow algorithm using a second-order differentation approach"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- L. Herding, R. Cossent, M. Rivier, *"Enhancing RES grid connection via dynamic hosting capacity and hybridization"*, Poster in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- N. Jankovic, J. Roldán-Pérez, M. Prodanovic, S. D'Arco, J.A. Suul, L. Rouco, *"Multimode power oscillation damping controller synthesis using vector fitting"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- G.L. Rajora, M.A. Sanz-Bobi, *"Development of a smart environment for asset management in power grids – ATTEST project"*, Paper in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- N. Rodríguez Pérez, J. Matanza, G. López, M. Hajigholi, *"Scalability analysis of a wireless M-Bus system for smart metering and sensoring"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- A. Rouco, M. Rajabdorri, E. Lobato, L. Sigrist, *"Analytical frequency-constrained UC for island power systems"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- A. Tomás-Martín, A. García-Cerrada, L. Sigrist, S.J. Yagüe, D. Rubio Miguel, F.D. Martín Utrilla, *"Re-synchronisation of a microgrid to the main grid using multi-agent secondary control"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- M. Vadillo, L. Sigrist, U. Rudez, *"Design and comparison of UFLS schemes of isolated power systems based on frequency stability margin"*, Communication in 15th IEEE PowerTech Conference - PowerTech 2023. Belgrade (Serbia). 25-29 June 2023.

- A. Tomás-Martín, A. García-Cerrada, L. Sigrist, S.J. Yagüe, J. Suárez Porras, *"State relevance and modal analysis in electrical microgrids with 100% grid-forming converters"*, Communication in XXX Seminario Anual de Automática, Electrónica industrial e Instrumentación - SAAEI 2023. Seville (Spain). 05-07 July 2023.

- E. Centeno, F.A. Campos, L.J. Fernández, *"Capex temporal allocation and cost recovery in long-term generation capacity expansion planning"*, Communication in 23rd Conference of the International Federation of Operational Research Societies - IFORS 2023. Santiago de Chile (Chile). 10-14 July 2023.

- A. Polo-Molina, E.F. Sánchez-Úbeda, J. Portela, R. Palacios, C. Rodríguez-Morcillo, A. Muñoz, C. Álvarez-Romero, C. Hernández-Quiles, *"Analyzing mobility patterns of complex chronic patients using wearable activity trackers: a machine learning approach"*, Communication in 9th International Conference on Time Series and Forecasting - ITISE 2023. Las Palmas de Gran Canaria (Spain). 12-14 July 2023.

- F. Rodríguez-Cuenca, E.F. Sánchez-Úbeda, J. Portela, A. Muñoz, V. Guizien, A. Veiga, A. Mateo, *"Probability density-based energy-saving recommendations for household refrigerating appliances"*, Communication in 9th International Conference on Time Series and Forecasting - ITISE 2023. Las Palmas de Gran Canaria (Spain). 12-14 July 2023.

- M. Reneses, M. Riberas-Gutiérrez, N. Bueno-Guerra, *"“Sólo es humor”. Sexismo, homofobia y violencia online en la conformación del género y la sexualidad en los adolescentes"*, Communication in Jornadas Internacionales EDIGA: Género, Entornos Digitales y Adolescencia - EDIGA 2023. Santiago de Compostela (Spain). 13-14 July 2023.

- M. Riberas-Gutiérrez, M. Reneses, N. Bueno-Guerra, *"Género, sexualidad y online grooming: diferencias en las estrategias de los agresores y en la percepción del riesgo de las víctimas"*, Communication in Jornadas Internacionales EDIGA: Género, Entornos Digitales y Adolescencia - EDIGA 2023. Santiago de Compostela (Spain). 13-14 July 2023.

- M. Vadillo, L. Sigrist, L. Rouco, U. Rudez, *"Design and sensitivity analysis of underfrequency load-shedding schemes of isolated power systems based on frequency stability margin"*, Communication in IEEE Power & Energy Society General Meeting - IEEE PES GM 2023. Orlando (United States of America). 16-20 July 2023.

- J. Pérez, E. Awad, M. Castro, G. López, *"Causality guiding survey analysis: a use case on cyberbullying"*, Communication in 9th International Conference on Computational Social Science - IC2S2 2023. Copenhagen (Denmark). 17-20 July 2023.

- P. Brito-Pereira, P. Rodilla, P. Mastropietro, C. Batlle, *"Firm supply of demand resources and CRM cost allocation"*, Communication in 18th IAEE European Energy Conference. Milano (Italy). 24-27 July 2023.

- D.M. Navarrete Cruz, A. Bello, P. Rodilla, *"A two-stage approach to represent the daily LNG carriers unloading in natural gas optimization models"*, Communication in 18th IAEE European Energy Conference. Milano (Italy). 24-27 July 2023.

3.3.5 IIT working papers

This section includes working papers that have been registered.

- R. Barrella, E. Centeno, J.C. Romero, *"Evaluation of CLIMAte change and energy poverty mitigaTIon in EU member StatEs".* November 2022. Ref: IIT-22-250WP.

- S. Bindu, J.P. Chaves, L. Olmos, *"The devil is in the details. An evaluation of intrazonal congestion management methods in Europe".* March 2023. Ref: IIT-23-037WP.

- E. Centeno, F.A. Campos, J. Maguregui, L.J. Fernández, S. Wogrin, *"Minimum-cost-based capacity planning: does annualized capital expenditure always yield full cost recovery with marginal pricing? (extended version)".* January 2023. Ref: IIT-23-006WP.

- J.P. Chaves, R. Cossent, T. Gómez, P. Linares, M. Rivier, *"An assessment of the European electricity market reform options and a pragmatic proposal".* March 2023. Ref: IIT-23-035WP.

- A. Cidoncha, A. Fernández Rodríguez, A.P. Cucala, A. Fernández-Cardador, *"Predictive traffic regulation algorithm for a railway mass transit line equipped with CBTC".* July 2023. Ref: IIT-23-159WP.

- T. Domínguez Larre, L.A. Herrero, F.A. Campos, *"Batteries ageing impact on economic medium-term dispatch models of electricity generation".* June 2023. Ref: IIT-23-140WP.

- M.A.E. Elabbas, *"African power pools: institutions, reforms, issues and challenges".* April 2023. Ref: IIT-23-052WP.

- T. Freire-Barceló, F. Martín, A. Sánchez, *"Demand participation in balancing services".* February 2023. Ref: IIT-23-027WP.

- L.A. Herrero, F.A. Campos, J. Villar, *"A Cournot joint equilibrium model for the medium-term hydrogen and electricity markets".* June 2023. Ref: IIT-23-138WP.

- J. Mahou, R. Castañón, F.A. Campos, A. Rodrigues de Oliveira, J. Villar, *"Integrating mobility and power system expansion models to assess the role of fuel cell vehicles in the Iberia energy transition".* June 2023. Ref: IIT-23-139WP.

- D.P. Morán-Río, A. Anta, J. Roldán-Pérez, M. Prodanovic, A. García-Cerrada, *"Coordination of distributed resources for frequency support provision in microgrids".* September 2022. Ref: IIT-22-181WP.

- N. Morell, J.P. Chaves, T. Gómez, P. Dueñas, T. Schittekatte, *"Advancing in the implementation of forward-looking incremental network charges: locational granularity, ex-post pricing, and customer response coordination".* April 2023. Ref: IIT-23-058WP.

- P. Otaola-Arca, J. García-González, P. Linares, *"Assessing the impact of environmental taxes on electricity price makers with shared asset ownership".* April 2023. Ref: IIT-23-054WP.

- P. Rodilla, P. Mastropietro, P. Brito-Pereira, C. Batlle, *"The challenge of integrating demand response in capacity remuneration mechanisms".* November 2022. Ref: IIT-22-249WP.

- A. Rodrigues de Oliveira, J. Villar, J.P. Tomé Saraiva, F.A. Campos, *"Modelling single price area interconnections in the EU electricity market".* November 2022. Ref: IIT-22-244WP.

- A.F. Rodríguez Matas, P. Linares, M. Pérez-Bravo, J.C. Romero, *"Robustness in strategic energy planning: A decision support method based on robust optimization and min-max regret".* July 2023. Ref: IIT-23-160WP.

- N. Rodríguez Pérez, J. Matanza, G. López, R. Cossent, J.P. Chaves, C. Mateo, T. Gómez, M.A. Sánchez Fornié, *"Measuring the digitalisation of electricity distribution systems: towards the smart grid".* November 2022. Ref: IIT-22-241WP.

- R. Rodríguez-Vilches, F. Martín, A. Sánchez, J.R. Gutiérrez de la Cámara, *"Assessing the openness of European electricity markets to prosumer participation: an indicator-based analysis".* March 2023. Ref: IIT-23-030WP.

- M. Valdano, J.R. Jiménez-Octavio, B. Pipkorn, A. Otero-Peinador, L.F. S. Merchante, F.J. López-Valdés, *"Evaluation of AIS3+ car occupant injuries using deterministic and probabilistic methods in frontal crashes".* September 2022. Ref: IIT-22-193WP.

3.3.6 Other publications

This section includes both technical reports prepared for companies and institutions in the framework of research projects that are usually confidential documents, as well as electronic press.

- D. Alfaya, *"Innovación docente, sello de identidad de Comillas".* Electronic press in Universidad Pontificia Comillas. Madrid (Spain). July 2023.

- E. Aracil, *"Finanzas sostenibles para nuestro futuro común".* Electronic press in Universidad Pontificia Comillas. Madrid (Spain). December 2022.

- E. Aracil, *"Las empresas que cuidan la sostenibilidad obtienen mayor rentabilidad financiera".* Electronic press in The Conversation Media Group Ltd. Madrid (Spain). December 2022.

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4. Teaching

The experience that the IIT holds in various technological fields is a valuable input for the different Bachelor's and Master's degrees offered by the ICAI School of Engineering

This section presents the Bachelor and Master Theses that have been supervised by IIT staff during the last academic year, and the list of Master courses where IIT Researchers have participated as lecturers.

4.1 Supervised undergraduate theses at IIT

4.1.1 Bachelor's Degree in Engineering for Industrial Technologies

- *Análisis comparado del marco y los incentivos a la creación de comunidades energéticas en Reino Unido, California (EE.UU.), Queensland (Australia) y España.*
  Fernández-Vega Escandón, Mónica. Supervised by Jesús José Fernández García, Jose Pablo Chaves Ávila.

- *Análisis del Ciclo de Vida social de la agricultura intensiva de invernadero*
  Martín Moreno, Miriam. Supervised by José Carlos Romero Mora.

- *Análisis del impacto en la red de distribución eléctrica de diferentes estrategias de recarga inteligente para vehículos eléctricos*
  Damotte Huedo, Lucas. Supervised by Miguel Martínez Velázquez.

- *Análisis prospectivo de la demanda energética residencial e implementación de medidas de adaptación al riesgo de shock de precios*
  Bernabeu Villena, José. Supervised by José Carlos Romero Mora, Roberto Barrella.

- *Centrales solares fotovoltaicas flotantes*
  Santos Piñas, Guillermo. Supervised by Luis Rouco Rodríguez.

- *Comparación de alternativas de bajas emisiones para la producción de acero primario en España en base a diferentes indicadores.*
  Aseguinolaza Cartas, Javier. Supervised by Timo Gerres.

- *Comparing optimal power for the provision of flexibility by distribution system*
  Téllez Ruiz, Ignacio. Supervised by Álvaro Ortega Manjavacas, Lukas Sigrist.

- *Contribución de las comunidades energéticas en la descarbonización de la economía local: Un caso de estudio para España.*
  Arcos Presedo, María Cruz. Supervised by Jesús José Fernández García, Manuel Pérez Bravo.

- *Convertidor CC-CC reductor multi-fásico controlado por microprocesador*
  Urgel Fernández, María Cinta. Supervised by Aurelio García Cerrada.

- *Convertidor CC-CC reductor trifásico 24V a 5V y 3.3V*
  Macarulla Trell, Jorge. Supervised by Aurelio García Cerrada.

- *Desarrollo de un modelo de optimización de los movimientos de una comercializadora de gas*
  Canseco Olalla, Jacobo. Supervised by Javier García González.

- *Desarrollo de un modelo de planificación de la operación de un sistema eléctrico en Python-Pyomo*
  Raposo Picos, Juan. Supervised by Javier García González.

- *Development of a PSS/E tool for simulating multiple high voltage direct current multiterminal links with voltage source converters*
  Prieto Rodríguez de Vera, Carlos. Supervised by Luis Rouco Rodríguez.

- *Development of a VSC-based low voltage STATCOM system*
  Pérez del Río, Emilio. Supervised by Jorge Suárez Porras.

- *Development of Low-Cost IoT-Based Crop Monitoring system using LoRa and Wireless Sensor Networks*
  Fluxá Íñiguez, María Irene. Supervised by GopaL Lal Rajora.

- *Dimensiones de pobreza energética y modelos de optimización de largo plazo: una categorización para una transición energética justa*
  Banqueri Camy, Carmen. Supervised by Miguel Angel Rios Ocampo, Roberto Barrella.

- *Estudio de impacto teórico de la Rehabilitación Exprés en el consumo energético de los hogares españoles*
  Río Miño, Ana del. Supervised by José Carlos Romero Mora, Roberto Barrella.

- *Estudio de la capacidad de conexión distribuida de vehículos eléctricos en redes urbanas*
  Gracia de Dios, Juan de. Supervised by Carlos Mateo Domingo, Miguel Martínez Velázquez.

- *Estudios cuantitativos sobre el impacto de la economía de la longevidad en diferentes realidades sociales*
  González-Ferrer Redondo, Paula. Supervised by David Roch Dupré.

- *Financial levers for making under-the-grid minigrid viable*
  Enríquez de la Fuente, Germán. Supervised by Pablo Dueñas Martínez.

- *Implementación de la función criptográfica E1 del estándar de Bluetooth en VHDL*
  Rivier Julien, Bosco Antonio. Supervised by Antonio Vázquez Blanco.

