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Preface

The Seventh International Conference on Sustainability and Energy in Buildings 2015 (SEB15) was a major international conference organised by a partnership made up of KES International and the UNINOVA research institute at the Universidade Nova de Lisbon (the New University of Lisbon)

SEB-15 invited participation and paper submissions across a broad range of sustainability and energy related topics relevant to the main theme of Sustainability in Energy and Buildings. Applicable areas including sustainable design and of buildings, neighbourhoods and cities (built and natural environment); modelling, monitoring and optimisation techniques; smart energy systems for smart cities; energy and resource efficiency in industry; and well as a broad range of solar, wind, wave and other renewable energy topics.

The aim of the conference was to bring together researchers and government and industry professionals to discuss the future of energy in buildings, neighbourhoods and cities from a theoretical, practical, implementation and simulation perspective. The conference formed an exciting chance to present, interact, and learn about the latest research in Sustainability in Energy and Buildings.

In addition to presentations of full and short papers in general tracks and invited session tracks, SEB-15 also included expert keynote talks and doctoral student poster sessions.

The conference featured four General Tracks:-

- Sustainable Buildings
- Energy Systems and Cities
- Renewable Energy Technologies, Applications and Integration
- Energy and Resource Efficiency in Industry

In addition there were eight Special Sessions proposed and organised by prominent researchers in the field.

The conference attracted submissions from around the world. Submissions for the Full-Paper Track were subjected to a two-stage blind peer-review process. With the objective of producing a high-quality conference, only the best of these were selected for presentation at the conference and publication in the Elsevier Procedia Energy proceedings. Submissions for the Short Paper Track were subjected to a 'lighter-touch' review and published in an online medium but not the Procedia proceedings.

Thanks are due to the very many people who have given their time and goodwill freely to make SEB-15 a success. We would like to thank the members of the International Programme Committee who were essential in providing their reviews of the conference papers, ensuring appropriate quality. We thank the high-profile keynote speakers for providing interesting talks to inform delegates and provoke discussion. Important contributors to the conference were made by the authors, presenters and delegates without whom the conference could not have taken place, so we offer them our thanks. Finally we would like to thanks UNINOVA and the New University of Lisbon for their considerable support.

It is hoped that you find the proceedings an interesting, informative and useful resource for your research.

SEB-15 Chairs and Organising Committee

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KES International
SEB-15 is a part of the Sustainability in Energy and Buildings conference series run by KES International.

Previous conferences
SEB-09: Brighton, UK
SEB-10: Brighton, UK
SEB-11: Marseilles, France
SEB-12: Stockholm, Sweden
MGEF-13: Fes, Morocco
SEB-14: Cardiff, UK

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Keynote Speakers

Dr Alfonso Capozzoli
Politecnico di Torino, Italy

Extracting knowledge from building energy data

Abstract: Nowadays, performance monitoring systems and energy management in buildings provide an opportunity to collect a large amount of building-related data. Thanks to adoption of information and communication technology in buildings, a growing number of complex databases becomes available. As a consequence, there is an increasing need to analyse a great amount of heterogeneous data and information. Building related data potentially contain knowledge about the interactions between the building's energy consumption and its most influencing factors. Therefore, the energy data can provide information about the building operation modes, making it possible to improve management and reduce the energy demand. Retrieving the hidden knowledge that can be extracted from these data is highly desirable for improving the building energy performance. However, exploring such data and understanding the underlying energy patterns is a complex issue. For this purpose, intelligent data analysis techniques (e.g. data mining, machine learning) can be used to reveal hidden dependences and to support decision of energy efficiency measures for users, owners and operators. Expertise in building physics is needed when these techniques are used for building applications, in order to properly select the attributes related to the demand objectives, to choose the most suitable methodology to adopt, and to interpret the extracted knowledge for practical uses.
Significant applications of data analysis in the building sector concern the classification of consumption profiles and characterisation of occupant behaviour, the evaluation of energy benchmarks, the prediction of energy consumption and peak power demand as well as the fault detection and diagnosis analysis.
In this keynote the aforementioned issues and several applications in the building physics sector are discussed with the aim to clarify how the process of discovering knowledge through energy data analysis is today an important opportunity to drive and to plan the strategies for energy efficiency.

