PARTICIPANT REPORT

on mobility experience provided by the

EU's Erasmus+ Programme

Report prepared by Galyna Strelkova, Associate Professor, PhD.,
The National Technical University of Ukraine “Kiev Polytechnic Institute”,
Institute of Energy Saving and Energy Management
**Mobility Information**

**Call:** 2015 – KA1 – Mobility of Staff in Higher Education – International staff mobility for teaching and training activities

**Participant:**
*First and last name:* Galyna Strelkova  
*Position:* Associate Professor, PhD., The National Technical University of Ukraine “Kiev Polytechnic Institute”, Institute of Energy Saving and Energy Management,  
*E-mail:* galyna.strelkova@ukr.net

**Sending Institution:**
*Name of University:* The National Technical University of Ukraine “Kiev Polytechnic Institute”, Ukraine  
*Faculty/Department:* Institute of Energy Saving and Energy Management  
*Address:* Borschagivska Str., 115.03056, Kyiv, Ukraine  
*Contact person (name and position):* Professor Sergii Denysiuk, Director of Institute of Energy Saving and Energy Management  
*e-mail:* spdens@ukr.net  
*phone:* (+38) 044-2048514

**Receiving Institution:**
*Name of University:* Universitat Politècnica de Valencia, Spain  
*Faculty/Department:* Department of Electrical Engineering  
*Address:* Camino de Vera, s/n, 46022 Valencia  
*Contact person (name and position):* Professor Carlos Roldán Porta, Director of Department of Electrical Engineering  
*e-mail:* croldan@die.upv.es

**Mobility Agreement:**  
*Type of activity:* Staff mobility for training  
*Language of training:* English  
*Date of signing:* February, 2016  
*Duration (excluding travel days):* 15  
*Period of the training activity:* from 30/09/2016 till 16/10/2016

**Overall objectives of the mobility:**

- to develop collaboration between the Department of Electrical Engineering of the Universitat Politècnica de València (hereinafter the DEE UPV) and the Institute of Energy Saving and Energy Management of the National Technical University of Ukraine “Kyiv Polytechnic Institute” (hereinafter the IEE NTUU “KPI”) on education and research within the area of energy efficiency and sustainable energy;

- to facilitate student and staff mobility between the DEE UPV and the IEE NTUU “KPI”;

- to facilitate exchange of professional experiences and best practices on research techniques and pedagogical approaches within the area of energy efficiency and sustainable energy for the 2nd (MSc) and 3rd (PhD) cycles of education;

- to assist development of academic communication between the DEE UPV and the IEE NTUU by searching partners and contacts within the area of energy efficiency and sustainable energy.
Added value of the mobility (in the context of the modernisation and internationalisation strategies of the institutions involved):

- contributing to institutional modernization on education and research at the IEE NTUU “KPI” for the 2nd (MSc) and 3rd (PhD) cycles of education in alignment with educational regulations within EU and qualifications framework of the European higher education;
- contributing to promotion mobility between both institutions and future ERASMUS+ activities;
- contributing to knowledge transfer and exchange of innovative teaching practices, within the area of energy efficiency and sustainable energy;
- contributing to strengthening contacts between institutions, teachers and staff in order to increase international cooperation among education and research on energy efficiency and sustainable energy.
GENERAL INFORMATION

Universidad Politécnica de Valencia (UPV) is a public institution of higher education in Spain. UPV was established in 1971. Focuses of the UPV activities are science, technologies, and high-quality education. All of them are strongly linked to socio-economic context and internationalization.

Today the UPV’s structure is formed by more than 13 schools and faculties, which are combined into several Campuses: Vera Campus (Valencia), Gandia Campus and Alcoy Campus. An academic community of the UPV has over then 42 000 people. It integrates 37 800 students, 2 600 teachers and 1 700 administration staff and personnel services.

According to the Academic Ranking of World Universities (ARWU) 2016 the Universitat Politècnica de València was recognized as the best polytechnic university in Spain.

For details see: https://www.upv.es/

UPV’S INTERNATIONAL ACTIVITIES

In order to promote an international dimension, the UPV implements numerous international exchange programs in higher education that are funded by the EU as well as programmes financed by the UPV.