- *Implementation of a data-driven underfrequency load shedding in the unit commitment formulation of island power systems*
  Rouco Ferriz, Almudena. Supervised by Lukas Sigrist.

- *Massive RES integration in power systems - linking planning and dynamic simulations*
  Escartín Fernández de Landa, Ignacio. Supervised by Enrique Lobato Miguélez, Lukas Sigrist.

- *Mejora de un algoritmo de AGC para la integración de parques eólicos en regulación*
  Frutos de la Torre, Natalia de. Supervised by Ignacio Egido Cortés.

- *Optimización de la configuración de un parque solar utilizando diversos tipos de orientaciones y seguimientos*
  Pineda Salcedo, Beatriz. Supervised by Javier Reneses Guillén.

- *Planning for energy resilience: application to individual buildings*
  Muela Madrid, Jaime. Supervised by Pablo Dueñas Martínez.

- *Virtual synchronous machines - providing inertia in low-inertia RES power systems*
  Valdivielso Suárez, Emilio Juan. Supervised by Lukas Sigrist.

- *Wind uncertainty when providing primary frequency control*
  Rodríguez Barrero, Gonzalo Manuel. Supervised by Lukas Sigrist.

4.1.2 Bachelor's Degree in Engineering in Telecommunications Technologies

- *Análisis de los efectos producidos combinando diferentes fuentes de información en la recomendación de puntos de interés*
  Sicilia Gómez, Beatriz. Supervised by Pablo Sánchez Pérez.

- *Aplicación de técnicas de machine learning al análisis de arranques de turbinas de gas de generación eléctrica*
  Vaquero Serrano, Daniel. Supervised by Miguel Ángel Sanz Bobi.

- *Deep Learning-Based Outfit Generator System for Zara.com*
  Sanz Barro, Marta. Supervised by Miguel Ángel Sanz Bobi.

- *Desarrollo de una plataforma de extracción de conocimiento a partir de datos arbitrarios ?Machine Learning as a Service?*
  Divassón González, Ignacio. Supervised by Miguel Ángel Sanz Bobi.

- *Detección de anomalías cardiacas mediante técnicas de procesado digital y caracterización de la señal ECG*
  Barquero Jiménez, Sofía. Supervised by Javier Matanza Domingo.

- *Detección de ataques a redes y sistemas de información empleando técnicas de Deep Learning*
  Colino Ruipérez, Miriam. Supervised by Miguel Ángel Sanz Bobi.

- *Diseño, simulación y pruebas de un radar pasivo en la banda DVB-T2*
  López Gómez, Alejandro Manuel. Supervised by Javier Matanza Domingo.

- *Energy Communities: Current Situation, Benefits and Disadvantages and Scalability via Blockchain application*
  Magdalena Camacho, José Ignacio. Supervised by José Carlos Romero Mora.

- *Evaluación de clasificadores de voz para Smart Personal Assistants*
  Ríos Goytre, Pablo. Supervised by Gregorio Ignacio López López.

- *Evaluación de mecanismos de ciberseguridad en el sector del automóvil*
  Porro Nieves, José Ramón. Supervised by Gregorio Ignacio López López.

- *Evaluación de técnicas de Deep Learning para la detección de anomalías en máquinas rotativas*
  López Argote, Carlota. Supervised by Miguel Ángel Sanz Bobi.

- *Gamificación de Microprocesadores*
  Rica Escudero, Alejandra de la. Supervised by Francisco María Martín Martínez.

- *Generación sintética de datos para modelos de Machine Learning orientados a la caracterización dieléctrica de líquidos mediante un resonador dieléctrico*
  Villacampa Porta, Javier. Supervised by Francisco Javier Herraiz Martínez.

- *Generador de melodías mediante redes neuronales*
  Esteban Quesada, Claudio. Supervised by Miguel Ángel Sanz Bobi.

- *HONEYPOT PARA EL ANÁLISIS DE ATAQUES EN DISPOSITIVOS IoT*
  Hidalgo Felipe, Ernesto. Supervised by Gregorio Ignacio López López.

- *Mejora de la interfaz y experiencia de usuario de una mesa interactiva para análisis de movilidad a través de la generación de escenarios urbanos fotorrealistas*
  López Buendía, Tatiana. Supervised by Ignacio de Rodrigo Tobías.

- *Modelo de optimización para abordar el despliegue de infraestructura TIC en entornos rurales*
  Menéndez Ruiz de Azúa, Pablo. Supervised by Javier Matanza Domingo.

- *Predicción del éxito de la inversión de un Venture Capital en una Startup utilizando algoritmos de Machine Learning*
  Sala López, Armando. Supervised by Miguel Ángel Sanz Bobi.

- *Programming Energy Models in Python for the Decarbonization of the Spanish Energy System*
  Pérez Gutiérrez, Tomás. Supervised by Antonio Francisco Rodríguez Matas, Manuel Pérez Bravo.

- *Sistema inteligente para habitaciones hoteleras*
  Bueno Archaga, Luis. Supervised by Francisco María Martín Martínez.

4.2 Postgraduate teaching

4.2.1 Graduate courses

On the University website, as well as in the corresponding information brochures, you can find detailed information on the different master programs available. The master courses given by IIT staff in which they participate as lecturers are listed hereafter.

4.2.1.1 Official Master's Degree in the Electric Power Industry (MEPI)

Director: Luis Olmos Camacho
This master can also be taken in the context of the Erasmus Mundus *Master in Economics and Management of Network Industries* (EMIN). More information at http://www.icai.upcomillas.es/en/master/mepi-en

- *Fundamentals on electrical engineering and optimization techniques*
  Francisco Alberto Campos Fernández, Javier García González

- *Law and Legislation of the power industry*
  Tomás Gómez San Román

4.2.1.2 Master in Railway Systems

Director: Antonio Fernández Cardador
More information at http://www.icai.upcomillas.es/en/master/msf-en

- *Control, surveillance and digitization*
  José Antonio Rodríguez Mondéjar

- *Traffic operation design*
  Asunción Paloma Cucala García, Antonio Fernández Cardador

- *Electrification*
  Luis Rouco Rodríguez

- *ERTMS and RAMS regulations*
  Adrián Fernández Rodríguez

4.2.1.3 Master's Degree in Smart Industry (MIC)

Director: Bernardo Villazán
More information at
https://www.comillas.edu/en/masters/master-degree-in-smart-industry

- *IIoT-Cloud Communications*
  Gregorio López López, Néstor Rodríguez Pérez

- *Master Thesis*
  Álvaro Jesús López López

- *Smart Systems Applied to Industry*
  Álvaro Sánchez Miralles

4.2.1.4 Master's Degree in Big Data Technologies and Advanced Analytics (MBD)

More information at
https://www.comillas.edu/en/masters/master-degree-in-big-data-technologies-and-advanced-analytics

- *Machine Learning II*
  Eugenio Francisco Sánchez Úbeda, Miguel Ángel Sanz Bobi

- *Master Thesis*
  Eugenio Francisco Sánchez Úbeda

4.2.1.5 Master's Degree in Smart Grids (MSG)

Director: Miguel Ángel Sánchez Fornié
More information at
https://www.comillas.edu/en/masters/master-degree-in-smart-grids

- *Master Thesis*
  Javier Matanza Domingo

- *Operation and Planning of Future Distribution Networks*
  José Pablo Chaves Ávila, Rafael Cossent Arín, Francisco Miguel Echavarren Cerezo, Carlos Mateo Domingo, Álvaro Ortega Manjavacas, Lukas Sigrist

- *Operation and Planning of Future Distribution Networks*
  José Pablo Chaves Ávila, Rafael Cossent Arín, Francisco Miguel Echavarren Cerezo, Carlos Mateo Domingo, Álvaro Ortega Manjavacas, Lukas Sigrist

- *Operation and Planning of Future Distribution Networks Laboratory*
  Álvaro Ortega Manjavacas, Lukas Sigrist

- *Regulation and New Business Models*
  Carlos Batlle López, Pablo Rodilla Rodríguez

- *Regulation and New Business Models*
  Carlos Batlle López, Pablo Rodilla Rodríguez

- *Telecommunications for Smart Grids*
  Javier Matanza Domingo

4.2.2 Graduate theses supervised at IIT

4.2.2.1 Official Master's Degree in Industrial Engineering (MII)

- *A case for the European electric network in 2030*
  González Rodríguez de Biedma, Itziar. Supervised by Andrés Ramos Galán.

- *Análisis comparativo de datasets de imágenes reales vs. Imágenes sintéticas en entornosindustriales*
  Güitta López, Lionel. Supervised by Álvaro Jesús López López, Ignacio de Rodrigo Tobías.

- *Análisis de ciclo de vida de sistemas que usan energía en un entorno doméstico e impacto en el mismo de un sistema de gestión de la misma*
  Mejía Guinea, Alberto. Supervised by Miguel Ángel Sanz Bobi.

- *Análisis de la posición de conducción en patinetes*
  Esperanza Miranda, Pelayo Ramón de la. Supervised by Juan Manuel Asensio Gil.

- *Analysis of additional fire protection measures in energy poor dwellings in Spain*
  Chacón Porcel, Juan. Supervised by José Carlos Romero Mora.

- *Analysis of decarbonization options for steel making*
  Esperanza Herrando, Pablo de la. Supervised by Jose Pablo Chaves Ávila, Timo Gerres.

- *Analysis of information from the installed Dynamic Line Rating (DLR) systems, to definea deployment plan up to 2030*
  Morales Montoya, Beatriz. Supervised by Matteo Troncia.

- *Battery Network Design Using Quantum Computing*
  Barragán Castro, Cristina. Supervised by Carlos Mateo Domingo.

- *Blockchain application to distributed energy resources management*
  Rodríguez García, Ricardo. Supervised by Jose Pablo Chaves Ávila, Morsy Abdelkader Morsy Mohammed Nour.

- *Broadband PLC over Low Voltage deployment planning tool development*
  Ayala Bernaola, Leire. Supervised by Javier Matanza Domingo.

- *CO2 LIFE CYCLE ASSESSMENT FOR A SOLAR PHOTOVOLTAIC INSTALLATION*
  Arcos Presedo, María Eugenia. Supervised by Jose Pablo Chaves Ávila.

- *Comportamiento del auto-consumidor de electricidad e impacto en el mercado eléctrico*
  Molina González, Manuel. Supervised by Francisco Alberto Campos Fernández, José Villar Collado.

- *Desarrollo de un modelo de unit-commitment en Python-Pyomo para su ejecución mediante interfaz-web.*
  Labora Gómez, Francisco. Supervised by Javier García González.

- *Development of a chaotic-warehouse simulator representing human and artificial agents*
  Pérez Vilanova, Juan. Supervised by Álvaro Jesús López López.

- *Estrategias de inversión bursátil basadas en redes neuronales*
  Terrón Martín, Francisco Javier. Supervised by Juan Luis Zamora Macho.

- *Estudio de mecanismos de casación alternativos para un mercado eléctrico regional en un contexto de subsidios nacionales: aplicación al mecanismo de ajuste de la excepción ibérica.*
  Barruso Recuero, Miguel Ángel. Supervised by Carlos Batlle López, Pablo Rodilla Rodríguez.

- *Estudio del submarining del dummy Hibrido III 50% percentil para distintas posicionesreclinadas en impactos frontales*
  Álvarez Fernández, Jaime. Supervised by Francisco José López Valdés.

- *Evaluación de los asientos mitigadores de energía en condición de explosión bajo el vehículo*
  Gómez-Cambronero Gutiérrez de Cabiedes, Ignacio. Supervised by Francisco José López Valdés.

- *Experimental designs to evaluate consumer?s preferences related to energy procurement and the adoption of low-CO2 technologies*
  Pérez-Tabernero Silva, María. Supervised by Jose Pablo Chaves Ávila, María del Carmen Valor Martínez.

- *Financial analysis and business models for microgrids in emerging economies*
  Valcarce Barbosa, Alejandro. Supervised by Pablo Dueñas Martínez, Santos-José Díaz Pastor.

- *ICAI factory digital twin*
  Carrasco Velilla, Gonzalo. Supervised by José Antonio Rodríguez Mondéjar.

- *Impacto del envejecimiento de las baterías en modelos de explotación de la generación*
  Domínguez Larre, Teresa. Supervised by Francisco Alberto Campos Fernández, Luis Alberto Herrero Rozas.

- *Impacts on energy vulnerability caused by the 2022 energy crisis in the framework of a just transition in Spain*
  Blas Álvarez, Laura. Supervised by Miguel Angel Rios Ocampo, Roberto Barrella.

- *Integración y uso de robots colaborativos en la minifábrica de ICAI*
  Lettieri Palencia, Marina Beatriz. Supervised by José Antonio Rodríguez Mondéjar.

- *INTEROPERABILITY OF APPLICATIONS IN THE SMART GRIDS CONTEXT*
  Lerena Rubio, María. Supervised by Néstor Rodríguez Pérez.

- *MIT-IIT Universal Access Lab: optimization and simulation models for clean-cooking planning*
  Serra Llavona, Judith. Supervised by Fernando de Cuadra García, Pablo Dueñas Martínez.

- *Modelado y análisis de datos para generación solar de autoconsumo*
  Carbonell de la Cámara, Jorge. Supervised by Jose Pablo Chaves Ávila.

- *Modelling Demand Side Response for Heat Pumps through locational network tariffs*
  Cabot Sancho, Luis. Supervised by Jose Pablo Chaves Ávila, Matteo Troncia.

- *Plan de incorporación de la tecnología SDN (Software Defined Networks) en la evolución de las Smart Grids*
  Hidalgo Ramírez, Luis Javier. Supervised by Javier Matanza Domingo.

- *Predicción de la tendencia del precio de valores bursátiles basada en clustering y en redes neuronales por intervalos*
  González del Campo Artesero, Javier. Supervised by Juan Luis Zamora Macho.

