

ANNUAL ACADEMIC REPORT

Academic Year

2018-2019



IIT
INSTITUTO DE
INVESTIGACIÓN
TECNOLÓGICA

Index

1. Introduction	1
2. Organizational structure	3
2.1 Management.....	3
2.2 Council.....	3
2.3 Area coordinators.....	4
2.4 Scientific advisory board.....	4
2.5 Academic staff.....	4
2.6 Associated academic staff.....	12
2.7 Research assistants.....	15
2.8 Services staff.....	18
2.8.1 Systems administrator staff.....	18
2.8.2 Administrative staff.....	18
3. Research	19
3.1 Research areas.....	19
3.1.1 Energy systems.....	19
3.1.1.1 <i>Electric Power Systems (MAC)</i>	19
3.1.1.2 <i>Smart and Sustainable Grids (REDES)</i>	19
3.1.1.3 <i>Energy Economics and Regulation (RYE)</i>	20
3.1.1.4 <i>Energy Systems Models (SADSE)</i>	20
3.1.2 Industrial systems.....	20
3.1.2.1 <i>Fire Safety, Thermal and Fluids Engineering (PCI)</i>	20
3.1.2.2 <i>Railway Systems (ASF)</i>	20
3.1.2.3 <i>Intelligent Systems (ASI)</i>	21
3.1.2.4 <i>Bioengineering (BIO)</i>	21
3.2 Research projects.....	21
3.2.1 Energy systems.....	21
3.2.1.1 <i>Research and development projects</i>	21
3.2.1.2 <i>Consultancy and technological support</i>	42
3.2.1.3 <i>Services and analysis projects</i>	47
3.2.2 Industrial systems.....	50
3.2.2.1 <i>Research and development projects</i>	50
3.2.2.2 <i>Consultancy and technological support</i>	57
3.2.2.3 <i>Services and analysis projects</i>	58
3.3 Publications.....	58
3.3.1 Chapters in books.....	58
3.3.2 Publications in journals.....	59
3.3.3 Conference presentations.....	66
3.3.4 IIT technical documents.....	71
3.3.5 Other publications.....	73
4. Teaching	77
4.1 Supervised undergraduate theses at IIT.....	77
4.1.1 Electrical, Electronics, and Mechanical Engineering.....	77
4.1.2 Telematics Engineering.....	78
4.1.3 Bachelor's Degree in Engineering for Industrial Technologies.....	78

4.1.4 Bachelor's Degree in Engineering in Telecommunications Technologies	83
4.2 Postgraduate teaching	85
4.2.1 Graduate courses	85
4.2.1.1 Official Master's Degree in Research in Engineering Systems Modeling (MRE)	85
4.2.1.2 Official Master's Degree in the Electric Power Industry (MEPI)	85
4.2.1.3 Master in Railway Systems	86
4.2.1.4 Master in Project, Construction and Maintenance of High Voltage Electrical Transmission (On-line)	87
4.2.1.5 Master's Degree in International Industrial Project Management	87
4.2.1.6 Official Master's Degree in Biomechanics and Sports Physiotherapy	87
4.2.1.7 MBA in the Global Energy Industry	88
4.2.1.8 Master's Degree in Smart Industry (MIC)	88
4.2.1.9 Master's Degree in Big Data Technologies and Advanced Analytics (MBD)	88
4.2.1.10 Master's Degree in Smart Grids (MSG)	88
4.2.1.11 Master in Mobility and Safety Engineering (MMS)	89
4.2.2 Graduate theses supervised at IIT	89
4.2.2.1 Official Master's Degree in Industrial Engineering (MII)	89
4.2.2.2 Official Master's Degree in Telecommunications Engineering (MIT)	93
4.2.2.3 Official Master's Degree in the Electric Power Industry (MEPI)	93
4.2.2.4 Master's Degree in Smart Industry (MIC)	93
4.2.2.5 Master's Degree in Big Data Technologies and Advanced Analytics (MBD)	94
5. Doctorate	95
5.1 ICAI Engineers' Association	95
5.2 Training complements	95
5.3 Training activities	95
5.4 Doctoral theses	96
5.4.1 Comillas submitted theses	96
5.4.2 Comillas ongoing theses	97
5.4.3 Submitted theses in other universities	101
6. Other activities	103
6.1 EES-UETP	103
6.1.1 EES-UETP partners	103
6.1.2 Teached courses	104
6.2 International exchanges	104
6.3 Visiting professors	105
6.4 Visiting students	106
6.5 Courses offered and coordinated to external companies and institutions ..	107
6.6 Seminars	109
6.7 Organization of congresses, seminars and workshops	114
6.8 Organization and management of other academic activities	115
6.9 Other activities	118

7. Data about IIT	141
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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 and 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.

A handwritten signature in blue ink, consisting of stylized initials and a surname, enclosed within a circular scribble.

Tomás Gómez San Román

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 the participation in specific projects of interest for the industry and the administration. It is a nonprofit institute that seeks to be flexible and pragmatic in the way it works. Its funding mainly comes from projects contracted with companies; therefore, IIT responds to a social demand.

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 research staff of the IIT is composed of professors of the school of engineering ICAI who develop their research activities at IIT together with IIT full-time research scientists. They supervise the research conducted by the research assistants who are enrolled in different engineering PhD programs of Comillas.

This report covers the period for the academic year 2018 - 2019, from September 1, 2018 to August 31, 2019.

2. Organizational structure

2.1 Management

The management of the IIT during the course 2018 - 2019 has been carried out by the following Professors and Researchers:

- **Frías Marín, Pablo.** Deputy Director for Internal Affairs (until September 2018)
- **García González, Javier.** Deputy Director for Academic and Economic affairs
- **Gómez San Román, Tomás.** Director
- **Sigrist, Lukas.** Deputy Director for Institutional Relationships

2.2 Council

The members of the council of the IIT during the course 2018 - 2019 were the following ones:

- **Cossent Arín, Rafael.** Researcher Representative
- **Frías Marín, Pablo.** Deputy Director for Internal Affairs (until September 2018)
- **García González, Javier.** Deputy Director for Academic and Economic affairs
- **Gómez San Román, Tomás.** Director
- **López López, Álvaro Jesús.** Researcher Representative
- **Otaola Arca, Pedro de.** IEF Representative
- **Ramos Galán, Andrés.** Researcher Representative
- **Rivier Abbad, Michel.** Researcher Representative
- **Roch Dupré, David.** IEF Representative
- **Rodilla Rodríguez, Pablo.** Researcher Representative
- **Sigrist, Lukas.** Secretary General
- **Sigrist, Lukas.** Deputy Director for Institutional Relationships

2.3 Area coordinators

IIT's research activities are divided into eight research areas. The coordinators of the eight research areas during the course 2018 - 2019 were the following ones:

- **Cantizano González, Alexis.** PCI Coordinator
- **Cossent Arín, Rafael.** REDES Coordinator
- **Cucala García, Asunción Paloma.** ASF Coordinator
- **Ramos Galán, Andrés.** SADSE Coordinator
- **Rodilla Rodríguez, Pablo.** RYE Coordinator
- **Rodríguez-Morcillo García, Carlos.** BIO Coordinator
- **Rouco Rodríguez, Luis.** MAC Coordinator
- **Sánchez Miralles, Álvaro.** ASI Coordinator

2.4 Scientific advisory board

The members of the scientific advisory board (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 the IIT consisted of the following professors and research scientists:

- **Bello Morales, Antonio.** Research Assistant 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.
- **Boal Martín-Larrauri, Jaime.** Assistant Professor
Ph.D. in Industrial Engineering (Comillas)
Electronics Engineer (Comillas)
Areas of interest: Home automation and energy efficiency · Analog and digital electronics, wireless communications · Deep learning · Autonomous mobile robots, computer vision, topological modeling of the environment

- **Campos Fernández, Francisco Alberto.** Research Associate Professor
 Ph.D. in Industrial Engineering (Comillas)
 Mathematics Science degree (UCM)
Areas of interest: Nash equilibriums. Possibility theory. Optimization under uncertainty. Electricity markets. Cryptanalysis.
- **Centeno Hernández, Efraim.** Professor
 Ph.D. in Industrial Engineering (Comillas)
 Electronics Engineer (Comillas)
Areas of interest: Electric power system operation models. Hydrothermal coordination. Electric power markets.
- **Chaves Ávila, José Pablo.** Research Assistant 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 gas 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 Assistant Professor
 Ph.D. in Industrial Engineering (Comillas)
 Electrical Engineer (Comillas)
Areas of interest: Power system economics and regulation. Regulation of electricity distribution activity, integration of renewable and distributed generation, demand response and smart distribution grids.
- **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
- **Echavarren Cerezo, Francisco Miguel.** Research Assistant Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical Engineer (Comillas)
Areas of interest: Modeling, analysis and simulation of power systems.
- **Egido Cortés, Ignacio.** 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.** 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: Economy and optimization of electric power systems.
- **García González, Pablo.** Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical Engineer (Comillas)
Areas of interest: Control. Power electronics. Power electronics applied to the electric power systems (FACTS devices, active filters, HVDC, etc.). Electric power systems stability and control.
- **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.
- **Latorre Canteli, Jesús María.** Research Assistant Professor
Ph.D. in Industrial Engineering (Comillas)
Electronics Engineer (Comillas)
Areas of interest: Operations research and modeling. Stochastic programming. Parallel and distributed computing. Algorithms and numerical methods.
- **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 Assistant 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 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.
- **Lumbreras Sancho, Sara.** Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical Engineer (Comillas)
Areas of interest: Decision methods applied to complex problems.
---Techniques:--- 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: Microgrids. Distributed generation and energy efficiency. Digital electronics systems.
- **Mastropietro, Paolo.** Research Assistant 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.** Assistant 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 Assistant 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. Data mining. Application of artificial intelligence techniques to the monitoring and diagnosis of industrial processes. Analog electronics and digital signal processing.
- **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.** 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.
- **Palacios Hielscher, Rafael.** Senior Associate 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.** Assistant Professor
 PhD in Engineering (Comillas), Electronics Engineer (Comillas), M.Sc. in Research in Engineering Systems Modeling (Comillas)
Areas of interest: Functional Data Analysis, Neural Networks, time series models
- **Ramos Galán, Andrés.** Professor
 Ph.D. in Industrial Engineering (UPM)
 Electrical Engineer (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.

- **Renedo Anglada, Francisco Javier.** Research Assistant Professor
PhD in Engineering (Comillas)
Electrical Engineer (Comillas)
M.Sc. in Mathematical Engineering (UC3M)
Areas of interest: VSC-HVDC multi-terminal systems, power system stability
- **Reneses Guillén, Javier.** Research Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical Engineer (Comillas), Mathematics Science degree (UNED)
Areas of interest: Operation, regulation and planning of power and natural gas systems. Tariff design.
- **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.
- **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 Pecharromán, Ramón.** Senior Associate Professor
 Ph.D. in Industrial Engineering (Comillas)
 Electronics Engineer (Comillas)
Areas of interest: Control systems. Railway electrification. Thermoelectricity.
- **Rodríguez-Morcillo García, Carlos.** Research Assistant Professor
 Ph.D. in Industrial Engineering (Comillas)
 Electronics Engineer (Comillas), M.Sc. in Communication Technologies and Systems (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.** Research 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: Electric power systems stability and control. System identification. Simulation of electromagnetic transients.
- **Sánchez Fornié, Miguel Ángel.** Research Affiliate
 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 Úbeda, Eugenio Francisco.** 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 Assistant Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical and Electronics Engineer (École Polytechnique Fédérale de Lausanne - EPFL, Switzerland)
Areas of interest: Modeling, analysis and control of electric power systems. Energy Systems Models.
- **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.
- **Wogrin, Sonja.** Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Technical Mathematics degree (Graz University of Technology, Austria), M.Sc. in Computation for Design and Optimization (Massachusetts Institute of Technology - MIT, U.S.A.)
Areas of interest: Optimization. Bilevel programming. Generation expansion planning. Energy storage.

2.6 Associated academic staff

The following professors have collaborated with the IIT as associate researchers:

- **Arenas Pinilla, Eva María.** Assistant 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.
- **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.** Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Mechanical Engineer (Comillas)
Areas of interest: Numerical methods in engineering. Railway Catenary.
Catenary-pantograph dynamic interaction
- **Castro Ponce, Mario.** Senior Associate Professor
Ph.D. in Physics Science (UCM)
Physics Science degree (UCM)
Areas of interest: Fluid mechanics. Statistical mechanics. Communication
networks. Nonlinear physics. Nanomaterials. Biophysics.
- **Fernández Bernal, Fidel.** Senior Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Electrical Engineer (Comillas)
Areas of interest: Dynamics of electrical systems. Motor control. Renewable
energies integration.
- **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 from biomass using LCA.
- **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.
- **Jiménez Octavio, Jesús.** Associate Professor
Ph.D. in Industrial Engineering (Comillas)
Mechanical Engineer (Comillas)
Areas of interest: Computational mechanics
- **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 Valdés, Francisco José.** Assistant 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
- **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.
- **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 embedded 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

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

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

2.7 Research assistants

The Research Assistants (PhD students) that developed their activity at the IIT during the academic course 2018 - 2019 were the following ones:

- **Barrella, Roberto**. Bachelor's Degree in Energy Engineering (Università degli Studi di Roma La Sapienza)
Master's degree in Energy Engineering (Università degli Studi di Roma La Sapienza)
- **Calvo Báscones, Pablo**. Electromechanical Engineer (Comillas). M.Sc. in Industrial Engineering (Comillas)
- **Candela Ripoll, Ignacio**. Degree in Energy Engineer, Polytechnic University of Valencia (UPV).
Master of Science in Sustainable Energy Engineer, Technical University of Denmark (DTU).
- **Ciller Cutillas, Pedro**. Electronics Engineer (Comillas), Mathematics (UCM)
- **Correa Ramírez, Mauricio** . Electrical Engineer (National University of Colombia)
Specialist in Electronics and Informatics (University of Antioquia)
MBA in Corporate Finance (University of Viña del Mar)
- **Cunillera Pérez, Alejandro**. Bachelor's Degree in Mathematics and Physics, Universidad Complutense de Madrid.
Master's Degree in Physics of Complex Systems, Universidad de las Islas Baleares.
- **Doenges, Kai**. Master of Science in Industrial Engineering, Technical University of Dortmund (TU Dortmund)
- **Doménech Martínez, Salvador**. Mechanical Engineer (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.
- **García Aguilar, Javier**. Master's Degree in Industrial Engineering. Universidad P. Comillas
- **Gerres, Timo**. B.Sc. in Business Administration and Engineering (Universität Paderborn) (DE)
M.Sc. in Systems Engineering, Policy Analysis & Management (Technische Universiteit Delft) (NL)
- **González Romero, Isaac Camilo**. B.Sc. in Economics and Mathematics (Colombian School of Engineering «Julio Garavito»)
Master's degree in the Electric Power Industry (Comillas Pontifical University)
Master in the Network Industries and Digital Economy (Paris Sud University -France)
- **Huclin, Sébastien** . Master's degree in Physics (University of Paris-Sud)
- **Jiménez Serrano, Clara**. Bachelor's Degree in Electromechanical Engineering. Universidad Pontificia Comillas.
Master's Degree in Industrial Engineering. 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)

- **Marcos Peirotén, Rodrigo Alejandro de.** Electronics Engineer (Comillas)
- **Martín Lopo, Miguel.** Electronics Engineer (Comillas)
- **Marulanda García, Geovanny Alberto.** Electrical Engineer, Universidad Tecnológica de Pereira (Colombia)
Master in Electrical Engineering, Universidad Tecnológica de Pereira (Colombia)
- **Mestre Marcos, Guillermo.** Bachelor's Degree in Mathematics (Universidad de Alicante)
Master's Degree in Advanced Mathematics (Universidad Complutense de Madrid)
- **Montero Guirao, Luis Manuel.** Degree in Chemical Engineering. Universidad de Granada.
Master's degree in Chemical Engineering. 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 Institute of Technology, USA.
- **Mosácula Atienza, Celia.** Chemistry Engineer (UPV/EHU), M.Sc. in Renewable Energies (CEU San Pablo University)
- **Orgaz Gil, Alberto.** Electronics Engineer (Comillas). Master's Degree in Research in Engineering Systems Modeling (Comillas)
- **Otaola Arca, Pedro de.** Bachelor's degree in Electromechanical Engineering (major in Electronics)(Comillas)
Master's degree in Industrial Engineering (Comillas)
- **Pérez-Andújar Carretié, Clara.** Electromechanical Engineering specialized in electronics. Universidad P. Comillas.
Master's Degree in Industrial Engineering. Universidad P. Comillas.
- **Postigo Marcos, Fernando Emilio.** Electromechanical Engineer (Comillas)
M.Sc. in Industrial Engineering (Comillas)
- **Roch Dupré, David.** Electromechanical Engineer (Comillas)
M.Sc. in Industrial Engineering (Comillas)
Official Master's Degree in Research in Engineering Systems Modeling (MRE)
- **Rodríguez Gallego, Alejandro.** Industrial Engineer (ICAI). Universidad Pontificia Comillas
Executive MBA. IE Business School
Master's degree in Stock Markets & Financial Derivatives. UNED
Master's degree in Business Intelligence & Big Data. EOI
- **Rosso Mateo, Ángel.** Industrial Engineering (Comillas)
MPhil in Electrical Engineering (University of Manchester)
- **Utrilla Bustamante, María Candelaria.** Double Degree in Electromechanical Engineering. Universidad Pontificia Comillas- CentraleSupélec..
Official Master's Degree in Industrial Engineering. Universidad Pontificia Comillas.

- **Vásquez del Solar, Mónica.** Food industry engineer.(Universidad Nacional Agraria La Molina)
Master in Economic and Innovation Management.(Universidad Autónoma de Madrid)

2.8 Services staff

2.8.1 Systems administrator staff

System administrator staff covers the management of networks and computer systems, and the development of web-tools. System administrator staff consists of:

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

2.8.2 Administrative staff

Administrative staff covers the general and the technical secretariat, the management of databases and of the documentation used or generated at IIT (like books, papers, working papers, reports, CV, etc), and the management of communication, dissemination and of international relations. The administrative staff consists of:

- **García Lecuona, Paula.** Degree in Hispanic Philology (Universidad Complutense de Madrid)
- **Ruiz González-Mateo, Cristina.** Law and Legal Advisor Companies degree (Comillas)
- **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 eight research areas that can be grouped into two major categories: *Energy systems* and *Industrial systems*.

3.1.1 Energy systems

The following four areas mainly focus on the energy sector, and in particular, on the generation, transmission and distribution of electrical energy:

3.1.1.1 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>

3.1.1.2 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: Rafael Cossent Arín

Web page: <https://www.iit.comillas.edu/research-area/redes>

3.1.1.3 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: Pablo Rodilla Rodríguez

Web page: <https://www.iit.comillas.edu/research-area/rye>

3.1.1.4 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: Andrés Ramos Galán

Web page: <https://www.iit.comillas.edu/research-area/sadse>

3.1.2 Industrial systems

The following four areas mainly focus on technical fields different from but increasingly related to the energy sector:

3.1.2.1 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>

3.1.2.2 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: Asunción Paloma Cucala García

Web page: <https://www.iit.comillas.edu/research-area/asf>

3.1.2.3 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: Álvaro Sánchez Miralles

Web page: <https://www.iit.comillas.edu/research-area/asi>

3.1.2.4 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: Carlos Rodríguez-Morcillo García

Web page: <https://www.iit.comillas.edu/research-area/geac>

3.2 Research projects

This section includes all the research projects developed at IIT during this academic year grouped by the category of areas 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 Energy systems

3.2.1.1 Research and development projects

3.2.1.1.1 Private funding

- **Technologies and strategies for the optimal participation of renewable energies in electricity markets**

Gas Natural Fenosa Engineering, SL. January 2017 - December 2019. (Enrique Lobato Miguélez, Ignacio Egido Cortés, Kai Doenges, Lukas Sigrüst)

SILILA project develops a set of tools and optimal strategies for the efficient participation of renewables energies in the Spanish electricity markets.

- **Tools and methodologies for energy planning under uncertainty**

XM Compañía de Expertos en Mercados, SA. November 2017 - December 2018. (Andrés Ramos Galán, Jesús María Latorre Canteli)

In this project we are going to introduce improvements in the two medium- and long-term energy planning models for the Colombian system. Both are integrated in a single tool sharing input data and output results and the piece of code that is suitable. The forecasted improvements are the following ones:

Introduction of a variable production function of hydro plants of relevant reservoirs

Optimal representation of the uncertainty for variables like hydro inflows, wind and solar power by means of scenario trees for being used in the energy planning model

Development of a simulation module of deterministic scenarios after the stochastic optimization solution

Development of a synthetic multivariate series generator for hydro, solar and wind generation to be used in the energy planning model

- **Long-term risk analysis in the electricity markets. Maintenance of the ARIES tool**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Antonio Bello Morales, Javier Reneses Guillén, Rodrigo Alejandro de Marcos Peirotén)

The aim of this collaboration between IIT and Endesa is the maintenance of the ARIES tool for long-term risk management in the Iberian electricity market.

- **Forecasts and analysis of the short- and medium-term operation in the Spanish extrapeninsular power systems**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Antonio Bello Morales, Javier Reneses Guillén, Daniel López Rodríguez)

The objective of this collaboration is the improvement of the VALORE tool so that it can be used in the short- and medium-term operation of the insular and extra-peninsular Spanish electrical systems.

- **The energy company of the future electrification in developing countries**

Shell Foundation. January 2018 - December 2018. (José Ignacio Pérez Arriaga, Fernando de Cuadra García, Carlos Mateo Domingo, Andrés González García, Pedro Ciller Cutillas)

The objective of the project is to define a viable large-scale business model, to be deployed in one or more developing countries, which would accelerate energy access and be attractive for corporate investment.

- **Short- and medium-term risk analysis in electricity markets. Improvements in the asset representation**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Antonio Bello Morales, Javier Reneses Guillén, Rodrigo Alejandro de Marcos Peirotén, Geovanny Alberto Marulanda García)

The aim of this project is to continue with the developments of the ACUARIO tool. In particular, the improvement in the representation of the different assets modeled in ACUARIO is addressed. Continued support is also being given on the use of the tool and the interpretation of the results.

- **Medium and long term gas portfolio risk modeling**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Jesús María Latorre Canteli, Javier Reneses Guillén, Antonio Bello Morales, Celia Mosácula Atienza)

The aim of this collaboration is to continue with the developments in the AURIGA mid-term risk-management tool for the natural gas market. During 2018 the project focuses on obtaining a better representation of the valuation of the portfolio and improving the management of correlation, such as considering the correlation between the different time horizons of the markets.

- **Medium- and long-term planning in the Iberian electricity market. Integration of hourly executions**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Antonio Bello Morales, Javier Reneses Guillén, Daniel López Rodríguez, Alberto Orgaz Gil, Leopoldo Javier Cabrera Azpilicueta)

This project between IIT and Endesa focuses on the medium and long-term planning of the Iberian electricity market (MIBEL). Specifically, in addition to the continuous assistance to users, the integration of the hourly executions and its associated tools is addressed, as well as the flexibilization of the BIP executions.

- **Operation and planning of the Iberian natural gas market: hub representation and Monte Carlo executions**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Jesús María Latorre Canteli, Javier Reneses Guillén, Antonio Bello Morales, Ángel Rosso Mateo, Diego Martínez Morales, Aurora del Valle Díez)

This project, which is included in the framework of a continuous research between Endesa and the IIT, is focused on the operation and forecasting in the context of the Iberian natural gas market. The objective of this new phase of the development of OMEGA is to improve the computation process of the OMEGA MonteCarlo tool and the outputs it provides, as well as the enhancement of the modelling of the hub balance market.