The International Exchange Programmes Office coordinates the mobility programmes at UPV.

For details see: http://www.upv.es/entidades/OPII/

ERASMUS+ PROGRAM

One of programs, funded by the EU, is Erasmus+ program, which can be provided for partner universities. The National Technical University of Ukraine “Kyiv Polytechnic Institute” (NTUU “KPI”) is in list of partner universities of UPV, thus Erasmus+ Program offers possibilities for exchange of students, teaching and administrative staff between the UPV and the NTUU “KPI”.

2016: Implementation of ERASMUS+ Program for staff mobility for training between Department of Electrical Engineering, Universitat Politècnica de València and Institute of Energy Saving and Energy Management, National Technical University of Ukraine “Kyiv Polytechnic Institute”.

In the beginning of 2016, in the frame of ERASMUS+, negotiations about Mobility Agreement to participate in the Program of staff mobility for training was officially started between the Department of Electrical Engineering of the Universitat Politècnica de València (the DEE UPV) and Institute of Energy Saving and Energy Management of the National Technical University of Ukraine “Kyiv Polytechnic Institute” (IEE NTUU “KPI”). As a result of the negotiations, there was prepared a Mobility Agreement for Mrs. Galyna Strelkova, PhD, Associate Professor of
the IEE NTUU “KPI” and a Program of staff mobility for training in the field of energy research and innovating teaching methods and education.

In February 2016, Prof., D.Sc. Carlos Roldán Porta, Director of Department of Electrical Engineering of the Universitat Politècnica de València and Prof., D.Sc. Sergii Denysiuk, Director of Institute of Energy Saving and Energy Management of the National Technical University of Ukraine “Kyiv Polytechnic Institute” approved and signed the Mobility Agreement for Galyna Strelkova, Assoc. Prof., PhD.

http://ep.kpi.ua/en
http://ep.kpi.ua/en/content/denisyuk-sergii

UPV’s International Exchange Programmes Office of ERASMUS+ organized, coordinated and supported realization of staff mobility for training at the DEE UPV from 30 September to 16 October, 2016.

Professor, Dr. Carlos Roldán Porta, Director of DEE UPV was a supervisor of the Program of staff mobility for training in the field of energy research and innovating teaching methods and education.

The Program of staff mobility for training, provided by the DEE UPV, was focused on knowledge on theoretical approach, innovations and practice of experimental design, methodology and software application for data analysis and optimization in areas of electrical engineering and energy efficiency linked to electricity supply and consumption, renewable energy technologies as well as electricity market and pricing demand response coupled with SMART-grids and SMART-metering systems.

In the frame of the Mobility Agreement, Mrs. Galyna Strelkova, PhD, Associate Professor of the IEE NTUU “KPI” has successfully completed a Program of staff mobility for training in the field of energy research and innovating teaching methods for modernization of the 2nd (MSc) and 3rd (PhD) cycles of education and internalization of academic collaboration.
DEPARTAMENTO DE INGENIERÍA ELÉCTRICA, UPV
DEPARTMENT OF ELECTRICAL ENGINEERING, UPV

GENERAL INFORMATION. Department of Electrical Engineering (the DEE) is a part of the UPV. The DEE activities cover education, research and innovations within the area of electrical engineering and energy technologies for sustainable development. The DEE provides the 1st, 2nd and 3rd cycles of education. In the frame of UPV education system the DEE provides teaching per knowledge areas, which are focused on the area of Electrical Engineering.

The DEE is responsible for teaching, organizing and developing research in the field of Electrical Engineering for bachelor's and master's students. Students also have possibilities to study the subjects on optimization of renewable energy sources in microgrids, efficiency of renewable source application, innovative storage techniques, control system for reliable electricity supply, SMART grids etc.

The DEE also provides materials for the 1st and 2nd cycles of education at the following schools: E. Politécnica Superior de Alcoy, ETS Engineering Design, ETSI Roads, Channels and Ports and ETSI Industrials (ETS/ Escuela Técnica Superior de Ingenieros).