- *Reconocimiento y predicción de patrones de velas japonesas en el mercado financiero*
  Villagrán Prieto, Marta. Supervised by Juan Luis Zamora Macho.

- *Revisión de modelos de lenguaje y aplicación a la automatización de tareas de oficina en empresas industriales*
  Zamora Fraguas, Jacobo. Supervised by Álvaro Jesús López López.

- *Standardization and harmonization of the flexibility market in the Spanish and European electricity wholesale market*
  Sagaz Spottorno, Diego. Supervised by Jose Pablo Chaves Ávila.

- *Strategy for the development of a BPL-based solution in smart meters from 2030*
  Plaza Ramos, María Cristina. Supervised by Javier Matanza Domingo.

- *Techno-economic assessment and analysis of local markets for system services*
  Marcos López-Baissón, José María de. Supervised by Jose Pablo Chaves Ávila, Matteo Troncia.

- *The impact of building location accuracy on electrification planning*
  Sanz Azuara, Fidel. Supervised by Pablo Dueñas Martínez.

- *Towards an operational understanding of transport poverty in Spain: from the definition to the measurement*
  García González, Carmen. Supervised by José Carlos Romero Mora, Manuel Pérez Bravo.

- *Training a Virtual Reinforcement Learning Agent for Obstacle Avoidance and Transferring It to a Real Mobile Robot*
  Carrera Fresneda, Javier José. Supervised by Juan Luis Zamora Macho.

4.2.2.2 Official Master's Degree in Telecommunications Engineering (MIT)

- *A Comprehensive Evaluation of Ethereum, Solana, and Avalanche in Addressing the Blockchain Trilemma*
  Bayona Bultó, Álvaro. Supervised by Javier Matanza Domingo.

- *Análisis de vulnerabilidades en dispositivos HVAC*
  Font García, José Antonio. Supervised by Gregorio Ignacio López López.

- *Digitalización de máquinas mediante OPC UA para ser integrables en sistemas bajo filosofía industria 4.0*
  Díaz Romero, María Angustias. Supervised by José Antonio Rodríguez Mondéjar.

- *Simulación de un plan de migración integral a la nube*
  Benito Cháfer, Juan Sebastián de. Supervised by Gregorio Ignacio López López.

4.2.2.3 Official Master's Degree in the Electric Power Industry (MEPI)

- *Demand Response integration in Capacity Remuneration Mechanisms:Firm Capacity and Cost Allocation*
  Villarreal del Ángel, René Inés. Supervised by Pablo Rodilla Rodríguez, Paulo Brito Pereira.

- *Design of the deployment of EV charging points*
  Gastelum Fernández, Gabriela Orisell. Supervised by Jose Pablo Chaves Ávila.

- *Modelado en CEVESA del sistema eléctrico italiano*
  Molina González, Manuel. Supervised by Francisco Alberto Campos Fernández, José Villar Collado.

- *Study of efficiency gains derived from cross-border coordination in national capacity remuneration mechanisms*
  Zunzunegui Fernández, Blanca. Supervised by Geovanny Alberto Marulanda García, Pablo Rodilla Rodríguez.

- *The EU renewable energy financing mechanism from a host project perspective - an approach through an academic case study*
  Linares Calero, Sara. Supervised by Antonio Bello Morales, Geovanny Alberto Marulanda García.

4.2.2.4 Master's Degree in Smart Industry (MIC)

- *Análisis comparativo de datasets de imágenes reales vs. Imágenes sintéticas en entorno sindustriales*
  Güitta López, Lionel. Supervised by Álvaro Jesús López López, Ignacio de Rodrigo Tobías.

- *Development of a chaotic-warehouse simulator representing human and artificial agents*
  Pérez Vilanova, Juan. Supervised by Álvaro Jesús López López.

- *Entrenamiento de un agente virtual para evitar obstáculos mediante aprendizaje por refuerzo y transferencia a un robot móvil real*
  Carrera Fresneda, Javier José. Supervised by Juan Luis Zamora Macho.

- *ICAI factory digital twin*
  Carrasco Velilla, Gonzalo. Supervised by José Antonio Rodríguez Mondéjar.

- *Integración y uso de robots colaborativos en la minifábrica de ICAI*
  Lettieri Palencia, Marina Beatriz. Supervised by José Antonio Rodríguez Mondéjar.

- *Modelling local markets and flexibility services providers for the electricity sector towards decarbonisation*
  Cabot Sancho, Luis. Supervised by Jose Pablo Chaves Ávila.

- *Revisión de modelos de lenguaje y aplicación a la automatización de tareas de oficina en empresas industriales*
  Zamora Fraguas, Jacobo. Supervised by Álvaro Jesús López López.

4.2.2.5 Master's Degree in Big Data Technologies and Advanced Analytics (MBD)

- *Analysis and description of sealed-bid auction*
  Escobar Llori, Victor Manuel. Supervised by Eugenio Francisco Sánchez Úbeda.

- *ANALYSIS OF THE SPATIAL AND TEMPORAL CORRELATIONS BETWEEN SOLAR, WIND AND HYDRO POWER GENERATION IN SPAIN*
  Lee, Jeonghyeon. Supervised by Eugenio Francisco Sánchez Úbeda.

4.2.2.6 Master's Degree in Smart Grids (MSG)

- *Analysis of information from the installed Dynamic Line Rating (DLR) systems, to definea deployment plan up to 2030*
  Morales Montoya, Beatriz. Supervised by Matteo Troncia .

- *Battery Network Design Using Quantum Computing*
  Barragán Castro, Cristina. Supervised by Carlos Mateo Domingo.

- *Broadband PLC over Low Voltage deployment planning tool development*
  Ayala Bernaola, Leire. Supervised by Javier Matanza Domingo.

- *Interoperable IoT-SG Platforms*
  Lerena Rubio, María. Supervised by Néstor Rodríguez Pérez.

- *Plan to incorporate Software Defined Networks (SDN) technology in the evolution of the Smart Grids*
  Hidalgo Ramírez, Luis Javier. Supervised by Javier Matanza Domingo.

- *Strategy for development of a BPL-based solution in smart meters for 2030*
  Plaza Ramos, María Cristina. Supervised by Javier Matanza Domingo.

4.2.2.7 Master in Mobility and Safety Engineering (MMS)

- *Ensayos experimentales y análisis de datos de airbags cervicales para cascos de bicicleta*
  Álvarez Fernández, Jaime. Supervised by Francisco José López Valdés.

- *Estudio paramétrico de la influencia de un airbag cervical para ciclistas*
  Faria-Pereira Pérez de Rada, Luis María de. Supervised by Manuel Valdano.

- *Evaluation of the spine in Underbody blast conditions with energy mitigating seats.*
  Gómez-Cambronero Gutiérrez de Cabiedes, Ignacio. Supervised by Francisco José López Valdés.

4.2.2.8 Master in Environment and Energy Transition

- *Regulatory analysis and models of independent aggregators in the peninsular electricity system*
  Herrero Yáñez, Luis Álvaro. Supervised by José Carlos Romero Mora.

4.3 Other academic activities

4.3.1 Supervised Master Theses in other Universities

- *Optimizing Prompt Engineering for Improved Generative AI Content*.
  Supervisor: Mario Castro Ponce

- *A geospatial approach to clean cooking planning in Rwanda*.
  Supervisor: Pablo Dueñas Martínez

- *Simulation tools for a 100% renewable power market*.
  Supervisor: Tomás Gómez San Román

5. Doctorate

5.1 ICAI Engineers' Association

The IIT maintains a close relationship with the ICAI Engineers' Association in several aspects. On the one hand, the Association partially funds one of the IIT doctoral theses. During this academic year, the thesis developed by Javier García Aguilar has benefited from such financial support. On the other hand, the IIT collaborates with the Association sending some of its research for publication to its official journal *Anales de Mecánica y Electricidad.*

5.2 Training complements

Training complements typically correspond to Master courses that complement the training of the student in those aspects relevant for the doctoral thesis and that have not been tackled in the academic or professional career.

- *Research Methods I: Introduction, Information Sources and Quantitative Research Methods*
  Carmen Valor Martínez

- *Optimization Techniques*
  Jesús María Latorre Canteli

- *Publishing Research Results*
  Aurelio García Cerrada

5.3 Training activities

Training activities have to be carried out by all students. These activities provide the students with basic information about various research techniques.

- *Doctorado e Investigación Científica en Comillas (20h): El proceso de investigación*
  Carmen Valor Martínez

- *Doctorado e Investigación Científica en Comillas (20h): La investigación en una universidad de la Compañía de Jesús*
  Pedro Linares Llamas

- *Doctorado ICAI: Advanced Excel for research (10h)*
  Javier García González, Jesús María Latorre Canteli

- *Doctorado ICAI: Advanced GAMS for applied research (10h)*
  Pedro de Otaola Arca, Andrés Ramos Galán

- *Doctorado ICAI: Advanced VBA-Excel for applied research (10h)*
  Jesús María Latorre Canteli

- *Doctorado ICAI: Current research topics*
  Ana Baringo Morales, Roberto Barrella, Illia Diahovchenko, Pablo Dueñas Martínez, Pablo Sánchez Pérez, Matteo Troncia

- *Doctorado ICAI: Data Management (10h)*
  Jesús María Latorre Canteli

- *Doctorado ICAI: Forecasting techniques (10h)*
  José Portela González

- *Doctorado ICAI: Introduction to Python (10 h)*
  David Domínguez Barbero, Andrés Ramos Galán

- *Doctorado ICAI: Reinforcement learning*
  Álvaro Jesús López López

- *Programa oficial de doctorado CETIS 99/2011: Planteamiento de una investigación y una tesis doctoral. Avances en investigación en Business/Finance y Management (12h)*
  Elisa María Aracil Fernández

- *Seminario Interdisciplinar III: Seminario Interdisciplinar III*
  Mario Castro Ponce

- *Seminarios Interdisciplinares: Seminarios Interdisciplinares*
  Mario Castro Ponce

- *Taller de Gestión Bibliográfica (15h): Generación de bases de datos bibliográficas (6h)*
  José Pablo Chaves Ávila

5.4 Doctoral theses

The following doctoral theses defended in this academic year or currently in development are or have been conducted and led by researchers at the IIT. Usually, these theses are developed in conjunction or in close relationship with some of the research projects mentioned above.

5.4.1 Comillas submitted theses

- Title: *Inclusive methodologies for anomaly detection and prognosis of industrial systems based on behavior patterns, smart indicators and digital twin ecosystems*
  Author: Pablo Calvo Báscones
  Supervisor: Miguel Ángel Sanz Bobi
  Date: September 05, 2022

- Title: *Transmission Expansion Planning under imperfect competition*
  Author: Isaac Camilo González Romero
  Supervisors: Sonja Wogrin and Tomás Gómez San Román
  Date: October 28, 2022

- Title: *Algorithms for distribution system planning: applications to U.S. synthetic networks and improving resilience through microgrids*
  Author: Fernando Emilio Postigo Marcos
  Supervisors: Carlos Mateo Domingo and Tomás Gómez San Román
  Date: November 23, 2022

- Title: *Development of nanomaterial based scaffolds for bone tissue regeneration*
  Author: Sara López de Armentia Hernández
  Supervisors: Eva Paz Jiménez and Nicholas Dunne
  Date: December 02, 2022

- Title: *Optimal self-unit commitment of combined cycle power plants. Bridging the gap between the state of the art and current regulation of electricity and natural gas markets*
  Author: Pedro de Otaola Arca
  Supervisor: Javier García González
  Date: December 12, 2022

- Title: *Highly sensitive microwave sensors for liquid dielectric characterization*
  Author: Mahdieh Gholami Mayani
  Supervisors: Romano Giannetti and Javier Matanza Domingo
  Date: March 06, 2023

- Title: *Island system operation with high degree of renewable energy resources: proposing solutions for smaller power systems to ease the transition to clean energy generation*
  Author: Mohammad Rajabdorri
  Supervisors: Enrique Lobato Miguélez and Lukas Sigrist
  Date: March 16, 2023

- Title: *Bridging disconnections through social entrepreneurship to tackle energy poverty*
  Author: María José Manjón Rodríguez
  Supervisors: Amparo Merino de Diego and Iain Cairns
  Date: April 18, 2023

- Title: *Improvements in intraoperative neurophysiological monitoring towards a wireless technology*
  Author: Eduardo Alonso Rivas
  Supervisors: Carlos Rodríguez-Morcillo García and Romano Giannetti
  Date: July 17, 2023

5.4.2 Submitted theses in other universities

- Title: *New tools for the optimal expansion planning of power systems considering uncertainty and operational variability*
  Author: Álvaro García Cerezo
  Supervisors: Luis Baringo Morales and Raquel Garcia Bertrand
  Universidad de Castilla-La Mancha. Ciudad Real (Spain).
  Date: October 31, 2022

- Title: *Multiagentes inteligentes para reduzir alarmes falsos em sistemas de monitoramento de turbinas eólicas*
  Author: Weldon Carlos Elías Teixeira
  Supervisors: Roberto Célio Limão Oliveira and Miguel Ángel Sanz Bobi
  Universidade Federal do Pará. Belem (Brazil).
  Date: April 28, 2023

- Title: *Desarrolo de sistemas expertos con programación funcional y metodología Big Data*
  Author: Gabriel Antonio Valverde Castilla
  Supervisors: Beatriz González Pérez and José Manuel Mira McWilliams
  Universidad Complutense de Madrid. Madrid (Spain).
  Date: May 16, 2023

- Title: *Guidelines for improving motorcycle helmet testing standards*
  Author: Oscar Juste Lorente
  Supervisors: Francisco José López Valdés and Mario Vicente Maza Frechín
  Universidad de Zaragoza. Zaragoza (Spain).
  Date: May 26, 2023

5.4.3 Comillas ongoing theses

- Title: *Natural gas tariff design: a comprehensive framework for analyzing economic efficiency.*
  Author: Celia Mosácula Atienza
  Supervisors: Javier Reneses Guillén and José Pablo Cháves Avila

