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ICEER2019Aveiro: Energy and environment - challenges towards circular economy

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6th International Conference on Energy and Environment Research, ICEER 2019, July 22–25,
University of Aveiro, Portugal

ICEER2019@Aveiro: Energy and environment - challenges towards circular economy

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Abstract

The 6th edition of the International Conference on Energy and Environment Research, ICEER 2019, took place in the end of July 2019, at the University of Aveiro, Portugal. With most of the participants coming from academia, and a few from the professional field, ICEER series is still growing and attracting increased interest. Energy production, distribution and use are fundamental for the Sustainable Development of nations, showing a clear link between the energy and environment issues. Nevertheless, these matters are frequently dealt with separately, reflecting the way they are taught, and causing strong negative impacts, and hindering progress. With a growing trend in circular economy models applied to common goods production and commercialization, ICEER 2019 had as focus theme the challenges posed by energy and environment research in a circular economy-based model.

This paper presents the main achievements and conclusions of ICEER 2019 participants, through their research in the fields of energy and environment, including a brief analysis of the current requirements of Education on Sustainable Development applied to the modern technological curricula.

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Keywords: Circular economy; Energy; Environment; Sustainable development; Technological education

1. Introduction

ICEER 2019 was the 6th edition of the Energy and Environment Research series of conferences from the SCIENCE and Engineering Institute (SCIEI). ICEER2019@Aveiro was a joint organization of University of Aveiro (UA), of *Instituto Superior de Engenharia do Porto* (ISEP) of the Polytechnic of Porto (P.Porto) and of SCIEI. This edition

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of the ICEER series took place at the University of Aveiro, with the collaboration and promotion of the CESAM, CIETI and LEPABE research laboratories, and of *Climate, Energies* and *Sustainability* journals as media partners.

This Special Issue of *Energy Reports* publishes 150 full papers of the works presented at ICEER 2019. There is no distinction of those that were presented as full oral, poster + oral flash or poster presentation, as the type of presentation depends not only on the quality of the supporting material, but also on the format preferred by their authors and, above all, on the best support for communicating the research results.

In ICEER 2019, there were two Keynote Lectures, followed by parallel sessions for oral presentations, and meeting areas to discuss research results and prospects in smaller groups.

The social events (conference dinner, lunches, coffee breaks, boat trip, and cultural moment) enhanced the networking of participants from different geographies, allowing a fruitful multicultural and multidisciplinary experience.

Therefore, this Special Issue of *Energy Reports*, where the supporting full papers have been gathered, serves as the Proceedings of ICEER 2019 - the 6th International Conference on Energy and Environment Research, 22–25 July 2019, Aveiro, Portugal.

2. Conference topics

The focus of ICEER series includes a broad scope of energy and environment research topics, with the related aspects of education.

ICEER2019@Aveiro provided a privileged environment to discuss themes related to Energy and the Environment Research, having explored recent developments, technologies and concepts in a collaborative way, bringing together researchers from all over the world. The challenges posed by changing the economy from linear to circular models have been thoroughly analysed and discussed. Furthermore, the requirements and specifications of the models of education for today and future professionals were the object of intense debate during ICEER 2019.

The conference was organized under three main themes, as follows:

- Energy
- Environment
- Education for Sustainable Development

Specifically, ICEER 2019 contributions covered 14 topics, each one forming at least one conference session:

- Biomass and Bio-based Products
- Climate Change and Global Warming
- Eco-design and Eco-efficiency
- Ecology and Biodiversity Conservation
- Education for Sustainable Development
- Efficient Use of Resources
- Energy Efficiency
- Energy Policy, Economics, Planning and Regulation
- Environmental Impact Assessment
- Environmental Policy, Economics, Planning and Regulation
- Environmental Pollution and Pollution Control
- Integrated Energy Systems
- Modelling, Simulation and Forecasting of Energy and Carbon Markets
- Sustainable Communities

As we can see, in the 2019 edition of ICEER, particular attention was devoted to energy production, especially the one derived from renewable sources, besides to energy distribution and efficient use. However, the environmental aspects of energy were also addressed by several researchers. In addition, there was also a strong focus and discussion on policy, eco-management systems and regulations associated with energy and environment topics, not only due to climate change mitigation, but also due to sustainability objectives. The link between energy and water availability/scarcity and food resources has become of the outmost importance, and it can also be the engine of development and nations' security. An extended debate on Circular Economy has shown the need for profound transformation of the mechanisms governing today's engineering and economics, i.e., production and consumption, to preserve the value and usefulness of the materials and energy used and to improve the productivity.

3. Organizing, scientific and technical committees

The quality of a Conference largely depends on the expertise and generosity of their Scientific and Technical advisors, as members of the Scientific and Technical Committee (STC) who have the huge task to peer review the large number of papers submitted. Furthermore, in some particular cases, additional reviewers were invited to peer review a few papers. Thus, the ICEER 2019 Chairs and Program Chairs would like to express their deepest gratitude to the Scientific and Technical Committee (STC) and Invited Reviewers. Second, we must not forget the Staff of SCIEI who allowed us to run this process smoothly. The Scientific and Technical Committee of ICEER 2019, as well as the other relevant is described below.