- **Support in forecasting and optimizing the operation in electricity markets**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil, Leopoldo Javier Cabrera Azpilicueta, Geovanny Alberto Marulanda García)

This project is framed into the on-going cooperation line followed by Endesa and IIT in the framework of medium-term operation and planning in the context of the Iberian electricity market. The collaboration is focused on the integration of France in the LPM simulations, as well as on redesigning the internal structure of the tool for Monte Carlo executions.

- **Simulation and sizing of hybrid systems based on energy storage systems**

Gas Natural SDG, S.A . January 2018 - March 2019. (Enrique Lobato Miguélez, Lukas Sigrist, José María Fernández de Bobadilla Navarrete)

Optimal Simulation and sizing of hybrid systems based on batteries for different business models.

- **VALSA-EXPANDE integration and developments for the long-term analysis**
Enel Iberoamerica S.R.L. January 2018 - December 2018. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)
VALSA is an expansion model for generation investment and complementary service analyses of the Spanish electricity system in the long-term. The objectives of this collaboration include the follow-up of the strategic reflection that begun in the previous collaboration, to know what elements are currently determining the system behaviour and what is the best way to address them. Another objectives are to guarantee the adaptation of VALSA to the system changes expected in the next few years (as for example the changes in the generation or consumption structure) and also the continued assistance in the use of VALSA.
- **Simulation of the global gas market in the medium term**
Enel Iberoamérica S.R.L. February 2018 - January 2019. (Javier Reneses Guillén, Aurora del Valle Díez, Antonio Bello Morales, Ángel Rosso Mateo, Diego Martínez Morales, Luis Manuel Montero Guirao)
The aim of this collaboration between IIT and Enel is to develop a simulation tool able to accurately represent the global natural gas market in the medium term.
- **Predictive models in healthcare**
Medsavana, S.L. June 2018 - October 2020. (Sara Lumbreras Sancho)
The widespread adoption of the electronic medical record (Electronic Health Records, EHR) opens the way to evidence-based medicine, based on the history of large numbers of real patients rather than limited clinical trials. This can be used to create custom risk profiles or predictive models to anticipate the effect of specific treatment lines. Although a substantial amount of work has been done in this field in recent years, there are still unresolved limitations. One of the main ones is the use of unstructured text data, which contains most of the relevant information. This text is considerably difficult to use, given the complexity of medical terminology. The second limitation is the large number of variables that can be explained or used in the models.
Savana is an EHR manager that provides innovative solutions for the extraction of knowledge of these data and support for the decision-making in research, clinic and management. It owns the SAVANA MANAGER, SAVANA CONSULTA, SAVANA RESEARCH and SAVANA PREDICT platforms, as well as the EHREAD and ENTROPIA technology, which are computer tools capable of reading and interpreting the information contained in the electronic clinical records. In addition, it is able to associate each medical term with the concepts related to it, linking them to the standard medical oncology Snomed. Savana has access to one of the largest EHR databases internationally, with several hundred million stories.
This proposal describes the future collaboration between the Technological Research Institute and Savana, which has the fundamental objective of accelerating the development of predictive models as well as the dissemination of research results.

- **Development of scenarios of Spanish island power systems**

Gas y Electricidad Generación S.A. July 2018 - December 2018. (Lukas Sigrist, Luis Rouco Rodríguez, Clara Jiménez Serrano)

The aim of the project is to determine the characteristics of a battery storage system to reduce reserve requirements and improve frequency stability of the island power system of Menorca. The project will also show how the battery storage system associated to a conventional generator contributes to the fulfillment of the connection requirements of this generator. The project will finally show how the hybrid generator fits into the operational procedure and the economic regulation of the Spanish isolated systems.

- **Non conventional electrification solutions**

Iberdrola Distribución Eléctrica S.A.U. October 2018 - December 2018. (Carlos Mateo Domingo, Lukas Sigrist, Rafael Cossent Arín, Pablo Frías Marín, Fernando Emilio Postigo Marcos)

The objective of this project is designing and simulating non-conventional electrification solutions to improve supply in a distribution network when there are faults in the power lines. In the project, alternatives based on micro-grids are proposed to improve reliability and use renewable sources. The main components are photovoltaics, storage and diesel power units. The solutions are found with an exhaustive search, being this approach feasible for small scale networks.

- **Frequency and transient stability of isolated power systems**

Iberdrola Renovables Energías, S.A.U. November 2018 - January 2019. (Lukas Sigrist, Luis Rouco Rodríguez, Enrique Lobato Miguélez)

The objective of the project is to evaluate the impact of large PV plants on the stability of the Spanish mainland power system. Frequency and transient stability will be studied.

- **Tuning power system stabilizers for damping very low frequency oscillations**

Redes Energéticas Nacionales, SGPS, S.A. December 2018 - December 2019. (Luis Rouco Rodríguez, Francisco Javier Renedo Anglada)

The project objective is the review of the tuning of the PSSs of the proposed set power plants. If the review of the tuning of the PSSs reveals poor performance in a wide frequency range, new settings will be proposed.

- **Inception phase of the EXCOM-EXLA CLOUD project and Epic execution 1**

Endesa Medios y Sistemas S.L. December 2018 - March 2019. (Javier García González, Pedro de Otaola Arca)

The EXCOM model is the tool developed by the IIT in collaboration with Endesa that allows 1) to determine the strategic self unit-commitment as well as its hourly schedule, 2) determine the optimal management of water resources, and 3) obtain estimates of the daily market prices taking into account ENDESA's full portfolio of purchases and sales, as well as estimates of the competitors behavior. The EXLA model allows the planning in the medium term and in the short term of all the hydroelectric resources belonging to Endesa.

The result of the model is the optimal management of the reservoirs over the following months until the end of the next hydrological year, as well as the optimal policy hydro production with all the generation units. This project covers the development of the first "epic" (Agile methodology) oriented to connect with the Big Data of Endesa all the data set and results of the EXCOM model, as well as to run a simplified version of the model in Amazon Web Services.

- **Black start of wind farms**

Iberdrola Renovables Energías, S.A. December 2018 - December 2018. (Luis Rouco Rodríguez, Lukas Sigrist)

This project is aimed at investigating black start of wind farms. The project will develop control schemes of wind generators to make possible the provision of the black start ancillary service.

- **Improvements of the risk management tools ACUARIO and AURIGA**

Enel Iberoamerica S.R.L. January 2019 - June 2019. (Antonio Bello Morales, Javier Reneses Guillén, Rodrigo Alejandro de Marcos Peirotén, Geovanny Alberto Marulanda García)

The objective of this collaboration is carry out improvements in the risk management tools in the electricity market (ACUARIO) and in the natural gas market (AURIGA).

- **Assistance and evolutionary maintenance of the risk management tool AURIGA**

Enel Iberoamerica S.R.L. January 2019 - December 2019. (Antonio Bello Morales, Javier Reneses Guillén, Celia Mosácula Atienza)

The objective of this collaboration is to assist the users of the gas portfolio risk management tool AURIGA with its use, as well as perform an evolutionary maintenance of the tool.

- **Assistance and maintenance of Middle Office models**

Enel Iberoamerica S.R.L. January 2019 - December 2019. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao, Celia Mosácula Atienza, Ángel Rosso Mateo, Rodrigo Alejandro de Marcos Peirotén)

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 VEIMAO.

- **New developments of the VALORE tool**

Enel Iberoamerica S.R.L. January 2019 - June 2019. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

This project includes different developments, adaptations and improvements of the VALORE tool to respond to new market situations and new needs of LPM and HEPLASE users.

- **Representation of the European electricity market in the VALORE-HEPLASE model**

Enel Iberoamerica S.R.L. January 2019 - June 2019. (Antonio Bello Morales, Javier Reneses Guillén, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

This project between IIT and Endesa focuses on the medium and long-term planning of the Iberian electricity market (MIBEL). Specifically, this proposal addresses the improvement in the fundamental representation of the European electricity market in VALORE-HEPLASE.

- **New developments of the OMEGA model, consideration of gas demand in Monte Carlo executions, and daily simulations**

Enel Iberoamerica S.R.L. January 2019 - December 2019. (Javier Reneses Guillén, Antonio Bello Morales, Ángel Rosso Mateo, Luis Manuel Montero Guirao)

This project between IIT and Endesa focuses on the operation and forecasting in the context of the Iberian natural gas market. Specifically, this proposal addresses three tasks. First, the implementation of new functionalities for the OMEGA tool. Second, the improvements so that gas demand is considered within Monte Carlo executions. Finally, the developments in the model in order to include daily detail during the first months of the simulations.

- **Consideration of demand, hydro and wind production scenarios in Monte Carlo executions of the VALORE model**

Enel Iberoamerica S.R.L. January 2019 - November 2019. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao, Daniel López Rodríguez)

This project between IIT and Endesa focuses on the medium-term operation and planning of the Iberian electricity market (MIBEL). Specifically, this proposal addresses the improvement in the way demand, hydro and wind uncertainty is considered within Monte Carlo executions.

- **New hourly outputs for the VALORE-SEIE model and new demand horizon**

Enel Iberoamerica S.R.L. January 2019 - September 2019. (Antonio Bello Morales, Javier Reneses Guillén, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

This project between IIT and Endesa focuses on the short- and medium-term planning of the insular and extra-peninsular electrical systems. Specifically, this proposal addresses two tasks. First, the generation of new hourly outputs within the framework of executions with different time scopes. Second, the consideration of a longer time horizon for demand forecasting.

- **Integration of Expande and Valsa models. Codex**

Endesa Medios y Sistemas S.L. January 2019 - December 2019. (Efraim Centeno Hernández, Diego Alejandro Tejada Arango, Francisco Alberto Campos Fernández)

On the one hand, the project address the update of some modeling details of the tool Expande, mainly to improve de renewable generation modelling. On the other hand, a new model development is started, integrating the characteristics of the two models that are currently used for long-term analysis of the electric system.

- **Modeling and assessment of electrical networks´ needs for the energy transition in Spain**

Iberdrola España S.A.U. January 2019 - December 2019. (Michel Rivier Abbad)

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 in Spain under different possible scenarios, and to develop proposals to facilitate the decarbonisation objectives to be achieved in the most efficient possible way.

- **VALSA-EXPANDE integration and unification algorithms, unique interface and preparation for migration to the cloud: initial phase**

Enel Iberoamerica S.R.L. January 2019 - July 2019. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

The main objective of the collaboration is the integration of the EXPANDE and MORSE systems in a single system called CODEX that integrates the best capabilities of both systems, among which stand out the time representation of the time horizon, the modeling of the competition and of the secondary reserve as well as the treatment of the uncertainty by characterizing the stochastic variables mentioned above. In addition, it includes extending the data entry interface shared so far by EXPANDE and MORSE, guaranteeing the consistency of the data used by both systems, in order to become the interface of the future CODEX integrated system. Regarding the market model, in this phase only the hydrothermal part of the electricity generation resources is developed.

- **Identification of appropriate sites for mini-grids, and development of adequate regulatory approach for integration in selected states in India**

Massachusetts Institute of Technology (MIT). January 2019 - June 2019. (Rafael Palacios Hielscher, José Ignacio Pérez Arriaga, Clara Pérez-Andújar Carretié, Andrés González García)

This project focuses on the identification of appropriate sites for the deployment of a large number of mini-grids in the preselected number of Indian states, including preliminary design features of these mini-grids.

The project is developed by the Universal Energy Access Lab, partnership between Comillas-IIT and MITeI (Massachusetts Institute of Technology - Energy Initiative).

IIT also participates in developing the most adequate regulatory approach to integrate the presence of this large number of mini-grids into the existing

activity of the distribution companies in the corresponding territories, looking for the maximum short-term energy access while considering also a long-term efficient outcome. This required working with the incumbent distribution companies and with the relevant central and state governmental bodies to define workable deployment paths with both a short-, medium- and long-term views, to establish adequate collaboration and to identify and implement any necessary policy reforms.

- **Proof of concept of the use of VALORE in a grid and cloud computing environment**

Enel Iberoamerica S.R.L. January 2019 - February 2019. (Antonio Bello Morales, Javier Reneses Guillén)

In this project, a practical demonstration of the use of VALORE in a cloud and grid computing environment is carried out.

- **Further developments to the hydrothermal scheduling model MHE**

Iberdrola Generación España, S.A.U. February 2019 - December 2019. (Andrés Ramos Galán, Jesús María Latorre Canteli)

In this project we have introduced a set of developments that allow to speed up the model runs for numerous and varied hydro scenarios, and at the same time being accurate enough in representing the system operation under the current conditions. Among them they are: i) run time reduction, ii) change from week to month, iii) peaking of hydro production, iv) adaptation of MHE results to simulator, v) exchanges with France.

- **Connection of large PV power plants to the transmission grid**

Ibernova Promociones, S.A. March 2019 - October 2019. (Luis Rouco Rodríguez, Lukas Sigríst)

The objective of the project is to evaluate the connection of large PV plants to the Spanish transmission grid. Power flow and short circuit analysis are performed.

- **VALORE in a grid and cloud computing environment using Linux**

Enel Iberoamerica S.R.L. March 2019 - June 2019. (Antonio Bello Morales, Javier Reneses Guillén, Rodrigo Alejandro de Marcos Peiroten, Geovanny Alberto Marulanda García)

This project focuses on launching a version of VALORE in a cloud and grid computing environment that works in Linux.

- **Modeling of the thermal plants, increase of the time horizon, treatment of scenarios, and consideration of hydro generation**

Endesa Medios y Sistemas S.L. April 2019 - July 2019. (Javier García González, Pedro de Otaola Arca, Ignacio Candela Ripoll)

The objective of this project is to introduce improvements in the modeling of the thermal groups in the EXCOM tool, to extend the tool's temporal scope and

to improve the treatment of the scenarios in order to allow their parallel execution in the cloud. In addition, a first version of the EXLA tool, focused on hydro generation, will be developed.

- **Analysis of the «Ni un hogar sin energía» program dataset**

Fundación Ecología y Desarrollo (ECODES). May 2019 - October 2019. (Eva María Arenas Pinilla, José Carlos Romero Mora, José Ignacio Linares Hurtado, Roberto Barrella, Efraim Centeno Hernández)

The project consisted in the analysis of the dataset collected by ECODES in the "Ni un hogar sin energía" program and covered basically two points. First, the characterization of the vulnerable families served by "Ni un hogar sin energía" was carried out, following the methodologies proposed at national and European level and, secondly, an energy demand prediction model (thermal and electrical) for Spanish households was developed.

- **Outputs of VALORE-LPM in Big Data**

Enel Iberoamerica S.R.L. June 2019 - July 2019. (Antonio Bello Morales, Javier Reneses Guillén, Alberto Orgaz Gil)

The objective of this collaboration is to carry out all the necessary developments to enable the outputs of the executions of VALORE-LPM of each one of the cases executed in the Montecarlo tool to be loaded later in the Big Data in a structured way.

- **Obtaining a feasible unit commitment of thermal groups using Machine Learning techniques from the results of VALORE**

Enel Iberoamerica S.R.L. July 2019 - December 2019. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil, Geovanny Alberto Marulanda García, Luis Manuel Montero Guirao)

This project between IIT and Endesa focuses on obtaining a feasible unit commitment for Endesa thermal groups using the results obtained in a VALORE execution (either deterministic or Monte Carlo), using machine learning techniques.

- **New developments of the risk management tool ACUARIO and the price simulation algorithm**

Enel Iberoamerica S.R.L. July 2019 - July 2019. (Antonio Bello Morales, Javier Reneses Guillén, Rodrigo Alejandro de Marcos Peiroten)

This project includes different developments, adaptations and improvements of the risk management tool in the electricity market (ACUARIO) to respond to new market situations and new needs of end users.

- **Development of the Excom-Exla Minimum Viable Product and improvements in the modeling of hydraulics**

Endesa Medios y Sistemas S.L. August 2019 - December 2019. (Javier García González, Pedro de Otaola Arca, Ignacio Candela Ripoll)

The objective of this proposal is to develop the Minimum Viable Product so that it can be put into production in December 2019 as well as to introduce improvements in the modeling of the hydroelectric system.

3.2.1.1.2 Public funding

- **Beyond state-of-the-art technologies for re-powering ac corridors & multi-terminal hvdc systems**

Comisión Europea. September 2014 - September 2018. (Javier García González, Michel Rivier Abbad, Quanyu Zhao)

A group of eight transmission system operators with a generator company, manufacturers and research organizations, propose 5 demonstration projects to remove several barriers which prevent large-scale penetration of renewable electricity production in the European transmission network. The full large scale demonstrations led by industry aim at proving the benefits of novel technologies coupled with innovative system integration approaches: HVDC links , HVDC-VSC multi-terminal control , innovative components and architectures, AC overhead corridors, and DC superconducting links within an AC meshed network .The experimental results will be integrated into European impact analyses to show the scalability of the solutions.

Video [here](#)

Video [here](#)

Video [here](#)

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Video [here](#)

Project funded by European Union, within Seventh Framework Programme:



- **Micrositing of wind farms and transmission network impact**

Ministerio de Economía y Competitividad. January 2015 - December 2018. (Andrés Ramos Galán, Sara Lumbreras Sancho, Rafael Espejo González)

This task is divided in two:

- Micrositing, i.e., location of the wind turbines in a farm area

The effect of the separation of the wind turbines are introduced in a wind farm layout design model, considering the power output results obtained from CFD models for many possible separation steps. The ultimate objective is to define the optimal micrositing of the wind turbines.

- Transmission network impact of wind farms.

In a second step, an advanced optimization model capable to represent the

complexity of the transmission network is developed.

Project funded by Ministerio de Economía y Competitividad.



- **Overcoming technological, economic, and regulatory barriers to the development of HVDC supergrids (ENE2015-67048-C4-2-R)**

Ministerio Economía y Competitividad - ENE2015-67048-C4-2-R (MINECO/FEDER), Fondo Europeo de Desarrollo Regional (FEDER) - ENE2015-67048-C4-2-R (MINECO/FEDER). January 2016 - December 2018. (Luis Olmos Camacho, Michel Rivier Abbad, Javier García González, Francisco Miguel Echavarren Cerezo, Quanyu Zhao, Deniz Sun)

This project aims at facilitating the development and operation of HVDC grids in a market context through several interrelated research lines:

- Definition of benefit (and cost) allocation schemes for HVDC infrastructures
- The design of market developments to be implemented to facilitate the integration of RES generation in the system and the grid
- The modeling of the operation of HVDC grids in a market context (considering them accurately enough in the system dispatch and operation planning problems).

Project funded by Ministerio de Economía y Competitividad.



Project funded by Fondo Europeo de Desarrollo Regional (FEDER).



- **Open phase detection system for start-up transformers in nuclear generating stations (RTC-2016-5160-3)**

Ministerio de Economía, Industria y Competitividad. March 2016 - December 2019. (Luis Rouco Rodríguez, Enrique Lobato Miguélez, Francisco Miguel Echavarren Cerezo, Kai Doenges)

The aim of this project is the development of a detection system of open phase conditions in the start-up transformers of nuclear generating stations. The challenge comes from the fact that start-up transformers are at no load. The project involves simulation studies, development of small-scale laboratory prototypes and the implementation of a full scale prototype in Cofrentes nuclear generating station.

Project cofunded by the Ministerio de Economía, Industria y Competitividad, and by EDRF funds, under the thematic objective "Strengthening research, technological development and innovation".



- **Navigating the roadmap for clean, secure and efficient energy innovation**

Comisión Europea. April 2016 - April 2019. (Sara Lumbreras Sancho, Andrés Ramos Galán, Luis Olmos Camacho, Quentin Ploussard)

The overarching goal of SET-Nav is to support strategic decision making in Europe's energy sector, enhancing innovation towards a clean, secure and efficient energy system. It prescribes a wide range of analyses in order to better understand the complex links, interactions and interdependencies between the different actors, the available technologies and the impact of the different interventions in the energy system. To meaningfully contribute to the call objectives requires a large modelling portfolio. To ensure focus on the most important aspects and policy relevance, industry partners and stakeholders with varying perspectives should be involved from start to finish.

This leads up to the three key objectives of SET-Nav:

- 1) Enhance modelling capacities to increase understanding of interactions and interdependencies between actors, technologies and policy interventions in Europe's energy system.
- 2) Provide model-based decision support for enhancing energy innovation towards a clean, secure and efficient energy system – through strategic policy analyses tackling relevant technology and policy options, complemented by detailed comparative assessments of energy transformation pathways.
- 3) Ensure a proper research orientation and a high impact through a continuous and in-depth stakeholder involvement and dialogue.

Project funded by European Union, within Horizon 2020 Programme:



- **Value of pumping-storage in insulated electrical systems with strong wind penetration**

Ministerio de Economía y Competitividad. December 2016 - December 2019.
(Javier García González)

The main objective of the project is to estimate the value of storage by pumping (AB) in isolated electrical systems with strong wind penetration.

For this, it is planned to use the electrical systems of four Spanish islands as case studies. In those where the installation of AB is not foreseen, the project team (EP) will define the main parameters of these facilities according to their experience.

Various optimization models will be developed for the assignment of groups (Unit Commitment, UC) and the optimal dispatch of power (Power Dispatch, PD).

- **Strategic network and generation expansion planning under uncertainty in the electricity market**

Ministerio de Economía, Industria y Competitividad. December 2016 - September 2020. (Sonja Wogrin, Isaac Camilo González Romero, Tomás Gómez San Román, Efraim Centeno Hernández, Diego Alejandro Tejada Arango)

In an effort to mitigate climate change and to achieve a sustainable supply of energy, the Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad – and in particular the Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016 – seeks to promote research and development (R&D) of renewable energy (RE) technologies and to foster their adoption by the market. The challenge to obtain “safe, efficient and clean energy”, declared by the Estrategia Española de Ciencia y Tecnología y de Innovación, is also in line with the the EU's Strategic

Energy Technology Plan (SET-Plan). Indeed, given the deregulation of energy sectors, i.e., both electricity and natural gas, in most EU member states, power companies would adopt RE technologies only if they contributed to their profit-maximising incentives. Furthermore, since RE technologies like wind and solar power are typically intermittent and uncertain in their output and geographically dispersed, their viability will depend on integration with the existing transmission network. However, grid-expansion decisions are taken by separate entities with differing and even conflicting objectives, i.e., welfare-maximising regulated transmission system operators (TSOs). Most policy-enabling models of the EU energy system overlook these intricacies and are based on assumptions of either perfect competition or perfect foresight, which do not adequately reflect the current paradigm and, thus, may lead to flawed market designs. Consequently, in order for the Spanish Plan Estatal's objectives to be achieved, policymakers and market participants alike will require an enhanced understanding of how market fundamentals and strategic behaviour interact. Towards that end, STEXEM will develop completely new models that will be better suited for the research challenge of uncovering the impact of policy measures and market designs on investment and operational decisions in deregulated industries. Moreover, STEXEM will carry out state-of-the-art analyses based on stochastic optimisation and game theory in order to provide insights on efficient market design, the sustainable integration of RE and storage technologies, and the transmission investment necessary to maintain system security.