Biography: Alfonso Capozzoli graduated in Mechanical Engineering and obtained a PhD in Mechanical Engineering Systems at University of Naples Federico II. Currently he works as assistant professor -with a tenure track position for associate professor- at the Department of Energy of Politecnico di Torino. From 2014 he is qualified for associate professor position (Italian Ministry for University and Research). He teaches HVAC systems and building physics at the Faculty of Engineering and Architecture.
During the PhD, his research activity was related to HVAC systems, energy performance dynamic simulation in buildings, thermal building physics, indoor humidity control analysis, energy saving strategies in air conditioning. More recently his research fields have been focused on inverse modeling, smart building in smart cities, fault detection and diagnosis, energy data analysis, thermal management in data centers and super insulating materials in building components.
He was member of the Directive Board of IBPSA-Italy (International Building performance Simulation Association) and he is an expert within CTI (Italian thermo-technical committee) on energy certification and building energy performance.
He was chairman in several technical sessions in international conferences on building energy performance. He has been member of the Scientific or Organizing Committee of the following conferences: IBPSA-Italy Conference Building Simulation Applications (BSA 2013, BSA 2015), International Building Physics Conference (IBPC 2015), International Conference on Sustainability in Energy and Buildings (SEB 2014, SEB 2015), 12th International Conference on the European Energy Market (EEM15).
He is involved as principal investigator in International Research Projects on building energy performance financed by European Commission. He is active in various research groups of the International Energy Agency (IEA- EBC) and in the Joint Program "Smart Cities" in EERA (European Energy Research Alliance).
Alfonso Capozzoli has been responsible for different research/consultancy scientific contracts of the Department of Energy at the Politecnico di Torino and for research projects financed by the Italian Ministry of Economic

Development and ENEA (Italian National Energy Agency).
He is reviewer for some of the most relevant international journals in the building physics sector e.g.: Applied thermal engineering, Building and Environment, Journal of Cultural Heritage, Energy efficiency, Applied Energy, Neurocomputing, Expert systems with applications, Measurement.
His research activity is summarized in more than 70 scientific papers published in international journals and conference proceedings.

Prof. Antonio Gagliano
University of Catania, Italy

Envelope Renovation to improve energy efficiency in existing buildings

Abstract: Energy renovation has implications for growth and jobs, energy and climate and cohesion policies. The building and real estate management sector is responsible for more than one-third of the total, primary energy demand in the industrialized countries. At the same time, the building sector is identified as providing the largest potential for CO2 reduction. Many countries across the world have set very ambitious targets for energy efficiency improvements in new and existing buildings. Given this context the European Union trying to meet its ambitious climate and energy targets for 2020 and 2050 have introduced several legislative initiatives for building renovation. Such as implementing energy efficiency measures for major renovations and economic support instruments to stimulate the renovation of the existing building stock.
The EPBD also asked EU Member States to establish strategies for the renovation of national building stocks, as well as to renovate 3 % of the building stock of central governments annually to a high-energy performance level. For successfully achieve such a target it is necessary to identify and develop innovative technologies, which facilitates energy savings and the implementation and integration of renewable energy devices within the built environment. The potential benefits and the challenges posed by these new technologies need to be investigated and defining the methodology for studying and testing such components for analysing their thermal and energy performances.
The most relevant results of a decade-long research activity (numerical and experimental studies) carried out on various building envelope components, will be presented.

Biography: Antonio Gagliano is Aggregate Professor at the Department of Industrial Engineering of Catania University, Italy. He holds a M.S. Environmental Engineering (1991) and a Ph.D. (1995-1998) in Applied Building Physics.
His research and teaching subjects are within environmental engineering and are focused on the following topics: Energy-efficient building design (Net zero energy buildings, design of low energy buildings - numerical modelling of ventilated facades (computational fluid dynamics), night cooling of buildings and utilization of thermal mass, passive energy technologies for buildings, indoor thermal comfort), Building Acoustic, Renewable Energy (Solar thermal system, Biomass, micro wind turbine), application of GIS as support tool for energy planning.
Antonio has been responsible/participant for more than 10 research/consultancy contracts of the Department of Industrial Engineering at the University of Catania and research projects financed by the Italian Ministry of Education and Regional Authorities. He is a member of the Scientific Committee of the following conferences: ICREPQ - International Conference on Renewable Energy and Power Quality, IREC - International Renewable Energy Conference, SEB -Sustainability in Energy and Building, MGEF, Mediterranean Green Energy.
He is a reviewer for some of the most relevant international journals in the sector, e.g.: Energy, Building and Environment, Energy and Building, Thermal Science, Energy Conversion and Management, Energy Efficiency, Building, Sustainable Cites and Societies ,International Journal of heat and mass transfer, International Journal of Thermal Science, Journal of Computational Environmental Sciences.
His research activity is summarized in more than 90 scientific papers published in national and international conference proceedings, as well as national and international journals and books.