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4. Conference statistics

The 6th edition of ICEER received 245 submissions by 648 authors from 54 countries, from 5 continents in the world. At least two reviewers (from the 84 STC members and 4 invited reviewers) thoroughly reviewed these 245 submissions. 155 full papers and 20 abstracts have been accepted for oral/poster+oral flash and poster presentation, respectively.

The distribution of participants (180) by country is shown in Fig. 1.

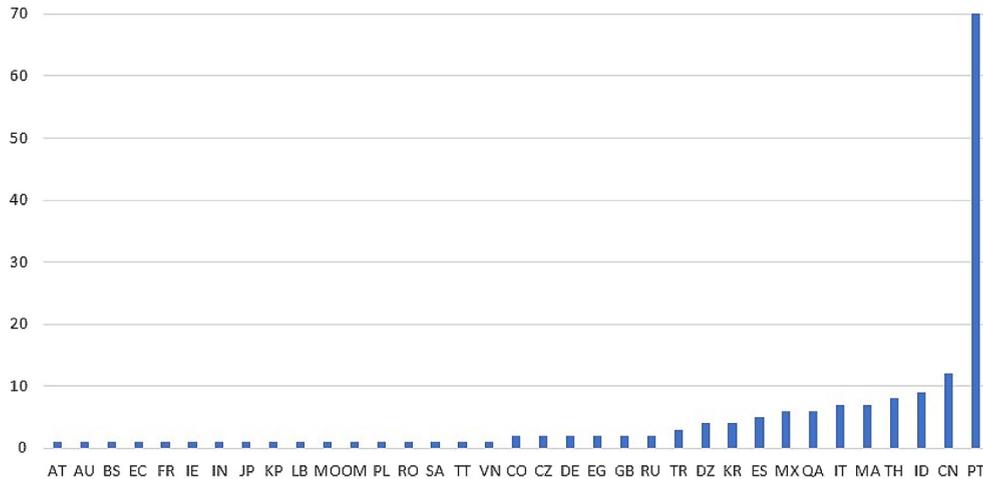


Fig. 1. Distribution of ICEER 2019 participants by country.

Fig. 1 shows that the highest number of participants (42%) came from Portugal, followed by China (7%), India and Thailand (5% each), Morocco, Italy, Qatar and Mexico (4% each) and Spain (3%). This broad distribution of participants confirms the still rising tendency of internationalization of ICEER, with important delegations coming from very different places in the world. Although authors from Asian countries have demonstrated huge willingness to be present in ICEER 2019, their participation was limited. The ICEER community includes now a significant number of participants from previous editions, coming from a very large number of countries, who are bringing new authors to the conference. With such a broad range of cultures, this conference was an inclusive arena, able to promote the free and active participation of the delegates from 35 countries from five continents, as stated above. In spite of earlier decision communication, there was a significant number of potential authors who could not attend ICEER, due to difficulties in obtaining a travel Visa.

In what concerns the topics most hotly presented and debated by researchers and practitioners who attended ICEER 2019 a brief statistic of the number of papers presented within each topic is shown in Fig. 2. From the list of 15 topics, ICEER 2019 had the largest number of presentations related to Biomass and bio-based products, followed by Energy efficiency. The third biggest group of contributions was the one related to Modelling, simulation and forecasting of energy and carbon markets. Other two hot topics debated in ICEER 2019 were Environmental policy, economics, planning and regulation and Integrated energy systems. The least participated topic, in terms of presentations, was Climate change and global warming, a new topic included in this conference. Nevertheless, authors of full papers that were apparently only environment related have been challenged to discuss in their papers, how their research would impact on energy consumption, distribution or use, a challenge that was promptly accepted.

5. Keynote speakers and lectures of ICEER 2019

In ICEER 2019 there were two Keynote Lectures, that took place in the morning of the second and third days of the conference. Two international specialists accepted the invitation to share their expertise on their preferred topics within the scope of the conference, aiming to launch vivid debate and interaction among participants. This debate extended through the social moments. Experienced and not so experienced researchers had the opportunity to meet these experts, without any kind of gender, cultural or generational barriers hindering participants' interaction. The