- **Integrid - Demonstration of intelligent grid technologies for renewables integration and interactive consumer participation enabling interoperable market solutions and interconnected stakeholders**

Comisión Europea. December 2016 - May 2020. (Rafael Cossent Arín, Pablo Frías Marín, José Pablo Chaves Ávila, Leandro Lind, Lorenzo August Simons, Mauricio Correa Ramírez, Michel Rivier Abbad, Pedro Linares Llamas, Paolo Mastropietro, Pablo Rodilla Rodríguez, Timo Gerres, Javier Matanza Domingo, Gregorio López López)

The InteGrid project intends to bridge the gap between citizens and technology in the area of smart distribution grids. The main objectives are:

- To demonstrate how distribution system operators (DSOs) may enable the different stakeholders to actively participate in the energy market and to develop and implement new business models, making use of new data management and consumer involvement approaches, and
- To demonstrate scalable and replicable solutions in an integrated environment that enable DSOs to plan and operate the network with a high share of distributed renewable energy sources (DRES) in a stable, secure and economic way, using flexibility inherently offered by specific technologies and interaction with different stakeholders.

In order to achieve these goals, three large demonstration sites have been selected to be part of InteGrid: 1) «From smart grid to disruptive business models» (Lisbon district, Portugal), «Consumer engagement towards sustainability» (Stockholm, Sweden), «Self-sustainability facilitation» (Ljubljana, Slovenia).

Comillas University is leading the Work Package dealing with cost-benefit analyses, regulation and business models definition. Additionally, Comillas actively contributes to the assessment of stakeholder engagement and perspectives as well as the scalability and replicability potential of tested smart grid solution.

Video [here](#)

Project funded by European Union, within Horizon 2020 Programme:



- **Solutions to improve the performance of wind generators connected to weak grids**

FEDER, Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación, Proyecto _Proyecto RTC-2017-6074-3. January 2018 - December 2020. (Luis Rouco Rodríguez, Aurelio García Cerrada, Ignacio Egido Cortés, Lukas Sigrist, Javier García Aguilar, Juan Luis Zamora Macho)

This project is aimed at developing control control systems aimed at improving the performance of doubly fed induction generators connected to weak grids.

Project funded by FEDER/Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación/ _Proyecto _Proyecto RTC-2017-6074-3



"To promote technological development, innovation and quality research"

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"Una manera de hacer Europa"

- **Mozambique geospatial options analysis towards universal electrification**
World Bank. May 2018 - April 2019. (Carlos Mateo Domingo, Andrés González García, José Ignacio Pérez Arriaga, Fernando de Cuadra García, Pedro Ciller Cutillas, Clara Pérez-Andújar Carretié)
Since the end of Mozambique's civil war in 1992, the country has had strong and sustainable economic growth, averaging 7.4 percent annually. However, GDP per capita is low (US\$600 in 2016), and approximately, 50 percent of the population still live below the poverty line. Moreover, most of the population lives in rural areas, and only 26 percent of people were connected to the electricity grid in 2016.
The objective is to prepare a geospatial analysis and present the options for electrification – encompassing grid and off-grid access delivery modalities and technology choices – with an overall target of universal access by 2030 in Mozambique. The analysis provides detailed estimation of investment and operating cost requirements for the various options.
- **EU Energy system: modelling, data collection and studies**
Comisión Europea. June 2018 - August 2021.
The objective of this project is upgrading the operation model of the European electricity system METIS to include the electricity transmission and distribution grids. Then, this model will be applied to analyse several case studies related to the future evolution and operation of the system and draw conclusions on these analyses.
- **Control and protection systems for island operation of distribution feeders**
FEDER, Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación, Proyecto _Proyecto RTC-2017-6296-3. September 2018 - August 2020. (Luis Rouco Rodríguez, Pablo García González, José Daniel Muñoz Frías, Francisco Miguel Echavarren Cerezo, Francisco Javier Renedo Anglada, María Candelaria Utrilla Bustamante, Lukas Sigríst)
This project is aimed at developing control and protection systems for island operation of distribution feeders to improve the quality and continuity of electricity supply taking advantage of distributed energy resources.

Project funded by FEDER/Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación/ _Proyecto _Proyecto RTC-2017-6296-3



"To promote technological development, innovation and quality research"



- **Climate friendly materials platform: supporting transition in Central and Southern Europe**

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. September 2018 - April 2019. (Pedro Linares Llamas, José Pablo Chaves Ávila, Timo Gerres)

The project initiates a networks of policy makers, industry, practitioners industrial and applied researchers to facilitate mutual understanding of successfully transforming and the decarbonisation of basic materials sector into a climate friendly materials sector.

Through the network, facilitated by the project's provision of suitable "knowledge material" and embedded in the national and EU level policy discourses, the project starts to elaborate a portfolio of key incentives (and corresponding instruments) for the large-scale use of climate friendly options for selected materials sectors. The project contributes first to inform appropriate structures and the effective coordination of innovation funding for the transformation of the basic material sector.

- **Large scale campaigns to demonstrate how TSO-DSO shall act in a coordinated manner to procure grid services in the most reliable and efficient way**

Comisión Europea. January 2019 - June 2022. (José Pablo Chaves Ávila, Rafael Cossent Arín, Tomás Gómez San Román, Leandro Lind, Timo Gerres, Luis Olmos Camacho, Miguel Ángel Sánchez Fornié, Álvaro Sánchez Miralles, Nicolás Mariano Morell Dameto, Javier Matanza Domingo, Gregorio López López)

The CoordiNet project aims at demonstrating how DSOs and TSOs shall act in a coordinated manner to procure and activate grid services in the most reliable and efficient way through the implementation of three "TSO-DSO-Consumer" demonstrations at large scale, in cooperation with market participants (and consumers). The consortium defines and adapts, demonstrates and promotes future standardized products for grid services and related market platforms to contribute to the seamless pan-European electricity market.

The project covers not only typical market situations but also advanced and futuristic scenarios, such as P2P markets, to paint the most flexible and advanced vision of how a cooperative service platform may look in the future European energy system.

In a nutshell the innovation introduced by CoordiNet can be captured in the following points:

- Creation of the appropriate conditions of cooperation among all the actors including the customers removing barriers;
- Complete analysis and definition of flexibility in the grid at every voltage level

encompassing TSO and DSO domain and including consumer participation;

- Definition of new mechanisms more suitable for real time operations;
- Implementation of large-scale field-tests able to comprehend all the voltage level and to trigger the participation of all the actors including the small players;
- Definition of the requirements for a standard unified European platform to be exploited beyond the limit of the project.

Three large-scale demonstration projects are foreseen, implemented by both DSOs and TSOs for the networks covered within the respective demonstration areas in Spain, Sweden and Greece.

Each demonstration assesses the application of selected coordination schemes and prototype market platforms and test a complete set of products for grid services. Demonstration areas are selected based on existing and future needs for additional / adapted grid services for the network operator and the availability of flexibility from energy consumers, storage and or small-scale (RES) generation connected to the network. The demonstration regions provide versatility in terms of geographical location, market maturity and their load / generation profile. Finally, the results of these demonstrators are extrapolated to other European countries to pave the way towards a pan-European platform.

- **Transport and policies for the transition to a low-carbon economy in Spain**

Ministerio de Ciencia, Innovación y Universidades. January 2019 - December 2021. (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.

- **IELECTRIX - Indian and European Local Energy Communities for Renewable Integration and the Energy Transition**

Comisión Europea. March 2019 - August 2022. (Rafael Cossent Arín, Pablo Frías Marín, Carlos Mateo Domingo, Fernando Emilio Postigo Marcos, Nicolás Mariano Morell Dameto)

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

- **Open energy transition analyses for a low-carbon economy**

Comisión Europea. May 2019 - April 2023. (Luis Olmos Camacho, Sara Lumbreras Sancho, Andrés Ramos Galán, Michel Rivier Abbad)

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.

- **Disruption in the electricity sectors of the MENA region**

World Bank. May 2019 - June 2019. (Paolo Mastropietro, Pablo Rodilla Rodríguez)

The MENA (Middle East and North Africa) region is facing a convergence of disruptive energy technology change and long overdue structural reform needs. This project aims to produce an Approach Paper that provides direction for MENA as a region on how disruptive technologies would impact Consumers, SOEs and the electricity sector in general. Supported by the "MENA Tech" initiative in the World Bank, this project is part of the "MENA Energy Program on Disruptive Transformation".

3.2.1.2 Consultancy and technological support

3.2.1.2.1 Private funding

- **Energy access: scoping the energy company of the future**

Shell Foundation. July 2017 - October 2018. (Fernando de Cuadra García, Pedro Ciller Cutillas, Andrés González García)

The objective of the Comillas team is to contribute to frame some of the aspects that will need to be addressed, specifically focused on the in-depth analysis of the relevant literature and the utilization of analytical tools, and where needed the development of new models to understand how the electric power sector in least developed countries will face the challenge of Universal Access to Electricity in the coming decade.

- **Individual control of hydro units within the Endesa AGC control**

Endesa Medios y Sistemas S.L. October 2017 - October 2018. (Ignacio Egido Cortés, Luis Rouco Rodríguez, Kai Doenges, Lukas Sigrist)

Endesa has a primary EMS in Madrid and secondary EMSs in Montearenas, Lérida and Sevilla. The AGC control in the primary EMS sends control signal to each individual thermal units a to the secondary EMSs. Each secondary EMS then distributes the received signal among the individual hydro units. This research project analyses the possibility of sending control signal from the primary EMS to each individual hydro unit and studies the due changes to allow this control.

- **Technical assistance for the integration an commissioning of the AGC-IIT in the Scada of Alpiq**

Alpiq Energía España S A U. December 2017 - September 2018. (Ignacio Egido Cortés, Luis Rouco Rodríguez)

Alpiq already has a licence of the AGC-IIT software integrated in the SCADA from Nucleo. Alpiq has changed its Scada provided, so AGC-IIT needs to be commissioned in the new SCADA. In this project the services of integration and commissioning of AGC-IIT in the new SCADA are provided.

- **The future of the Spanish electricity sector**

Iberdrola S.A. April 2018 - September 2018. (Tomás Gómez San Román, Pedro Linares Llamas, Pablo Rodilla Rodríguez, Michel Rivier Abbad, Pablo Frías Marín, Álvaro Sánchez Miralles, Rafael Cossent Arín, Luis Olmos Camacho, Andrés Ramos Galán, Luis Rouco Rodríguez, José Pablo Chaves Ávila, Timo Gerres, Francisco Martín Martínez)

Report that summarizes the main challenges and policies for guiding the transition to a more decarbonized electricity system in general, and in particular including the peculiarities of the Spanish system.

- **Analysis of the Spanish nuclear power plants' lifespan extension, from the plant owners perspective**

Iberdrola S.A. May 2018 - December 2018. (Michel Rivier Abbad, Tomás Gómez San Román, José Pablo Chaves Ávila, Francisco Martín Martínez, Timo Gerres)

The objective of the project is to analyze the profitability of the extending the lifespan of the Spanish nuclear power plants, from the perspective of the owners of such plants. First, for a set of future scenarios, expected market revenues for those plants are computed for the lifespan extension period, in a high renewable generation penetration environment due first to the expected reduction of their investment costs, and second to the renewable production quotas set by the European Commission. It follows an evaluation of the costs to be faced by those power plants during the lifespan extension period, including the costs they must face to be able to extend the lifespan of those plants. Finally, based on the revenues and costs estimations, the profitability, for the owners of such plants, of extending their lifespan is assessed.

- **Study of the electrical interconnection between Bolivia and Peru**

Banco Interamericano Desarrollo (BID). June 2018 - September 2019. (Andrés Ramos Galán, Luis Olmos Camacho, Michel Rivier Abbad, Jesús María Latorre Canteli)

Technical and economical assessment of an HVDC cross-border line between Bolivia and Peru.

- **Market report of two wind farms in the Spanish electricity system**

G-Advisory. September 2018 - September 2018. (Javier Reneses Guillén)

This project consists of the collaboration of IIT in a market report focused on two wind farms in Spain. In particular, a forecast of future revenues during twenty years is carried out, as well as a number of alternative scenarios.

- **Study on the European grid code compliance of generating unit projects**

Endesa Generación S.A. September 2018 - November 2018. (Luis Rouco Rodríguez, Lukas Sigríst)

This work is aimed at studying the European grid code compliance of generating unit projects. Two candidate suppliers of diesel engines for Los Guinchos power plant (La Palma) and three candidate suppliers of gas turbines for Candelraria power plant (Tenerife) are evaluated.

- **Technical support for the EXCOM tool**

Endesa Medios y Sistemas S.L. September 2018 - December 2018. (Javier García González, Pedro de Otaola Arca)

The objective of the EXCOM model, developed by the IIT in collaboration with Endesa, is to help the planning of the operation of the entire Endesa generation portfolio. The objective of this project is to provide technical advice on the use of the tool to Endesa personnel as well as perform maintenance tasks.

- **Technical support for the EXLA tool**

Endesa Medios y Sistemas S.L. September 2018 - December 2018. (Javier García González)

The model EXLA, developed by the Institute for Research in Technology (IIT) in collaboration with Endesa, aims at helping the planning of the hydroelectric generation resources of Endesa. The objective of this project is to provide technical advice on the use of the tool to Endesa personnel as well as perform maintenance tasks.

- **Advising of German electricity balancing market**

AlphaSights Ltd. September 2018 - October 2018. (José Pablo Chaves Ávila)

This project advises a Japanese electricity company about the balancing market in Germany, including the procurement of balancing services and the imbalance settlement.

- **Development of scenarios of Spanish island power systems**

Endesa Generación S.A. October 2018 - December 2018. (Lukas Sigrist, Luis Rouco Rodríguez, Clara Jiménez Serrano)

The aim of the project is to determine the influence of a battery storage system on the frequency stability of Melilla and in particular, of the avoided amount of shed load.

- **Grimel tool update**

Viesgo Generación S.L. October 2018 - November 2018. (Enrique Lobato Miguélez)

Update of Grimel tool for generation groups BRR1 and PNN3

- **New outputs for VALORE Montecarlo**

Enel Iberoamerica S.R.L. November 2018 - November 2018. (Javier Reneses Guillén, Antonio Bello Morales, Alberto Orgaz Gil)

This project focuses on the creation of new outputs for the execution of the LPM using the VALORE Montecarlo tool.

- **Support in the development of an electricity market model and in market studies in the Iberian Market**

Invesyde S.L. November 2018 - June 2019. (Javier Reneses Guillén)

This project consists of the collaboration of IIT in a market report focused on a series of renewable assets in Spain. In particular, a forecast of future electricity

prices and revenues for 10 wind farms is carried out.

The objective of this collaboration is twofold. On the one hand, it focuses on advising on the development of an electricity market model that represents the Iberian market (MIBEL) in the long term. On the other, the IIT supports Inveside in market studies carried out with the model.

- **Power evacuation study of solar thermal power plants in the Spanish transport network**

Inveside S.L. November 2018 - December 2018. (Pablo Frías Marín)

The objective of the collaboration is to carry out a study to calculate the hosting capacity at the Villanueva del Rey substation, in the 220kV Spanish transmission network. Different scenarios of generation, demand and configuration of the transmission network will be studied.

- **Assessment of Spanish secondary regulation market**

Viesgo, S.L. November 2018 - June 2019. (Enrique Lobato Miguélez, Ignacio Egido Cortés, Kai Doenges)

The project will explore if the amount of band cleared in the secondary regulation market influences a set of fundamental variables related to the economic performance of that market. In the case of finding significant correlations, quantitative functions of these relationships will be sought to allow these parameters to be included in the process of building the offer to submit to the secondary regulation market. On the other hand, this influence will be checked by simulating real-time operation of the Spanish AGC. The AGC power assignment to the most efficient regulatory units from a technical-economic point of view will be explored.

- **Least-cost electrification plan of Maluku-Papua region of Indonesia**

Asian Development Bank. November 2018 - June 2019. (José Ignacio Pérez Arriaga, Clara Pérez-Andújar Carretié, Andrés González García)

The Government of Indonesia has the objective of providing near full electrification access by 2020. Despite the progress made so far, this objective will be particularly difficult to meet in the easternmost regions of the country, which presently have the lowest electrification rates.

An electrification plan is needed to estimate the investment required to achieve the established objectives and to guide and coordinate the activities of the state electricity company PLN as well as of other stakeholders.

A former electrification plan for the four provinces of Papua, Papua Barat, Maluku and Maluku Utara (in what follows Papua and Maluku) was developed for the Government of Indonesia and the Asian Development Bank (ADB) in December 2017 by Castlerock Consulting.

The objective of this new plan is to assess, complement and develop in more detail the aforementioned plan using the Reference Electrification Model (REM) developed jointly by the Universal Energy Access Lab of IIT-Comillas and MIT. We will test diverse hypothetical scenarios to reflect the uncertainty of main input variables to the plan and the degrees of freedom of the planner: demand growth, priorities in the deployment of electrification, existence and treatment

of embedded generation, and reliability of the main grid. The proposed study will also focus on Maluku and Papua. If successful, the software and methodology could be applied to more regions in Indonesia, in particular to remote non-electrified islands.

This project is developed jointly with the Massachusetts Institute of Technology (MIT).

- **Maintenance of HAPER tool**

Iberdrola Renovables Energías, S.A.U. December 2018 - December 2018. (Lukas Sigrist)

The aim of the project is to extend the functionalities of the HAPER tool during 2018. HAPER is a tool for losses analysis in wind farms connected to a common infrastructure.

- **Market report of hydro assets in the Spanish electricity system**

G-Advisory. May 2019 - June 2019. (Javier Reneses Guillén)

This project consists of the collaboration of IIT in a market report focused on hydro assets in Spain. In particular, a forecast of future revenues during twenty-five years is carried out, as well as a number of alternative scenarios.

- **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 - August 2020. (Luis Olmos Camacho, Andrés Ramos Galán, Michel Rivier Abbad, Jesús María Latorre Canteli)

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

3.2.1.2.2 Public funding

- **Grid integration technical study to assess the expansion of assessment of impacts of high shares of variable renewable energy in the operation of the power system of the Dominican Republic**

International Renewable Energy Agency (IRENA). September 2018 - January 2019. (Francisco Javier Renedo Anglada, Lukas Sigrist, Ignacio Egido Cortés, Luis Rouco Rodríguez, Clara Jiménez Serrano)

The Dominican Republic has set a national target to reduce its green-house emissions by 25 % (compared to 2010 levels) by 2030. To achieve this goal, the Dominican Republic is planning the integration of large amounts of variable renewable energy technologies (VRE's) into its power system, mainly wind and solar PV energy.

The objective of this grid integration study is the assessment of the impact and constraints of the integration of large amounts of VRE's into the Dominican Republic's power system on technical operation (contingency analysis, transient stability and frequency stability). Consistent recommendations will be provided to guarantee the security of the system, based on the findings and conclusions of the study.

Findings of the study will aim to support the development and implementation of policies, regulation and operation practices to allow the operability of a future power system in the Dominican Republic with high shares of renewable energy.

- **Analysis of energy and economic plans and policies**

Isdefe, S.A. November 2018 - January 2019. (Pedro Linares Llamas, José Pablo Chaves Ávila, José Carlos Romero Mora, Timo Gerres)

Support to Isdefe, in collaboration with BC3, towards the elaboration of the national integrated energy and climate plan.

- **Assessment and proposal for modification of the electricity regional transmission charges in Central America**

Consejo Director del Mercado Eléctrico Regional de América Central (CDMER), Consejo de Electrificación de América Central (CEAC). January 2019 - July 2019. (Luis Olmos Camacho, Michel Rivier Abbad)

The electricity regional transmission charges applied in the Central American regional electricity market must be assessed. Based on this assessment, and a review of the best international practices, changes to the design and implementation of these charges must be proposed.

3.2.1.3 Services and analysis projects

3.2.1.3.1 Private funding

- **Report about the impact of the new hydrological plans on the remuneration of a hydroelectric power plant IBR**

Iberdrola Renovables Energías, S.A. June 2016 - May 2019. (Andrés Ramos Galán)

Writting of a brief report que assess and explains the impact of new hydrological plan on the remuneration of a hydroelectric power plant.

- **Technical support for the tool SIROCO**

Enel Iberoamérica S.R.L. January 2018 - December 2018. (Francisco Alberto Campos Fernández, José Portela González)

The objective of this project is to provide ENDESA with technical support and maintenance of the tool SIROCO developed by IIT.

- **Disruptive technologies in the electricity sector**

Banco Interamericano Desarrollo (BID). August 2018 - November 2018. (José Pablo Chaves Ávila)

This project consists in describing the disruptive technologies in the electricity sector considering the following aspects:

- 1) A quick introduction showing the key disruptive technologies.
- 2) The reason why these technologies are disruptive or how they could dramatically change the industry.

3) The advances pointing out the future for these technologies and what are the technical barriers that need to be surpassed to be actual implemented.

- **Regulatory analysis on electricity tariff reform in power systems with distributed energy resources**

Associação Brasileira de Distribuidores de Energia Elétrica (Abradee). September 2018 - May 2019. (Paolo Mastropietro, Pablo Rodilla Rodríguez)

The project studies, from a theoretical point of view and through a review of international experiences, which aspects of electricity tariff design have to be reformed when distributed energy resources enter the power system.

- **Impact studies of wind farms in Soria and Zaragoza**

Capital Energy S.A. October 2018 - December 2018. (Lukas Sigrist)

- **Power flow analysis of the Manzanares corridor**

Aries Solar Termoeléctrica S.L. November 2018 - December 2018. (Francisco Miguel Echavarren Cerezo, Luis Rouco Rodríguez)

Power flow analysis of the Manzanares corridor using an actual scenario of the Spanish electric power system. Next hypothesis will be considered:

* Arenas de San Juan 220: 319 MW

* Las Carroyuelas 220: 304 MW

* Manzanares 220: 435 MW

* La Paloma 220: 309 MW

* Madridejos 220: 123 MW

This study will check the fulfillment of the P.O. 1.1 in base case and under N-1.

- **Ampacity studies for the Hashfela corridor of the Israel railway electrification project**

Sociedad Española de Montajes Industriales (SEMI). November 2018 - December 2018. (Francisco Miguel Echavarren Cerezo, Luis Rouco Rodríguez)

Continuation of the SEMIcables project.

The study will consist of determining the temperature of the cables according with some current profile among the installation. If temperatures would be unacceptable, SEMI will propose an alternative configuration.

Computation of core conductor temperatures will be carried out using a modified version of a three-phase model for ampacity computation, adapted to deal with one-phase railway feeders.

- **Assistance and maintenance of tools for back office and reserve areas.**

Endesa Medios y Sistemas S.L. January 2019 - December 2019. (Efraim Centeno Hernández, Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

Assistance and maintenance of tools developed by IIT for Endesa for back office and reserve areas.

- **Technical support for the tools EXCOM, EXLA AND SIROCO**

Endesa Medios y Sistemas S.L. January 2019 - December 2019. (Eugenio Francisco Sánchez Úbeda, Javier García González, Antonio Muñoz San Roque, José Portela González)

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

- **Evolutive maintenance for the long-term market analysis Expande tool**

Endesa Medios y Sistemas S.L. January 2019 - April 2019. (Efraim Centeno Hernández, Francisco Alberto Campos Fernández)

Evolutive maintenance for the long-term market analysis Expande tool.

- **Technical support for the tool SIROCO**

Enel Iberoamérica S.R.L. January 2019 - December 2019. (Francisco Alberto Campos Fernández, José Portela González)

The objective of this project is to provide ENDESA with developing maintenance of the tool SIROCO developed by IIT.

- **Technical support for the tool VALSA**

Enel Iberoamérica S.R.L. January 2019 - December 2019. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

The objective of this project is to provide ENEL with technical developing maintenance of the tool VALSA developed by IIT.

