Faculty of Engineering
Division of Infrastructure, Geomatics and Architecture

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Architecture, Climate & Environment

RESEARCH REVIEW

2012-2013

Sustainable Energy Technologies
Climate Responsive Architecture

Disclaimer

While all due care and attention has been taken to establish the accuracy of the material presented, The University of Nottingham and the authors disclaim liability for any loss which may arise from any person acting in reliance upon the contents of this document. Please direct any queries to the editor listed below.

Rodrigues, L. T., Ed. (2013). Annual Activity Review Report 2012-2013: Architecture, Climate and Environment Research Group, University of Nottingham.

Reported prepared by

Lucelia Taranto Rodrigues | Lucelia.Rodrigues@nottingham.ac.uk
University of Nottingham, Faculty of Engineering
Department of Architecture and Built Environment
Lenton Firs, University Park, NG7 2RD - UK

Content Contributors in alphabetic order

Auwal Muktar Dodo
Andrew Rollinson
Benjamin Martin
Benson Lau
Blaise Mempouo
Brian Ford
Chris Wood
David Tetlow
Guillermo Guzman
Faidon Nikiforiadis
Hao Liu
Haoyang Liu
Hongfei Zheng
Lucelia Taranto Rodrigues
Mark Gillott
Mark Worall
Mohammed Gadi
Patrizia Riganti
Robert Shipman
Saffa Riffat
Sean Casey
Siddig Omer
Sophie Bailey
Tom Rogers
Wenbin Zhang
Xiaofeng (Ken) Zheng
Xiaojia Wang
Xiaoli Ma
Yuehong Su
Zeny Amante-Roberts

With special thanks to our PhD candidates for their contribution and to our technical staff for their support.

Cover Photo: The Nottingham H.O.U.S.E. at the Creative Energy Homes Project (photo by Anita De Domenico).

Foreword

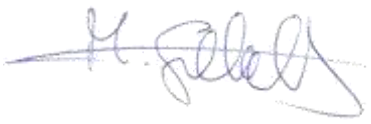
It gives me great pleasure to introduce the first Architecture, Climate and Environment (ACE) Research Group Activity Review Report. This activity review document has been prepared to provide an overview of the research activities undertaken by the Group during the 2012-2013 academic year, as well as provide information on the staff and students who lead and contribute to these activities.

The Group was newly formed during 2013 by combining the solid foundations of existing engineering and architecture research expertise from the Sustainable Energy Technologies Group and the Environmental Design in Architecture Group. In a world that is seeing the massive expansion of city populations combined with the environmental threats of pollution and global warming there is a requirement for interdisciplinary research that cuts across the professional and research boundaries of architecture and engineering. The combined strengths of ACE enable us to position the Group as internationally leading in multidisciplinary sustainable energy and built environment related research. The research undertaken by the Group focuses on two broad interlinked priority areas: Sustainable Energy in the Built Environment (technology focus) and Climate Responsive Architecture (design focus). The research group currently comprises 12 academic staff members and 15 research staff members in addition to a cohort of over 50 PhD students. During the year we have seen six of our PhD students graduate and move on to pastures new, and we wish them all the very best with their new careers. In the 'alumni catch-up' section you can see what two of our graduates, Dr Alexandra Albuquerque Maciel (2007) and Dr Kevin Hard (2005) have been up to since leaving us.

The 'grand challenge' of creating a truly sustainable built environment which embraces low carbon technologies is one that needs be tackled through industry academia collaborations. A significant proportion of the Groups work is applied research supported by industry partners, who have been instrumental in helping us pursue our goals of developing innovative energy efficient low carbon technologies and buildings. Over the last five year period the Group's research income is just under £7M, in addition to a further £1.9M invested by industry partners. The group's research strength is reflected by its research publications and the impact of these on the scientific and wider community. Over the last year members of the group have published 97 research outputs in research journals, conference proceedings and book chapters.

It is our firm aim that the research undertaken by the Group should bring about innovations in design, technologies and processes for industry in the UK and beyond in order to have economic, societal and environmental impact. To date this has been realised on numerous occasions, for example, our award winning Creative Energy Homes project has helped inform the UK's zero carbon housing and retrofit agendas, and fundamental research has led to inventions which are now commercial products such as Monodraught's Cool-Phase low energy cooling and ventilation system.

I would like to finish by thanking Group colleagues and students for their contributions to this report and to all those who have helped us in different capacities in the Groups pursuit of research excellence.



Prof Mark Gillott

Deputy Head of the Architecture, Climate & Environment Research Group

CONTENTS

Contents

Year Highlights

And what a year it has been. Not only has our group grown but our group members have also been extremely busy developing significant projects and products, winning awards, giving high-impact keynotes… There are lots of reasons to celebrate our achievements in 2012/13!