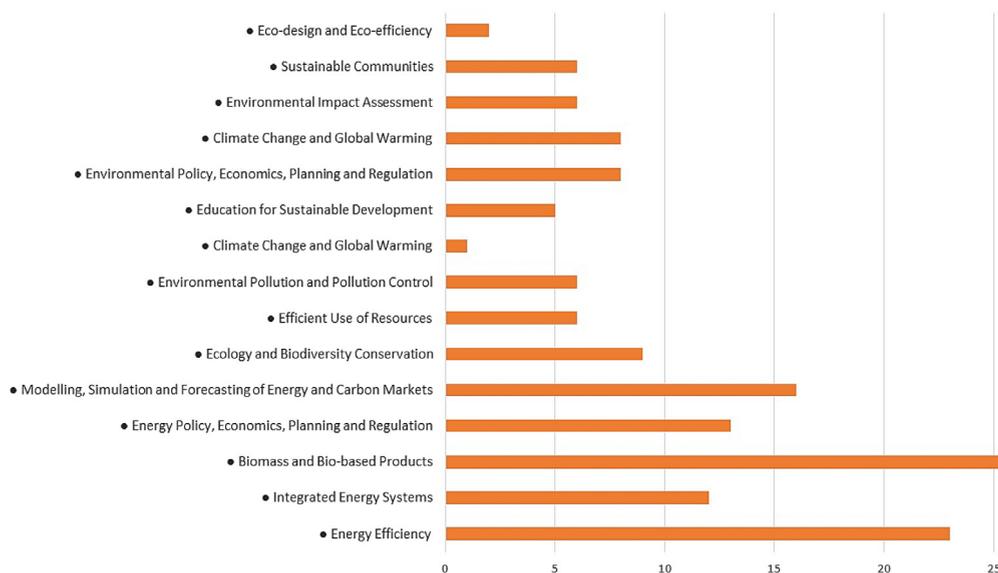


Fig. 2. Distribution of ICEER 2019 papers by topic.

ICEER Chairs and Program Chairs are deeply grateful to Prof. Didac Ferrer-Balas and Prof. Zita Vale for sharing their enormous and valuable expertise.

Didac Ferrer-Balas (Barcelona, 1974) graduated as an industrial & materials engineer in 1997. He obtained a doctorate in materials science in 2001 from the Technical University of Catalonia (UPC-Barcelona Tech). Since year 2000, he has been in charge of sustainability management at the University, with a wide number of projects in curriculum development, sustainable education, sustainable management, interdisciplinary research and communication. He is currently the head of the Innovation and Community Office at UPC, working on issues as sustainability, gender, inclusion or collaboration, with special focus as coordinator of the Nexus24 collaborative communities programme. He has been member of the editorial boards of Journal of Cleaner Production and of the journal Sustainability Science. He has been in the scientific committees and the chair of various international conferences (EESD, AGS, EMSU). He has taught in the Masters of Sustainability at UPC, in the fields of sustainable organizations, industrial ecology and sustainable technology. Prof. Didac Ferrer-Balas is also co-founder (and was innovation director) of Tarpuna, a non-profit cooperative that creates social inclusion through sustainability projects in the fields of social fabrication, social farming, fuel poverty, collaborative consumption, among other emerging fields. He has been advising the *Ajuntament de Barcelona* for the *Ateneus de fabricació* network, among other collaborations.

With over 20 years of experience working for sustainability at the university and the community in many different projects, Prof. Didac Ferrer-Balas is convict that transforming society towards sustainability is not a matter of knowledge availability. It is fundamentally a matter of “*shared purposes and of the type of relationships and organizational systems we build and use to develop our goals*”.

In his words, although one could easily give up the pursuit for sustainability, the good news is that there is an inspirational model in nature. Living systems have succeeded to survive through million years, thanks to some fundamental principles as interdependence, cooperation, self-organization, recycling, flexibility and diversity. The question is thus: How can we learn from living systems and add human intention on the top to drive the urgent transition humanity needs?

When applied, those principles can help us to transform any community, as our schools, neighbourhoods, companies or universities. Yet, other questions arise then: How to do it? Can we manage those transitions? What is the toolbox that sustainability professionals need today? Are we educating our students for that?

In his Keynote Lecture entitled *The path towards a sustainable community: A collaborative approach inspired by living systems*, Prof. Didac Ferrer-Balas presented a case of energy efficiency success, at the *Universitat*

Politécnica de Catalunya (UPC), carried out in the period 2011–2014. After the success achieved in the project, UPC management and the team in charge of this project started building a new operative system to manage the university on a collaborative mode, called Nexus24. After 5 years of experiences, there are several examples of the potential of collaboration in communities and Prof. Didac Ferrer-Balas could share some of his learning, management experience and monitoring results. Interestingly, one of the measures that was most successful in motivating the academic community towards sustainability was the sharing of a significant part of the revenue from energy savings, which allowed the replication to other faculties and the increased participation of the academic community.

Chaired by Prof. Carlos Borrego, *Emeritus* Professor at the Department of Environment and Planning (DAO) of the University of Aveiro and Conference Chair, this lecture motivated a very interactive and debated session, with several researchers from academia sharing also their experience. Knowing that Nature itself is resource-efficient and can inspire or support innovation, there was an interesting discussion on the use of nature-based solutions as a solution that will increase society's economic, social and environmental resilience. It was highlighted the need to implement solutions that bring more nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.