3.2.1.3.2 Public funding

- **Designing binding day ahead and intraday markets in the Colombian electricity system**

Comisión de Regulación de Energía y Gas (CREG). June 2018 - November 2018. (Pablo Rodilla Rodríguez, Paolo Mastropietro, Luiz Augusto Nobrega Barroso, Paulo Brito Pereira)

The study contains four sections:

- 1.-Study the CREG proposal CREG 004B of 2016, as well as the proposal by the market operator XM S.A.S.P., and other studies conducted in this area by the sector. Review of the international experience that has been carried out in these studies on the design of the spot energy market.
2. Complete revision of Resolutions CREG 024 and 025 of 1995, as well as all those that modify them. Likewise, the agreements of the CNO that have some relation to the subject under study must be reviewed.
3. Development of a normative proposal aimed at the implementation of a binding dispatch, intraday markets, and balance mechanisms.
4. Development of a regulatory proposal regarding the commercial treatment of constraints and their settlement in the presence of a binding dispatch, intraday markets and balancing mechanisms.

- **Modernization of electricity tariff structure for Costa Rica**

Instituto Costarricense de Electricidad. January 2019 - April 2019. (José Pablo Chaves Ávila)

The objective of this project is to support Grupo Mercados Energéticos Consultores to identify the criteria and long-term methodologies for the definition of electricity tariffs for Costa Rica. In order to reach this objective, different aspects are analyzed:

- structure of the Costa Rican electricity system
- consumption patterns for the different kind of consumers,
- separation for the different activities and division of costs,
- technological challenges that the sector is experiencing such as the distributed generation, in self-generation mode as well as owned by distribution companies,
- definition of tariff groups and exemptions of consumers groups
- tariffs components and new possibilities that smart meters provide, among other aspects

3.2.2 Industrial systems

3.2.2.1 Research and development projects

3.2.2.1.1 Private funding

- **Monitor X**

Energi Norge. October 2015 - September 2019. (Miguel Ángel Sanz Bobi)

The aim of the MonitorX-project is to develop a model and corresponding software prototypes for optimal lifetime utilization of hydropower components based on monitoring of technical condition and risk. The model integrate advanced systems for condition monitoring and fault diagnosis based on machine learning and artificial intelligence. This project is supported by the Research Council of Norway and there are an important number of partners cooperating.

IIT assist the project in developing advanced condition monitoring algorithms and integration of these algorithms with models for maintenance planning and optimization. IIT contribute with scientific advisory and consultancy in model developing. Furthermore, IIT is a partner for student exchange,

- **Modeling and forecasting of the demand for natural gas and electricity in Spain and Portugal**

Enel Iberoamerica S.R.L. October 2017 - December 2018. (Eugenio Francisco Sánchez Úbeda, Antonio Muñoz San Roque, Guillermo Mestre Marcos)

The objective of this project is modeling and forecasting of the demand for natural gas and electricity in Spain and Portugal.

- **VALSA-EXPANDE integration and developments for the long-term analysis**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

VALSA is an expansion model for generation investment and complementary service analyses of the Spanish electricity system in the long-term. The objectives of this collaboration include the follow-up of the strategic reflection that begun in the previous collaboration, to know what elements are currently determining the system behaviour and what is the best way to address them. Another objectives are to guarantee the adaptation of VALSA to the system changes expected in the next few years (as for example the changes in the generation or consumption structure) and also the continued assistance in the use of VALSA.

- **Applying data analysis and forecasting techniques to monitor and analysis of the strategic bidding behaviour in the Iberian electricity market**

Enel Iberoamerica S.R.L. January 2018 - December 2018. (Eugenio Francisco Sánchez Úbeda, Santiago Moreno Carbonell)

The primary aim of this project is the improvement of the information system and the methodology implemented for the analysis of the Iberian market operation and the characterization of participants bidding strategies.

Taking as input the information published by the market and system operators, the proposed methodology establish the most appropriate mechanisms of data mining for its treatment, with the purpose of analyzing the bidding behaviour of firms and their pricing of the different generation technologies.

- **Predictive diagnosis and preventive (on condition) maintenance of power train subsystems and components: ATS Subsystem and AdBlue Filter**

SATE, S.r.l. - Systems & Advanced Technologies Engineering. January 2018 - December 2018. (Miguel Ángel Sanz Bobi, Álvaro Sánchez Miralles, Pablo Calvo Bascónes)

This project develops a predictive diagnostic algorithm and the corresponding software in Matlab for the After Treatment System (ATS) of the gases in a vehicle. Also the project develops a predictive diagnostic algorithm and the corresponding software in Matlab for the AdBlue filter component of a vehicle engine to be integrated in the Client off-board infrastructure that allows its condition-based maintenance.

- **Development of the data analytics tool HADES**

Endesa Medios y Sistemas S.L. March 2018 - December 2018. (Antonio Muñoz San Roque, José Portela González)

The main objectives of this collaboration are the development of advanced forecasting models, the automation of the training and evaluation of the predictive models and the integration of IAMEX and IAM in HADES.

- **Modeling and forecasting of the demand for natural gas and electricity in Spain and Portugal**

Enel Iberoamerica S.R.L. June 2018 - December 2018. (Eugenio Francisco Sánchez Úbeda, Antonio Muñoz San Roque, Guillermo Mestre Marcos)

The objective of this project is modeling and forecasting of the demand for natural gas and electricity in Spain and Portugal. A probabilistic approach is used to fulfill this objective.

- **Radio frequency system to detect micro wires**

Inprotec Robótica Industrial, S.L. November 2018 - April 2019. (Álvaro Sánchez Miralles, Javier Matanza Domingo, Francisco Javier Herraiz Martínez, Carlos Rodríguez-Morcillo García, Jaime Boal Martín-Larrauri, Miguel Martín Lopo)

The aim of the project is to develop a functional system which able to detect micro wires. This is a disruptive concept that is going to be a breakthrough in the security of shops. This system is based on putting a micro wire, undetectable by sight, in the products of a shop, which are going to replace the traditional security tags.

- **Tool of optimal design and simulation of high speed trains**

Patentes Talgo S.L.U. December 2018 - December 2020. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez)

In this project a new software tool is developed to design the driving of high speed trains based on detailed simulation of train dynamics and energy consumption. The tool includes eco-driving optimisation algorithms that minimise the energy consumption for a target running time. Simulated drivings will be compared with real measurements registered at Talgo trains in order to validate the tool.

- **VALSA-EXPANDE integration and unification algorithms, unique interface and preparation for migration to the cloud: initial phase**

Enel Iberoamerica S.R.L. January 2019 - July 2019. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

The main objective of the collaboration is the integration of the EXPANDE and MORSE systems in a single system called CODEX that integrates the best capabilities of both systems, among which stand out the time representation of the time horizon, the modeling of the competition and of the secondary reserve as well as the treatment of the uncertainty by characterizing the stochastic variables mentioned above. In addition, it includes extending the data entry interface shared so far by EXPANDE and MORSE, guaranteeing the consistency of the data used by both systems, in order to become the interface of the future CODEX integrated system. Regarding the market model, in this phase only the hydrothermal part of the electricity generation resources is developed.

- **Scenario generation for medium-term forecasting using automatic learning techniques**

Enel Iberoamerica S.R.L. January 2019 - December 2019. (Eugenio Francisco Sánchez Úbeda)

The aim of this project is the development of probabilistic scenario generators for the medium-term operation and planning tools of the Iberian electricity market (MIBEL).

- **Modeling and forecasting of the demand for natural gas and electricity in Spain and Portugal**

Enel Iberoamerica S.R.L. January 2019 - December 2019. (Eugenio Francisco Sánchez Úbeda, Antonio Muñoz San Roque, Guillermo Mestre Marcos)

The objective of this project is modeling and forecasting of the demand for natural gas and electricity in Spain, Portugal and France. A probabilistic approach is used to fulfill this objective.

- **Identification of appropriate sites for mini-grids, and development of adequate regulatory approach for integration in selected states in India**

Massachusetts Institute of Technology (MIT). January 2019 - June 2019. (Rafael Palacios Hielscher, José Ignacio Pérez Arriaga, Clara Pérez-Andújar Carretié, Andrés González García)

This project focuses on the identification of appropriate sites for the deployment of a large number of mini-grids in the preselected number of Indian states, including preliminary design features of these mini-grids.

The project is developed by the Universal Energy Access Lab, partnership between Comillas-IIT and MITeI (Massachusetts Institute of Technology - Energy Initiative).

IIT also participates in developing the most adequate regulatory approach to integrate the presence of this large number of mini-grids into the existing activity of the distribution companies in the corresponding territories, looking for the maximum short-term energy access while considering also a long-term efficient outcome. This required working with the incumbent distribution companies and with the relevant central and state governmental bodies to define workable deployment paths with both a short-, medium- and long-term views, to establish adequate collaboration and to identify and implement any necessary policy reforms.

- **Modeling a distributed processing network using distributed ledger technology (DLT)**

DAINWARE S.L. January 2019 - May 2020. (David Contreras Bárcena, David Alfaya Sánchez, José Luis Gahete Díaz, Israel Alonso Martínez, Alejandro García San Luis)

This project aims to model a distributed processing network based on DLT for the transaction log. In addition to the definition of the model, the technologies used in current DLT and Blockchain systems should be evaluated from the point of robustness, proof of work, consensus, etc. The final model defined must be validated mathematically.

- **Eco-driving design for the British railway lines H2S and CRN London-Birmingham-Glasgow**

INDRA SISTEMAS, S.A. February 2019 - April 2019. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez)

In this project eco-driving will be designed for two British railway lines, minimising the energy consumption for a target running time: the high speed line HS2 from London Euston to Birmingham Curzon Street, and CRN line from

Handsacre Junction to Glasgow. Eco-driving in HS2 will consider the new ATO over ERTMS system.

- **Predictive diagnosis and preventive (on condition) maintenance of power train subsystems and components: ATS Subsystem and AdBlue Filter-Extension of a previous project**

SATE, S.r.l. - Systems & Advanced Technologies Engineering. March 2019 - July 2019. (Miguel Ángel Sanz Bobi, Pablo Calvo Báscones)

This project is an extension of a previous cooperation focussed on the research around the development of a predictive diagnostic algorithm and the corresponding software in Matlab for the After Treatment System (ATS) of the gases in a vehicle. Also the project develops a predictive diagnostic algorithm and the corresponding software in Matlab for the AdBlue filter component of a vehicle engine to be integrated in the Client off-board infrastructure that allows its condition-based maintenance.

- **Development of an tool to optimize the filling of containers and trucks**

Pladur Gypsum S.A. April 2019 - July 2019. (Álvaro Jesús López López, Fernando de Cuadra García)

This project is aimed at improving productivity in Pladur operations. Specifically, we develop an tool to optimize the filling of containers and trucks that will allow the reduction of time and costs, the exploration of diverse and more ambitious solutions, and materialize the knowledge of the company in a stable tool, beyond of dependence on expert employees.

- **Optimal design of ATO driving parameters for Metro de Barcelona to Line 1**

Bombardier. July 2019 - December 2020. (Antonio Fernández Cardador, Asunción Paloma Cucala García, Adrián Fernández Rodríguez)

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. 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.

3.2.2.1.2 Public funding

- **Research programme on smart grids in Madrid**

Comunidad de Madrid. October 2014 - December 2018. (Aurelio García Cerrada, Juan Luis Zamora Macho)

This project will look into the application of smart grid technologies in Madrid. The analysis will be spelled out as follows.

(1) Devices and infrastructure: Application of power electronics devices to improve the present infrastructure.

(2) Operation level: Power-frequency control. Integration of renewable resources in micro-grids. Optimal energy dispatch. Management of energy storage.

- (3) Management level: Application of computational intelligence (CI) to the prediction of the generation from renewable sources. Implementation of CI techniques in big data platforms to model the energy consumption from data collected by smart meters and sensors deployed in the system. Investigation on variable-pricing scenarios.
- (4) Decision level: Medium-term improvement of safety and service. Optimization of electricity consumption based on better activity schedules.
- (5) Finally, a transversal study on the communications network for information exchange between agents and devices will be carried out, with focus on low and medium voltage networks and their problems concerning latency and bandwidth.

Project funded by Comunidad de Madrid, into Programa de Actividades de I+D entre Grupos de Investigación en Tecnologías 2013.



Project funded by European Union, into European Social Fund.



- **Metrology for smart energy management in electric railway systems**

Comisión Europea. September 2017 - September 2020. (Asunción Paloma Cucala García, Antonio Fernández Cardador, Adrián Fernández Rodríguez)

The project aims to develop the metrological infrastructure for accurate measurement of energy exchange and for reliable system monitoring, which underpins the implementation of an energy efficient management of the European DC and AC railway and DC subway system. The project also focuses on the characterisation of the railway subsystem as a producer-consumer, with a view to its integration in a wide smart grid as well as on the assessment of eco-driving performances.

- **Scientific and technical innovations for safer Powered Two Wheelers (PTW)**

European Cooperation in Science and Technology (COST). June 2018 - February 2019. (Francisco José López Valdés)

Enhancing traffic safety is an on-going quest. Traffic accidents cause human suffering and huge economic losses. In the period 2000-2012, the riders killed per 10,000 Powered Two Wheelers (PTW) registered has more than halved, passing from 2.68 to 1.32. Nevertheless, PTW riders are still among the most vulnerable road users and other efforts are necessary toward a vision zero (accident) concept. On the other end, the use of PTW is currently increasing worldwide, especially in urban environments, since PTW offer many benefits for personal mobility: less congestion, time gain, energy savings, easier parking. These beneficial opportunities can only be capitalised if PTW safety is further prioritised. As prior initiatives to improve PTW safety have concentrated on single aspects, a truly holistic and integrated approach towards PTW safety is still lacking. This COST Action addresses this gap, by bringing together PTW safety experts to i) acquire, unify and coordinate PTW safety research, and ii) ensure broad dissemination towards PTW users, industry and public authorities.

- **Software tools for the design of high capacity railway lines [TOOLTRAIN]**

FEDER, Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación, Proyecto _Proyecto RTC-2017-6506-4. June 2018 - May 2020. (Asunción Paloma Cucala García, Antonio Fernández Cardador, Adrián Fernández Rodríguez, Alejandro Cunillera Pérez)

The objective of the TOOLTRAIN project is the research and development of new software tools for the design of high capacity railway lines, equipped with the latest signalling systems: CBTC and ERTMS level 2.

This way, the transport capacity is increased and trains can be operated safely with a shorter interval between consecutive trains providing flexibility to railway traffic control. Therefore, safety, reliability punctuality and frequency can be improved.

Project funded by FEDER/Ministerio de Ciencia, Innovación y Universidades – Agencia Estatal de Investigación/ / _Proyecto _Proyecto RTC-2017-6506-4



"To promote technological development, innovation and quality research"



- **Implementation of EN 50463-4 Ed 2017 in the Spanish railway system**
 Adif. January 2019 - January 2020. (José Antonio Rodríguez Mondéjar, Yolanda González Arechavala)
 EN 50463-4 defines the communications protocol between energy meters on trains (EMS) and ground. This project deals with their use and the improvements to be made for their application in the Spanish railway system.
- **Multi-objective optimization of railway operation. Collaboration with Beijing Jiaotong University-China**
 State Key Lab of Rail Traffic Control and Safety (Beijing Jiaotong University). February 2019 - February 2021. (Asunción Paloma Cucala García, Antonio Fernández Cardador, Adrián Fernández Rodríguez)
 This project is a collaboration between Comillas University and the State Key Lab of Rail Traffic Control and Safety (Beijing Jiaotong University-China). It aims to tackle the optimal operation of trains in a railway system. Optimal operation can be achieved by means of a two level optimization problem. These levels optimize not only the train speed profiles but also the timetable. The tasks of this project produce methods to assist the designing process of efficient operation in a railway line applying multi-objective optimization techniques and Pareto analysis.

3.2.2.2 Consultancy and technological support

3.2.2.2.1 Private funding

- **4D certification of a project development to automatize the ink making process**
 OCA Instituto de Certificación, S.L.U. October 2018 - January 2019. (Pedro Sánchez Martín)
 Perform of a 4D certification control to determine the characteristics of the expert to evaluate a project development to automatize the ink making process and afterwards the quality of the performed evaluation by the expert based on the certification company requirements.
- **Adapt output files form GEDEX forecasting module to Big Data**
 Enel Iberoamérica S.R.L. April 2019 - April 2019. (José Portela González)
 The goal is to adapt the output files from GEDEX forecasting module to Endesa's Big Data implementation

3.2.2.3 Services and analysis projects

3.2.2.3.1 Private funding

- **Technical support for the tool SIROCO**

Enel Iberoamérica S.R.L. January 2018 - December 2018. (Francisco Alberto Campos Fernández, José Portela González)

The objective of this project is to provide ENDESA with technical support and maintenance of the tool SIROCO developed by IIT.

- **Technical support for the tools EXCOM, EXLA AND SIROCO**

Endesa Medios y Sistemas S.L. January 2019 - December 2019. (Eugenio Francisco Sánchez Úbeda, Javier García González, Antonio Muñoz San Roque, José Portela González)

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

- **Technical support for the tool SIROCO**

Enel Iberoamérica S.R.L. January 2019 - December 2019. (Francisco Alberto Campos Fernández, José Portela González)

The objective of this project is to provide ENDESA with developing maintenance of the tool SIROCO developed by IIT.

- **Technical support for the tool VALSA**

Enel Iberoamérica S.R.L. January 2019 - December 2019. (Francisco Alberto Campos Fernández, Salvador Doménech Martínez)

The objective of this project is to provide ENEL with technical developing maintenance of the tool VALSA developed by IIT.

3.3 Publications

3.3.1 Chapters in books

- I. Abdelmottaleb, T. Gómez, J.P. Chaves, "*New distribution network charges for new integrated network services*". Chapter in the book "Consumer, prosumer, prosumager: how service innovations will disrupt the utility business model". Editors: Sioshansi, Fereidoon P. Publisher: Academic Press. Pp. 189-208. ISBN: 978-0-12-816835-6. March 2019.

- S. Burger, I. Schneider, A. Botterud, I.J. Pérez-Arriaga, "*Fair, equitable, and efficient tariffs in the presence of distributed energy resources*". Chapter in the book "Consumer, prosumer, prosumager: how service innovations will disrupt the utility business model". Editors: Sioshansi, Fereidoon P. Publisher: Academic Press. Pp. 155-188. ISBN: 978-0-12-816835-6. March 2019.

- S. Lumbreras, A. Ramos, "*Better transmission networks for a smarter global system*". Chapter in the book "Pathways to a smarter power system". Editors: Tascikaraoglu, A.; Erdinc, O.; Publisher: Elsevier Ltd.. Pp. 205-223. ISBN: 978-0-08-102592-5. April 2019.
- D. Robinson, P. Linares, X. López, R. Rodrigues, "*Fiscal policy for decarbonisation of energy in Europe, with a focus on urban transport: case study and proposal for Spain*". Chapter in the book "Environmental fiscal challenges for cities and transport. Critical Issues in Environmental Taxation series. Volumen XXI.". Editors: Villar, M.; [et al]. Publisher: Edward Elgar Publishing. Pp. 75-90. ISBN: 978-1-78990-417-8. August 2019.
- M. Sáenz, J. Marcos, M.J. Fernández-Pintelos, J. Sánchez Real, A.M. Mariblanca, "*Some Spanish approaches on standardization management: discussion of the experiences with university students and collaboration with Spanish industry*". Chapter in the book "Corporate standardization management and innovation". Editors: Jakobs, Kai. Publisher: IGI Global. Pp. 276-294. ISBN: 9781522590088. April 2019.

3.3.2 Publications in journals

- H. Abdi, H. Fattahi, S. Lumbreras, "*What metaheuristic solves the economic dispatch faster? A comparative case study*", *Electrical Engineering*, vol. 100, n°. 4, pp. 2825-2837. ISSN: 0948-7921. October 2018/December 2018.
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- J. Portela, A. Bello, "*Functional regression for estimating probability density functions: an application to electricity price forecasting*", Paper in 11th International Conference of the ERCIM WG on Computational and Methodological Statistics - CMStatistics 2018. Pisa (Italy). 14-16 December 2018.
- L. Rouco, "*Damping controllers of subsynchronous oscillations for doubly fed induction generators*", Paper in 2nd International Conference on Future Electric Power Systems and the Energy Transition - FEPSET 2019. Champéry (Switzerland). 03-05 February 2019.
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- T. Gerres, J.P. Chaves, F. Martín, M. Rivier, T. Gómez, *"The role of nuclear power plants in electricity systems with high RES share"*, Communication in 13th PowerTech Conference - PowerTech 2019. Milano (Italy). 23-27 June 2019.

- P. Otaola-Arca, J. García-González, F. Mariño, I. Rivera, "*Impact of gas third party access in the unit commitment optimal solution*", Communication in 13th PowerTech Conference - PowerTech 2019. Milano (Italy). 23-27 June 2019.
- J. Renedo, L. Sigrist, L. Rouco, "*Design of power system stabilizers to damp low frequency inter-area oscillations with limited information*", Communication in 13th PowerTech Conference - PowerTech 2019. Milano (Italy). 23-27 June 2019.
- D.A. Tejada, G. Morales-España, S. Wogrin, E. Centeno, "*Addressing flexibility issues in clustered unit commitment formulations for generation expansion planning models*", Communication in 30th European Conference on Operational Research - EURO 2019. Dublin (Ireland). 23-26 June 2019.
- D.A. Tejada, S. Wogrin, P. Sánchez, A. Ramos, "*Unit commitment with ACOPF constraints: practical experience with solution techniques*", Communication in 13th PowerTech Conference - PowerTech 2019. Milano (Italy). 23-27 June 2019.
- E.M. Arenas, A. Cantizano, I. Asenjo, J.I. Linares, "*Design and analysis of radial and axial turbomachinery of supercritical CO₂ power cycles*", Communication in 14th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics - HEFAT 2019. Wicklow (Ireland). 22-24 July 2019.
- A. Cantizano, P. Ayala, M. Fernández, A. Ares, "*Modeling urban fire spread based on specific characteristics of substandard housing in Spain*", Communication in 14th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics - HEFAT 2019. Wicklow (Ireland). 22-24 July 2019.

3.3.4 IIT technical documents

This section includes both technical reports prepared for companies and institutions as well as working papers that have been registered.

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- R. Barrella, J.I. Linares, E.M. Arenas, J.C. Romero, "*Towards a hidden energy poverty indicator for Spanish households*". May 2019. Ref: IIT-19-046A.

- C. Batlle, P. Mastropietro, P. Rodilla, *"Redesigning residual cost allocation in electricity tariffs: a proposal to balance efficiency, equity and cost recovery"*. November 2018. Ref: IIT-18-119A.
- S. Burger, Ch. Knittel, I.J. Pérez-Arriaga, I. Schneider, F. Scheidt, *"The efficiency and distributional effects of alternative residential electricity rate designs"*. February 2019. Ref: IIT-19-011A.
- E. Centeno, S. Wogrin, D.A. Tejada, *"On the proper use of net present value for capacity expansion planning with renewable generation"*. November 2018. Ref: IIT-18-128A.
- C.A. García-Montoya, J.M. López-Lezama, T. Gómez, *"Estimación del gasto total (TOTEX) de empresas de distribución mediante modelos de red de referencia y fronteras de eficiencia"*. June 2019. Ref: IIT-19-065A.
- S. Lumbreras, *"As a leader, you need to set your value agenda. Here's why."*. April 2019. Ref: IIT-19-037A.
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- C. Mateo, F. Postigo, F. de Cuadra, T. Gómez, T. Elgindy, P. Dueñas, B. Palmintier, B.M. Hodge, V. Krishnan, *"Building large-scale synthetic U.S. distribution network models"*. February 2019. Ref: IIT-19-004A.
- N. Morell, R. Cossent, J.P. Chaves, P. Rodilla, T. Gómez, *"Respuesta a la Consulta pública previa a la elaboración del Real Decreto por el que se establece las metodologías de cálculo de los cargos del sistema eléctrico del Ministerio para la Transición Ecológica."*. June 2019. Ref: IIT-19-063A.
- Ll. Oviedo, S. Lumbreras, *"Belief networks as complex systems"*. April 2019. Ref: IIT-19-036A.
- F. Postigo, C. Mateo, T. Gómez, F. de Cuadra, P. Dueñas, T. Elgindy, B.M. Hodge, B. Palmintier, V. Krishnan, *"Phase-selection algorithms to minimize cost and imbalance in U.S. synthetic distribution datasets"*. February 2019. Ref: IIT-19-010A.
- J. Renedo, L. Rouco, A. García-Cerrada, L. Sigrist, *"A communication-free reactive-power control strategy in VSC-HVDC multi-terminal systems to improve transient stability"*. May 2019. Ref: IIT-17-005A.
- L. Simons, *"Adapting energy markets in Europe to integrate industrial demand response"*. September 2018. Ref: IIT-18-108A.