Taking into consideration requests of socio-economic priorities, the DEE is strongly focused on education for Industrial Engineering.

DIRECTOR OF DEPARTMENT OF ELECTRICAL ENGINEERING OF THE UPV: Professor, DSc. Carlos Roldán Porta, croldan@die.upv.es

DEPARTMENT OF ELECTRICAL ENGINEERING, UPV

Location: Vera Campus (building 5E), UPV. For details see: http://www.upv.es/entidades/DIEI/

2ND and 3RD CYCLES OF EDUCATION AT THE DEE UPV

2ND CYCLE EDUCATION. Total amount of credits for Master's Degree is 90 ECTS. Duration of study: 1,5 academic years (including preparation and defend of Master Thesis). The DEE provides teaching for:

- MASTER'S DEGREE IN INDUSTRIAL ENGINEERING
  - Master in Industrial Engineering (Grade I. Access from Electric)
  - Master's Degree in Industrial Engineering (Route 5)
  - Master in Industrial Engineering (Grade I. Access from Electronics and Automation)
  - Master in Industrial Engineering (Grade I. Access from Mechanics)
  - Master in Industrial Engineering (from Grade I. Access Energy)
- MASTER'S DEGREE IN ENERGY TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT
- MASTER'S DEGREE IN ENGINEERING MAINTENANCE
- MASTER'S DEGREE IN MECHATRONICS ENGINEERING
- MASTER'S DEGREE IN INDUSTRIAL CONSTRUCTIONS AND INSTALLATIONS
- MASTER'S DEGREE IN AERONAUTICAL
3rd CYCLE OF EDUCATION. PhD Program: “Industrial Production and Engineering.” The DEE does not provide any special courses for PhD students. The purpose of 3rd cycle of education is to prepare a PhD thesis under supervision of the DEE’s professors. PhD students investigate various topics in the field of Electricity Engineering and Sustainable Energy (modeling and simulation, control systems, testing, measurements, monitoring, diagnostics for electrical machines; SMART Grids; Energy Systems, Renewable Energy Technologies, Efficient Energy Use etc.).

LABORATORIES FOR BACHELOR’S AND MASTER’S STUDENTS ON ELECTRICAL ENGINEERING
INNOVATING METHODS FOR TEACHING:
The DEE applies a broad approach on including innovations in educational process for electricity generation, supply and distribution as well as automatization, monitoring and control.

Innovating methods for teaching on SMART grids and SMART metering are provided during laboratory sessions and practical classes at LabDer - Distributed energy resources laboratory, Laboratories of electric power systems, Laboratory of electrical machine, Laboratory of information technology and industrial automation. Students use LabDer Modelling and Simulation Program, Microgrids for buildings, Virtual Instrument Laboratory applications for operation of electrical machine and appliance and some other innovating methods for teaching.

INTERNALIZATION OF HIGHER EDUCATION AT THE DEE UPV.

ENGLISH THOUGHT COURSES. Most of provided courses and classes are teaching in Spanish. However, some of courses for master students are English thought ones. These are:
- “Energy Audit” and “Advanced Energy Systems and Technologies”, which are teaching by Guillermo Escrivá Escrivá, PhD, Associate Professor at Department of Electrical Engineering of the UPV gueses@die.upv.es
- “Circuits theory”, which is teaching by Carlos Roldán-Blay, PhD, Associate Professor, Department of Electrical Engineering of the UPV, carrolbl@die.upv.es

INTERNATIONAL RELATIONS AND EXCHANGE PROGRAM. Since the DEE is strongly focused on education for Industrial Engineering, thus the possibilities to apply for Master Programmes are linked to a Higher Technical School of Industrial Engineering at the Polytechnic University of Valencia - La Escuela Técnica Superior de Ingenieros Industriales (ETSII) de la Universitat Politècnica de València. The Higher Technical School of Industrial Engineering at the UPV is an institution that performs its duties as a public service for Technical Higher Education in industrial branch of Engineering. As an educational institution is responsible for the administrative management and organization of leading to the award of academic degrees in Industrial Engineering, Chemical Engineering, Industrial Management Engineer, Engineer in Automation and Industrial Electronics and Materials Engineering university education.