Zita Vale (Porto, 1963) is full professor at the Polytechnic Institute of Porto. She received her diploma in Electrical Engineering in 1986 and her PhD in 1993, both from the University of Porto. Prof. Zita Vale works in the area of Power and Energy Systems, with special interest in the application of Artificial Intelligence techniques. She has been involved in more than 50 funded projects related to the development and use of Knowledge-Based systems, Multi-Agent systems, Genetic Algorithms, Neural networks, Particle Swarm Intelligence, Constraint Logic Programming and Data Mining. Energy resources management, distributed generation, demand response and electric vehicles are important topics of her research in the current projects. The main application fields of these projects comprise: 1) Smart Grids, accommodating an intensive use of Renewable Energy Sources, Distributed Energy Resources (DER) and Distributed Generation (DG). She addresses the management of energy resources, the impact of DER on electrical networks, the negotiation of DER in electricity markets, demand response, storage, energy management in buildings, and electrical vehicles, including the ones with gridable capability (V2G); 2) Electricity markets, addressing contracts, prices and tariffs, decision-support for market participants, aggregation, ancillary services, and wholesale and local market simulation; 3) Control Centre applications, namely intelligent alarm processing, intelligent interfaces and intelligent tutors. Prof. Zita Vale published over 800 works, including more than 100 papers in international scientific journals, and more than 500 papers in international scientific conferences.

In her Keynote Lecture, entitled *Sustainable and intelligent management of distributed energy resources in buildings and smart grids*, Prof. Zita Vale highlighted that ensuring current and future energy needs for dynamic economies and highly demanding societies raises environmental concerns. Smart grids put together renewable-based generation, demand response, distributed storage, and electric vehicles, bring new solutions able to significantly reduce the environmental impact of traditional electrical energy generation and energy use. However, the actual use of such resources in an intensive way, poses new technical and business challenges to the power and energy sector. The keynote addressed the current and envisioned solutions for the management of these distributed energy resources, enabling the implementation of sustainable energy solutions in the frame of a user centric and market driven approach for smart grids and electricity markets. Artificial intelligence-based approaches bring important new possibilities enabling efficient individual and aggregated energy management. Such approaches can provide different players aiming to accomplish individual and common goals in the frame of a market-driven environment with advanced decision-support and automated solutions. An example of such approach is the *MARTINE* (Multi-Agent based Real-Time Infrastructure for Energy), a platform to support real-time energy management and simulation of buildings and smart grids that was described by Prof. Zita Vale. The platform was used as the basis to present different data-driven and cognitive approaches to support efficient energy management in buildings and smart grids.

Chaired by Prof. Nídia Caetano, Coordinator Professor at the Chemical Engineering Department of ISEP and Conference Chair, this lecture served as the departing point for a highly participated debate. It was highlighted the importance of technical solutions to support sustainable management of buildings, of which the University buildings are of the outmost importance, as they represent a privileged showcase of the best technical solutions that exist and that can be disseminated easily by their graduates, who will be the experts in real life companies.

6. ICEER 2019 at a glance

Besides the two Keynote Lectures, eighteen sessions were organized for full oral presentations and three other sessions for oral flash presentations, where authors had to pitch their findings in a three minutes speech. Posters were

presented during the coffee-breaks, with authors and participants interacting in an informal environment (Fig. 3). The first day of the conference was devoted to registration and socializing, followed by two days of a very intense work, but it paid the efforts, as very interesting research results could be shared and discussed.

All the four parallel sessions in the second day and three parallel sessions in the third day of the conference were chaired by at least one conference member from academia, who promoted the discussion of the research presented. Participants of ICEER 2019 had the opportunity to listen to and interact with experts in different fields of energy and environment.

Selecting the best oral presentation is not an easy task. Nevertheless, the Session Chairs have been invited to perform this task, either on their own, or assisted by the audience. Some of the awarded best presentations are briefly described below.

Pio et al. performed the study of *in-situ* application of ilmenite (FeTiO_3) for upgrading the producer gas from a pilot-scale bubbling fluidized bed gasifier and analysed its influence on the gas characteristics and gasifier performance. They concluded that ilmenite caused an increase of H_2 concentration and H_2 :CO molar ratio of 35.1% and 40.7%, respectively, improving the suitability of the gas produced for advanced gas applications that require high H_2 :CO ratios. (*Ilmenite as low-cost catalyst for producer gas quality improvement from a biomass pilot-scale gasifier*).

Moreira et al. studied the fluidized bed combustion of chars made from two different biomass species, vine and kiwi pruning wastes, operating in bubbling bed regime. They concluded that for the tested chars the combustion was kinetically controlled, and applied the Arrhenius law to the kinetic data for each char, to obtain the corresponding pre-exponential factor and activation energy. (*Determination of kinetic data through the fluidized bed combustion of chars made from Vine and Kiwi Pruning wastes*).

Worldwide, over 95% of biodiesel production feedstocks come from edible oils, which is not sustainable. The waste cooking oils (WCO) are an alternative feedstock for biodiesel production; they are significantly cheaper and its use has environmental benefits due to being a waste recovered instead of eliminated. However, the production process needs further optimization. Therefore, in this work Solano et al. optimized the process to produce Fatty Acid Methyl Esters (FAME) using the response surface methodology (RSM) and a Box-Behnken experimental design applied to mixtures of refined palm oil (RPO) with WCO using a residual solid material as catalyst (biomass fly ashes). They studied the influence of four operational variables (catalyst loading, methanol/oil molar ratio, RPO/WCO ratio and reaction temperature) on FAME yield. The higher FAME yield achieved using the RSM was 77.1% for: 14.6 wt% of catalyst loading, 5.42/1 of methanol/oil molar ratio, 14.8 wt% of RPO in the oil mixture at 55 ° C reaction temperature. (*FAME production from residual materials: optimization of the process by Box-Behnken model*).