- Title: *Contribuciones al análisis y la previsión de los precios del petróleo*
  Author: Pedro Moreno Alonso
  Supervisor: Antonio Muñoz San Roque

- Title: *Determinants of shareholder value and valuation of banks*
  Author: José Miguel Fernández de Bilbao Ortega
  Supervisor: Isabel Catalina Figuerola-Ferreti Garrigues

- Title: *ESG Investing, corporate performance and idiosyncratic risk*
  Author: Paraskevas Paraskevas
  Supervisors: Isabel Catalina Figuerola-Ferretti Garrigues and Sara Lumbreras Sancho

- Title: *Multi-area electricity market modeling using intelligent data techniques and an advanced temporal framework*
  Author: Alberto Orgaz Gil
  Supervisors: Javier Reneses Guillén and Antonio Bello Morales

- Title: *DSO-TSO Coordination in the European context*
  Author: Leandro Lind
  Supervisors: Rafael Cossent Arín and Pablo Frías Marín

- Title: *Addressing the provision of Sustainable Universal Access to Modem Power for All : comprehensive decision support framework*
  Author: Andrés González García
  Supervisor: José Ignacio Pérez Arriaga

- Title: *Analysis of policy strategies for renewable energy integration in multi-area electricity markets*
  Author: Geovanny Alberto Marulanda García
  Supervisors: Antonio Bello Morales and Javier Reneses Guillén

- Title: *Modeling and Optimizing the behavior of distributed agents in decentralized power systems by Reinforcement Learming techniques*
  Author: David Domínguez Barbero
  Supervisors: Javier García González and Miguel Angel Sanz Bobi

- Title: *Medium-term technical and economical analysis of storage impacts on power systems under different scenarios with high renewable share*
  Author: Sébastien Huclin
  Supervisors: Andrés Ramos Galán and José Pablo Cháves Avila

- Title: *THE FACTORS FOR SUSTAINABLE BRAND EXTENSION SUCCESS*
  Author: María Luisa Hernández Olalla
  Supervisors: Carmen Valor Martínez and Carmen Abril Barrie

- Title: *Optimal Power Grid Design for a Low Carbon Emisson Future*
  Author: Erik Francisco Alvarez Quispe
  Supervisors: Andrés Ramos Galán and Luis Olmos Camacho

- Title: *Assessment of electricity network requierements for the energy transition*
  Author: Leslie Lara Herding
  Supervisors: Michel Rivier Abbad and Rafael Cossent Arín

- Title: *Nuevos enfoques para la monitorización y dimensionamiento de aisladores de alta tensión*
  Author: Héctor de Santos Yubero
  Supervisor: Miguel Ángel Sanz Bobi

- Title: *Evaluating Local Energy Trading For Massive Integration Of Distributed Energy Resources*
  Author: Morsy Abdelkader Morsy Mohammed Nour
  Supervisors: José Pablo Cháves Avila and Alvaro Sánchez Miralles

- Title: *Control of grid-forming VSC-based generators to improve transient stability in power systems with 100% non-synchronous generation*
  Author: Régulo Enrique Avila Martinez
  Supervisor: Luis Rouco Rodríguez

- Title: *Medium-term hydrothermal scheduling considering short-term uncertainty*
  Author: Jesús David Gómez Pérez
  Supervisors: Andrés Ramos Galán and Jesús María Latorre Canteli

- Title: *Selecting flexibility mechanisms for DSOs in the energy transition*
  Author: Fernando David Martín Utrilla
  Supervisors: Rafael Cossent Arín and José Pablo Cháves Avila

- Title: *Dealing with Uncertainty in Energy Planning: Robust Optimization for Energy Models.*
  Author: Antonio Francisco Rodríguez Matas
  Supervisors: Pedro Linares Llamas and José Carlos Romero Mora

- Title: *Mejoras en el control secundario de microrredes con sistemas de batería.*
  Author: Diana Patricia Morán Río
  Supervisors: Aurelio García Cerrada and Javier Roldán Pérez

- Title: *A bilevel model for the long-term evolution of tariffs in the power sector considering behind-the-meter distributed generation*
  Author: Salvador Doménech Martínez
  Supervisors: Francisco Alberto Campos Fernández and José Villar Collado

- Title: *Women need to be pushed. Narratives of Ugandan female informal educators on their roles in women entrepreneurship*
  Author: Grace Akullo
  Supervisors: Elisa María Aracil Fernández and Samuel Mbugua Mwaura

- Title: *Access Based Services Customer misbehaviour and value co-creation in carshaning explained through the lens of academic theories in social sciences. Evidence from the data*
  Author: Andres Camacho Donézar
  Supervisors: Carmen Valor Martínez and José Portela González

- Title: *Are you sustainable product? Consumer´s and practitioner´s categorization of sustainable products*
  Author: María Aranzazu Larrañaga Muguerza
  Supervisors: Carmen Valor Martínez and Antonetti Paolo

- Title: *Distribution Network Tariff Design under Decarbonization, Decentralization and Digitalization*
  Author: Nicolás Mariano Morell Dameto
  Supervisors: José Pablo Cháves Avila and Tomás Gómez San Román

- Title: *Interaction between DSO and third-party flexibility resources in the operation of distribution grids*
  Author: Orlando Mauricio Valarezo Rivera
  Supervisors: Tomás Gómez San Román and José Pablo Cháves Avila

- Title: *Risk Assessment and Modelling of Human Behaviour through Serious Games and Artificial Intelligence*
  Author: Jaime Pérez Sánchez
  Supervisors: Gregorio López López and Mario Castro Ponce

- Title: *Robust control of electric power systems with important share of electronic generation*
  Author: Javier García Aguilar
  Supervisors: Juan Luis Zamora Macho and Aurelio García Cerrada

- Title: *The impact of explicit demand flexibility for generation investment planning and operationof the future electric system*
  Author: Teresa Freire Barceló
  Supervisors: Álvaro Sánchez Miralles and Francisco María Martín Martínez

- Title: *Improving medium-term models to deal with the low-carbon reality of modern power systems.*
  Author: Luis Manuel Montero Guirao
  Supervisors: Javier Reneses Guillén and Antonio Bello Morales

- Title: *Detección de Ciberataques mediante algoritmos de aprendizaje y clasificación en la matriz de MITRE ATT&CK*
  Author: Antonio Pérez Sánchez
  Supervisors: Rafael Palacios Hielscher and Gregorio Ignacio López López

- Title: *Cryogenic Supply System with Magnetic Refrigeration Stage*
  Author: Carlos José Hernando López de Toledo
  Supervisors: Juan Carlos del Real Romero and Javier Munilla López

- Title: *Improving the representation of the transport sector within energy models*
  Author: Manuel Pérez Bravo
  Supervisors: Pedro Linares Llamas and Pablo Frías Marín

- Title: *Coordination between Generation and Transission expasion planning in a liberalized electricoty context, and the use os fte of FTRs as a coordination tool*
  Author: Stefania Gómez Sánchez
  Supervisor: Luis Olmos Camacho

- Title: *DC segmentation of power system*
  Author: Mathieu Guillaume Robin
  Supervisors: Francisco Javier Renedo Anglada and Aurelio García Cerrada

- Title: *Desarrollo y aplicación real de un indicador de degradación de un sistema BESS operando en regulación*
  Author: Jose Ignacio Alvarez-Monteserin Garcia
  Supervisor: Miguel Ángel Sanz Bobi

- Title: *Explainable Artificial Intelligence (XAI) Techniques based on Partial Derivatives*
  Author: Jaime Pizarroso Gonzalo
  Supervisors: José Portela González and Antonio Muñoz San Roque

- Title: *Multi-agent secondary control of microgrids*
  Author: Andrés Tomás Martín
  Supervisors: Aurelio García Cerrada and Lukas Sigrist

- Title: *The impact of bike-sharing systems in urban mobility : the BiciMad case*
  Author: Carlos Miguel Vallez Fernández
  Supervisors: Mario Castro Ponce and David Contreras Bárcena

- Title: *Assessment of restrain systems for passenger-vehicle occupants in a wide spectrum of impact conditions*
  Author: Manuel Valdano
  Supervisors: Francisco José López Valdés and Bengt Pipkorn

- Title: *Development of smart environment for asset management based on Machine Learning Models in power grids*
  Author: GopaL Lal Rajora
  Supervisor: Miguel Ángel Sanz Bobi

- Title: *Optimal Operation and Configuration of RVPP under Uncertainty of Non-Dispatchable RES in the Energy and Ancillary Markets*
  Author: Hadi Nemati
  Supervisors: Álvaro Ortega Manjavacas and Pedro Sánchez Martín

- Title: *Long-term Active Distribution Network Planning with High Shares of Distributed Energy Resources*
  Author: David Ulrich Ziegler
  Supervisors: Tomás Gómez San Román and Carlos Mateo Domingo

- Title: *Real-Time Operation of RES-based Virtual Power Plants*
  Author: Oluwaseun Enoch Oladimeji
  Supervisors: Lukas Sigrist and Álvaro Ortega Manjavacas

- Title: *Rigid Body Simulation with Implicit Shape Descriptions*
  Author: Pedro López-Adeva Fernández-Layos
  Supervisor: Luis Francisco Sánchez Merchante

- Title: *Actitudes hacia la tecnología y el pensamiento computacional en la Educación STEM del profesorado de Primaria, Secundaria y en formación*
  Author: Ana María González Cervera
  Supervisors: Olga Martín Carrasquilla and Yolanda González Arechavala

- Title: *FINANCING UNIVERSAL ELECTRICITY ACCESS - AN INTEGRATED REGULATORY AND BUSINESS MODEL APPROACH*
  Author: Santos-José Díaz Pastor
  Supervisor: José Ignacio Pérez Arriaga

- Title: *Un modelo ético para la inteligencia artificial: el caso de la toma de decisiones automatizadas (ADM)*
  Author: Sonia Liliana Acosta Arias
  Supervisors: Sara Lumbreras Sancho and Gonzalo Génova

- Title: *The Conceptualization of Resistance*
  Author: Veronika María Cieslak
  Supervisor: Carmen Valor Martínez

- Title: *Implementación de Metodologías Estocásticas Novedosas en la Modelización de Incendios Forestales*
  Author: Juan Luis Gómez González
  Supervisors: Mario Castro Ponce and Alexis Cantizano González

- Title: *Techno-economic Analysis of Green Hydrogen Supply Chain in Spain*
  Author: Santiago Serna Zuluaga
  Supervisors: Rafael Cossent Arín and Timo Gerres

- Title: *Provision of Ancillary Services with Converter Interfaced Generators*
  Author: Njegos Jankovic
  Supervisors: Luis Rouco Rodríguez and Javier Roldán Pérez

- Title: *Impacto de las calificaciones ESG y otros factores en el riesgo de las empresas cotizadas*
  Author: Jorge Abdon Merladet Artiach
  Supervisors: Sara Lumbreras Sancho and Andrés Ramos Galán

- Title: *From stand-alone to combined mechanisms for acquiring distribution system operator services*
  Author: Eliana Carolina Ormeño Mejía
  Supervisors: José Pablo Cháves Avila and Matteo Troncia

- Title: *Alternate Models for European Short-Term Electricity Markets*
  Author: Shilpa Bindu
  Supervisors: José Pablo Cháves Avila and Luis Olmos Camacho

- Title: *Prediction of Q Violations and Convergence Control of Multi-Stage Holomorphic Embedding Method (MSHELM)*
  Author: Álvaro Benítez Domínguez
  Supervisors: Luis Rouco Rodríguez and Francisco Miguel Echavarren Cerezo

- Title: *Future-Proof Design of Capacity Mechanisms During the Energy Transition: Firm Supply Calculation, Demand Participation and Cost Allocation*
  Author: Paulo Brito Pereira
  Supervisors: Pablo Rodilla Rodríguez and Paolo Mastropietro

- Title: *African Power Pools and Regional Trade: Adoption of international best practices in the African context*
  Author: Mohamed Abbas Eltahir Elabbas
  Supervisors: Luis Olmos Camacho and José Ignacio Pérez Arriaga

- Title: *The role of demand-response independent aggregator in the power system. How does it change the balance between the actors?*
  Author: Jesús José Fernández García
  Supervisors: Matteo Troncia and José Pablo Cháves Avila

- Title: *Bilevel programming applied to the study of the impact of hydrogen economy in electric markets*
  Author: Luis Jesús Fernández Palomino
  Supervisor: Efraim Centeno Hernáez

- Title: *Assessing the impact of electrolyzer operational characteristics on integration in the electricity markets.*
  Author: Juan Francisco Gutiérrez Guerra
  Supervisors: José Pablo Cháves Avila and Andrés Ramos Galán

- Title: *A long-term joint equilibrium model for the wholesale electricity and hydrogen markets*
  Author: Luis Alberto Herrero Rozas
  Supervisors: Francisco Alberto Campos Fernández and José Villar Collado

- Title: *Integrating flexibility from Electric Vehicles and other Distributed Energy Resources in Distribution Network Planning*
  Author: Miguel Martínez Velázquez
  Supervisors: Pablo Frías Marín and Carlos Mateo Domingo

- Title: *Value-Creation Strategies for Engaging Small-Load Flexibility-Service-Providers (SL-FSP) in Electricity Markets*
  Author: Valeria Karina Moreno
  Supervisors: Carmen Valor Martínez and José Pablo Cháves Avila

- Title: *Research Plan Proposal - Year 1 Frequency Behavior in Electric Power Systems in the Power Electronics Age.*
  Author: Carlo de Paolis Robles
  Supervisors: Ignacio Egido Cortés and Aurelio García Cerrada

- Title: *A Comprehensive Energy Poverty Analysis in Sustainable/Just Energy Transitions: From Conceptualization to Decision-Making*
  Author: Miguel Angel Rios Ocampo
  Supervisors: José Carlos Romero Mora and Efraim Centeno Hernáez