SUBDIRECCIÓN DE RELACIONES INTERNACIONALES DE ESCUELA TÉCNICA SUPERIOR DE INGENIEROS INDUSTRIALES (ETSII) –

International Relations Office of Higher Technical School of Industrial Engineering, UPV.

International Relations is responsible for promoting, managing and processing mobility of students, teachers and administrative staff and services through various programs of exchanges (Erasmus+, Euromovex, PROMOE, Sicue-Seneca, APICID, etc.).

STAFF AT INTERNATIONAL RELATIONS OFFICE:

Arantxa Querol Monforte is a Vice Dean for International Relations ETSII at the Universitat Politècnica de València (UPV).

Josefina Soler Martínez is an International Relations Officer.

e-mail: internacional@etsii.upv.es
For details see: http://www.etsii.upv.es/relint
POSSIBILITIES FOR DEVELOPMENT OF ACADEMIC COMMUNICATION FOR JOINT RESEARCH

1. RESEARCH FRAMEWORK OF THE DEE UPV

Research framework of the DEE UPV includes five institutions:

- University Research Institute of Energy Engineering
- Department of Electrical Engineering
- Institute of Electrical Technology
- Institute of Material Technology
- Center of Biomaterials and Tissue Engineering

2. SCOPE OF RESEARCH AREA AT THE DEE UPV

- ELECTRICAL POWER SYSTEMS,
- ELECTRICITY MARKET AND DEMAND RESPONSE,
- RENEWABLE ENERGY TECHNOLOGIES AND ADVANCED ENERGY SYSTEMS,
- SMART GRIDS,
- MICROGRIDS,
- ELECTRICAL MACHINE,
- MODELING AND SIMULATION,
- CONTROL SYSTEMS,
- INFORMATION TECHNOLOGY AND INDUSTRIAL AUTOMATION,
- ADVANCED AUTOMATION PROCESSES.
3. RESEARCHERS: RESEARCH INTERESTS and INNOVATING METHODS FOR TEACHING

➤ AREA: ELECTRICAL SYSTEMS, SMART GRIDS, RENEWABLE ENERGY SOURCES AND ENERGY EFFICIENT TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT, DEMAND RESPONSE

CARLOS ROLDÁN PORTA,
DSC, PROFESSOR,
DIRECTOR OF DEPARTMENT OF ELECTRICAL ENGINEERING, UPV,
e-mail: croldan@die.upv.es

Carlos Roldán Porta is Director and Professor of the Electrical Engineering Department of the UPV. He also works in the Electricity Systems and Markets Area as well as in the LabDER at the Institute of Energy Engineering, UPV (Instituto de Ingeniería Energética, Universitat Politecnica de Valencia).

RESEARCH INTERESTS are focused on electric power systems, industrial production and engineering, renewable and advanced energy systems, electricity systems, demand response and Smart-grids.

TOPICS OF RESEARCH:
- Electric power systems,
- SMART grids,
- Renewable energy sources and energy efficient technologies for sustainable development,
- Demand response,
- Energy efficiency and Energy innovations for Industrial Engineering.

INNOVATING METHODS FOR TEACHING: LabDer and innovating electric power systems.
CARLOS ÁLVAREZ BEL
DSC, PROFESSOR,
DEPARTMENT OF ELECTRICAL ENGINEERING, UPV.
e-mail: calvarez@die.upv.es

Carlos Álvarez Bel is Professor of the Electrical Engineering Department of the UPV. He is also leads the Electricity Systems and Markets Area at the Institute of Energy Engineering, UPV (Instituto de Ingeniería Energética, Universitat Politecnica de Valencia).

For details see: http://iie.webs.upv.es/staff/electricity-systems-and-markets-area-staff

RESEARCH INTERESTS are focused in the area of Electricity Market and Demand Response (DR). Scientific interests cover various problems regarding DR in Deregulated Electricity markets; DR in Smart Grids; participation of customers in DR programs; ability of customers to respond on price signals of electricity market; economic evaluation and assessment of DR for industrial and commercial consumers.