Within the framework of European Directives, and contributing to energy decarbonization, pellets from locally produced biomass can serve as a substitute of coal, which still are widely used for local heating in the Czech Republic and other Central and Eastern European countries. Wood chips from short rotation coppice plantations (SRC) is a suitable source of biomass to produce pellets for local space heating. Tomáš et al. modelled the cost of pellets production from biomass from SRC plantations using cash flow simulation related with all parts of pellets production chain. They estimated the cost of pellets, considering the whole production cycle from biomass cultivation to pelleting, ranges from 7.85–8.55 €/GJ for typical yields of SRC plantations 8–10 t(DM)/(ha,year). Further, they concluded that to achieve competitiveness with domestic (Czech) brown coal (6.5–7.3 €/GJ) for local space heating, it would be necessary either to increase the ecological tax on coal 10 fold (to about 3.3 €/GJ) or to subsidize the establishment of the SRC plantation (1300 €/ha) or to double the area subsidy per year (to 390 €/ha,year). (*Impact of pelleting cost on competitiveness of intentionally grown biomass for local space heating: case example of the Czech Republic*).

In the Northern Africa, Morocco economy still relies heavily on agriculture, with vegetal and animal waste abundantly available. This waste used to be disposed of by incineration, to generate electricity, with loss of nutrients and causing high environmental impacts. Therefore, anaerobic digestion is being used more. El Ibrahimy et al. studied a wet, mesophilic, anaerobic co-digestion of animal and vegetable waste, including a thermal study where it was investigated the influence of the liquid recirculation flowrate and the substrate's presence/absence on the heat transfer to the digester. Further, they performed a Computational Fluid Dynamics (CFD) analysis using FLUENT software, to better understand the fluid's behaviour inside the digester. Their results showed that a higher recirculation flowrate increases heat delivery to the effluent but has a negative impact on pressure drop.

Conversely, the liquid percolated more easily and through a larger portion of the waste at lower flowrates. (*Anaerobic co-digestion in a liquid recirculation pilot-scale reactor: thermal and hydraulic study*).

The Ichkeul Lake ecosystem was registered as a biosphere reserve in 1977 (MAB-UNESCO Convention), a UNESCO World Heritage site in 1979, and a RAMSAR site in 1980. Damming and global warming drought drastically diminished the freshwater supply to the lake, causing water level and salinity fluctuation throughout the year. Consequently, the water clarity of this shallow lake was altered. If the situation persists, it will seriously affect the hydromorphology and ecology of this wetland. Ouni et al. modelled the 3D hydrodynamic water circulation in the Ichkeul Lake and the transport of the Total Suspended Matter (TSM). Upon calibration, this numerical model showed that the sedimentary material supplied by connecting rivers will be primarily deposited in a limited area of influence (around the mouth of rivers), after that, it may be subject to further resuspension and transport. These results will allow planning intervention to reverse the adverse effects caused by dams that intersect the normal water flow to lakes. (*Numerical modelling of hydrodynamic circulation in Ichkeul Lake-Tunisia*).

Ren et al. applied a soft computing approach to estimate surface vector fields using the observed radar data provided by high frequency radar system installed in Galway Bay area to monitor near real time surface currents and waves since July 2011. Results indicate that soft computing is a novel and promising method to estimate surface vector fields. It provides a potential way to obtain useful information of coastal water body for marine renewable energy development. (*Surface vector fields estimation using soft computing and remote sensing data*).

Flores Mateos and Hartnett developed an alternative approach for simulating turbine array energy capture, momentum sink-TOC, to improve conventional methodologies for assessing tidal-stream energy resource. Momentum sink-TOC was implemented in two depth-average complex hydrodynamic models to evaluate tidal-stream energy resource using a fence. While the first model solves smooth and slow flows (SSF), the second model solves rapidly varying flows (RVF). Calculation of head drops across turbine arrays enabled the calculation of turbine efficiency and power available for electricity generation. (*Tidal power assessment - a novel modelling approach*).

Roque et al. studied a farm of Kite Power Systems (KPS) in the field of Airborne Wind Energy (AWE), in which each kite is connected to an electric ground generator by a tether. They addressed the problem of selecting the best layout of such farm in a given land area such that the total electrical power generated is maximized. The kites, typically, fly at high altitudes, sweep a greater area than that of traditional wind turbines, and move within a conic shaped volume with vertex on the ground station. Considering a specific KPS and wind characteristics of the location, they studied the power curve as a function of the tether length and elevation angle. Combining these results with terrain characteristics and introducing constraints concerning kite collision avoidance, Roque et al. developed and implemented a heuristic optimization procedure to devise the best layout of a KPS farm. (*Layout optimization of an airborne wind energy farm for maximum power generation*).