- Title: *Distribution system operator remuneration for fostering flexibility procurement. Valuing flexibility solutions in planning distribution networks*
  Author: Miguel Ángel Ruiz Hernández
  Supervisors: José Pablo Cháves Avila and Tomás Gómez San Román

- Title: *How to improve the coordinated use of models for energy planning towards to a zero-carbon system*
  Author: Dilayne Santos Oliveira
  Supervisors: Sara Lumbreras Sancho and Andrés Ramos Galán

- Title: *Increasing the penetration of inverter-based resources to weak grids with synchronous compensators*
  Author: Jorge Suárez Porras
  Supervisors: Fidel Fernández Bernal and Luis Rouco Rodríguez

- Title: *UNDERSTANDING INJURY MECHANISMS IN E-SCOOTER RIDERS*
  Author: Juan Manuel Asensio Gil
  Supervisors: Jesús Jiménez Octavio and Alberto Carnicero López

- Title: *Operación eficiente de tráfico ferroviario*
  Author: Manuel Blanco Castillo
  Supervisors: Asunción Paloma Cucala García and Antonio Fernández Cardador

- Title: *Effect of minimally invasive endodontic on teeth lifespan: A post-mortem and FEA study*
  Author: Saúl Manuel Dorado Nuño
  Supervisors: Jesús Jiménez Octavio and Ana Arias Paniagua

- Title: *Analysis of cybersecurity systems in the automotive sector*
  Author: Roberto Gesteira Miñarro
  Supervisors: Gregorio López López and Rafael Palacios Hielscher

- Title: *Effective Use of Virtual Coupling for Trains System.*
  Author: Rohit Raj Goswami
  Supervisors: Asunción Paloma Cucala García and Adrián Fernández Rodríguez

- Title: *Efficiently transferring deep reinforcement learning experience to industrial assets*
  Author: Lucía Güitta López
  Supervisors: Álvaro Jesús López López and Jaime Boal Martín-Larrauri

- Title: *Guiding the Decarbonisation of the Energy- and Emission-Intensive EU Industries*
  Author: Léonard Lefranc
  Supervisors: Timo Gerres and Pedro Linares Llamas

- Title: *Enhancing keyphrase extraction from long documents*
  Author: Roberto Martínez Cruz
  Supervisors: Álvaro Jesús López López and José Portela González

- Title: *Machine Learning techniques to enhance capacitive sensing of microwave resonant structures*
  Author: Miguel Monteagudo Honrubia
  Supervisors: Javier Matanza Domingo and Francisco Javier Herraiz Martínez

- Title: *Generating Synthetic Datasets: Towards Bridging the Gap Between Deep Learning and Applications with Limited Data*
  Author: Ignacio de Rodrigo Tobías
  Supervisors: Álvaro Jesús López López and Jaime Boal Martín-Larrauri

- Title: *Contribution to the analysis and evaluation of the digitalization of smart grids*
  Author: Néstor Rodríguez Pérez
  Supervisors: Javier Matanza Domingo and Gregorio Ignacio López López

- Title: *Abdominal Injuries in Occupants Seated in Reclined Configurations in Autonomous Vehicles*
  Author: Carmen María Vives Torres
  Supervisor: Francisco José López Valdés

- Title: *Bio-hydrogen with CCUS (golden hydrogen) as decarbonisation tool in hard-to-abate industrial sectors Ph.D*
  Author: Luis Yagüe Muñoz
  Supervisors: José Ignacio Linares Hurtado and Eva María Arenas Pinilla

- Title: *Exploring the relationship between spiritual discermment and decision quality in an organizational context*
  Author: Norma Carolina Verdugo Rojas
  Supervisors: David Roch Dupré and Elisa María Aracil Fernández

- Title: *Forecasting the price of crude oil under the energy transition.*
  Author: Carlos Casarrubio Feijoo
  Supervisor: Isabel Catalina Figuerola-Ferreti Garrigues

- Title: *Aligning Business and National interests: Industrial Policy as an enabler of Spanish National Sovereignty and Autonomy*
  Author: Margarita del Castillo Sancho
  Supervisors: Edurne Magro and Carmen Valor Martínez

- Title: *CLIMATE-RELATED CREDIT RISK: RETHINKING THE CREDIT RISK FRAMEWORK*
  Author: María Helena Redondo García
  Supervisor: Elisa María Aracil Fernández

- Title: *Contibuciones al uso óptimo de los protocolos de comunicación en entornos específicos de ámbito industrial y ferroviario*
  Author: Juan Manuel Cerezo Sánchez
  Supervisor: José Antonio Rodríguez Mondéjar

- Title: *Contributions to automatic detection of inconsistencies on Description texts of protocol Behaviour*
  Author: Sonia León del Rosario
  Supervisors: José Antonio Rodríguez Mondejar and Cristina Puente Águeda

- Title: *Research status report: The intentionality in impact funds: how to measure it and effects on impact perfomance*
  Author: Olga de Bergé Pineo
  Supervisors: José Luis Fernández Fernández and Elisa María Aracil Fernández

- Title: *Planning and assessment of the impact of distribution networks interconnection in urban districts with high deployment of flexible distributed energy resources.*
  Author: Luca de Rosa
  Supervisors: Tomás Gómez San Román and Carlos Mateo Domingo

6. Other activities

6.1 EES-UETP

The Electric Energy Systems - University Enterprise Training Partnership (EES-UETP) is a consortium of 3 companies and 22 universities and research centers in 15 European countries. They started operations in July 1992 under the program COMETT (COMmunity program for Education and Training in Technology). Since its origin, the IIT has participated very actively in the management and maintenance of this Association.

The main objective of the EES-UETP is to increase the competitiveness of the electric power industry sector through technology training. In this sense, the main activities of the EES-UETP are the organization of advanced courses in electric power systems and exchanges of students and researchers.

More information at http://www.ees-uetp.com.

6.1.1 EES-UETP partners

Currently, the partners of the ESS-UETP are as detailed below, classified by country:

- **Belgium**
  - Katholieke Universiteit Leuven (KU Leuven)
- **Cyprus**
  - University of Cyprus
- **Denmark**
  - Danmarks Tekniske Universitet
- **Germany**
  - Technische Universität Dortmund
- **Italy**
  - Universitá degli Studi di Cagliari
- **Portugal**
  - Institute for Systems and Computer Engineering of Porto (INESC Porto)
- **Spain**

- Universidad Politécnica de Catalunya
- Iberdrola, S.A.
- Universidad Pontificia Comillas

• **Switzerland**
- École Polytechnique Fédérale de Lausanne (EPFL)
- ETH Zürich

• **United Kingdom**
- University of Manchester
- University of Strathclyde

Besides being an active member of the network, the Comillas Pontifical University covers the following positions in the EES-UETP:
- Chairman of the Executive Board: Mr. Luis Rouco Rodríguez
- Coordinating Secretary: Mr. Luis Olmos Camacho

6.1.2 Teached courses

- *Advanced Optimization, Learning and Game-Theoretic Models in Energy Systems*
  Technical University of Denmark

- *Advanced laboratory testing methods for modern power systems*
  TU Dortmund University

- *Control of power systems dominated by power electronic converters*
  CITCEA-UPC, Technical University of Catalonia - BarcelonaTech

6.2 International exchanges

It is an IIT policy to encourage and finance, to the extent possible, that its members expand their education and research experience abroad. Some members of IIT have spent some time at foreign universities and agencies, as visiting scientists or engineers, working on specific projects and expand its expertise in research problems. During this academic year, the stays are:

- Erik Francisco Alvarez Quispe, in Division of Applied Mechanics and Energy Conversion (TME) of the Department of Mechanical Engineering, Katholieke Universiteit Leuven, Leuven (Belgium). April-July 2023.

- Régulo Enrique Ávila Martínez, in École centrale de Lille, Université Lille Nord-de-France, Lille (France). October 2022-January 2023.

- Javier García González, in MIT Energy Initiative, Massachusetts Institute of Technology (MIT), Cambridge (United States of America). June-July 2023.

- Miguel García Sánchez, in Strathclyde Business School. Hunter Centre for Entrepreneurship Department, University of Strathclyde, Glasgow (United Kingdom). May-August 2023.

- Lucía Güitta López, in Department of Computer, Control and Management Engineering, Sapienza Università di Roma, Rome (Italy). August-December 2023.

- Leslie Herding, in Power and Energy Systems Department, INESC-TEC, Porto (Portugal). June-July 2023.

- Miguel Martínez Velázquez, in Distribution Operations and Planning Department, EPRI Europe, Dublin (Ireland). June-September 2023.

- Luis Manuel Montero Guirao, in Energy Markets Department, Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Amsterdam (Netherlands). January-April 2023.

- Nicolás Mariano Morell Dameto, in MIT Energy Initiative, Massachusetts Institute of Technology (MIT), Boston (United States of America). March-September 2022.

- Oluwaseun Enoch Oladimeji, in Laboratoire des Sciences du Numérique de Nantes - LS2N, Ecole Centrale de Nantes, Nantes (France). March-April 2023.

- Jaime Pérez Sánchez, in Department of Economics, University of Exeter, Exeter (United Kingdom). November-December 2022.

- Mohammad Rajabdorri, in Department of Engineering, University of Durham, Durham (United Kingdom). June-September 2022.

- Néstor Rodríguez Pérez, in Electrical Sustainable Energy Department, Technische Universiteit Delft (TU Delft), Delft (Netherlands). April-July 2023.

- Manuel Valdano, in Simulation and Active Structures, Autoliv Development AB, Gothenburg (Sweden). August-November 2023.

6.3 Visiting professors

- Tarek Elgindy, from National Renewable Energy Lab, Carnegie Mellon University, Denver (USA). April-October 2023.

- Edmond Awad, from Economics, University of Exeter, Exeter (United Kingdom). June 2023.

6.4 Visiting students

- Marco Galici, from Department of Electrical and Electronic Engineering, University of Cagliari, Caligary (Italy). June 2022.

- Marco Galici, from Department of Electrical and Electronic Engineering, University of Cagliari, Caligary (Italy). October-December 2022.

- Marco Galici, from Department of Electrical and Electronic Engineering (DIEE), University of Cagliari, Caligari (Italy). May-July 2023.

- Michael Anthony Giovanniello, from MIT Technology and Policy Program, Massachusetts Institute of Technology (MIT), Cambridge (USA). June 2023.

- Michael Anthony Giovanniello, from MIT Technology and Policy Program, Massachusetts Institute of Technology (MIT), Cambridge (USA). June-July 2023.

- Venecia Shajarit González Victoria, from Industrial Engineering, Instituto Tecnológico de Toluca, Toluca (Mexico). June 2023.

- Venecia Shajarit González Victoria, from Industrial Engineering, Instituto Tecnológico de Toluca, Toluca (Mexico). June-July 2023.

- Peter Heller, from SM Technology and Policy, Massachusetts Institute of Technology (MIT), Cambridge (USA). June 2023.

- Peter Heller, from SM Technology and Policy, Massachusetts Institute of Technology (MIT), Cambridge (USA). July 2023.

- Christine Juta, from Power Futures Lab, University of Cape Town, Cape Town (South Africa). June-July 2023.

- Andrés Felipe Oviedo Gómez, from School of Electrical and Electronic Engineering, Universidad del Valle, Cali (Colombia). September 2022.

- Andrés Felipe Oviedo Gómez, from School of Electrical and Electronic Engineering, Universidad del Valle, Cali (Colombia). September 2022-March 2023.

- Shima Sasanpour, from Energy Systeme Analysis, German Aerospace Center, Stuttgart (Germany). April-June 2023.

- Jan Marc Schwidtal, from Department: Industrial Engineering, University of Padua, Padua (Italy). October 2020.

- Graham Turk, from Technology & Policy Program, Massachusetts Institute of Technology (MIT), Cambridge (USA). June 2023.

- Graham Turk, from Technology & Policy Program, Massachusetts Institute of Technology (MIT), Cambridge (USA). June-July 2023.

6.5 Courses offered and coordinated to external companies and institutions

The courses offered to companies and consultancy activities are frequently related to research projects. There have been as follows:

- Pablo Rodilla Rodríguez, *"FSR e-learning course on regulation of energy utilities".* European University Institute (EUI), Florence School of Regulation. USA. Online.

- Luis Olmos Camacho, Luis Rouco Rodríguez, Rafael Palacios Hielscher, *"Coordination of the course committee of the EES-UETP network during the year 2022".* Electric Energy Systems - University Enterprise Training Partnership Association (EES-UETP). USA. Madrid, Madrid.

- Luis Rouco Rodríguez, Lukas Sigrist, *"Course on power syetm protection fundamentals".* Red Eléctrica de España, S.A. USA. Tres Cantos, Madrid.

- Francisco José López Valdés, *"Child restraint system expert course".* Inscripciones asistentes. USA. Madrid, Madrid.

- José Portela González, *"Training course: Opening the black box of neural networks - calculation of sensitivities with the NeuralSens package".* Universidad Complutense de Madrid. USA. Madrid, Madrid.

- Andrés Ramos Galán, *"Review of the advanced GAMS features for developing optimisation models applied to decision-making in power systems".* Polska Grupa Energetyczna S.A (PGE). USA. Online.

- Luis Olmos Camacho, Luis Rouco Rodríguez, Rafael Palacios Hielscher, *"Coordination of the course committee of the EES-UETP network during the year 2023".* Electric Energy Systems - University Enterprise Training Partnership Association (EES-UETP). USA. Madrid, Madrid.

- Javier García González, Andrés Ramos Galán, Pablo Dueñas Martínez, *"Computational modeling for promoting low-carbon electricity".* Massachusetts Institute of Technology (MIT). USA. Cambridge, MA (United States of America).

- José Portela González, *"Training course: Opening the black box of neural networks - calculation of sensitivities with the NeuralSens package".* Universidad Autónoma de Madrid. USA. Madrid, Madrid.