TOPICS OF RESEARCH:
- Energy Systems and Energy Markets,
- Electricity Systems and Electricity Market,
- Demand Response: aggregation, forecasting, management and planning.
- Commercialization of electric energy in free electricity market.
- Decentralized energy and security of energy supply.

INNOVATING METHODS FOR TEACHING: Distributed energy resources and customer demand issues in SmartGrids. Simulation of demand side participation in Spanish short term electricity markets.

GUILLERMO ESCRIVÁ ESCRIVÁ,
PHD., ASSOCIATE PROFESSOR,
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Guillermo Escrivá Escrivá is Associate Professor of the Electrical Engineering Department of the UPV. He also works in the Electricity Systems and Markets Area as well as in the LabDER at the Institute of Energy Engineering, UPV (Instituto de Ingeniería Energética, Universitat Politecnica de Valencia).


RESEARCH INTERESTS are focused on Renewable Energy
Technologies, Efficient Energy Use, Advanced Energy Systems, Electricity Systems and Smart Building. Scientific interests cover various problems regarding tools to encouragement of active demand response in competitive electricity markets and improvement of energy efficiency of the micro-grids components.

TOPICS OF RESEARCH:
- SMART Grids and Micro-grids control system,
- Renewable energy generation and distribution,
- Efficiency of renewable source application, innovative storage techniques,
- Control system for reliable electricity supply,
- Modelling and forecasting of electricity consumption.

INNOVATING METHODS FOR TEACHING: LabDer, Microgrids for buildings. English thought courses for Masters.

CARLOS ROLDÁN-BLAY,
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DEPARTMENT OF ELECTRICAL ENGINEERING, UPV

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Carlos Roldán-Blay is Associate Professor of the Electrical Engineering Department of the UPV. He also works in the Electricity Systems and Markets Area at the Institute of Energy Engineering, UPV (Instituto de Ingeniería Energética, Universitat Politècnica de Valencia).

For details see: http://iie.webs.upv.es/staff/electricity-systems-and-markets-area-staff


TOPICS OF RESEARCH:
- Electric Power Systems,
- Electrical consumption forecast,
- Artificial neural network prediction method for electrical consumption forecasting,
- Integrated Energy Planning for Renewable Energy Sources,
- Microgrids and Demand response

INNOVATING METHODS FOR TEACHING: LabDer, English thought courses for Masters.

LABDER - DISTRIBUTED ENERGY RESOURCES LABORATORY

For details see: http://iie.webs.upv.es/labder_1

General concept of Distributed Energy Resources Laboratory (LabDer). Taking into account, that conventional technologies for renewable energy sources (solar photovoltaic, biomass and wind power) have reached a mature stage of technical development regarding innovation life cycles, a progressive substitution of fossil fuels becomes possible in the future energy scenarios. Economic viability of this substitution is still complicated because of high prices of the technologies. Major problem for penetration of renewable energies is linked to feasibility problem of these sources, especially for stand-alone applications, in grid connected systems.
One of the possible solutions for this problem is to combine several renewable sources in a hybrid system and integrate them with energy storage system. The advances of these Hybrid Renewable Energy Systems (HRES) are possible due to using power electronics. Combining two or more renewable systems allow to solve problem of reliability of each of them and get and improve energy efficiency for whole system. Thus, HRES would allow to overcome the limitations of renewable energies regarding their flexibility, reliability and economic feasibility.

LabDER is a separate laboratory for research and developments, which is located in campus of Vera at the UPV. It was designed to integrate various types of renewable energy sources for reliable electricity supply, to optimize an integration of renewable energy resources in advanced energy systems for generation, distribution and reliable electricity supply as well as to investigate the tools for DR.

**LabDER COMPONENTS:**

**A) Biomass** (2 biomass gasification plants, which are mainly use woody biomass; a power of; each of plant - 10 kW, technology of combustion: downdraft fixed bed technology and bubbling fluidized bed technology, electricity is produced from generated gas in internal combustion engine)

**B) Solar:** photovoltaic solar plant of 2.1 kWp, consisting of crystalline silicon panels (monocrystalline and polycrystalline on the roof of laboratory.