Integration of renewable resources in the energy mix is fundamental in grid-connected systems as well as in off-grid applications. However, designing hybrid renewable energy systems (HRES) presents some challenges and difficulties. Alberizzi et al. developed a methodology based on Mixed Integer Linear Programming (MILP), using the software Matlab© to calculate the optimal sizing of a hybrid off-grid Solar–Wind system with battery storage, designed to meet the electric demand of a mountain lodge located in a remote area at an altitude of 2200 in South Tyrol (Italy), and replace a diesel generator. (*A MILP algorithm for the optimal sizing of an off-grid hybrid renewable energy system in South Tyrol*).

To improve the energy efficiency of refrigeration cycles, Sheikhnejad et al. proposed a new application of a Tesla turbine (TT) that was represented as a regenerative system that minimizes the energy wasted without compromising the system output quality or sacrificing standards of design. They performed a 3D thermohydrodynamic analysis of the Newtonian turbulent compressible flow of high-pressure methane through the TT under different configurations and operational conditions. They used a complex unstructured grid generation to produce a low-skewness mesh for a CFD model using ANSYS Fluent for simulation of heat and mass transfer. The results obtained in this study allowed them to propose practical design rules to support engineers defining optimized TTs for predetermined operating conditions, namely regarding power output, disc sizes and angular velocity. (*Introducing Tesla turbine to enhance energy efficiency of refrigeration cycle*).

Concerning buildings, they are responsible for a significant part of the global energy consumption. Besides the need to improve their energy efficiency as imposed by legislation, new buildings also need to generate their

own energy, preferably from renewable sources, to fulfil sustainability requirements. However, renewable energy generation strongly depends on the climatic conditions; therefore, energy storage must be considered when designing such a system. Gouveia et al. performed a cradle-to-grave life cycle assessment (LCA) study of a renewable energy generation system with a prototype Vanadium flow battery integrated in a Near Zero Energy Building (NZEB). A combined grid-connected PV and a solar thermal system generates the energy that was projected to supply the annual energy needs of a household in Porto, Portugal, considering the local climatic conditions. The study results show that environmental impacts are reduced when the energy is produced onsite and the battery components are recycled or reused. (*Life cycle assessment of a renewable energy generation system with a Vanadium redox flow battery in a NZEB*).

Renewable Energy Sources (RES) and Carbon Capture and Sequestration (CCS) technologies have been consistently pointed out as the most promising routes to decarbonization. Silva et al. proposed an equilibrium model where labor and energy are used to produce final-goods, and energy is produced from non-polluting RES and polluting fossil fuels. In this model, a Green Tax Reform (GTR) is implemented by the government, through a tax on emissions, and revenues are used to finance subsidies to RES and to support CCS technologies. The results of this model show that the GTR has positive impacts on the economy, translated into higher output per worker, higher wages and lower energy prices. Although there is an increase in the energy per worker, it is generated using RES more intensively, and therefore, the environmental effects of the GTR may also be positive. Further, they also concluded that the substitution effects are enhanced by higher share of tax revenues devoted to RES subsidies. (*Green tax reforms with promotion of renewable energy sources and carbon capture and sequestration: comparison of different alternatives*).

Within the framework of promoting the use of renewable energy production and use, as a strategy towards world's climate change mitigation, Proença and Fortes, analysed the relation between historical values of power sector renewables installed capacity and employment, over the period 2000–2016, for the 28 member states of European Union. Through their study, they concluded that there is a positive relation between these two variables, with an increase of 0.48% in employment for each 1% increase in renewable power generation capacity. These results facilitate the understanding of the social context of renewables, providing relevant insights that could be an important auxiliary instrument to support decision-making. (*The social face of renewables: econometric analysis of the relationship between renewables and employment*).

Energy efficiency in buildings has been the object of several regulations all over the world. Energy Building Certification (SCE) was implemented in Portugal through the publication of the *Decreto-Lei n.º78/2006* and due to the compulsion to adjust the national legislation imposed by EPBD. Thus, from January 1, 2009 all residential, commercial and services buildings, new, refurbished or existing must have an Energy Certificate (CE) in any construction, purchase or lease process. During the last 10 years, and not only due to EPBD recast, the legislation has undergone dozens of changes, interpretations and corrections being important to realize their impact on the main indicators of energy efficiency of buildings. Ferreira applied the three calculation methodologies, adopted by SCE in these 10 years, to a single-family house that was certified in 2009, to conclude that the main indicators of energy efficiency have changed drastically. (*Buildings energy certification system in Portugal: ten years later*).