3.3.5 Other publications

- R. Barrella, E. Centeno, P. Linares, P. Mastropietro, J.C. Romero, "*Contribución a la consulta pública para la Estrategia Nacional de Lucha contra la Pobreza Energética*". Technical Report in Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). January 2019.

- R. Barrella, J.C. Romero, E. Centeno, "*Contribución de la Cátedra de Energía y Pobreza a la consulta pública para el Proyecto RDL sobre Certificación de la eficiencia energética de los edificios*". Technical Report in Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). April 2019.

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- O. Chiappinelli, M. Bartek-Lesi, M. Btocka, J.P. Chaves, B. Felsmann, T. Gerres, P. Linares, K. Neuhoff, A. Sniegocki, G. Szajkó, Z. Wetmanska, "*Inclusive transformation of the European materials sector*". Technical report in EUKI. Madrid (Spain). May 2019.
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- T. Gerres, J.P. Chaves, P. Linares, "*El futuro de las materias primas en España*". Technical report in Ministerio de la Transición Ecológica. Madrid (Spain). May 2019.
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- T. Gerres, J.P. Chaves, P. Linares, "*La transición del sector de materias primas hacia una economía baja en carbono*". Technical report in EUKI. Madrid (Spain). May 2019.
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Informativos Telecinco. Marzo 2019. <https://goo.gl/5H6QYW>

- P. Linares, "*¿Por qué no se aplican más impuestos para reducir emisiones?*". Electronic press in The Conversation Media Group Ltd. Madrid (Spain). March 2019.
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- P. Linares, R. Cossent, J.C. Romero, "*Observatorio BP de Energía y Sostenibilidad en España. Informe año 2018*". Technical Report in Cátedra BP de Energía y Sostenibilidad. Universidad Pontificia Comillas. Madrid (Spain). April 2019.
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- P. Linares, P. Rodilla, T. Gómez, M. Rivier, P. Frías, J.P. Chaves, A. Sánchez, T. Gerres, R. Cossent, L. Olmos, A. Ramos, L. Rouco, F. Martín, "*El sector eléctrico español del futuro: retos y políticas. Resumen ejecutivo*". Technical report in Iberdrola S.A. Madrid (Spain). December 2018.
Proyecto: FUTUROSECTOR-IBD /
- P. Linares, P. Rodilla, T. Gómez, M. Rivier, P. Frías, J.P. Chaves, A. Sánchez, T. Gerres, R. Cossent, L. Olmos, A. Ramos, L. Rouco, F. Martín, "*El sector eléctrico español del futuro: retos y políticas*". Technical report in Iberdrola S.A. Madrid (Spain). December 2018.
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- L. Lind, J.P. Chaves, "*Market and regulatory analysis: analysis of current market and regulatory framework in the involved areas*". Technical report in Comisión Europea. Madrid (Spain). April 2019.
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- L. Lind, R. Cossent, L. Simons, J.P. Chaves, P. Frías, "*Updated comparative analysis of regulatory frameworks in the target countries*". Technical report in Comisión Europea. Madrid (Spain). December 2018.
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- S. Lumbreras, "*¿Quiere subir su mente a la nube?*". Electronic press in The Conversation Media Group Ltd. Madrid (Spain). May 2019.
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- S. Lumbreras, "*«El posthumano podría ser más refinado emocionalmente que las personas actuales»: una entrevista con Natasha Vita-More*". Electronic press in Cátedra Francisco José Ayala de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas. Madrid (Spain). May 2019.
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- I.J. Pérez-Arriaga, J.M. Glachant, P.L. Alessi, P. Bhagwat, S. Bhagwat, S.Y. Hadush, G. Montesano, C. Papa, N. Rossetto, "*FSR Global Forum Report*". Technical report in European University Institute. Madrid (Spain). June 2019.
Proyecto: /

- J. Román, "*Guerra al coche: impuestos, contaminación, motonetas, bicicleta ... ¿Tendrán nuestros hijos uno?*". Electronic press in Mediaset España Comunicación S.A. Madrid (Spain). October 2018.
Informativos Telecinco. Octubre 2018. <https://goo.gl/5G4xMn>

4. Teaching

The experience that the IIT holds in various technological fields is a valuable input for the different undergraduate and graduate degrees offered by the school of engineering ICAI.

This section presents the undergraduate and graduate theses that have been supervised by IIT staff during the last academic year, and the list of graduate courses led by members of the IIT or they have participated as lecturers.

4.1 Supervised undergraduate theses at IIT

4.1.1 Electrical, Electronics, and Mechanical Engineering

- *Control de tensión y/o corriente de salida en convertidores electrónicos fuente de tensión modulares y multinivel (MMC) para su conexión a la red eléctrica*
Pablo Gallego Fernández. Supervised by Aurelio García Cerrada and Francisco Javier Renedo Anglada.
- *Control de un sistema de suspensión activa para un vehículo a escala*
José Esteban Rivero Ríos. Supervised by Juan Luis Zamora Macho.
- *Desarrollo de patrones de calibración en defectos de forma*
Álvaro Valdés Gómez. Supervised by María Ana Sáenz Nuño.
- *Desarrollo de una prótesis low cost destinada a países en conflicto o en vía de desarrollo*
Beatriz Quiralte Moreno. Supervised by María Ana Sáenz Nuño.
- *Detección de anomalías de un aerogenerador a través de sus curvas de estado*
Ramón Conejero Guillén. Supervised by Miguel Ángel Sanz Bobi.
- *Diseño de la suspensión trasera de una moto de competición*
Tomás Manuel Bañegil Collado. Supervised by Pablo Ayala Santamaría.

- *Diseño e integración de un control predictivo de temperatura en un sistema domótico*
Sara Puente Iglesias. Supervised by Juan Luis Zamora Macho.
- *Estudio y diseño de un hidroala y posibles aplicaciones en el sector marítimo y de recreo*
Francisco Javier López Salcedo. Supervised by Jesús Jiménez Octavio.
- *Integration of interurban delivery vehicles in the grid and optimization of the charging process*
Marta García-Borregón Castañeda. Supervised by Pablo Frías Marín.
- *Modularización de tareas en la minifábrica ICAI*
Aurora Valdés Zafra. Supervised by José Antonio Rodríguez Mondéjar.

4.1.2 Telematics Engineering

- *Desarrollo de una plataforma IoT para conocer el mapa sonoro ambiental de un entorno exterior*
María de la Concepción Martín Velázquez-Gaztelu. Supervised by Miguel Ángel Sanz Bobi.
- *Implementación de una solución distribuida IoT mediante la tecnología Blockchain*
José María Moyano Suárez. Supervised by David Contreras Bárcena.

4.1.3 Bachelor's Degree in Engineering for Industrial Technologies

- *Análisis de alternativas de coberturas de riesgos para inversiones en generación transfronteriza en la región latinoamericana*
Alberto Pascual Virués. Supervised by José Pablo Chaves Ávila.
- *Análisis de estrategias de inversión basadas en aprendizaje no supervisado*
Marta Martínez Esteban. Supervised by Juan Luis Zamora Macho.
- *Análisis de estrategias de inversión basadas en aprendizaje supervisado*
Gonzalo Sierra Calero. Supervised by Juan Luis Zamora Macho.
- *Análisis del despliegue de puntos de recarga interurbanos para vehículos eléctricos*
Pablo Mendoza Caballero. Supervised by Pablo Frías Marín.
- *Aplicación de la realidad virtual a la programación de robots*
Francisco Javier Domínguez Sánchez-Girón. Supervised by José Antonio Rodríguez Mondéjar.

- *Aplicación de la realidad virtual a la programación de robots industriales de grandes dimensiones*
Mario Serrano Rodríguez. Supervised by José Antonio Rodríguez Mondéjar.
- *Aplicación de un filtro de Kalman a la gestión óptima de una cartera de valores*
Javier Maguregui Ortiz. Supervised by Juan Luis Zamora Macho.
- *Asistente electrónico de entrenamientos de natación*
Jorge Zumarraga Martínez. Supervised by Álvaro Sánchez Miralles.
- *Automatización de una línea de acabado de planchas de acero inoxidable*
Gonzalo Valencia Torralbo. Supervised by José Antonio Rodríguez Mondéjar.
- *Blockchain-based carbon credit solution*
Álvaro Nicolás Gemperle Sánchez del Corral. Supervised by José Pablo Chaves Ávila.
- *Cálculo y diseño para un sistema integrado de almacenamiento de energía eléctrica en subestación de media/alta tensión para la optimización de generación de energía renovable*
Laura Cansado Romera. Supervised by Pablo Frías Marín.
- *Comparación de dos métodos de ajuste de estabilizadores de oscilaciones subsíncronas de aerogeneradores basados en generadores de inducción doblemente alimentados*
Paloma López Díaz. Supervised by Luis Rouco Rodríguez.
- *Comparativa de la sostenibilidad de los mixes energéticos de distintos países bajo la perspectiva del análisis de ciclo de vida*
Antonio Andrés Rebollar Juárez. Supervised by Yolanda González Arechavala.
- *Comparativa de la sostenibilidad de los mixes energéticos de distintos países europeos bajo la perspectiva del análisis de ciclo de vida*
Diego Benito Adrados. Supervised by Ana María Santos Montes.
- *Comparative analysis of international offshore wind sector*
María Gabriela Rubio Domingo. Supervised by Jesús Jiménez Octavio.
- *Comportamiento a fractura y fatiga de cementos óseos reforzados con grafeno*
Íñigo Sagaz Spottorno. Supervised by Yolanda Ballesteros Iglesias and Eva Paz Jiménez.
- *Comportamiento de un adhesivo de construcción frente al aumento de temperatura generada en un incendio*
Pablo Lozano Gil. Supervised by Yolanda Ballesteros Iglesias and Pablo Ayala Santamaría.

- *Construcción de un equipo de equilibrado de una esfera sobre plataforma móvil para docencia*
Enrique Alonso Álvarez. Supervised by Juan Luis Zamora Macho.
- *Control de navegación autónoma de un cuadricóptero en interiores*
Jorge Jacobo Bennasar Vázquez. Supervised by Juan Luis Zamora Macho.
- *Control de un coche teledirigido mediante reconocimiento de gestos*
Marcos Ventosa Pontes. Supervised by Álvaro Sánchez Miralles.
- *Control de un levitador magnético*
Patricia García de Castro Iribas. Supervised by Juan Luis Zamora Macho and Aurelio García Cerrada.
- *Control de un vehículo equilibrista mediante una raspberry pi*
Carmen Jiménez Cortés. Supervised by Juan Luis Zamora Macho.
- *Desarrollo de un modelo simplificado para la simulación de la dinámica corporal en un impacto*
Federico Gil Fernández. Supervised by Alberto Carnicero López.
- *Desarrollo de una app de reconocimiento facial con técnicas de inteligencia artificial*
Alberto Menéndez Ruiz de Azúa. Supervised by Álvaro Jesús López López.
- *Desarrollo de una plataforma IoT para conocer la calidad medioambiental*
Jorge Suárez Porras. Supervised by Miguel Ángel Sanz Bobi.
- *Desarrollo y fabricación de un sistema de iluminación automático de pasos de cebra*
Francisco Gregorio Lacruz Sisamón. Supervised by Alberto Carnicero López.
- *Design of a self-supplied sensor for an industrial vibrating machine*
Alfonso Vijande Fernández. Supervised by Alberto Carnicero López.
- *Diseño de sistema de control de un péndulo invertido accionado mediante volante de inercia*
Ignacio Martín-Bustamante González-Iglesias. Supervised by Juan Luis Zamora Macho.
- *Diseño de un control por realimentación del espacio de estado de un aerogenerador basado en un generador de inducción doblemente alimentado*
Aurora Navarro Villacieros. Supervised by Luis Rouco Rodríguez.
- *Diseño del control de navegación para un dron parrot mambo*
Marcos Roa Escobar. Supervised by Juan Luis Zamora Macho.

- *Diseño personalizado del cuadro de una bicicleta btt*
Santiago Sanz Ruiz. Supervised by Francisco José López Valdés.
- *Diseño y construcción de un dron de apoyo a personas con discapacidad visual*
Miguel Rodríguez de Robles Pozo. Supervised by Juan Luis Zamora Macho and María Ana Sáenz Nuño.
- *Diseño y fabricación del carenado para Formula Student*
Sergio Hernández Blanco. Supervised by Jesús Jiménez Octavio.
- *Diseño y fabricación del fondo plano para Formula Student*
Nuria González Ochoa. Supervised by Jesús Jiménez Octavio.
- *Diseño y optimización de los bujes delanteros y traseros para Fórmula Student*
Pablo Borreguero Aláez. Supervised by Alberto Carnicero López.
- *Diseño, fabricación y ensayo de un rodete axial de 6 álabes para una turbina Kaplan rápida*
Rodrigo Basante Moreno. Supervised by Eva María Arenas Pinilla.
- *Diseño, fabricación y ensayo de un rodete de 4 álabes para una turbina Kaplan rápida*
Ana Manzano García. Supervised by Eva María Arenas Pinilla.
- *Diseño, fabricación y ensayo de un rodete para una turbina Kaplan*
Miguel Cabello Reyes. Supervised by Eva María Arenas Pinilla.
- *Economía experimental en el análisis del comportamiento de los consumidores en la toma de decisiones de inversión en generación distribuida*
Gonzalo Suardíaz Álvarez del Manzano. Supervised by Salvador Doménech Martínez and Francisco Alberto Campos Fernández.
- *Enchufes inteligentes y vehículo eléctrico*
José Cubelos Ordás. Supervised by José Pablo Chaves Ávila.
- *Entrenador del personal de mantenimiento de la minifábrica ICAI basado en realidad virtual*
Borja Rojo González. Supervised by José Antonio Rodríguez Mondéjar.
- *Estrategias de control en sistemas VSC-HVDC multi-terminal para la mejora de la estabilidad transitoria*
Cristina Yusta Fernández. Supervised by Aurelio García Cerrada and Francisco Javier Renedo Anglada.

- *Estrategias para el control primario de frecuencia entre áreas asíncronas interconectadas por sistemas VSC-HVDC multi-terminal*
María Balbás de la Fuente. Supervised by Aurelio García Cerrada and Francisco Javier Renedo Anglada.
- *Estrategias para el modelado y análisis computacional en la resolución de problemas de programación matemática binivel para la caracterización de las decisiones regulador-agente del sector eléctrico*
Miguel Martínez Velázquez. Supervised by Salvador Doménech Martínez and Francisco Alberto Campos Fernández.
- *Estudio de envejecimiento in vitro de cementos óseos enriquecidos con antibióticos*
Alicia Vivas Hernando. Supervised by Yolanda Ballesteros Iglesias and Eva Paz Jiménez.
- *Estudio de estabilidad de un sistema eléctrico con generación 100% eólica*
Ricardo Noreña Alcalá-Galiano. Supervised by Luis Rouco Rodríguez.
- *Hacia la securización de los sistemas de industriales. El caso de las infraestructuras críticas*
Isabel Rivera Ruiz. Supervised by Álvaro Jesús López López.
- *Hacia la securización de los sistemas de control industriales. El caso de la industria manufacturera*
Carlos Redondo Alamillos. Supervised by Álvaro Jesús López López.
- *Interpretación y análisis de sensibilidad de CNN mediante imágenes sintéticas*
Gabriela Martín Carballo. Supervised by Jaime Boal Martín-Larrauri and Eugenio Francisco Sánchez Úbeda.
- *Modelado y control de un brazo robótico SCARA*
Erik Martín Vik Espárrago. Supervised by Juan Luis Zamora Macho.
- *Navegación autónoma en interiores basada en un LIDAR*
Javier González del Campo Artesero. Supervised by Juan Luis Zamora Macho.
- *Navegación externalizada de robots móviles en un almacén*
Nerea Zabala Orive. Supervised by Álvaro Sánchez Miralles.
- *Optimización del encendido-apagado de subestaciones en una red ferroviaria metropolitana*
Carlos Moro García. Supervised by Ramón Rodríguez Pecharromán and Álvaro Jesús López López.

- *Prepago de contadores de energía utilizando tecnología Blockchain*
Julio Canuto García-Mina Peñaranda. Supervised by José Pablo Chaves Ávila.
- *Primary frequency control quality under high RES scenarios: role of conventional generation*
Jaime Fernández-Kelly Rodríguez-Marqués. Supervised by Luis Rouco Rodríguez and Lukas Sigríst.
- *Sensitivity analysis of impact of clusterization methods in medium-term power system models*
Marta Niño Serrano. Supervised by Sonja Wogrin and Diego Alejandro Tejada Arango.
- *Simulación detallada de la etapa intermedia de un transformador electrónico*
Manuel Florez Montes. Supervised by Aurelio García Cerrada.
- *Simulación y ajuste del conjunto inversor+motor para un vehículo ligero eléctrico de competición*
Juan Fernando Soriano Botella. Supervised by Fidel Fernández Bernal.
- *Sistema de control de cuadricópteros para navegación en exteriores*
Diego Gil de Antuñano Durán. Supervised by Juan Luis Zamora Macho.
- *Sistema de gestión de una cartera bursátil mundial basado en la influencia de algunas variables del análisis fundamental*
Marcos Dhanwani Díaz. Supervised by Juan Luis Zamora Macho.
- *Sistema domótico para el control remoto del acceso a una vivienda*
Eduardo Martínez Jiménez. Supervised by Juan Luis Zamora Macho.

4.1.4 Bachelor's Degree in Engineering in Telecommunications Technologies

- *Actualización del sistema de detección de obstáculos para apoyo a invidentes en la práctica de la hípica*
Francisco José Aranda Serrano. Supervised by José Daniel Muñoz Frías.
- *Algoritmo de predicción de los mercados a través de múltiples criterios como el análisis de redes sociales entre otros*
Luis Puyol Lombos. Supervised by Rafael Palacios Hielscher.
- *Algoritmos de clasificación y clustering para identificar la demanda de una compañía eléctrica y predecirla*
Pedro Murcia Morilla. Supervised by Miguel Ángel Sanz Bobi and David Contreras Bárcena.

- *Análisis de electrocardiogramas mediante técnicas de ingeniería para la detección de enfermedades cardíacas*
Juan Quer Martínez. Supervised by Carlos Mateo Domingo.
- *Análisis de la sensibilidad a la temperatura de un resonador de radio frecuencia*
Daniil Panasik. Supervised by Javier Matanza Domingo.
- *Aplicación de la visión artificial a la seguridad de un robot*
Concepción Góngora Luque. Supervised by Jaime Boal Martín-Larrauri and José Antonio Rodríguez Mondéjar.
- *Desarrollo de un interfaz de visualización en una infraestructura Big Data para una solución de procesamiento de datos masivos*
Cayetano Valero Amores. Supervised by David Contreras Bárcena.
- *Desarrollo de un sistema de procesamiento de datos en un proyecto Big Data*
Pablo Mena Gómez de Merodio. Supervised by David Contreras Bárcena.
- *Despliegue de una solución IoT sobre una infraestructura real Blockchain*
Esther Vázquez Rodríguez. Supervised by David Contreras Bárcena.
- *Entorno de desarrollo basado en técnicas de aprendizaje profundo por refuerzo*
Jaime Fúster De la Fuente. Supervised by Miguel Ángel Sanz Bobi.
- *Ingesta de datos en un proyecto Big Data*
Beltrán Rodríguez-Mon Barrera. Supervised by David Contreras Bárcena.
- *Integración de un sistema de visión artificial en la mano de un robot industrial*
Ana Berjón Valles. Supervised by Jaime Boal Martín-Larrauri and José Antonio Rodríguez Mondéjar.
- *Plataforma interactiva de análisis de imágenes de microscopio con aplicaciones en medicina*
Gonzalo José Echanove Puig. Supervised by Mario Castro Ponce and David Contreras Bárcena.
- *Sensor de radiofrecuencia para la clasificación de líquidos*
Jorge Rivera Rueda. Supervised by Francisco Javier Herraiz Martínez.
- *Sistema de procesamiento de análisis clínicos masivos mediante Herramientas open source*
Ignacio Cabrera Lama. Supervised by David Contreras Bárcena.
- *Tecnología Blockchain aplicada a competiciones en juegos de habilidad*
Mauricio David Muñoz López. Supervised by Rafael Palacios Hielscher.

- *Visualización descriptiva mediante geolocalización del análisis de consumos eléctricos por una compañía eléctrica*
Javier Caminos Colmenarejo. Supervised by Miguel Ángel Sanz Bobi and David Contreras Bárcena.

4.2 Postgraduate teaching

4.2.1 Graduate courses

The graduate courses led by members of the IIT or where they participate as lecturers are listed hereafter.