**C) Eolic:** permanent magnet synchronous three-phase wind turbine of 5 kW peak/

**D) Hydrogen:** hydrogen system works as an energy storage system which can consume production excess from renewable energy sources.composed by a 7 kW electrolyser which produce 1 Nm3 of hydrogen at 4 bar pressure and a purity of 99.8%).
E) Microgrid: Micro-grid is a low voltage electrical distribution network: it includes distributed energy sources, storage devices, loads, and control systems. A micro-grid was prepared in LabDER to analyze the control system design and the interaction between each component. This micro-grid has a Xantrex inverter used to join all the components and distribute the energy flow. This device is connected to the bulk grid, renewable resources and variable and programmable loads.
F) Diagnosis and Control: LabDER faces network management under two main control policies: energy efficiency and fast electricity demand. A data acquisition and storage system is also developed. This system is able to perform a detailed power consumption of each system in LabDER. Each energy source has the same functionality as in a large-scale network, but management, control, and diagnosis of micro-grid differ in comparison with large-scale networks.

The Condition Monitoring and Fault Diagnosis system will allow the user to know the state of each device in the LabDER network. Therefore, maintenance and repairing scheduling could be optimized so network reliability will be increased. The system compares real time data acquired from each device with simulated data. The simulator includes analytic and heuristic models. Each one of the signals and residues inputs an intelligent system that computes the current state of each device and the possible faults.
Martin Riera Guasp is Professor of the Electrical Engineering Department of the UPV. He also leads the Electrical Equipment and Systems Area at the Institute of Energy Engineering, Universitat Politecnica de Valencia (Instituto de Ingeniería Energética, Universitat Politecnica de Valencia).

For details see: [http://iie.webs.upv.es/staff/electrical-equipment-and-systems-area-staff](http://iie.webs.upv.es/staff/electrical-equipment-and-systems-area-staff)

**RESEARCH INTERESTS** are focused on electrical machines to prevent devastating consequences of faults and failures and to decrease losses of production and maintenance costs. Scientific interests cover various problems regarding development of predictive maintenance techniques to increase of service time in industrial processes and wind farms and to minimize losses because of unexpected interruptions caused by faults in induction machines.

**TOPICS OF RESEARCH:**

- modeling and simulation, control systems, testing, measurements, monitoring, diagnostics of electrical machines,
- development advanced software (applications) for electrical machines and electronic devices;
- electrical systems efficiency,
- numerical modeling of electrical machines,
- computer models of electromagnetic device,
- advanced automation processes and electrical installations.

**INNOVATING METHODS FOR TEACHING:** virtual instrument laboratory for operation of electrical machine - Laboratory of electrical machine; advanced automation processes and IT - Laboratory of information technology and industrial automation.

Angel Sapena Baño is Associate Professor of the Electrical Engineering Department of the UPV. He also works in the Electrical Equipment and Systems Area at the Institute of Energy Engineering, Universitat Politecnica de Valencia (Instituto de Ingeniería Energética, Universitat Politecnica de Valencia).
RESEARCH INTERESTS are focused on modeling and simulation of operational mode of electrical machines and appliance for testing, measurements, monitoring and diagnostics.

TOPICS OF RESEARCH:
- modeling and simulation of electrical machines and electromagnetic device,
- control systems, testing, measurements, monitoring, diagnostics of electrical machines,
- advanced software (applications) for electrical machines and electronic devices,
- advanced automation processes and electrical installations.

INNOVATING METHODS FOR TEACHING: virtual instrument laboratory for operation of electrical machine - Laboratory of electrical machine; advanced automation processes and IT - Laboratory of information technology and industrial automation.
LABORATORY OF ELECTRICAL MACHINE

Prof. Carlos Roldán Porta, Prof. Martin Riera Guasp, Assoc. Prof. Angel Sapena Baño and Assoc. Prof. Galyna Strelkova
LABORATORY OF INFORMATION TECHNOLOGY AND INDUSTRIAL AUTOMATION
 Thermal Area
JOSÉ MIGUEL CORBERÁN SALVADOR
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RESEARCH INTERESTS: Thermal Area, Energy Innovations