Climate change has driven an increase in outdoor temperatures, which in turn causes an increased building energy demand. The Gulf countries are particularly vulnerable to such impacts, due to the extreme climate conditions and dependency on fossil fuels. Andrić and Al-Ghamdi quantified such implications by considering the residential sector of Qatar as a case study. To this end, they chose representative buildings and modelled their energy consumption for present and forecasted weather conditions. They concluded that, in the future, heat waves would occur more frequently, with higher intensity and for longer periods, with the consequent increase of up to 30% of building energy consumption. Higher energy consumption results in higher CO₂ emissions, water and fossil fuel depletion rates, as well as increased impact on local marine ecosystem. To mitigate such impacts, Andrić and Al-Ghamdi recommended the development of new regional environmental policies for large-scale renovation of the existing building stock and installation of renewable energy systems. (*Climate change implications for environmental performance of residential building energy use: the case of Qatar*).

Exponential population growth, the poor management of water, particularly in the last century, allied to the climate change and increasing number of water applications, contributed to water scarcity in many regions of

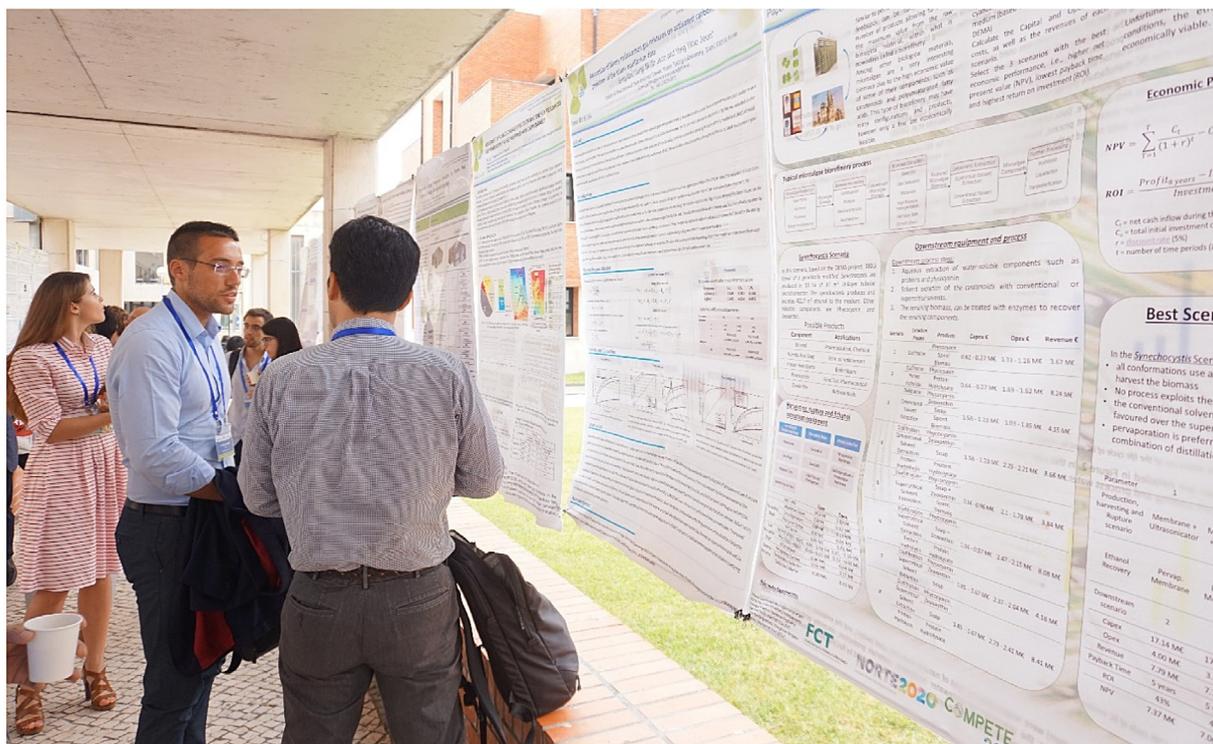


Fig. 3. Poster session during coffee-break in ICEER2019@Aveiro.

our planet. Driven by the European Union regulations or local governments' policies, various proposals have been proposed and/or implemented aiming to increase awareness and support for water saving measures. The work by Felgueiras et al. presents a proposal of a decentralized system developed to monitor detailed domestic water consumption. This system contributes to increase awareness, allowing for real water consumption reduction, while reducing the associated energy consumption. (*Development of a decentralized monitoring system of water consumption*).

Another problem related to water consumption, is the constant discharge of domestic and industrial effluents containing contaminants of emerging concern (CEC) in water bodies. CEC comprise a large variety of compounds like pharmaceutical and personal care products (PPCPs) and their metabolites that can bioaccumulate and their toxicity may lead to several health problems, including in the brain. Their concentrations range from $\text{ng}\cdot\text{L}^{-1}$ to $\text{mg}\cdot\text{L}^{-1}$ and may affect not only the aqueous environment but also human health. Electrochemical oxidation (EO) process is capable of removing these compounds from water, with several advantages such as the operation at ambient temperature and pressure, being easily combined with other technologies and generally not generating waste nor requiring auxiliary chemicals. Bosio et al. performed EO using a titanium-platinum (Ti/Pt) anode and a stainless-steel cathode, to degrade a solution containing paraben compounds. Their goal was to investigate the effect of the EO residual by-products on the formation of neuronal reactive oxygen species (ROS). The results suggest that, despite the complete degradation of the paraben compounds, the formed by-products still have a toxic effect, which is lower than that of the non-treated solution. The results indicate that the EO treatment caused a reduction of ROS formation and thus, of toxicity effects on neuronal activity. (*Electrochemical oxidation of paraben compounds and the effects of by-products on neuronal activity*).