- José Portela González, *"Training course: Using the NeuralSens package for interpretable machine learning on Neural Networks".* Universidad Complutense de Madrid. USA. Madrid, Madrid.

- Alexis Cantizano González, *"Course on numerical simulation of fires".* Dirección General de la Policía. División de Formación y Perfeccionamiento. USA. Madrid, Madrid.

6.6 Seminars

Dissemination seminars are organized throughout the year at IIT facilities to present final or preliminary results of the ongoing research lines, as well as to discuss hot topics of general interest. The speakers of these seminars are either IIT member or guest speakers coming from other institutions. The seminars that have taken place in this course are the following ones.

- David Alfaya Sánchez, *"Maths team contest: refinement and extension of teaching methodologies".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- David Alfaya Sánchez, José Portela González, Antonio Muñoz San Roque, *"Advances in Machine Learning".* Seminario de Investigación GIIDA. Grupo de Investigación en Innovación Docente y Analytics - GIIDA. Universidad Pontificia Comillas.

- Erik Francisco Alvarez Quispe, *"A methodology for the impact assessment of local energy communities on the expansion of centralized storage and the grid, as well as the operation of the system in Norway and Spain".* ECEMP 2022 - Acting on the ambitions to a net-zero EU: roadblocks, challenges and opportunities. European Climate and Energy Modelling Platform - ECEMP.

- Elisa María Aracil Fernández, David Roch Dupré, Pablo Calvo Báscones, *"Progress towards longevity economics: the silver economy tracker".* I Encuentro sobre longevidad y bienestar social y económico. Cátedra Iberdrola de Ética Económica y Empresarial. Universidad Pontificia Comillas.

- Juan Manuel Asensio Gil, *"Development of a 50th percentile female human multibody model with active musculature".* 9th International Symposium Human Modeling and Simulation in Automotive Engineering. Carhs GmbH.

- Ana Baringo Morales, *" Frequency restoration reserve in Spain. From RCP to SRS-PICASSO".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Roberto Barrella, *"Panel 1: Technical and economic challenges of the renewable energy transition".* III Congreso Institucional de Sostenibilidad - Miradas multidimensionales para la transición energética en Colombia. Universidad La Salle.

- Roberto Barrella, *"Household electricity expenditure in the context of the energy crisis".* Taller «Propuestas para mejorar la estrategia nacional contra la pobreza energética 2019-2024». Unión General de los Trabajadores de España - UGT.

- Roberto Barrella, *"Energy for all. A learning and service project".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- Roberto Barrella, *"Assessing the impact of express refurbishment on energy poverty: a case study analysis".* Seminario «¿Impactan las medidas contra la pobreza energética en las familias en situación de vulnerabilidad?» . Fundación Naturgy.

- Roberto Barrella, *"The amendments to the EPBD directive. A harmonised framework for climate neutrality in buildings.".* XVIII Encuentro Anual de Atecyr. . Asociación Técnica Española de Climatización y Refrigeración (Atecyr).

- Roberto Barrella, *"Minimum energy needs: from a theoretical approach to real case studies".* Engager Café. ENGAGER COST Action.

- Roberto Barrella, *"Presentation of the EPAH report: "Energy Poverty National Indicators: Insights for a more effective measuring" and of the latest data on energy poverty in Spain".* Webinar «Iniciativas para paliar la pobreza energética en el contexto europeo. Proyecto Europeo SocialWatt y Proyecto EPIU Getafe». Fundación Naturgy.

- Roberto Barrella, Miguel Angel Ríos Ocampo, *"Development of concrete policy initiatives that can help achieve a just energy transition in Spain (working group)".* Jornada ADJUST: Hacia una transición justa. Basque Centre for Climate Change (BC3); Österreichische Forschungsstiftung für Internationale Entwicklung (ÖFSE); y Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC).

- Shilpa Bindu, *"Efficiency vs. simplicity: an evaluation of intrazonal congestion management methods in Europe".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Mario Castro Ponce, *"Identifiability and data-driven modeling in virus infections and immne response systems".* Workshop to doctorate students at School of Mathematics. University of Leeds.

- Mario Castro Ponce, *"Identifiability matters: A closer look at the art of mathematical modelling".* Mathematical Immunology and Virology Meeting. University of Leeds; British Society for Immunology.

- Mario Castro Ponce, *"If correlation does not imply causation, then what?".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Efraim Centeno Hernáez, *"Revisiting cost recovery in marginalist markets in long-run studies: How far does the theory go?".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- José Pablo Chaves Ávila, *"Lessons learnt from community of practice on regulatory sandboxes".* Workshop on "Regulatory sandboxes for the energy transition". Florence School of Regulation (FSR).

- Jenny Alexandra Cifuentes Quintero, *"Ethical Challenges of AI: Towards FAIR Machine Learning ".* Semana de la Ciencia y la Innovación 2022. Fundación para el conocimiento madri+d. Comunidad de Madrid.

- Rafael Cossent Arín, *"Energy in the bus of the future in the short and medium term. Science and application".* Curso de verano «La innovación del autobús en el transporte público». Universidad Complutense de Madrid (UCM).

- Rafael Cossent Arín, *"Panel of experts : Open innovation, talent and data".* Innovation Week. Iberdrola.

- Rafael Cossent Arín, *"Public presentation of the 2022 Annual Report of the Chair of Hydrogen Studies ".* Cátedra de Estudios sobre el Hidrógeno. Universidad Pontificia Comillas.

- Rafael Cossent Arín, Santiago Serna Zuluaga, *"Divide and conquer: dealing with nonlinearities in electrolyser performance under demand fluctuations. Session: The hydrogen economy".* Climate finance and the hydrogen economy 2023. Universidad Pontificia Comillas; y AM Fresh Group.

- Illia Diahovchenko, *"Integration of generic dynamic models of conventional generation, loads and RES in the dynamic model of CE grid".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Santos José Díaz Pastor, *"Overcoming the last mile: a holistic approach to Universal Electricity Access in Latin America".* Pulse Conference. RatedPower.

- Pablo Dueñas Martínez, *"Are distribution networks ready for electrification of heating? A tale of heat pumps, PV, tariffs, and H2".* Future Energy Systems Center Events- Fall Workshop y Advisory Meeting 2022. MIT Energy Initiative.

- Pablo Dueñas Martínez, *"Double entendre for electrification: how models at distribution level can help us out".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Julio Eisman Valdés, *"Distributed generation: a path to follow".* Webinar. Derecho & Sociedad; y Clínica Jurídica de la Pontificia Universidad Católica de Perú.

- Julio Eisman Valdés, *"Energy communities in Spain: experience and recommendations for alleviating energy poverty".* Jornada «Comunidades Energéticas y Pobreza». Instituto de la Ingeniería de España (IIE).

- Mohamed Abbas Eltahir Elabbas, *" Policy Dialoge on Renewable Generation and Regional Power Trade in Africa. Session 2. Regional institutions of African power pools".* SPIREC conference. African School of Regulation -ASR.

- Mohamed Abbas Eltahir Elabbas, *"Regional organisations and infrastructure planning".* International Online Conference on Power Pools in Africa: Releasing the potential of regional power trade. African School of Regulation - ASR.

- Tarek Elgindy, *"Topics in US power systems".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Isabel Catalina Figuerola-Ferreti Garrigues, Isabel Catalina Figuerola-Ferreti Garrigues, *"Public presentation of the Annual Report of the Chair of Hydrogen Studies ".* Cátedra de Estudios sobre el Hidrógeno. Universidad Pontificia Comillas.

- Isabel Catalina Figuerola-Ferreti Garrigues, Ignacio Segarra Tamarit, *"The optimal management of a hydropower reservoir. Session: The hydrogen economy".* Climate finance and the hydrogen economy 2023. Universidad Pontificia Comillas; y AM Fresh Group.

- Miguel García Sánchez, *"Knowledge co-creation for urban transitions. A systematic literature review by thematic coding analysis".* SGSS Interdisciplinary Conference «Making the crossing: Your interdisciplinary PhD and beyond». Scottish Graduate School of Social Science (SGSSS).

- Miguel García Sánchez, *"SGSSS Summer School 2023".* Scottish Graduate School of Social Science (SGSSS).

- Timo Gerres, *"Beyond hydrogen: what is needed for a Paris-aligned transition of the heavy industry".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Timo Gerres, *"Carbon contract for differences their role in European industrial decarbonization. Session: The hydrogen economy".* Climate finance and the hydrogen economy 2023. Universidad Pontificia Comillas; y AM Fresh Group.

- Timo Gerres, *"The industrial plan of the Green Deal".* Ciclo de Debates 2023 «Desafíos europeos del semestre español» . Europa en suma.

- Timo Gerres, *"EU policy: past, present and future product design".* Climate Friendly Materials (CFM) Platform Workshop: Towards High-Quality Material Recycling. . Deutsches Institut für Wirtschaftsforschung (DIW Berlín).

- Timo Gerres, *"Success cases and remaining challenges: views from the sectors".* Conference «Capturing competitiveness: carbon removal, renewable energies, and feedstock . RE4Industry project.

- Jesús David Gómez Pérez, *"Improving operating policies in stochastic optimization. An application to the medium-term hydrothermal scheduling problem".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Tomás Gómez San Román, *"Group work Tariffication in the EU. Session 2: Different models and methodologies for electricity and gas network charging in Europe".* CEER Training on Network Tariffs for Transmission and Distribution. Council of European Energy Regulators (CEER).

- Tomás Gómez San Román, *"How to design network charges in a context of high penetration of distributed resources, prosumers, on-site distributed generation and Energy Communities. Session 3: Tariffs setting in the context of new developments in Europe".* CEER Training on Network Tariffs for Transmission and Distribution. Council of European Energy Regulators (CEER).

- Tomás Gómez San Román, *"The regulation of renewable energies in the European Union".* XX Curso de Regulación Energética: "Regulación de la promoción de las energías renovables y la eficiencia energética". Comisión Nacional de los Mercados y la Competencia (CNMC); Asociación Iberoamericana de entidades reguladoras de la energía (ariae); y Cooperación Española Conocimiento/Intercoonecta.

- Tomás Gómez San Román, *"New challenges DSOs".* CEER Specialised Training on Network Tariffs for Transmission and Distribution. Council of European Energy Regulators (CEER).

- Tomás Gómez San Román, *"Tariffication in the EU : Working group".* CEER Specialised Training on Network Tariffs for Transmission and Distribution. Council of European Energy Regulators (CEER).

- Yolanda González Arechavala, *"ApS in ICAI: STEM education".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- Yolanda González Arechavala, *"Discovering Artificial Intelligence ".* Semana de la Ciencia y la Innovación 2022. Fundación para el conocimiento madri+d. Comunidad de Madrid.

- Yolanda González Arechavala, *"Education and talent".* Jornada «TaleMto con m de mujer». Ibredrola.

- Yolanda González Arechavala, *"Towards a diverse engineering ".* Presentación del Informe: El sonido de la ingeniería del futuro. Fundación Ingenieros ICAI; y Foro ICAI Mujer.

- Yolanda González Arechavala, *"Nutrition with Scratch".* 3ª edición Concurso de vídeos STEM EXPERIciencia. Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas.

- Yolanda González Arechavala, *"Career opportunities of STEM Vocational Training".* II Jornada de Orientación en Educación STEM. Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas.

- Yolanda González Arechavala, Gregorio López López, Mario Castro Ponce, *"Cybercrime: learn how to defend yourself by playing games ".* Semana de la Ciencia y la Innovación 2022. Fundación para el conocimiento madri+d. Comunidad de Madrid.

- Juan Francisco Gutiérrez Guerra, *"Bio-FlexGen project".* Workshop «District Heating and Cooling in the Future Energy System». Universidad Politécnica de Madrid (UPM); y Research to Market Solution.

- Juan Francisco Gutiérrez Guerra, *"Exploring the synergies of biomass-based top-cycle CHP plants with hydrogen for industrial applications".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Leslie Herding, *"An aggregated cost model for estimating distribution grid investment under the energy transition: a Spanish case study".* 31. Workshop des Student Chapters. Gesellschaft für Energiewissenschaft und Energiepolitik e.V.; y Technische Universität Dresden.

- Leslie Herding, *"Assessing the impact of RES penetration and geographical allocation on transmission expansion cost: a comparative analysis of two large-scale systems".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Carlos Hernando López de Toledo, *"Design and validation of cryogenic test stand components for the characterization of magnetocaloric materials".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Njegos Jankovic, *"Multimode power oscillation damping controller synthesis using vector fitting".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Álvaro Jesús López López, Nereida Bueno Guerra, *"What about ChatGPT? Artificial intelligence in higher education; Implications, challenges and opportunities".* Universidad Pontificia Comillas.

- Gregorio López López, *"The Horizon Europe project eFORT(establishment of a FramewORk for Transforming current European Power and Energy Systems into a more resilient, reliable and secure system all over its value chain".* Barcelona Cybersecurity Congress. Fira Barcelona; y Agència de Ciberseguretat de Catalunya.

- Francisco José López Valdés, *"Powering the electric ecosystem: batteries, security and digital currency payments".* GBO Electric Mobility Day. GBO; Armatura Capital; y Culpass.

- Sara Lumbreras Sancho, *"Artificial intelligence, ethics, and beliefs".* Logic & Religion Webinar. Logic and Religion Association - LARA.

- Sara Lumbreras Sancho, *"Artificial Intelligence in the decision making of complex problems".* Curso «Experto en Inteligencia Artificial en las Ciencias Sociales y Jurídicas». Universidad Complutense de Madrid (UCM).

- Sara Lumbreras Sancho, *"Not animals, neither machines: keys to human intelligence in the age of Artificial Intelligence. Plenary Session 4: Machines? Humanity in the age of Artificial Intelligence".* XIV Congreso Internacional de Antropología Filosófica: “Sociedad Hispánica de Antropología Filosófica”. Sociedad Hispánica de Antropología Filosófica; y UNED.