Prof. Rui Neves-Silva
Universidade Nova de Lisboa, Portugal

Model-based decision making to support energy efficiency investments

Abstract: It has been identified by many studies that the main driver for energy efficiency is cost reduction. After an initial stage of the energy efficiency process in which we can have large reductions just by applying obvious and almost costless measures, the additional gains require the deviation of financial resources that compete with other investment possibilities, including financial investments.
The typical measures and technologies in the market for energy efficiency are, nowadays, well supported by the literature, standards, vendors and consultants. The knowledge about what is available to face each challenge in energy consumption is somehow available. Nonetheless, the lack of precise knowledge about the return on investment has been identified by market players as a major barrier to convince investors towards energy efficiency. While for the basic energy efficient measures, the rules of thumb regarding typical payback periods (and associated risk) for the investments are considered trustworthy, the return on additional investments is very much dependent on the specific aspects of each case, undermining the confidence of the investor when compared with more explained alternatives.
This keynote presents a model-based decision support methodology based on the simulation of possible investment alternatives (i.e. technical solutions) for energy efficiency. The goal is to provide the investor (with the support of a technical consultant) well supported evidence on the source of each cash-flow item. The proposed approach has been applied in the scope of two European projects, the first in energy efficiency in office buildings, and the second in energy efficiency in manufacturing plants.

Biography: Developed his PhD in Electrical and Computers Engineering in 2000 in the Technical University of Lisbon in the area of modelling and control of industrial plants. Has been Senior Researcher at UNINOVA since January 2001 where he is responsible for the research group on Intelligent Control and Decision Support Systems. He is an Assistant Professor at the Department of Electrical Engineering of the Faculty of Science and Technology of the Universidade Nova de Lisboa (FCT/UNL), where he is responsible for the courses on Control Engineering. Experience in 19 National and European projects (including global coordination) in the scientific area of decision and control engineering, has published more than 50 publications in International Scientific Journals (CEP, IEEE CST, IJPC) and International Conferences relevant to the decision and control engineering area. He is also one of the co-founders of the company inknow-solutions, dedicated to the exploitation of the knowledge developed in 10 years of EU funded projects.

Prof. Despina Serghides
Cyprus University of Technology, Cyprus

Energy Efficient Refurbishment towards Nearly Zero Energy Houses, for the Mediterranean Region

Abstract: The building sector in Europe is responsible for an estimated 40% of the total energy consumption and 10% of the total CO2 emissions. Given that new buildings represent only about 1% of the housing stock annually, it is estimated that more than 80% of the existing buildings will still exist in 2020. Therefore, the energy efficient renovation of the existing housing stock is imperative in order to reduce the building energy consumption. It is for this reason that the European Union ranked the improvement of the energy performance of the old building stock, as a high priority in its research agenda. Following Europe's 20:20:20 objective, this case study investigates refurbishment scenarios in order to achieve Nearly Zero Energy houses, in Cyprus.
The research focuses on the Single Family House typology, as classified in previous studies for Cyprus, in the framework of the IEE, EU project EPISCOPE and specifically on retrofitting an old house that was built before 1980. The aim is to upgrade it into a Nearly Zero Energy Building (nZEB) with the implementation of the national energy performance requirements, as drafted by the Ministry of Energy, Commerce, Industry and Tourism (MECIT). Following the EPISCOPE project methodology, a representative Single Family House from the corresponding residential building typology in Cyprus was chosen and modeled using the iSBEMcy tool. This is the official governmental software in Cyprus used for issuing Energy Performance Certificates (EPC), for the categorization of the energy class of the building and the calculation of the CO2 emissions according to the European Directives 2002/91/EC and 2010/31/EC.
The study investigates whether it is possible for an old Single Family House to reach the nZEB standards and identifies the lurking obstacles and challenges, through building simulations. To this end, various refurbishment scenarios were developed, with the implementation of strategies aiming at fulfilling the MECIT requirements. Through analysis of the results, the efficiency of each strategy and technique employed towards minimising the energy consumption and the greenhouse gas emissions was evaluated, in terms also of its cost effectiveness. Furthermore, the results of the research were investigated in order to assess whether the nZEB requirements, as developed by the MECIT, are appropriate for the existing single-family houses in Cyprus and whether alternative strategies may be employed in order to meet the target of nZEB and to reduce effectively the energy consumption.

Biography: She is Professor in Bioclimatic Architecture and the Urban Environment and the vice chair of the Department of Environmental Science and Technology, at the Cyprus University of Technology. She is scientific coordinator of European projects and she carries out research in bioclimatic Architecture, energy conscious building design for sustainable indoor and outdoor environments. The architectural design and concepts of her research have been presented and discussed at international congresses, fora and conferences and most of it has been published in international journals and proceedings. She studied Architecture at the Architectural Association School of Architecture (AA) London, UK. She continued postgraduate studies in Planning at the Planning Department of the AA. Also from the AA she obtained her Master and Doctorate in "Architecture - Energy & Environment". She is the president of the International Solar Energy Society of Cyprus (ISES) and member of the Board of Directors of ISES-Europe of which she was the president. She has acted as a consultant for the Cyprus Government and Parliament and has been the national scientific representative of the National Scientific and Technical Co-operations with Greece and China. She gives lectures at National and international Universities and Institutes. She is on editorial boards and a reviewer in scientific journals and international conferences. She was honored with a lot of scholarships, awards and offices. She chairs and participates in organizing and scientific committees of International and National conferences, seminars and congresses of which she is invited plenary or and keynote speaker and presents papers.