Fog is a worldwide problem, causing accidents due to the poor visibility, affecting the roads and the crops at the plantations, producing economic losses but also interference with the aerial, maritime and military operations. Fog dispersion and the environment impact in the *Epipremnum aureum* plants were evaluated by del Río et al.

through three different electrostatic experiments with positive corona discharges inside an experimental chamber. Fog dispersion was evaluated as a function of the time for the optical signal detection of three sensors located at different heights inside the chamber. Environment impact was evaluated measuring the transpiration and absorption spectrum in the leaves of the *Epipremnum aureum* plants by means of LiCOR 6400XT system and the photoacoustic spectroscopy technique. The obtained results showed that the experiment with positive corona discharges allowed to disperse the fog with reliability levels in the data of 95%. Results also showed that the transpiration and photosynthetic activity on the plants were not affected by the action of the positive corona discharges in fog conditions. (*Fog dispersion by using electrostatic experimental techniques*).

The coffee-breaks served not only for a brief relaxing pause in the hard work, but also to present and discuss with their authors the achievements shown in the Posters (Fig. 3). There was also a chance to bring together many of the ICEER 2019 participants for a group photo, shown in Fig. 4.



Fig. 4. Group photo of participants of ICEER2019@Aveiro on the way to lunch place, wearing the Conference Polo Shirt.

This conference reinforced the certainty of the needs for more research in both environmental and energy fields. The desired economic growth must take place in harmony with environmental and social issues. The demands of energy by societies are increasing, but it is undeniable that to satisfy them, clean, renewable and efficient sources and technologies will be necessary. Pollution control (end-of-line solutions) for traditional pollutants is well established and the challenges now lie in emerging pollutants and an approach with a focus on preventing pollution, where efficient use of resources plays a crucial role.

7. Other activities within ICEER 2019

Conferences are not only places to discuss research and professional topics, but also large rooms to socialize and network. Lunch period, the Conference Dinner, preceded by a 10 min walk to the port and Boat Trip along the *Ria de Aveiro*, and the Farewell Session were the main relaxing and informal moments of the conference.

In the Conference Dinner, some of the participants/authors were distinguished with the *Academy aComedy Awards*, the most pursued (funny) prizes awarded to various paper categories such as the *wildest paper title*, *longest paper title*, *biggest research team*, *shortest research team*, and so on. The high fair play of all the nominees stood out. It was a very happy moment resulting in a high sharing of personal contacts.

Finally, the ICEER 2019 organization promoted a Closing Ceremony and a Farewell Event, in which authors were distinguished with formal awards: the Best Paper award, attributed in each Session of oral presentations; the Best Oral Flash award, attributed to the author of the Best Poster who also presented it as an Oral flash presentation.

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Dear participant in **ICEER2019@Aveiro**,

Our first acknowledgement goes to those who participated in the Conference and shared the results of their work and ideas with all of us – a very big THANK YOU for having been there with us! ICEER 2019 was a big success due to your efforts, and we sincerely hope you have enjoyed your stay and the Conference.

A very big THANK YOU also to the Keynote speakers, Prof. Didac Ferrer-Balas and Prof. Zita Vale, who generously shared with us their relevant ideas and research results.

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We must also publicly thank the SCIEI organization, for their joint efforts and commitment to improve ICEER quality, supporting the Chairs and Program Chairs, and the local organization. Particularly the kind and helpful staff – Tina, Frannie and Amy, from China.

We must thank our research group coordinators, who recognize the importance and encourage our efforts in dissemination in conferences. They allowed us to spend part of our time preparing the conference.

The process of editing the Conference Proceedings in *Energy Reports* – a Scopus Indexed journal from Elsevier, with IF of 3.830 – is now finished.

Still, there is opportunity to further present and discuss the results achieved by submitting new/supplementary discoveries and research results to one of the associated Special Issues in *Climate, Energies, Sustainability* or *Waste and Biomass Valorization*.

We hope to have contributed to increase the scientific importance and impact of ICEER series.

The next ICEER (ICEER 2020: Driving energy and environment in 2020 towards a sustainable future) will take place in 7-11 September 2020 @ Università degli Studi ROMA TRE, Rome, Italy – **Save the Date!**

We are excited to show you what we are preparing – website is already available with details and news.

Thank you all for supporting ICEER 2019 and for having been there with us.
ICEER 2020 will be even better!!!

We hope to meet you soon (again) in... **ICEER2020@Rome**

The ICEER 2019 Chairs & Program Chairs

Carlos Borrego & Nidia Caetano

Carlos Felgueiras & Isabel Nunes