4.2.1.1 Official Master's Degree in Research in Engineering Systems Modeling (MRE)

Director: Miguel Ángel Sanz Bobi

- *Preliminary research project*
Andrés Ramos Galán
- *Forecasting techniques*
Antonio Muñoz San Roque

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

Director: Luis Olmos Camacho

More information at

<https://www.comillas.edu/en/masters/master-universitario-en-sector-electrico-the-electric-power-industry>

- *Decision support models in the electric power industry*
Antonio Bello Morales, Andrés Ramos Galán, Efraim Centeno Hernández, Javier García González, Tomás Gómez San Román
- *Economy of the electric power industry*
José Pablo Chaves Ávila
- *Electric power systems*
Damián Laloux Dallemagne, Michel Rivier Abbad, Luis Rouco Rodríguez
- *Environmental and renewable energy policy*
Pedro Linares Llamas

- *Fundamentals on electrical engineering and optimization techniques*
Francisco Alberto Campos Fernández, Sonja Wogrin, Damián Laloux Dallemagne
- *Internship*
Luis Olmos Camacho
- *Law and legislation of the power industry*
Tomás Gómez San Román
- *Master's thesis*
José Pablo Chaves Ávila, Carlos Mateo Domingo, Luis Olmos Camacho, Lukas Sigrist, Pedro Linares Llamas, Javier García González, Tomás Gómez San Román
- *Network business: transmission, distribution and smart grids*
José Pablo Chaves Ávila, Rafael Cossent Arín, Luis Olmos Camacho, Pablo Frías Marín, Tomás Gómez San Román, Michel Rivier Abbad
- *Regulation of the electric power industry*
Paolo Mastropietro, Pablo Rodilla Rodríguez, Tomás Gómez San Román
- *Wholesale and retail electricity markets*
Paolo Mastropietro, Pablo Rodilla Rodríguez

4.2.1.3 Master in Railway Systems

Director: Antonio Fernández Cardador

More information at <http://www.icae.upcomillas.es/en/master/msf-en>

- *Electrification*
Luis Rouco Rodríguez
- *Catenary mechanics*
Alberto Carnicero López, Jesús Jiménez Octavio
- *ERTMS and RAMS*
Yolanda González Arechavala
- *Professional practice*
Asunción Paloma Cucala García
- *Design and traffic control advanced systems*
Antonio Fernández Cardador, Asunción Paloma Cucala García

- *Control and Supervision Systems*
José Antonio Rodríguez Mondéjar

- *Master thesis*
Antonio Fernández Cardador, Asunción Paloma Cucala García

4.2.1.4 Master in Project, Construction and Maintenance of High Voltage Electrical Transmission (On-line)

Director: Fernando de Cuadra García

More information at

<https://www.structuralia.com/formacion/master-en-proyecto-construccion-y-mantenimiento-de-infraestructuras-electricas-de-alta-tension>

- *Transmission Lines*
Francisco Miguel Echavarren Cerezo

4.2.1.5 Master's Degree in International Industrial Project Management

More information at

<https://www.comillas.edu/postgrado/master-en-direccion-internacional-de-proyectos-industriales>

- *Internship and final project report*
Pedro Sánchez Martín

- *Operations management*
Pedro Sánchez Martín

4.2.1.6 Official Master's Degree in Biomechanics and Sports Physiotherapy

Director: Ricardo Blanco Méndez

<https://www.comillas.edu/postgrado/master-universitario-en-biomecanica-y-fisioterapia-deportiva>

- *Assessment and objective diagnosis of advanced sports physiotherapy techniques*
María Ana Sáenz Nuño

4.2.1.7 MBA in the Global Energy Industry

Director: Andrés Ramos

- *Marketing management*
Pablo Rodilla Rodríguez

4.2.1.8 Master's Degree in Smart Industry (MIC)

Director: Bernardo Villazán

More information at

<https://www.comillas.edu/en/masters/master-degree-in-smart-industry>

- *Cyber-physical Systems and Robotics*
Jaime Boal Martín-Larrauri
- *Smart Systems Applied to Industry*
Álvaro Sánchez Miralles

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

Responsible: Carlos Morrás Ruiz-Falcó, Cristina Sánchez Rebollo, David Contreras Bárcena, Antonio Muñoz San Roque

More information at

<https://www.comillas.edu/en/masters/master-degree-in-big-data-technologies-and-advanced-analytics>

- *Big Data Architecture*
David Contreras Bárcena
- *Machine Learning I*
Antonio Muñoz San Roque, José Portela González
- *Machine Learning II*
Jaime Boal Martín-Larrauri, Eugenio Francisco Sánchez Úbeda, Miguel Ángel Sanz Bobi

4.2.1.10 Master's Degree in Smart Grids (MSG)

Director: Miguel Ángel Sánchez Fornié

<https://www.comillas.edu/en/masters/master-degree-in-smart-grids>

- *Operation and Planning of Future Distribution Networks*
Rafael Cossent Arín, Francisco Miguel Echavarren Cerezo, Francisco Javier Renedo Anglada, Lukas Sigrist, Pablo Frías Marín

- *Telecommunications for Smart Grids*
Javier Matanza Domingo

4.2.1.11 Master in Mobility and Safety Engineering (MMS)

Director: Alberto Carnicero

<https://www.comillas.edu/postgrado/master-en-ingenieria-para-la-movilidad-y-la-seguridad>

- *Vehicle dynamics*
Alberto Carnicero López
- *19/5000 Light structures*
Alberto Carnicero López, Jesús Jiménez Octavio
- *Advanced materials and joining techniques*
Juan Carlos del Real Romero, Eva Paz Jiménez

4.2.2 Graduate theses supervised at IIT

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

- *Análisis de la curva de oferta de biomasa en España para diferentes sectores industriales*
Jaime Alonso-Cortés Vivancos. Supervised by José Pablo Chaves Ávila and Timo Gerres.
- *Análisis del modelo de negocio de la infraestructura de recarga rápida para vehículos eléctricos*
Javier Zumárraga Martínez. Supervised by Pablo Frías Marín.
- *Análisis y mejora de la calidad del agua potable en el distrito de los Morochucos, en Ayacucho, Perú*
Juan Manzanares Estrada. Supervised by Yolanda Ballesteros Iglesias.
- *Análisis y propuestas de nuevos indicadores de pobreza energética*
Juan Torres Sánchez. Supervised by José Carlos Romero Mora and Roberto Barrella.
- *Aplicación de técnicas de Big Data Analytics para la detección de fugas de combustible en aviones*
Jaime Pizarroso Gonzalo. Supervised by Antonio Muñoz San Roque and José Portela González.
- *Arranque en negro de parques eólicos*
Ignacio Sanz Soriano. Supervised by Luis Rouco Rodríguez.

- *Blockchain Application to enable the financing of solar power plants*
Patricia Oliveros Rubio. Supervised by José Pablo Chaves Ávila.
- *Comparativa medioambiental de diferentes tipos de transporte de viajeros utilizando una perspectiva de análisis de ciclo de vida*
Inmaculada Caballero Ruiz. Supervised by Yolanda González Arechavala.
- *Construction of set-up for the evaluation of non-linear behavior of supercapacitors*
Simone Guidi. Supervised by Romano Giannetti.
- *Creación de herramientas de mejora continua en la planificación logística industrial*
Juan Francisco Aguilera Funes. Supervised by Pedro Sánchez Martín.
- *Desarrollo de un sistema flexible para personalizar el comportamiento de una vivienda inteligente*
Ignacio García Vera. Supervised by Jaime Boal Martín-Larrauri and Miguel Martín Lopo.
- *Design of quantitative models for developing automatic trading strategies in energy markets*
Carlos Jesús Pretel Parejo-Merino. Supervised by Javier Reneses Guillén and Antonio Bello Morales.
- *Despacho económico de sistemas eléctricos insulares incluyendo plantas desaladoras*
José Luis González Pizarro. Supervised by Enrique Lobato Miguélez and Lukas Sigrist.
- *Diseño de una vivienda de bajo coste para las aldeas de Quiché (Guatemala)*
Gonzalo García-Monsalve Olábarri. Supervised by Jesús Jiménez Octavio.
- *Diseño y desarrollo de un pedal de efectos para la guitarra eléctrica*
Luis Cobas Aranguren. Supervised by Javier García González and José Daniel Muñoz Frías.
- *Diseño y evaluación de estructuras porosas (scaffolds) reforzadas con grafeno y obtenidas mediante fabricación aditiva para mejorar la regeneración ósea*
Jorge Zamorano Aleixandre. Supervised by Eva Paz Jiménez.
- *Estudio de la implementación de la tecnología blockchain en un sistema de low voltage distribution Loop*
Diego Plata Rodilla. Supervised by Antonio Vázquez Blanco and Miguel Martín Lopo.

- *Estudio de viabilidad de la participación de los gestores de carga en los mercados de ajuste*
José María Pérez Cruz. Supervised by José Pablo Chaves Ávila and Pablo Rodilla Rodríguez.
- *Estudio sobre riesgos de incendios en infraviviendas*
Fernando José Lozano Zurita. Supervised by Alexis Cantizano González.
- *Estudio y redimensionamiento de la instalación de bombeo de la escuela secundaria Ignacio de Loyola en Mozambique*
Blanca Sáez Jaén. Supervised by Alexis Cantizano González.
- *Formulación de un algoritmo de flujo de cargas parabólico*
Alejandro Ruiz Berciano. Supervised by Francisco Miguel Echavarren Cerezo.
- *Identification method of consumer phase connection in distribution networks*
Juan Víctor Camarena Parada. Supervised by Carlos Mateo Domingo and Fernando Emilio Postigo Marcos.
- *Impacto de la reducción de la generación síncrona en la estabilidad del sistema eléctrico continental europeo*
Eduardo Campillos García. Supervised by Luis Rouco Rodríguez.
- *Impacto técnico-económico de una red HVDC para distintos escenarios de penetración de energía eólica y solar en el sistema eléctrico español*
Pablo Collado Ruiz. Supervised by Javier García González.
- *Implantación de técnicas de mejora continua en el proceso de elaboración artesanal de cerveza*
Jaime Royo Coll. Supervised by Pedro Sánchez Martín.
- *La descarbonización en España: el caso del sector agrícola*
Ernesto García Cantarero. Supervised by José Pablo Chaves Ávila and Timo Gerres.
- *Logística certificada en blockchain*
Ainhoa García Echeverría. Supervised by Francisco Martín Martínez.
- *Mechanical Verification methods for satellites considering flight transients*
Marcos Feria Cerrada. Supervised by Alberto Carnicero López.
- *Mejora de la eficiencia en el procesamiento de muestras en laboratorios clínicos*
Francisco Javier Caballero Fedriani. Supervised by Pedro Sánchez Martín.

- *Metodología de asignación de fases en redes de distribución*
Alberto Maté Piñero. Supervised by Carlos Mateo Domingo and Fernando Emilio Postigo Marcos.
- *Modelado del comportamiento cooperativo de los consumidores en la toma de decisiones de inversión en generación distribuida mediante teoría de juegos cooperativos*
María Elisa de Almansa Garrido. Supervised by Salvador Doménech Martínez and Francisco Alberto Campos Fernández.
- *Modelado y control de la planta AERO de Quanser*
Juan Pablo Dehesa Golding. Supervised by Juan Luis Zamora Macho.
- *Modelo de despacho de energía eléctrica con restricciones de red en potencia activa y reactiva*
Francisco Javier Gibello Rael. Supervised by Lukas Sigrist.
- *Obtención de modelo antropométrico parametrizado de pelvis*
Carlos de León Ortiz. Supervised by Jesús Jiménez Octavio and Francisco José López Valdés.
- *Rediseño de un transformador baja tensión/baja tensión monofásico para compensación de caída de tensión en líneas largas*
Fernanda Zamora Hernández. Supervised by Luis Rouco Rodríguez.
- *Reserve deployment of RES in island power systems*
Servando López Martínez. Supervised by Lukas Sigrist.
- *Simulación detallada de un transformador electrónico*
Jorge López Rodríguez-Roselló. Supervised by Aurelio García Cerrada.
- *Sistema de regulación del alumbrado en vías públicas y gestión remota punto a punto*
Lucía Güitta López. Supervised by Álvaro Jesús López López.
- *Spalling behaviour of concrete in fire: effect of different fibers*
Marta Tena Briceño. Supervised by Alberto Carnicero López and Alexis Cantizano González.
- *Techno-economic analysis of gas and electricity technologies to supply energy services to commercial consumers*
Jaime Dilla Piñero. Supervised by José Pablo Chaves Ávila.
- *Techno-economic feasibility analysis of Brayton supercritical CO₂ power cycles as power conversion system for fusion reactors based on HCPB blanket*
Mar Carmona Sanz. Supervised by Eva María Arenas Pinilla.

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

- *Aplicación de la realidad aumentada a la minifábrica ICAI*
Carlo Alonso Calleja. Supervised by José Antonio Rodríguez Mondéjar.
- *Gestión de una minifábrica mediante realidad aumentada*
Álvaro Bolinches Tejedor. Supervised by José Antonio Rodríguez Mondéjar.
- *Implementación de un sniffer de PRIME con BitScope*
Javier de la Paz Garcillán. Supervised by Javier Matanza Domingo.

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

- *Analysis of the carbon footprint evolution in Spain: economic and international trade drivers*
Mar Carmona Sanz. Supervised by Pedro Linares Llamas.
- *Comparison of different modelling approaches of combined cycle gas turbines and regulatory revision of Third Party Access to the gas network*
Ignacio García Vera. Supervised by Javier García González.
- *Distribution network archetypes for simulating flexibility provided by distributed energy resources*
Diego García Cuenca. Supervised by Tomás Gómez San Román and Carlos Mateo Domingo.
- *Flexible operation of nuclear power plants*
Santiago Cortezo Nieto. Supervised by Tomás Gómez San Román and José Pablo Chaves Ávila.
- *Lerning curves analysis for solar PV*
Lucas Prado Sendagorta. Supervised by Pedro Linares Llamas.
- *Spinning reserve provided by renewable energy sources*
Carmen Prats Soriano. Supervised by Lukas Sigrist.

4.2.2.4 Master's Degree in Smart Industry (MIC)

- *Aplicación de técnicas de big data analytics para la detección de fugas de combustible en aviones*
Jaime Pizarroso Gonzalo. Supervised by José Portela González and Antonio Muñoz San Roque.

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

- *Aplicación de técnicas de big data analytics para la detección de fugas de combustible en aviones*

Jaime Pizarroso Gonzalo. Supervised by José Portela González and Antonio Muñoz San Roque.

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 Eduardo Alonso Rivas 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.

- *Optimization techniques*
Andrés Ramos Galán

- *Preliminary research project*
Andrés Ramos Galán

- *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.

- *Advanced Excel for research*
Jesús María Latorre Canteli, Javier García González

- *Advanced GAMS for applied research*
Andrés Ramos Galán
- *Advanced Matlab for applied research*
Eugenio Francisco Sánchez Úbeda
- *Advanced VBA-Excel for applied research*
Francisco Alberto Campos Fernández, Jesús María Latorre Canteli
- *Data Analysis*
Eugenio Francisco Sánchez Úbeda
- *Data management*
Jesús María Latorre Canteli, Eugenio Francisco Sánchez Úbeda
- *Forecasting techniques*
Antonio Muñoz San Roque
- *Oral presentation of research results*
Efraim Centeno Hernández

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: *Train eco-driving optimisation based on simulation models*
Author: Adrián Fernández Rodríguez
Supervisors: Antonio Fernández Cardador and Asunción Paloma Cucala García
Date: November 20, 2018
- Title: *Designing electricity distribution network charges for an efficient integration of distributed energy resources and customer response*
Author: Ibtihal Abdelmottaleb
Supervisors: Tomás Gómez San Román and Javier Reneses Guillén
Date: December 17, 2018

- Title: *Technical and economic impact of the deployment of a VSC-MTDC supergrid with large-scale penetration of offshore wind*
 Author: Quanyu Zhao
 Supervisor: Javier García González
 Date: February 15, 2019

- Title: *Measuring energy sustainability: a new operational framework based on weak and strong indicators*
 Author: José Carlos Romero Mora
 Supervisor: Pedro Linares Llamas
 Date: April 26, 2019

- Title: *Efficient reduction techniques for a large-scale transmission expansion planning problem*
 Author: Quentin Ploussard
 Supervisors: Luis Olmos Camacho and Andrés Ramos Galán
 Date: May 28, 2019

- Title: *Co-optimization of energy storage technologies in tactical and strategic planning models*
 Author: Diego Alejandro Tejada Arango
 Supervisors: Efraim Centeno Hernández and Sonja Wogrin
 Date: July 03, 2019

- Title: *A model-based approach for the analysis of the European internal natural gas market*
 Author: Aurora del Valle Díez
 Supervisors: Javier Reneses Guillén and Sonja Wogrin
 Date: July 18, 2019

5.4.2 Comillas ongoing theses

- Title: *Mejora de la capacidad de líneas ferroviarias urbanas mediante indicadores dinámicos*
 Author: Luis Miguel Navarro Rodríguez
 Supervisors: Antonio Fernández Cardador and Asunción Paloma Cucala García

- Title: *Development of a wireless Brain-Computer-Interface system.*
 Author: Eduardo Alonso Rivas
 Supervisors: Carlos Rodríguez-Morcillo García and Romano Giannetti

- Title: *Desarrollo de un nuevo concepto de imán superconductor de alta eficiencia para un ciclotrón de producción de radioisótopos*
 Author: Javier Munilla López
 Supervisor: Mario Castro Ponce

- Title: *Total transfer capability computation in AC/DC electric power systems with VSC-HVDC.*
Author: José Carlos Fernández Pérez
Supervisors: Luis Rouco Rodríguez and Francisco Miguel Echavarren Cerezo
- Title: *Mejora de la infraestructura eléctrica de un sistema ferroviario electrificado en cc para incrementar su eficiencia energética, teniendo en cuenta topologías complejas y tráfico representativo*
Author: David Roch Dupré
Supervisors: Asunción Paloma Cucala García and Ramón Rodríguez Pecharromán
- Title: *Adapting Energy Markets in Europe to Integrate Industrial Demand Response.*
Author: Lorenzo August Simons
Supervisors: Pablo Frías Marín and Rafael Cossent Arín
- Title: *Building synthetic distribution networks in US and EU: Algorithms and applications to distributed energy resources integration studies.*
Author: Fernando Emilio Postigo Marcos
Supervisors: Tomás Gómez San Román and Carlos Mateo Domingo
- Title: *Contributions to the assessment of benefits of transmission investment projects: treatment of local environmental benefits and counterfactual problem*
Author: Deniz Sun
Supervisors: Michel Rivier Abbad and Luis Olmos Camacho
- Title: *Short-term forecasting of electricity prices: a hybrid methodology based on fundamental and statistical analysis*
Author: Rodrigo Alejandro de Marcos Peirotén
Supervisors: Javier Reneses Guillén and Antonio Bello Morales
- Title: *Natural gas tariff design: a comprehensive framework for analyzing economic efficiency.*
Author: Celia Mosácula Atienza
Supervisors: Javier Reneses Guillén and José Pablo Chaves Ávila
- Title: *Modelado y optimización de valoración de una empresa con métodos estocásticos usando el descuento de flujos de caja combinado con el Financing Feedback. Aplicación a sector eléctrico*
Author: Cristóbal Cantos Sánchez de Iburguen
Supervisors: Pedro Sánchez Martín and Sara Lumbreras Sancho
- Title: *Contribuciones al Análisis y la Previsión de los Precios del Petroleo*
Author: Pedro Moreno Alonso
Supervisor: Antonio Muñoz San Roque

- Title: *Evaluating the Impact of Industrial Decarbonisation on the Energy System with Special Emphasis on the Electricity Sector*
Author: Timo Gerres
Supervisors: Tomás Gómez San Román and José Pablo Chaves Ávila
- 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 Digital Communication Standards.*
Author: Sonia León del Rosario
Supervisor: José Antonio Rodríguez Mondéjar
- Title: *"Towards a flexible energy-oriented meta-simulator: From virtual to real"*
Author: Miguel Martín Lopo
Supervisors: Álvaro Sánchez Miralles and Jaime Boal Martín-Larrauri
- Title: *"Avoiding The" Lazy Director" Effect: Measures to Reduce Social Loafing in Boards . An Analysis in the Spanish Context"*
Author: Bernardo Villazán Gil
Supervisors: Laura Fernández Méndez and Sara Lumbreras Sancho
- Title: *Volatility premiums as a proxy for ESG scores*
Author: Paraskevas Paraskevas Kamforidou
Supervisors: Isabel Catalina Figuerola-Ferretti Garrigues and Sara Lumbreras Sancho
- Title: *Integration of unconventional power sources in the automatic generation control (AGC)*
Author: Kai Doenges
Supervisors: Lukas Sigrist and Ignacio Egido Cortés
- Title: *Multi-area electricity market modeling using Monte Carlo simulation and intelligent data techniques*
Author: Alberto Orgaz Gil
Supervisors: Javier Reneses Guillén and Antonio Bello Morales
- Title: *Strategic Generation and Transmission Expansion Planning under Uncertainty*
Author: Isaac Camilo González Romero
Supervisors: Sonja Wogrin and Tomás Gómez San Román
- Title: *DSO-TSO Coordination in the European context*
Author: Leandro Lind
Supervisors: Rafael Cossent Arín and Pablo Frías Marín

- Title: *Desarrollo de un modelo de mantenimiento colaborativo inteligente basado en indicaciones de salud y algoritmos adaptativos*
Author: Pablo Calvo Báscones
Supervisors: Miguel Ángel Sanz Bobi and Álvaro Jesús López López
- Title: *Functional time series forecasting: a probabilistic approach*
Author: Guillermo Mestre Marcos
Supervisor: Antonio Muñoz San Roque
- Title: *The rural Electrification Planning problem: strategies and solutions*
Author: Pedro Ciller Cutillas
Supervisor: Sara Lumbreras Sancho
- Title: *Addressing the provision of Universal Access to Modern Energy Services in developing countries: A comprehensive decision support framework*
Author: Andrés González García
Supervisor: Sara Lumbreras Sancho
- Title: *Modeling the particularities of the natural gas sector for a better representation of the strategic short-term optimal generation scheduling*
Author: Pedro de Otaola Arca
Supervisor: Javier García González
- Title: *Contribution of gas to the decarbonisation objectives of Europe. Modelling and regulatory framework*
Author: Ángel Rosso Mateo
Supervisors: Javier Reneses Guillén and Jesús María Latorre Canteli
- Title: *Application of machine learning techniques for the characterization of the European Electricity Market*
Author: Santiago Moreno Carbonell
Supervisors: Eugenio Francisco Sánchez Úbeda and Antonio Muñoz San Roque
- Title: *A Blockchain Proof-of-Concept for Managing Medical Records of Refugees*
Author: Sara Noureldin
Supervisors: Mercedes Fernández García and David Contreras Bárcena
- Title: *Incorporación de un nuevo factor sostenibilidad al modelo de valoración de activos de Fama-French*
Author: Alejandro Rodríguez Gallego
Supervisors: Isabel Catalina Figuerola-Ferretti Garrigues and Sara Lumbreras Sancho
- Title: *Characterisation of energy poor households in Spain proposal of feasible technical and policy solutions*
Author: Roberto Barrella
Supervisors: José Ignacio Linares Hurtado and José Carlos Romero Mora

5.4.3 Submitted theses in other universities

- Title: *Expansion governance of the integrated North Seas offshore grid*
Author: João Gorenstein Dedecca
Supervisors: Paulien M. Herder and Rudi A. Hakvoort
Delft University of Technology. Delft (The Netherlands).
Date: November 30, 2018

6. Other activities

6.1 EES-UETP

The Electric Energy Systems - University Enterprise Training Partnership (EES-UETP) is a consortium of 1 companies and 12 universities and research centers in 10 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
- **France**
 - École Centrale de Nantes
- **Germany**
 - Technische Universität Dortmund
- **Italy**
 - Università degli Studi di Cagliari
- **Portugal**

- Institute for Systems and Computer Engineering of Porto (INESC Porto)
- **Spain**
 - Catalonia Institute for Research in Technology (IREC)
 - 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 Taught courses

- *Advanced Data Analytics for Energy Systems*
INESC Technology and Science (INESC TEC), Porto, Portugal
- *Low Inertia Power Systems*
Universidad Pontificia Comillas, Madrid, Spain
- *Advanced controls for power systems with high penetration of renewables*
Ecole Centrale de Nantes
- *Data-Driven Analytics and Optimization for Energy Systems*
Technical University of Denmark, Denmark

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 the 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:

- Rafael Espejo González, in Dipartimento Energia, Politecnico di Torino, Turin (Italy). February-April 2019.

- Tomás Gómez San Román, in Profesor visitante en el Joint Research Centre. Directorate C. Unit 3, European Commission, Ispra (Italy). November 2018.
- Pedro Linares Llamas, in Energy Policy Research Group, University of Cambridge, Cambridge (United Kingdom). September-December 2018.
- Sara Lumbreras Sancho, in Marshall Memorial Fellowship, The German Marshall Fund of the United States, Washington (United States of America). March-April 2019.
- Rodrigo Alejandro de Marcos Peirotén, in Management Science and Operations, London Business School, London (United Kingdom). November 2018-January 2019.
- Javier Reneses Guillén, in Energy Technologies Area. Electricity Markets and Policy Group., Lawrence Berkeley National Laboratory (LBNL), Berkeley (United States of America). August 2018-July 2019.
- David Roch Dupré, in Faculty of Science and Technology. Department of Information and Communication Sciences, Sophia University, Tokyo (Japan). March-June 2019.
- Diego Alejandro Tejada Arango, in Energy Transition Studies, ECN part of TNO, Amsterdam (Netherlands). October-December 2018.
- Sonja Wogrin, Isaac Newton Institute for Mathematical Sciences, Cambridge (United Kingdom). March 2019.