- Sara Lumbreras Sancho, *"The mental diet: how conscious decisions about our beliefs can improve our emotional and physical wellbeing".* Conference on Religion, Spirituality, and Wellbeing. Cátedra Hana y Francisco José Ayala de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas.

- Sara Lumbreras Sancho, *"Vision of transhumanism from exponential technologies. Session 1. Transhumanism, science and technology".* Semana del Transhumanismo. Universidad Popular Autónoma del Estado de Puebla - UPAEP.

- Sara Lumbreras Sancho, *"What can we learn from transhumanism?".* Ist congress of the Society of Catholic Scientists. Universidad de Navarra.

- Paolo Mastropietro, Pablo Rodilla Rodríguez, *"Future-proofed resource adequacy metrics for elastic demand and integrated energy systems".* Resource Adequacy Working Group (RAWG) Annual Meeting 2023. Institute of Electrical and Electronics Engineers Power and Energy Society (IEEE PES).

- Ana María Megía Macías, *"Cold atmospheric plasmas: from the lab to the clinic".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Morsy Abdelkader Morsy Mohammed Nour, *"Impacts of community energy trading on low voltage distribution networks".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Emanuel Gastón Mompó Pavesi, *"Putting chaos, noise, and memory effects to work".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Miguel Monteagudo Honrubia, *"Automatic classification and permittivity estimation of glycerin solutions using a dielectric resonator sensor and Machine Learning techniques".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Nicolás Mariano Morell Dameto, *"Advancing in the implementation of forward-looking incremental network charges: locational granularity, ex-post pricing, and customer response coordination".* Future Electricity Tariffs Workshop. Florence School of Regulation (FSR).

- Luis Olmos Camacho, *"Flexibility options – the Open ENTRANCE case studies".* Open ENTRANCE project.

- José Ignacio Pérez Arriaga, *"An integrated approach to electrification. Lesson 17: Strategies issues. Wrapping up the course".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- José Ignacio Pérez Arriaga, *"Business models and challenges for grid extension. Lesson 13: Regulation and business models for networks".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- José Ignacio Pérez Arriaga, *"Business plans for electrification. Lesson 11: Financial electrification".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- José Ignacio Pérez Arriaga, *"Cross-Country – Enhancing regional power transmission network for optimized energy mix, energy security and green grow".* 6th Africa Energy Market Place Conference on "Delivering Desert to Power in the Horn of Africa: Enhancing Regional Power Trade". African Development Bank Group.

- José Ignacio Pérez Arriaga, *"Electrification planning. Lesson 9: Electrification planning".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- José Ignacio Pérez Arriaga, *"Lesson 10: Adapting regulation to achieve universal electricity access".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- José Ignacio Pérez Arriaga, *"Power systems of the future. Implications of variable, renewable, & distributed energy".* Managing New Power Markets and Regulation in Africa Course. University of Cape Town.

- José Ignacio Pérez Arriaga, *"Presentation of the African School of Regulation initiative".* Advancing the Green Gateway Between Africa and Europe – Seizing COP27 for energy access and climate stability - AEEP Forum 2022. Africa-EU Energy Partnership (AEEP).

- José Ignacio Pérez Arriaga, *"Presentation of the current activities of the GCEEP".* COP 26. UK Government; y United Nations Climate Change.

- José Ignacio Pérez Arriaga, *"Regional integration and its role in reducing power costs as well as decarbonizing and strengthening Africa's Power systems".* Africa Delivery Exchange-Climate Conference (ADX-Climate 2022). Commercial Agriculture for Smallholders and Agribusiness (CASA) Programme.

- José Ignacio Pérez Arriaga, *"Zambia: a master electrification plan. Lesson 9: Electrification planning".* Regulation for Sustainable Development Goal 7 Course. Florence School of Regulation (FSR).

- Jaime Pérez Sánchez, Gregorio López López, *"Expert vs. data-driven causal discovery: a case study on cyberbullying".* 13th Bayesian Inference for Stochastic Processes - BISP Workshop. Instituto de Ciencias Matemáticas (ICMAT).

- Andrés Ramos Galán, *"Accelerate and take care of your research".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Andrés Ramos Galán, *"Presentation of the Initiative".* NGIND - Comillas ICAI initiative on the next generation industry. Universidad Pontificia Comillas.

- Andrés Ramos Galán, *"Decomposition methods in integer programming: Benders decomposition".* Ciclo de Conferencias del IMI-DSC: Decisión, Optimización y Ciencia de Datos. Instituto de Matemática Interdisciplinar (IMI); y Universidad Complutense de Madrid.

- Miguel Angel Ríos Ocampo, *"A just energy transition is not just a transition: an energy poverty framework for a just energy transition".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Miguel Angel Ríos Ocampo, *"A just transition is not just a transition: an energy poverty-framed just energy transition".* Climate, Energy and Environmental Justices and Transitions: Rethinking Global Environmental law. European University Institute. Florence School of Regulation.

- Miguel Angel Ríos Ocampo, Roberto Barrella, *"Developing a vision for a just energy transition in Spain (working group)".* Jornada ADJUST: Hacia una transición justa. Basque Centre for Climate Change (BC3); Österreichische Forschungsstiftung für Internationale Entwicklung (ÖFSE); y Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC).

- Francisco Rodríguez Cuenca, *"Probability-based energy-saving recommendations for household appliances".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Carlos Rodríguez-Morcillo García, *"Research career options".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- José Carlos Romero Mora, *"Emergence of the energy issue, conflicts and poverty".* Avanzar en la seguridad humana y en los ODS. FUHEM Ecosocial.

- José Carlos Romero Mora, *"Real experiences of impact measurement".* Seminario «¿Impactan las medidas contra la pobreza energética en las familias en situación de vulnerabilidad?» . Fundación Naturgy.

- José Carlos Romero Mora, *"Indicators of energy poverty in Spain 2021".* Taller «Propuestas para mejorar la estrategia nacional contra la pobreza energética 2019-2024». Unión General de los Trabajadores de España - UGT.

- Luis Rouco Rodríguez, *"R&D&I Ecosystem in electric power systems: Collaboration between universities, research centers and industry".* IEEE PES Capítulo Español.

- Luis Rouco Rodríguez, *"The response of C.N. Cofrentes to the incident of loss of interconnection with France on 24 July 2021 reveals the importance of the stability of the grid of Spanish C.C.N.N.".* 47ª Reunión Anual Sociedad Nuclear Española. Sociedad Nuclear Española (SNE).

- María Ana Sáenz Nuño, *"The escape game as an activity to evaluate the knowledge learned. Escape room "Hope for the future"".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- José Luis Sancha Gonzalo, *"Presentation and welcome".* Jornada «La transición energética. Una oportunidad para emprender». Foro ICAI.

- Miguel Ángel Sánchez Fornié, *"Skills for the twin green and digital transition".* European Sustainable Energy Week - EUSEW 2022. EDDIE Project; EdgeFLEX Project; IEEE PES Task Force; DG EMPL.B2; y DG ENER.

- Álvaro Sánchez Miralles, *"ReDREAM Project".* Enlit Europe 2022. European Commission.

- Álvaro Sánchez Miralles, *"Users charging for smart consumption: the future of a democratic and sustainable energy system".* X Smart Energy Congress - SEC 2022. Ayuntamiento de Madrid; Ministerio de Ciencia e Innovación; y Comunidad Autónoma de Madrid.

- Eugenio Francisco Sánchez Úbeda, *"Zero paper in statistic subjects: Python as a vehicular language".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- Santiago Serna Zuluaga, *"Divide and conquer: delaing with nonlinearities and demand fluctuactions in electrolyser performance under demand fluctuations".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Jorge Suárez Porras, *"Dynamical patterns of synchronous compensators connected to a wind power plant".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Andrés Tomás Martín, *"Re-synchronisation of a microgrid to the main grid using multi-agent secondary control".* 18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Matteo Troncia, *"A unified vision for European market design: integration challenges, flexibility services, products, and interoperability. Special session: Challenges and solutions for a pan-European electricity market integration to accommodate grid services and needs o".* International Conference on Smart Energy Systems and Technologies - SEST 2022. Eindhoven University of Technology.

- Carmen Valor Martínez, *"P&G challenges: learning based on Green But Failed project".* Jornadas de Buenas Prácticas en Docencia Comillas 2022-23. Universidad Pontificia Comillas.

- Daniel Lewis Wuebben, *"Power lines: how communication threads the energy transition".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

6.7 Organization of congresses, seminars and workshops

- Miguel Ángel Sánchez Fornié, Fernando de Cuadra García, Carlos Mateo Domingo, Álvaro Jesús López López, *"European Sustainable Energy Week - EUSEW 2022. Session: Skills for the twin green and digital transition".* EDDIE Project; EdgeFLEX Project; IEEE PES Task Force; DG EMPL.B2; y DG ENER. Online. September 2022.

- Elisa María Aracil Fernández, *"Mesa redonda: El reto de la sostenibilidad para el sector financiero".* Universidad Pontificia Comillas. Madrid (Spain). October 2022.

- Rafael Palacios Hielscher, *" España Digital 2026 - Ciberseguridad y compliance".* Observatorio Legaltech & NewLaw Garrigues-ICADE; y Máster en Ciberseguridad ICAI. Madrid (Spain). October 2022.

- Timo Gerres, *"Potencial y retos de la captura de carbono. Su papel en la descarbonización.".* Cátedra BP de Energía y Sostenibilidad y Cátedra de Estudios sobre el Hidrogeno (Universidad Pontificia Comillas); y Club Español de la Energía. Madrid (Spain). October 2022.

- Álvaro Jesús López López, *"Metaverso".* Cátedra de Industria Conectada. Universidad Pontificia Comillas. Madrid (Spain). October 2022.

- Julio Eisman Valdés, *"Comunidades Energéticas y Pobreza".* Instituto de la Ingeniería de España (IIE). Madrid (Spain). November 2022.

- Miguel Angel Ríos Ocampo, *"¿Cómo afectó la pospandemia a la pobreza energética en España?. Indicadores de pobreza energética en España 2021".* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). November 2022.

- Lukas Sigrist, *"Sesión de cierre 2022".* IEEE PES España. Madrid (Spain). December 2022.

- Yolanda González Arechavala, *"Taller «Descubriendo la inteligencia artificial»".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas. Madrid (Spain). February 2023.

- Yolanda González Arechavala, *"Aulas +: Apuesta STEM para un futuro sostenible".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas. Madrid (Spain). February 2023.

- Eva María Arenas Pinilla, *"Microreactores nucleares y reactores modulares pequeños (SMRs). ¿Está el futuro de la energía nuclear en la pequeña escala?".* Cátedra Rafael Mariño de Nuevas Tecnologías Energéticas. Universidad Pontificia Comillas. Madrid (Spain). March 2023.

- Eva María Arenas Pinilla, *"La carrera por los recursos: Cómo las materias primas críticas pueden moldear el panorama energético futuro".* Cátedra Rafael Mariño de Nuevas Tecnologías Energéticas. Universidad Pontificia Comillas. Madrid (Spain). March 2023.

- Isabel Catalina Figuerola-Ferreti Garrigues, Rafael Cossent Arín, *"Climate finance and the hydrogen economy 2023".* Universidad Pontificia Comillas; y AM Fresh Group. Madrid (Spain). May 2023.

- Luis Rouco Rodríguez, Aurelio García Cerrada, Enrique Lobato Miguélez, Ignacio Egido Cortés, Lukas Sigrist, Francisco Miguel Echavarren Cerezo, Álvaro Ortega Manjavacas, *"21th International Conference on Renewable Energy and Power Quality - ICREPQ'23".* European Association for the Development of Renewable Energy, Environment and Power Quality (EA4EPQ); Universidad de Vigo; y Universidad Pontificia Comillas. Madrid (Spain). May 2023.

- Yolanda González Arechavala, Gregorio López López, *"Taller de Ciberdelitos: aprender a defenderse jugando".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas; y Proyecto RAYUELA. Madrid (Spain). June 2023.

- Miguel Angel Ríos Ocampo, Roberto Barrella, Efraim Centeno Hernáez, María José Manjón Rodríguez, *"X Sesión del Seminario Interdisciplinar. Iniciativas locales contra la pobreza energética".* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Sara Lumbreras Sancho, *"18th Workshop on Industrial Systems and Energy Technologies - JOSITE'2023".* Instituto de Investigación Tecnológica. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Yolanda González Arechavala, *"II Jornada de Orientación en Educación STEM".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Sara Lumbreras Sancho, *"XX Aniversario de la Cátedra Hana y Francisco José Ayala de Ciencia, Tecnología y Religión".* Cátedra Hana y Francisco José Ayala de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

6.8 Organization and management of other academic activities

- Elisa María Aracil Fernández, *"Chairman in Round table: The challenge of sustainability for the financial sector".* Universidad Pontificia Comillas. Madrid (Spain). October 2022.

- Roberto Barrella, *"Chairman in Session 2. «Impact of anti-crisis measures on vulnerable people. Lessons learned from the measures implemented and proposals for future measures» in «IX Sesión del Seminario Interdisciplinar «¿Cuál es el impacto real sobre las personas vulnera".* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). February 2023.

- Roberto Barrella, *"Chairman in Session 2. «Other experiences of local initiatives against energy poverty» in «X Sesión del Seminario Interdisciplinar «Iniciativas locales contra la pobreza energética»»".* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Mario Castro Ponce, *"Permanent member of Congress of Statistical Physics - FISES".* RSEF / GEFENOL. April 2014- Today.

- Mario Castro Ponce, *"Chairman in Round table: What about ChatGPT? Artificial intelligence in higher education; Implications, challenges and opportunities".* Universidad Pontificia Comillas. Madrid (Spain). March 2023.

- Efraim Centeno Hernáez, *"Chairman in Session 1. «Consumer support measures in the context of the current energy crisis» in «IX Sesión del Seminario Interdisciplinar «¿Cuál es el impacto real sobre las personas vulnerables de las medidas contra la crisis energética actual?»»".* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). February 2023.