6.3 Visiting professors

- Tayeb Allaoui, from L2GEGI Laboratory , Université Ibn Khaldoun Tiaret, Tiaret (Algeria). September 2018.
- Tayeb Allaoui, from L2GEGI Laboratory, Université Ibn Khaldoun Tiaret, Tiaret (Algeria). June 2019.
- Tayeb Allaoui, from L2GEGI Laboratory, Université Ibn Khaldoun Tiaret, Tiaret (Algeria). June-July 2019.
- Jenny Alexandra Cifuentes Quintero, from Program of Electrical Engineering, La Salle University, Bogotá (Colombia). November 2018-July 2019.
- Pablo Dueñas Martínez, from MIT Energy Initiative, Massachusetts Institute of Technology, Boston (USA). November 2018-June 2019.

- Paulo Sergio Franco Barbosa, from Water, Energy and Environmental Resources, School of Civil Engineering, Architecture and Urban Design, University of Campinas, Campinas (Brazil). September-October 2018.
- Mustapha Hatti, from Electronic Systems and Energy Storage, Unité de Développement des Equipements Solaires, Tipasa (Tipasa). June 2019.
- Néstor Pérez Mallada, from Escuela Universitaria de Enfermería y Fisioterapia "San Juan de Dios", Universidad Pontificia Comillas, Madrid (Spain). May 2018-May 2019.
- Francisco José Pérez Thoden Van Velzen, September 2018-August 2019.
- Diego Alejandro Tejada Arango, Universidad Pontificia Comillas, Madrid (Spain). July 2019-July 2020.

6.4 Visiting students

- Ibtihal Abdelmotteleb, from Electrical and Control Engineering, Arab Academy for Science, Technology and Maritime, Cairo (Egypt). September-December 2018.
- Manuel Alejandro Álvarez Pérez, from Department of Engineering Sciences and Mathematics, Lulea University of Technology, Skelleftea (Sweden). October 2018.
- Marc F. Barbar, from EECS, Massachusetts Institute of Technology, Cambridge (USA). January 2019.
- Duke Paul Richard Dennison, from Loyola-ICAM, LICET, Tamil Nadu (India). May-July 2019.
- Anna Evans, from Institute for Data, Systems and Society, Massachusetts Institute of Technology, Cambridge, MA (USA). January-February 2019.
- Juan Carlo Intriago Zambrano, from Water Resources Management, Delft University of Technology, Delft (The Netherlands). September 2018.
- Alan Kaduvathookil Sabu, from Loyola-ICAM, LICET, Tamil Nadu (India). May-July 2019.
- Alyssa Marotta, from BioEngineering, Universidad de Florida, Florida (USA). May-July 2019.

- Giovanni Micheli, from Department of Management, information and production engineering, University of Bergamo, Bergamo (Italy). November-December 2018.
- Giovanni Micheli, from Department of Management, information and production engineering, University of Bergamo, Bergamo (Italy). April-June 2019.
- Fabian Neumann, from Department of Informatics, Karlsruhe Institute of Technology, Karlsruhe (Germany). July 2019.
- José David Peñaloza Pérez, from Energetic Systems, Universidad Nacional Autónoma de México, Mexico City (Mexico). February-May 2019.
- Ana E. Shaw, from Computer Science, Universidad de Florida, Florida (USA). May-July 2019.
- Andrew Thompson, from Economics, University Paris-Sud, Paris (France). November 2018-July 2019.
- Matteo Troncia, from Department of Electrical and Electronic Engineering, University of Cagliari, Cagliari (Italy). March-July 2019.

6.5 Courses offered and coordinated to external companies and institutions

The courses offered to companies are frequently related to research projects. The following courses have been given:

- Tomás Gómez San Román, José Ignacio Pérez Arriaga, Carlos Batlle López, Michel Rivier Abbad, Pedro Linares Llamas, Pablo Rodilla Rodríguez, Rafael Cossent Arín, Javier Reneses Guillén, Luis Olmos Camacho, Damián Laloux Dallemagne, *"The regulation of the power sector"*. Florence School of Regulation (FSR). Italy. on-line.
- Pablo Frías Marín, José Pablo Chaves Ávila, *"ISGAN Academy webinars"*. International Smart Grid Action Network (ISGAN). Italy.
- Pablo Rodilla Rodríguez, *"FSR Summer school on regulation of energy utilities"*. Florence School of Regulation (FSR). Italy. Florence, Florence (Italy).

- Luis Olmos Camacho, Luis Rouco Rodríguez, Rafael Palacios Hielscher, *"Coordination of the course committee of the EES-UETP network during the year 2018"*. Electric Energy Systems - University Enterprise Training Partnership Association (EES-UETP). Italy. Madrid.
- Antonio Muñoz San Roque, Eugenio Francisco Sánchez Úbeda, José Portela González, *"Machine Learning Course for Airbus"*. Airbus Defence and Space S.A.U. Italy. Madrid.
- Antonio Muñoz San Roque, Eugenio Francisco Sánchez Úbeda, José Portela González, *"Machine Learning Course for Endesa"*. Endesa S.A. Italy. Madrid.
- Yolanda Ballesteros Iglesias, Eva Paz Jiménez, Juan Carlos del Real Romero, *"Course on testing and analysis of adhesive joints for the training program of the European Engineer of Adhesives (EAE)"*. Asociación Española de Soldadura y Tecnologías de Unión (CESOL). Italy. Madrid.
- Rafael Cossent Arín, Pablo Rodilla Rodríguez, Michel Rivier Abbad, Javier Reneses Guillén, *"FSR Annual Training on the Regulation of Energy Utilities (14th Edition)"*. European University Institute (EUI), Florence School of Regulation (FSR). Italy. Florence, Florence (Italy).
- Juan Carlos del Real Romero, *"European adhesive bonder training"*. Sika, S.A.U. Italy. Alcobendas, Madrid.
- Juan Carlos del Real Romero, Yolanda Ballesteros Iglesias, Eva Paz Jiménez, *"Practical course of mechanical, thermal and superficial characterization of adhesive joints for the European Adhesive Engineer (EAE)"*. Asociación Española de Soldadura y Tecnologías de Unión (CESOL). Italy. Madrid.
- Lukas Sigrist, Luis Rouco Rodríguez, Ignacio Egido Cortés, Francisco Javier Renedo Anglada, *"Workshop for the Clean Energy Corridor of Central America"*. International Renewable Energy Agency (IRENA). Italy. San Salvador (El Salvador).
- José Antonio Rodríguez Mondéjar, Carlos Mateo Domingo, *"Course on power system modeling using CIM"*. Crezer. Italy. Montevideo (Uruguay).
- Ignacio Egido Cortés, *"Course on secondary regulation, RCP and AGC-IIT"*. Axpo Iberia SL. Italy. Madrid.
- Francisco José López Valdés, Jesús Jiménez Octavio, *"63rd Association for the Advancement of Automotive Medicine Conference"*. Association for the Advancement of Automotive Medicine (AAAM). Italy. Madrid.

- Luis Olmos Camacho, Luis Rouco Rodríguez, Rafael Palacios Hielscher, *"Coordination of the course committee of the EES-UETP network during the year 2019"*. Electric Energy Systems - University Enterprise Training Partnership Association (EES-UETP). Italy. Madrid.
- Francisco José López Valdés, *"7th Advanced course on injury biomechanics"*. Inscripciones participantes. Italy. Madrid.
- Antonio Muñoz San Roque, José Portela González, *"Curso Forecasting Techniques para Airbus"*. Airbus Defence and Space S.A.U. Italy. Madrid.
- Javier García González, Andrés Ramos Galán, *"Electric power system modeling for a low carbon economy"*. Massachusetts Institute of Technology (MIT). Italy. Cambridge, MA (United States of America).
- Juan Carlos del Real Romero, *"European adhesive bonder training"*. Sika, S.A.U. Italy. Alcobendas, Madrid.
- Javier García González, *"Practical course on the theoretical foundations of the EXLA tool and introduction to GAMS"*. Endesa Medios y Sistemas S.L. Italy. Madrid.
- Luis Rouco Rodríguez, Lukas Sigríst, Francisco Javier Renedo Anglada, *"EES-UETP Course on low inertia power systems"*. EES-UETP. Italy. Madrid.
- José Portela González, Antonio Muñoz San Roque, Eugenio Francisco Sánchez Úbeda, *"Machine Learning Course for Endesa"*. Endesa S.A. Italy. Madrid.
- Antonio Muñoz San Roque, Eugenio Francisco Sánchez Úbeda, José Portela González, Miguel Ángel Sanz Bobi, *"Machine Learning Course for Endesa"*. Endesa S.A. Italy. Madrid.
- Luis Rouco Rodríguez, *"Contribution to the ECN-EES-UETP Course on advanced controls for power systems with high penetration of renewables"*. Ecole Centrale de Nantes. Italy. Nantes (France).
- Pablo Rodilla Rodríguez, Paolo Mastropietro, *"Course on wholesale market design"*. XM. Italy.

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

members or guest speakers coming from other institutions. The seminars that have taken place in this course are the following ones.

- Roberto Barrella, *"Towards a hidden energy poverty indicator for Spanish households"*. 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Efraim Centeno Hernández, *"Advances on the analysis of energy poverty in Spain"*. Jornada «El reto de la pobreza energética: causas y propuestas». Fundación Naturgy.
- Efraim Centeno Hernández, *"Lesson study: Researching about how we teach to improve how they learn"*. Reunión del GRID (Grupo de Reflexión sobre Innovación Docente). Universidad Pontificia Comillas.
- José Pablo Chaves Ávila, *"Planning, taxes and state of the industry"*. Energías Renovables: Valores sociales y ambientales para la descarbonización. CONAMA 2018.. Fundación CONAMA.
- José Pablo Chaves Ávila, *"Research activities within the Energy Sector in IIT-COMILLAS"*. ETIP SNET WG4. European Technology and Innovation Platform (ETIP); Smart Networks for Energy Transition (SNET); Universidad Pontificia Comillas.
- Pedro Ciller Cutillas, *"Off-grid generation in large electrification-planning problems: a direct-search approach"*. 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Asunción Paloma Cucala García, *"Ecodriving: first results from the European research project MyRails"*. EMRails 2019 - Electrical Measurements for Energy Management in Railway. Instituto Nazionale di Ricerca Metrologica; CIFI; Università degli studi della Campania Luigi Vanvitelli.
- Antonio Fernández Cardador, Asunción Paloma Cucala García, *"Energy efficiency in the railway network"*. La liberalización del sector ferroviario: hacia un nuevo mercado eficiente.. Universidad Pontificia Comillas.
- Adrián Fernández Rodríguez, *"Eco-driving in ATO over ERTMS"*. 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.

- Pablo Frías Marín, "*Demonstration of intelligent grid technologies for renewables integration and interactive consumer participation enabling interoperable market solutions and interconnected stakeholders*". First International Conference on Smart Energy Systems and Technologies - SETS 2018. Universidad de Sevilla.
- Javier García Aguilar, "*Damping controllers of sub-synchronous oscillations for doubly-fed induction generators*". 11th Seminar for Next Generation of Researchers in Power Systems. Technical University of Denmark.
- Timo Gerres, "*The role of nuclear power plants in electricity systems with high RES share*". 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Tomás Gómez San Román, "*Distribution grids: what are the new business models?*". FSR Workshop: New business models in the electricity sector and developments behind the meter. Robert Schuman Center for Advanced Studies - European University Institute - Florence School of Regulation.
- Tomás Gómez San Román, "*How to recover network and policy costs in the energy transition?*". Transition énergétique: Consommateurs et réseaux. Liège Université.
- Tomás Gómez San Román, "*How to recover the long term fixed costs of network infrastructure with declining use, more self-generation, local energy initiatives, etc.*". CEER Workshop on Emerging issues in Network Tariffs. CEER-CRE-FSR.
- Tomás Gómez San Román, "*Tariffs of the future: distribution and retail*". 6th EU-India Smart Grid Workshop. Robert Schuman Center for Advanced Studies - Florence School of Regulation.
- Tomás Gómez San Román, "*How the energy market should be reformed so that it adapts to the characteristics of photovoltaic energy?*". Unión Española Fotovoltaica - UNEF.
- Andrés González García, "*Integrated grid and off-grid energy supply models: regulation, planning, innovation and governance for universal access to energy*". International Conference on Solar Technologies & Hybrid Mini Grids to improve energy access. Universitat de Les Illes Balears.
- Andrés González García, "*How electrification planning can help*". 14º Foro BP de Energía y Sostenibilidad. Cátedra BP de Energía y Sostenibilidad de la Universidad Pontificia Comillas.

- Pedro Linares Llamas, "*Viable business models for the access to electricity*". Acceso universal a la energía eléctrica: retos regulatorios y empresariales. Cátedra BP de Energía y Sostenibilidad de la Universidad Pontificia Comillas.
- Pedro Linares Llamas, "*Three critical crossroads: nuclear closure, transport taxation and decarbonization of the industry*". 16º Encuentro del sector energético del IESE. IESE.
- Leandro Lind, "*Transmission and distribution coordination in power systems with high shares of DER providing balancing and congestion management services*". 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Gregorio López López, "*I choose you! But why?: proposal and evaluation of policies to promote service nodes to switches in PRIME networks*". 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Francisco José López Valdés, "*Main guidelines of I+D+I*". Reunión anual de la Plataforma de la Movilidad Conectada. ITS.
- Sara Lumbreras Sancho, "*Adults in the classroom: teaching strategies with master students*". Seminarios del Grupo de Reflexión en Innovación Docente (GRID) Curso 2018-2019.. Universidad Pontificia Comillas.
- Sara Lumbreras Sancho, "*Cyber-ethic*". Esto No Es una Charla; y Celera.
- Sara Lumbreras Sancho, "*The challenge of transhumanism*". Universidad Menéndez Pelayo.
- Sara Lumbreras Sancho, "*Life from an avatar*". FITUR 2019. FITUR.
- Sara Lumbreras Sancho, "*Robotics and cyborgs. Technological challenges of transhumanism*". Congreso Internacional de Transhumanismo. Desafíos antropológicos, éticos, jurídicos y teológicos. Cátedra de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas.
- Luiz Augusto Nobrega Barroso, "*Harmonizing energy planning and market mechanisms to ensure supply adequacy in electricity markets*". Electricity systems of the future: incentives, regulation and analysis for efficient investment - MESW02. Isaac Newton Institute for Mathematical Sciences.

- Pedro de Otaola Arca, "*Impact of gas third party access in the unit commitment optimal solution*". 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- José Ignacio Pérez Arriaga, "*A «utility-like» approach to large-scale electrification: the electricity company of the future*". FSR Global Forum World Energy Transition. Florence School of Regulation (FSR).
- José Ignacio Pérez Arriaga, "*Energy access*". The power of Knowledge for a clean energy future. Enel Foundation.
- José Ignacio Pérez Arriaga, "*Energy investment in developing countries*". 15th Annual HBS Energy Symposium. Harvard Business School.
- José Ignacio Pérez Arriaga, "*The utilities of the future*". Energy Perspectives. IESE; y Fundación Naturgy.
- José Ignacio Pérez Arriaga, "*Public presentation of the summary of internal sessions of BP Forum on Energy and Sustainability 2019*". Acceso universal a la energía eléctrica: retos regulatorios y empresariales. Cátedra BP de Energía y Sostenibilidad de la Universidad Pontificia Comillas.
- José Ignacio Pérez Arriaga, "*Removing barriers to massive electrification business models*". FSR Global Forum World Energy Transition. Florence School of Regulation (FSR).
- José Ignacio Pérez Arriaga, "*Topics in electricity policy*". Analysis and management of energy and environmental policy. Harvard University; Enel Foundation.
- José Ignacio Pérez Arriaga, "*Utilities of the future, regulatory challenges and innovative tools*". Regulatory challenges and tools to the introduction of new technologies. Inter-American Development Bank - IDB.
- María Ana Sáenz Nuño, "*Review of the SI for the 21st century: the rules of nature create the rules of measurements*". XVIII Semana de la Ciencia. Universidad Pontificia Comillas; Fundación para el conocimiento madri+d; y Comunidad de Madrid.
- Lukas Sigrist, "*Electrification*". The power of Knowledge for a clean energy future. Enel Foundation.

- Lukas Sigrist, "*Studies on the technical and economic potential of renewable energy on the Canary Islands*". Jornada «Un futuro renovable para Canarias». Asociación para el Progreso de la Dirección (APD) Asociación Canaria de Energías Renovables (Acer).
- Diego Alejandro Tejada Arango, "*Power-based generation expansion planning for flexibility requirements*". 14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019. Instituto de Investigación Tecnológica. Universidad Pontificia Comillas.
- Sonja Wogrin, "*Hierarchical optimisation and equilibrium problems in electricity systems: challenges and status quo*". Electricity systems of the future: incentives, regulation and analysis for efficient investment - MESW02. Isaac Newton Institute for Mathematical Sciences.

6.7 Organization of congresses, seminars and workshops

- Roberto Barrella, José Carlos Romero Mora, Efraim Centeno Hernández, "*1ª Sesión Seminario Interdisciplinar. ¿Cómo garantizar el suministro de los hogares vulnerables?*". Endesa. Madrid (Spain). November 2018.
- Pedro Linares Llamas, José Pablo Chaves Ávila, Timo Gerres, "*Plataforma de materiales amigables con el medio ambiente: apoyando la transición en el centro y sur de Europa*". Instituto de Investigación Tecnológica. Universidad Pontificia Comillas. Madrid (Spain). January 2019.
- José Ignacio Pérez Arriaga, "*FSR Global Forum World Energy Transition*". Florence School of Regulation (FSR). Florence (Italy). March 2019.
- Roberto Barrella, José Carlos Romero Mora, Efraim Centeno Hernández, "*II Sesión del Seminario Interdisciplinar. El reto de la estrategia nacional contra la pobreza energética*". Fundación Naturgy. Madrid (Spain). May 2019.
- Javier García González, "*14th Workshop on Industrial Systems and Energy Technologies - JOSITE'2019*". Instituto de Investigación Tecnológica. Universidad Pontificia Comillas. Madrid (Spain). May 2019.
- Asunción Paloma Cucala García, "*El ferrocarril conectado. ¿Cómo van a afectar las nuevas tecnologías del big data, el IoT al ferrocarril?*". Asociación de Ingenieros de ICAI; y Universidad Pontificia Comillas. Madrid (Spain). June 2019.

6.8 Organization and management of other academic activities

- Eva María Arenas Pinilla y Alexis Cantizano González, "*Member of the Scientific Committee of 14th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics - HEFAT 2019*". africaMASSIVE. Wicklow (Ireland). July 2019.
- Mario Castro Ponce, "*Permanent member of Congress of Statistical Physics - FISES*". RSEF / GEFENOL. April 2014- Today.
- Efraim Centeno Hernández, "*Chairman in II Session of the Interdisciplinary Seminar. The challenge of the national strategy against energy poverty*". Cátedra de Energía y Pobreza. Universidad Pontificia Comillas. Madrid (Spain). May 2019.
- Aurelio García Cerrada, "*Permanent member of Seminario Anual de Automática, Electrónica Industrial e Instrumentación - 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.
- Yolanda González Arechavala, "*Organization/Direction of the course «Technology Campus of ICAI 2019»*". Universidad Pontificia Comillas y Fundación Salvador Soler. Madrid (Spain). February-July 2019.
- Pedro Linares Llamas, "*Editor of Papeles de Energía*". FUNCAS. Madrid (Spain). June 2015- Today.
- Pedro Linares Llamas, "*Editor of Energy Transitions*". Springer. Riyadh (Saudi Arabia). June 2017- Today.
- Álvaro Jesús López López, "*Chairman in Roundtable «Virtual reality and augmented reality: applications in Industry 4.0»*". Instituto de Investigación Tecnológica. Universidad Pontificia Comillas. Madrid (Spain). March 2019.
- 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, "*Organization/Direction of the course «7th International Avance Course on Injury Biomechanics»*". Instituto de Investigación Tecnológica. Universidad Pontificia Comillas; University of Virginia. Madrid (Spain). March 2019.
- Sara Lumbreras Sancho, "*Editor of Micro espacios de investigación. Revista científica e interdisciplinar*". Asociación UBUNTU. Madrid (Spain). January 2016- Today.
- Sara Lumbreras Sancho, "*Chairman in Roundtable «Discussions with...science, technology and society»*". Cátedra de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas.. Madrid (Spain). April 2019.
- Sara Lumbreras Sancho, "*Member of the Scientific Committee of Transhumanism International Congress . Antropological, juridical, ethical and theological challenges*". Cátedra de Ciencia, Tecnología y Religión. Universidad Pontificia Comillas. Madrid (Spain). May 2019.
- 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, "*Chairman in Regulatory challenges and tools to the introduction of new technologies. Session: Research in energy regulation: results and methodologies*". Inter-American Development Bank - IDB. Washington (United States of America). September 2018.
- José Ignacio Pérez Arriaga, "*Chairman in 14º BP Forum on Energy and Sustainability. Session 3: Regulatory, political and government challenges.*". Cátedra BP de Energía y Sostenibilidad. Universidad Pontificia Comillas. Madrid (Spain). January 2019.
- José Ignacio Pérez Arriaga, "*Editor of FSR Global Forum Report*". Florence School of Regulation (FSR). Florence (Italy). March 2019.
- José Ignacio Pérez Arriaga, "*Chairman in FSR Global Forum. Session: Enhancing the effectiveness of regional power market institutions for emerging economies*". Florence School of Regulation (FSR). Florence (Italy). March 2019.

- José Ignacio Pérez Arriaga, "*Organization/Direction of the course «Annual training on the regulation of energy utilities»*". European University Institute. Florence School of Regulation (FSR). Florence (Italy). October 2018-June 2019.
- 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 - IJER. September 2012-Today.
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- José Ignacio Pérez Arriaga, Visiting professor at the Center for Energy and Environmental Policy Research (CEEPR) in Massachusetts Institute of Technology (MIT). Cambridge (United States of America). September 2008- Today.

Other activities

- José Ignacio Pérez Arriaga, Member of Scientific Committee in Economics for Energy. Vigo (Spain). July 2010- Today.
- José Ignacio Pérez Arriaga, Member of the Expert Advisory Group for the Director General for Energy of the European Commission for the development of the Roadmap 2050 Energy in Comisión Europea. Brussels (Belgium). May 2011- Today.
- José Ignacio Pérez Arriaga, Member of Editorial Board of the journal «Economics of Energy and Environmental Policy». Editorial Board. in International Association for Energy Economics (IAEE). Stockholm (Sweden). May 2011- Today.
- José Ignacio Pérez Arriaga, Member of the Board of Appeal in Agency for the Coordination of Energy Regulators (ACER). Ljubljana (Slovenia). October 2011- Today.
- José Ignacio Pérez Arriaga, Member of the International Scientific Committee in Enel Fundación. Rome (Italy). November 2011- Today.
- José Ignacio Pérez Arriaga, Member of the Advisory Board in ONGAWA. Madrid (Spain). July 2013- Today.
- José Ignacio Pérez Arriaga, Member of the Scientific Advisory Board in WAME & EXPO 2015. Milano (Italy). July 2013- Today.
- José Ignacio Pérez Arriaga, Director of the On-line Course on Regulation of the Power Sector in Florence School of Regulation; Universidad Pontificia Comillas. February 2015- Today.
- José Ignacio Pérez Arriaga, Course "*Annual training on the regulation of energy utilities*". European University Institute. Florence School of Regulation (FSR). Florence (Italy). October 2018-June 2019.
- José Ignacio Pérez Arriaga, Interview "*Power energy management*" in Radiotelevisión Española (RTVE). Madrid (Spain). November 2018.
- José Ignacio Pérez Arriaga, Tomás Gómez San Román, Member of Editorial Board of the journal «Papeles de Energía» in FUNCAS. Madrid (Spain). June 2015- Today.
- Clara Pérez-Andújar Carretié, BP Chair on Energy and Sustainability Prize for the best final year project 2017-18. «Estudio de mercado y planificación del suministro energético sostenible en la Amazonía peruana». Universidad Pontificia Comillas. Madrid (Spain). March 2019.

- Fernando Emilio Postigo Marcos, Nicolás Mariano Morell Dameto, Grant awards "*Iberdrola Scholarship to research in energy and the environment*". Iberdrola. Madrid (Spain). June 2019.
- Andrés Ramos Galán, Dissertation committee of *Tejada Arango, D.A. «Co-optimization of energy storage technologies in tactical and strategic planning models»*. Universidad Pontificia Comillas. Madrid (Spain). July 2019.
- Andrés Ramos Galán, Coordinator in Red Temática de Optimización bajo Incertidumbre (ReTOBI). Madrid (Spain). June 2005- Today.
- Andrés Ramos Galán, Dissertation committee of *López Salgado, C.J. «Modelo de corto plazo para la optimización conjunta de energía y reserva de sistemas hidrotérmicos frente a incertidumbre»*. Universidad Nacional de San Juan (UNSJ). San Juan (Argentina). February 2019.
- Andrés Ramos Galán, Director of MBA in the Global Energy Industry in Iberdrola; Universidad Pontificia Comillas; y Strathclyde University. Madrid (Spain). May 2015- Today.
- Andrés Ramos Galán, Course "*Electricity Market and Power System Optimization*". Aalborg University. Aalborg (Denmark). February 2019.
- Andrés Ramos Galán, Research proposal evaluator in "*Université Libre de Bruxelles (ULB)*". Université Libre de Bruxelles (ULB). Madrid (Spain). January 2019.
- Andrés Ramos Galán, Project evaluator. The Research Council of Norway. Oslo (Norway). January 2013- Today.
- Andrés Ramos Galán, Reviewer of "*IET Generation, Transmission and Distribution*". Institute for Engineering and Technology (IET). Quebec (Canada). September 2012- Today.
- Andrés Ramos Galán, Reviewer of "*European Journal of Operational Research*". Elsevier Science Ltd.. Amsterdam (Netherlands). September 2012- Today.
- Andrés Ramos Galán, Reviewer of "*IEEE Transactions on Power Systems*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). September 2012- Today.
- Andrés Ramos Galán, Reviewer of "*TOP (International Journal of Operations Research)*". Springer. Berlin (Germany). September 2012- Today.

- Andrés Ramos Galán, Reviewer of "*IEEE Transactions on Smart Grid*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). September 2012- Today.
- Andrés Ramos Galán, Reviewer of "*Annals of Operations Research*". Springer. Dordrecht (Netherlands). September 2012- Today.
- Juan Carlos del Real Romero, Standardization Technical Committee 143 «Adhesives» in AENOR. Madrid (Spain). January 2002- Today.
- Juan Carlos del Real Romero, Member of Editorial Advisory Board of the journal «*Journal of Adhesion*» in Taylor & Francis Ltd.. Philadelphia (United States of America). September 2012- Today.
- Juan Carlos del Real Romero, Member of Editorial Board of the journal «*Applied Adhesion Science*» in Springer. Heidelberg (Germany). July 2013- Today.
- Juan Carlos del Real Romero, Scientific Coordinator in Grupo Español de Adhesión y Adhesivos. Alicante (Spain). October 2013- Today.
- Juan Carlos del Real Romero, Reviewer of "*Journal of Adhesion*". Taylor & Francis Ltd.. Abingdon (United Kingdom). January 2011- Today.
- Juan Carlos del Real Romero, Reviewer of "*Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications*". Sage Publications Ltd.. London (United Kingdom). January 2013- Today.
- Juan Carlos del Real Romero, Reviewer of "*Applied Adhesion Science*". Springer. London (United Kingdom). January 2013- Today.
- Juan Carlos del Real Romero, Reviewer of "*Surface and Coatings Technology*". Elsevier Science S.A.. Lausanne (Switzerland). January 2013- Today.
- Juan Carlos del Real Romero, Reviewer of "*Applied Surface Science*". Elsevier Science B.V.. Amsterdam (Netherlands). January 2013- Today.
- Juan Carlos del Real Romero, Reviewer of "*Journal of Testing and Evaluation*". ASTM International. West Conshohocken (United States of America). January 2014- Today.
- Juan Carlos del Real Romero, Reviewer of "*Composites Part B: Engineering*". Elsevier SCI Ltd.. Oxford (United Kingdom). January 2014- Today.
- Juan Carlos del Real Romero, Reviewer of "*Measurement Science and Technology*". IOP Publishing Ltd.. Bristol (United Kingdom). January 2014- Today.

- Juan Carlos del Real Romero, Reviewer of "*Journal of Materials Science: Materials in Medicine*". Springer. Dordrecht (Netherlands). January 2014- Today.
- Juan Carlos del Real Romero, Reviewer of "*Science and Engineering of Composite Materials*". Walter de Gruyter GmbH. Berlin (Germany). January 2015- Today.
- Juan Carlos del Real Romero, Reviewer of "*Polymer International*". Wiley-Blackwell. Hoboken (United States of America). January 2015- Today.
- Juan Carlos del Real Romero, Reviewer of "*Journal of Composite Materials*". Sage Publications Ltd.. London (United Kingdom). January 2016- Today.
- Juan Carlos del Real Romero, Reviewer of "*Advances in Polymer Technology*". Wiley-Blackwell. Hoboken (United States of America). January 2016- Today.
- Juan Carlos del Real Romero, Reviewer of "*Textile Research Journal*". Sage Publications Ltd.. London (United Kingdom). January 2016- Today.
- Juan Carlos del Real Romero, Reviewer of "*Cellulose*". Springer. Dordrecht (Netherlands). January 2016- Today.
- Juan Carlos del Real Romero, Reviewer of "*Biomimetics*". MDPI AG. Basel (Switzerland). January 2017- Today.
- Juan Carlos del Real Romero, Reviewer of "*Microscopy and Microanalysis*". Cambridge Univ Press. New York (United States of America). January 2017- Today.
- Juan Carlos del Real Romero, Reviewer of "*Mechanics of Advanced Composite Structures*". Semnan University. Semnan (Iran). January 2017- Today.
- Juan Carlos del Real Romero, Reviewer of "*Journal of Materials Processing Technology*". Elsevier Science S.A.. Lausanne (Switzerland). January 2018- Today.
- Juan Carlos del Real Romero, Reviewer of "*Materials Science & Engineering C: Materials for Biological Applications*". Elsevier Science BV.. Amsterdam (Netherlands). January 2018- Today.
- Francisco Javier Renedo Anglada, Member of Working Group C4B4.52 «Guidelines for sub-synchronous oscillation studies in power electronics dominated power systems» in International Council on Large Electric Systems (CIGRE). Paris (France). January 2019- Today.

- Francisco Javier Renedo Anglada, Honorary Distinction to the best Doctoral Thesis. «Control of VSC-HVDC multi-terminal systems to improve angle stability in hybrid HVAC/HVDC electrical transmission systems». Universidad Pontificia Comillas. Madrid (Spain). January 2019.
- Michel Rivier Abbad, Dissertation committee of *Zhao, Q.* «*Technical and economic impact of the deployment of a VSC-MTDC supergrid with large-scale penetration of offshore wind*». Universidad Pontificia Comillas. Madrid (Spain). February 2019.
- Michel Rivier Abbad, Dissertation committee of *Romero Mora, J.C.* «*Measuring energy sustainability: a new operational framework based on weak and strong indicators*». Universidad Pontificia Comillas. Madrid (Spain). April 2019.
- José Antonio Rodríguez Mondéjar, Vocal in Technical Committee of Normalization 207 en «Transport and distribution of electricity», Subcommittee 57-205A in «Power Control and communication systems associates» in AENOR. Madrid (Spain). December 2007- Today.
- José Antonio Rodríguez Mondéjar, Expert in Technical Committee IEC/TC 57/WG 10 «Power system IED communication and associated data models» in AENOR. Madrid (Spain). December 2011- Today.
- José Antonio Rodríguez Mondéjar, Vocal in Technical Committee of Normalization 207 SC 13 «Instruments for measuring electrical energy and load control» in AENOR. Madrid (Spain). December 2011- Today.
- José Antonio Rodríguez Mondéjar, Expert in Technical Committee IEC/TC 57/WG 15 «Data and communication security» in AENOR. Madrid (Spain). December 2011- Today.
- José Antonio Rodríguez Mondéjar, Expert in Technical Committee IEC/TC 57/WG 21 «System interfaces and communication protocol profiles relevant for systems connected to the Smart Grid» in AENOR. Madrid (Spain). December 2011- Today.
- José Antonio Rodríguez Mondéjar, Expert in Technical Committee CENELEC/TC9X «Railway Applications»/WG11 «Energy measurement» in AENOR. Madrid (Spain). December 2014- Today.
- José Antonio Rodríguez Mondéjar, Project evaluator. Agencia Nacional de Evaluación y Prospectiva (ANEP). Madrid (Spain). April 2006- Today.
- Ramón Rodríguez Pecharromán, Reviewer of "*IEEE Transactions on Intelligent Transportation Systems*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). January 2014- Today.

- Ramón Rodríguez Pecharromán, Reviewer of " *IEEE Transactions on Vehicular Technology*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). January 2015- Today.
- Ramón Rodríguez Pecharromán, Reviewer of " *International Journal of Electrical Power & Energy Systems - IJEPES*". Elsevier SCI Ltd. Oxford (United Kingdom). January 2016- Today.
- Carlos Rodríguez-Morcillo García, Francisco Javier Herraiz Martínez, Javier Matanza Domingo, Romano Giannetti, José Daniel Muñoz Frías, I Cross4Health Hackathon in Madrid Prize. Proyecto Sepsisbell Analyzer.. Cross4Health Consortium. Madrid (Spain). January 2019.
- José Carlos Romero Mora, Interview " *A great global «company»*" in Universidad Pontificia Comillas. Madrid (Spain). December 2018.
- Luis Rouco Rodríguez, Member in Institute of Electrical and Electronic Engineers (IEEE). Piscataway (United States of America). January 1989- Today.
- Luis Rouco Rodríguez, Member of the Executive Committee of the National Committee of Spain in International Council on Large Electric Systems (CIGRE). Paris (France). January 2000- Today.
- Luis Rouco Rodríguez, Member in International Council on Large Electric Systems (CIGRE). Paris (France). January 2000- Today.
- Luis Rouco Rodríguez, President of the Spanish Chapter of the Power Engineering Society in Institute of Electrical and Electronic Engineers (IEEE). Seville (Spain). July 2009- Today.
- Luis Rouco Rodríguez, Coordinator of Courses Committee of EES-UETP in University Enterprise Training Partnership (EES-UETP). Porto (Portugal). January 2011- Today.
- María Ana Sáenz Nuño, Delegate expert in ISO / TC 213 Committee «Geometrical Product Specification and verification» in AENOR. Madrid (Spain). September 1999- Today.
- María Ana Sáenz Nuño, Member of the Forum on University Education on Standardization (EUE Forum) in AENOR. Madrid (Spain). September 2015- Today.
- María Ana Sáenz Nuño, Coordinator of the group on Health Metrology of AENOR on CTN 82/SC2/GT 4 BioMet in AENOR. Madrid (Spain). February 2016- Today.

Other activities

- María Ana Sáenz Nuño, Vocal of Committee AEN / CTN 82 «Metrology and Calibration» in AENOR. Madrid (Spain). March 2016- Today.
- María Ana Sáenz Nuño, Coordinator of the forum on Metrology Clinical on AEC in Asociación Española para la Calidad (AEC). Madrid (Spain). July 2016- Today.
- María Ana Sáenz Nuño, Néstor Pérez Mallada, Director of awarded final project in "*Une Awards. Director del TFM «Propuesta de norma técnica para la gestión metrológica en el sector sanitario español » por David Palancar Martínez.*". Asociación Española de Normalización - UNE. Madrid (Spain). October 2018.
- Miguel Ángel Sánchez Fornié, member of the Guiding Group of Futured in FUTURED. Madrid (Spain). June 2019- Today.
- Álvaro Sánchez Miralles, III Impulse of the Smart Industry Prize. Observatorio de la Industria 4.0. Madrid (Spain). November 2018.
- Eugenio Francisco Sánchez Úbeda, Reviewer of "*Energy*". Elsevier. Oxford (United Kingdom). May 2009- Today.
- Eugenio Francisco Sánchez Úbeda, Reviewer of "*Energy Economics*". Elsevier. Amsterdam (Netherlands). October 2012- Today.
- Lukas Sigrist, Treasurer of the Spanish Chapter of the IEEE Power & Energy Society - IEEE PES in IEEE Power & Energy Society (IEEE PES). Piscataway (United States of America). July 2017- Today.
- Lukas Sigrist, Member of Working Group 2018-3 in Congrès International des Réseaux Electriques de Distribution (CIRED). Liege (Belgium). March 2018- Today.
- Lukas Sigrist, Reviewer of "*IEEE Transactions on Power Systems*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). December 2010- Today.
- Lukas Sigrist, Reviewer of "*IET Generation, Transmission and Distribution*". Institute for Engineering and Technology (IET). Quebec (Canada). November 2011- Today.
- Lukas Sigrist, Reviewer of "*IEEE Transactions on Smart Grid*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). September 2012- Today.

- Lukas Sigrist, Reviewer of "*Power Engineering Letters*". IEEE Power & Energy Society (IEEE PES). Piscataway (United States of America). November 2013- Today.
- Lukas Sigrist, Reviewer of "*Electric Power Systems Research*". Elsevier Science Ltd.. Lausanne (Switzerland). January 2014- Today.
- Lukas Sigrist, Reviewer of "*IEEE Transactions on Power Delivery*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). July 2015- Today.
- Lukas Sigrist, Reviewer of "*International Transactions on Electrical Energy Systems*". Wiley-Blackwell. Hoboken (United States of America). July 2015- Today.
- Lukas Sigrist, Reviewer of "*Energies*". MDPI AG. Basel (Switzerland). August 2016- Today.
- Lukas Sigrist, Reviewer of "*Energy Conversion and Management*". Pergamon-Elsevier Science Ltd.. Oxford (United Kingdom). October 2017- Today.
- Lukas Sigrist, Reviewer of "*International Journal of Electrical Power & Energy Systems - IJEPES*". Elsevier SCI Ltd. Oxford (United Kingdom). January 2018- Today.
- Lukas Sigrist, Reviewer of "*Sustainable Energy, Grids and Networks*". Elsevier Science BV.. Amsterdam (Netherlands). February 2018- Today.
- Mariano Ventosa Rodríguez, Member of the Editorial Board of the journal «Anales de Mecánica y Electricidad» in Asociación de Ingenieros del ICAI. Madrid (Spain). September 2006- Today.
- Mariano Ventosa Rodríguez, Member of the Committee on Energy and Engineering Arbitration and Mediation in Asociación Europea de Arbitraje (AEADE). Madrid (Spain). December 2010- Today.
- Mariano Ventosa Rodríguez, Member of the Working Group on Digital Transformation in Círculo de Empresarios. Madrid (Spain). November 2017- Today.
- Mariano Ventosa Rodríguez, Antonio Muñoz San Roque, Interview "*Two engineers and one destination*" in Universidad Pontificia Comillas. Madrid (Spain). December 2018.

Other activities

- Sonja Wogrin, Dissertation committee of *Bylling, H.C. «Bilevel optimization with application in energy»*. University of Copenhagen. Copenhagen (Denmark). February 2019.
- Sonja Wogrin, Member in Society for Industrial and Applied Mathematics (SIAM). Philadelphia (United States of America). January 2014- Today.
- Sonja Wogrin, Member in Institute of Electrical and Electronic Engineers (IEEE). Piscataway (United States of America). January 2014- Today.
- Sonja Wogrin, Reviewer of "*IEEE Transactions on Power Systems*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). January 2010- Today.
- Sonja Wogrin, Reviewer of "*IET Generation, Transmission and Distribution*". The Institution of Engineering and Technology (IET). Hertford (United Kingdom). January 2011- Today.
- Sonja Wogrin, Reviewer of "*IEEE Transactions on Smart Grid*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). January 2012- Today.
- Sonja Wogrin, Reviewer of "*European Journal of Operational Research*". Elsevier Science Ltd.. Amsterdam (Netherlands). January 2014- Today.
- Sonja Wogrin, Reviewer of "*Mathematical programming*". Springer. Heidelberg (Germany). January 2015- Today.
- Sonja Wogrin, Reviewer of "*Energy Economics*". Elsevier. Amsterdam (Netherlands). January 2016- Today.
- Sonja Wogrin, Reviewer of "*Operations Research*". Institute for Operations Research and the Management Sciences (INFORMS). Catonsville (United States of America). January 2016- Today.
- Sonja Wogrin, Reviewer of "*IEEE Transactions on Sustainable Energy*". Institute of Electrical and Electronics Engineers (IEEE). Piscataway (United States of America). January 2017- Today.
- Sonja Wogrin, Reviewer of "*Applied Energy*". Elsevier SCI Ltd. Oxford (United Kingdom). January 2017- Today.

7. Data about IIT

The relevant numbers of the academic year 2018 - 2019 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:

5,4 M€ Turnover

72 Professors and researchers

31 Research assistants

51 Research projects

24 Consultancy projects

12 Services and analysis projects

5 Chapters in books

58 Papers published in JCR journals

13 Papers published in other journals

42 Papers presented at conferences

14 Technical reports

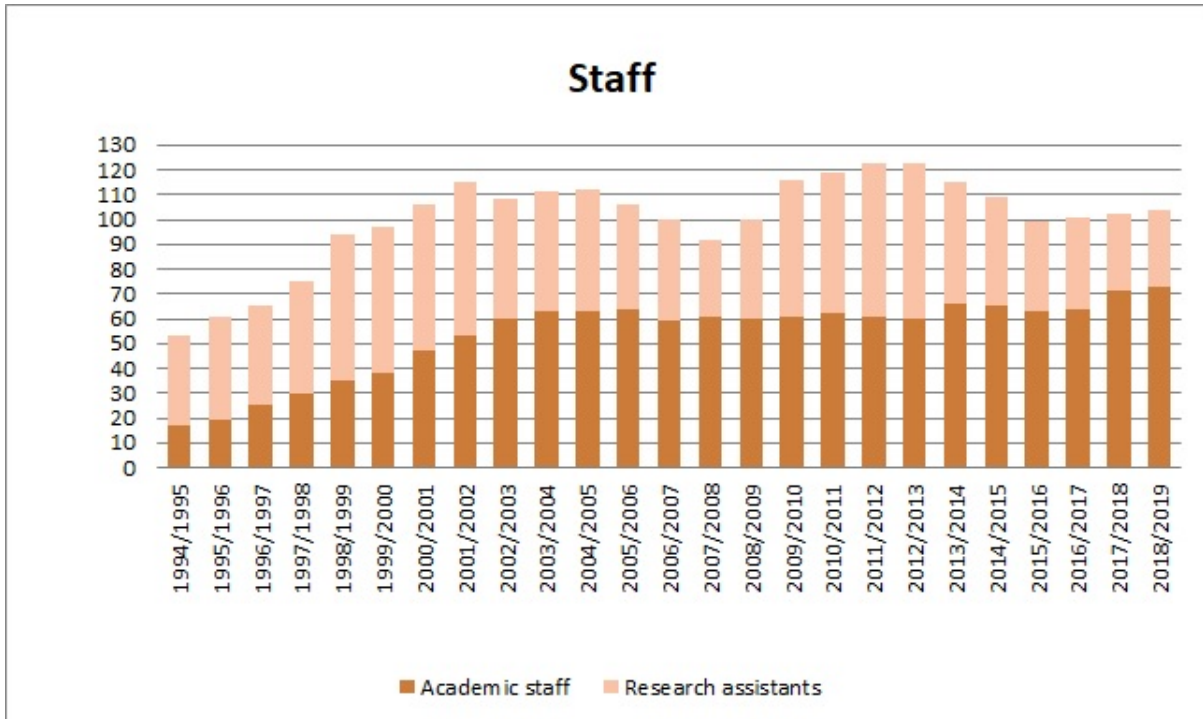
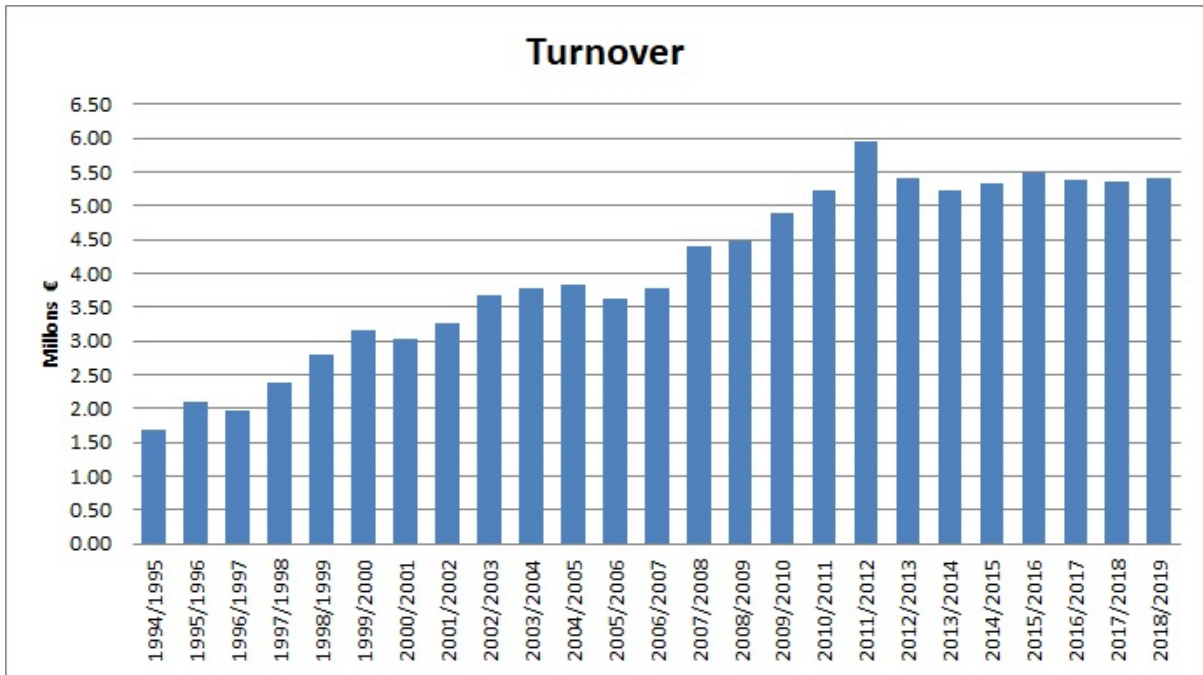
7 Submitted theses

41 Ongoing theses

10 Visiting professors and 15 visiting students

9 International exchanges

25 Courses offered to external entities





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