- Isabel Catalina Figuerola-Ferreti Garrigues, *"Member of the Scientific Committee of XI Meeting on International Economics".* Universitat Jaume I. Castellon de la Plana (Spain). May 2023.

- Isabel Catalina Figuerola-Ferreti Garrigues, *"Chairman in Climate change in «Climate finance and the hydrogen economy 2023»".* Universidad Pontificia Comillas; y AM Fresh Group. Madrid (Spain). May 2023.

- Aurelio García Cerrada, *"Permanent member of Annual Seminar on Automation, Industrial Electronics and Instrumentation - SAAEI".* September 1999- Today.

- Aurelio García Cerrada, *"Editor of IET Power Electronics".* Institute for Engineering and Technology (IET). Stevenage (United Kingdom). October 2007- Today.

- Javier García González, *"Permanent member of Power Systems Computation Conference - PSCC".* January 2001- Today.

- Tomás Gómez San Román, *"Editor of Sustainable Energy, Grids and Networks".* Elsevier Science BV.. Amsterdam (Netherlands). June 2014- Today.

- Tomás Gómez San Román, *"Editor of Journal of Modern Power Systems and Clean Energy".* Nanjing NARI Electric Power Information Co., Ltd. ; e Institute of Electrical and Electronics Engineers Inc. - IEEE. Piscataway (United States of America). March 2020- Today.

- Tomás Gómez San Román, *"Organization/Direction of the course «CEER Training on Network Tariffs for Transmission and Distribution»".* Council of European Energy Regulators (CEER). Brussels (Belgium). September 2022.

- Tomás Gómez San Román, *"Chairman in Round table: European business vision in «Jornada «El diseño del mercado eléctrico»».* Club Español de la Energía. Madrid (Spain). June 2023.

- Yolanda González Arechavala, *"Chairman in Round table: Classrooms +: a STEM bet for a sustainable future".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas. Madrid (Spain). February 2023.

- Yolanda González Arechavala, *"Chairman in Round table: Experiences of STEM Vocational Training Young Professionals in « II Jornada de Orientación en Educación STEM»".* Cátedra para la Promoción de la mujer en Vocaciones STEM en la Formación Profesional para la Movilidad Sostenible. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Pedro Linares Llamas, *"Editor of Papeles de Energía".* FUNCAS. Madrid (Spain). June 2015- Today.

- Francisco José López Valdés, *"Editor of Journal of Healthcare Engineering".* Hindawi Ltd.. London (United Kingdom). January 2016- Today.

- Francisco José López Valdés, *"Editor of Frontiers in Bioengineering and Biotechnology. Biomechanics".* Frontiers Editorial. Lausanne (Switzerland). November 2014- Today.

- Francisco José López Valdés, *"Editor of Injury Epidemiology".* Springer. London (United Kingdom). January 2022- Today.

- Francisco José López Valdés, *"Organization/Direction of the course «3rd Edition Advanced technical course in child retention systems»".* Universidad Pontificia Comillas. Madrid (Spain). September 2022.

- Sara Lumbreras Sancho, *"Editor of Micro espacios de investigación. Revista científica e interdisciplinar".* Asociación UBUNTU. Madrid (Spain). January 2016- Today.

- María José Manjón Rodríguez, *"Chairman in Session 1. «Experience of energy communities against energy poverty» in «X Sesión del Seminario Interdisciplinar «Iniciativas locales contra la pobreza energética»».* Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). June 2023.

- Luiz Augusto Nobrega Barroso, *"Editor of IEEE Power & Energy Magazine".* IEEE Power & Energy Society (IEEE PES). Piscataway (United States of America). January 2017- Today.

- Luiz Augusto Nobrega Barroso, *"Editor of IEEE Open Access Journal of Power and Energy".* IEEE Power & Energy Society (IEEE PES). Piscataway (United States of America). January 2020- Today.

- Luis Olmos Camacho y Luis Rouco Rodríguez, *"Permanent member of Power Systems Computation Conference - PSCC".* June 2017- Today.

- José Ignacio Pérez Arriaga, *"Editor of European Review of Energy Markets".* European Energy Institute. June 2015- Today.

- José Ignacio Pérez Arriaga, *"Organization/Direction of the course «Regulation for Sustainable Development Goal 7 (SDG7) Course»".* Florence School of Regulation (FSR). Online. May-October 2022.

- José Ignacio Pérez Arriaga, *"Chairman in Round table: Achieving compatibility between electrification planning, market freedom, universal access, and sustainability of electricity supply. Lesson 15: Regulation and business models for standalone systems in «Regulation for Sustainable ".* Florence School of Regulation (FSR). Online. October 2022.

- José Ignacio Pérez Arriaga, *"Chairman in Round table: Experiences and new approaches to clean cooking. Lesson 16: Clean cooking in «Regulation for Sustainable Development Goal 7 Course»".* Florence School of Regulation (FSR). Online. October 2022.

- José Ignacio Pérez Arriaga, *"Chairman in Round table: Current efforts and perspectives in universal energy access. Lesson 17. Strategic issues. Wrapping up the course in «Regulation for Sustainable Development Goal 7 Course»".* Florence School of Regulation (FSR). Online. October 2022.

- José Ignacio Pérez Arriaga, *"Organization/Direction of the course «Regulation for Sustainable Development Goal 7 (SDG7) Course»".* European University Institute. Florence School of Regulation. Florence (Italy) Online. May-October 2023.

- Andrés Ramos Galán, *"Editor of Computational Management Science".* Springer. Heidelberg (Germany). October 2011- Today.

- Andrés Ramos Galán, *"Member of the Scientific Committee of International Conference on Renewable Energy Research and Applications (ICRERA)".* International Journal of Renewable Energy Research - IJRER. September 2012- Today.

- Juan Carlos del Real Romero, *"Permanent member of Congress of Adhesion and Adhesives".* Grupo Español de Adhesión y Adhesivos (GEAA). Zaragoza (Spain). January 2000- Today.

- Juan Carlos del Real Romero, *"Permanent member of International Conference on Structural Adhesive Bonding".* Porto (Portugal). January 2011- Today.

- Juan Carlos del Real Romero, *"Permanent member of International Conference on Advanced Joining Processes - AJP".* January 2019- Today.

- José Carlos Romero Mora, *"Chairman in Round table: Circular economy. Responsible production and consumption in «Encuentros para la Sostenibilidad 2022»".* Fundación Casa de México en España; y Fundación Iberdrola España. Madrid (Spain). September 2022.

- Luis Rouco Rodríguez, *"Editor of Electric Power Systems Research".* Elsevier Science Ltd.. Lausanne (Switzerland). January 2000- Today.

- Luis Rouco Rodríguez, *"Editor of IET Generation, Transmission and Distribution".* The Institution of Engineering and Technology (IET). Hertford (United Kingdom). April 2016- Today.

- Luis Rouco Rodríguez, *"Editor of IEEE Transactions on Power Systems".* Institute of Electrical and Electronics Engineers Inc. - IEEE. Piscataway (United States of America). January 2017- Today.

- José Luis Sancha Gonzalo, *"Chairman in Round table: Energy system reforms from the consumer's perspective".* Universidad Pontificia Comillas; Asociación/Colegio Nacional de Ingenieros de ICAI; y Comisión Nacional de los Mercados y la Competencia. Madrid (Spain). June 2023.

- Lukas Sigrist, *"Editor of IET Generation,Transmission and Distribution".* Institute for Engineering and Technology (IET). Quebec (Canada). August 2017- Today.

- Carmen Valor Martínez, *"Editor of International Journal of Consumer Studies".* Wiley-Blackwell. Hoboken (United States of America). May 2020- Today.

7. Data about IIT

The relevant numbers of the academic year 2022 - 2023 are shown below, as well as the historical evolution of the turnover of the Institute and of its staff, separated into academic staff and research assistants:

8.394 M€ Turnover

89 Professors and researchers

78 Pre- and post-doctoral researcher

121 Research projects

43 Consultancy projects

14 Services and analysis projects

1 book

9 Chapters in books

102 Papers published in JCR journals

23 Papers published in other journals

73 Papers presented at conferences

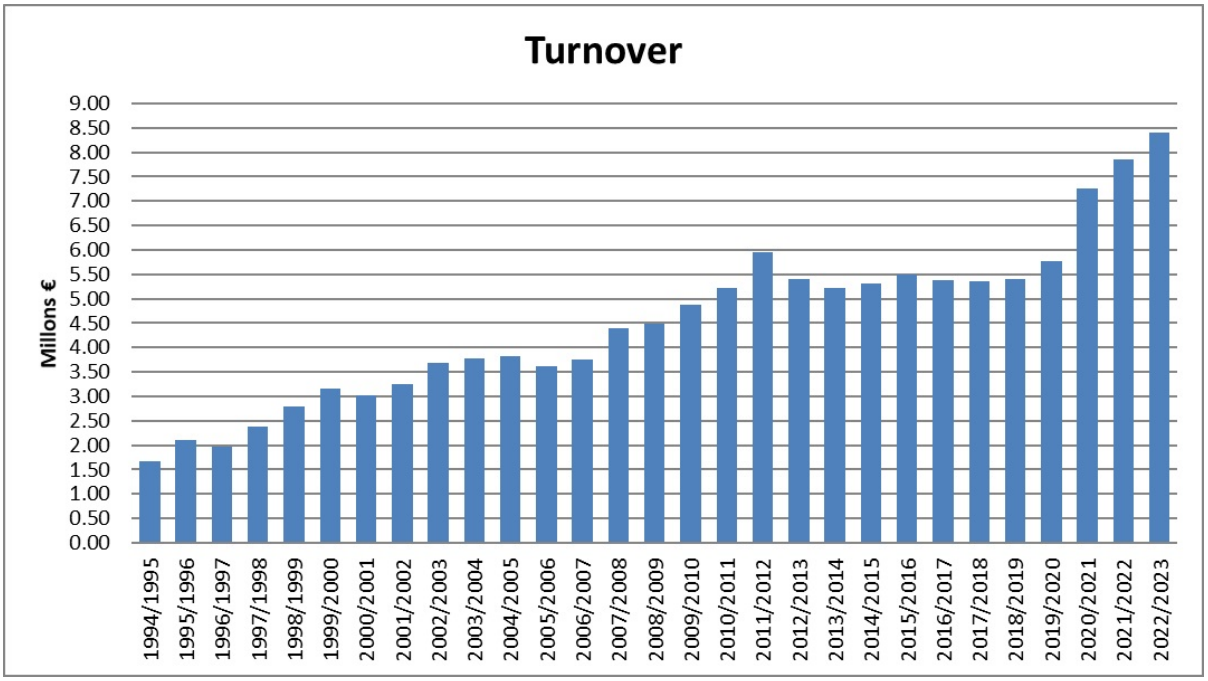
17 Technical reports and 21 working papers

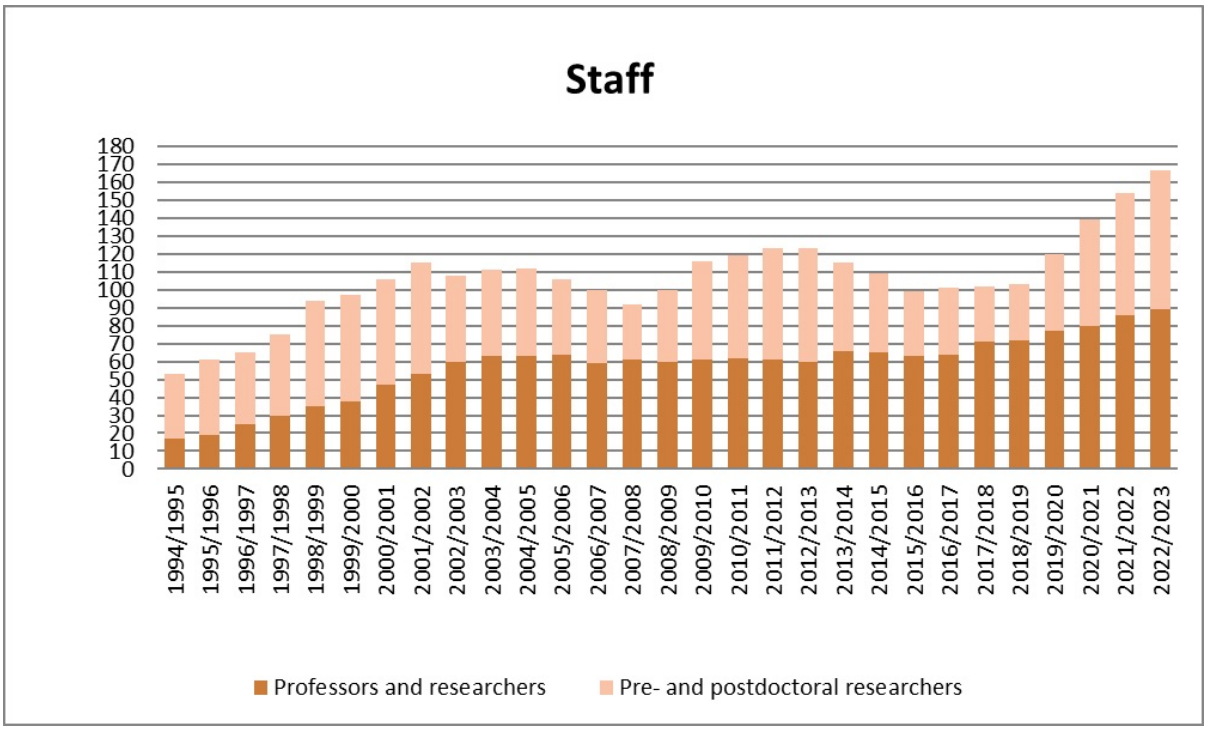
13 Submitted theses

90 Ongoing theses

11 Courses offered to external entities

Data about IIT





Institute for Research in Technology
ICAI School of Engineering
Comillas Pontifical University

C/ Santa Cruz de Marcenado 26
28015 MADRID
SPAIN

iit.comillas.edu

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