Figure 1: The Nottingham H.O.U.S.E. and the Mark Group EcoHouse at the Creative Energy Homes

The Completion of the Creative Energy Homes

It has taken time and effort but the Creative Energy Homes is finally ready: 2013 saw the completion of the Nottingham H.O.U.S.E. and of the Mark Group EcoHouse.

The Nottingham H.O.U.S.E (Home Optimising the Use of Solar Energy) is the result of academics, researchers and students from the various disciplines in the Department of Architecture and Built Environment collaborating with a select group of industrial sponsors and specialist consultants. It was designed to compete in the Solar Decathlon 2010 in Madrid, an international competition aiming to advance the knowledge of sustainable homes, and built twice (in Madrid and London) before finding its final home on Green Close. This full-scale family home was designed to some of the world's most stringent design standards such as the German Passivhaus, the UK Code for Sustainable Homes (Level 6 Zero-carbon), the Lifetime Homes and Secured by Design. This is the first time all these codes have been combined within a house of this type. This massive challenge was met by our students who designed and built this home as part of their learning experience at Nottingham. The home embodies a clear, spatially concise and sustainably efficient design from concept to reality. It is designed to be affordable and meet the requirements of dense urban sustainable living.

The Mark Group EcoHouse is a four-bedroom detached property with three floors including a basement. It was designed by interdisciplinary members of the teaching staff and a construction workforce of undergraduate students studying architecture and building technology who gained valuable experience of construction practices whilst working on aspects of the build. Students and staff have undertaken a number of research studies associated with the construction of the home. In addition to Mark Group's products installed (Solar PV, Solar Hot Water, Loft Insulation, External Wall Insulation, Timber/Steel frame Insulation and an Air Source Heat Pump) the house features several other complimentary products to create a concept house for energy efficient future living.

Now both houses have become part of the Creative Energy Homes Project for long-term monitoring and dissemination of their strategies and technologies. For more information visit our website or Facebook page: *www.nottingham.ac.uk/creative-energy-homes* & *www.facebook.com/CreativeEnergyHomes*

YEAR HIGHLIGHTS

Awards

This is the third time members of the group have won a prestigious Rushlight awards. This year Prof Saffa Riffat was awarded the 'Rushlight Energy Reduction Award' for his work on innovative technologies with industry partners Blue Planet (UK) Ltd, Tru-Stone Ltd and Marsh-Grochowski Architects LLP.

Prof Mark Gillott and Dr Robert Shipman have been awarded the 'E.ON International Research Initiative Grant' for their 'SWITCH project: Smart Wireless Integrated Technology Control in Homes'. The project uses the Creative Energy Homes project as a real-life test lab for evaluating how customers respond to living with smart home technologies.

Cool Planet, the renewable energy design and installation arm of British Gas, has partnered with Panasonic to deliver an industry-leading, eco heating solution for the BASF House, part of the Creative Energy Homes Project. The innovative solution received the 'Innovation of the Year 2012' award given by the Micropower Council sponsored by EDF Energy.

Our PhD students Yanti Chen and Mingwei Sun received awards for Best Overall Poster at the Passive and Low-Energy Architecture (PLEA) international conference 2013 and the Jeffrey Cook PLEA Travel Scholarship respectively.

Appointments and Promotions

Congratulation to Dr Hao Liu for his promotion to Associate Professor and Reader, and to Dr Yuehong Su for his promotion to Associate Professor. Our congratulations extend also to Dr Rob Shipman who advanced from research fellow to senior research fellow.

Appointments this year included the research fellows Dr Faidon Nikiforiadis, Dr Xiaofeng Zheng (Ken) and Dr Sean Casey, and the research associate Benjamin Martin. Many new PhD students have started; a warm welcome to all of them.

PhD Completions

Whereas some have just started, some have finished their journey with us. Congratulations to Dr Xiangjie Chen, Dr Haoyang Liu, Dr Xiaofeng Zheng (Ken), Dr Rukayyatu Tukur, Dr Nina Hormazábal and Dr Moataz Ali Khalifa on the award of their PhDs.

Chen, X.	Investigations of heat powered ejector cooling systems
Liu, H.	The development of novel window systems towards low carbon buildings
Zheng, X.	Exploration and development of domestic thermoelectric cogeneration system
Tukur, R.	Harnessing Daylight Potential as a Tool for Visual and Thermal Comfort in Residential Buildings
Hormazabal, N.	Post Occupancy Evaluation of Homes in the United Kingdom to Develop an Affordable P.O. Methodology for Homes in Chile
Khalifa, M. A.	Application of phase change materials as a solution for building overheating: A case for the UK

Our very best wishes to you all, we are looking forward to have you back in our alumni catch-up section!

YEAR HIGHLIGHTS

Talks and keynotes

Prof Saffa Riffat was a keynote speaker at the 8th International Conference on Fluid and Thermal Energy Conversion 2013. This conference aims to provide a forum for the exposure and exchange of ideas, methods and results in fluid mechanics, heat transfer, thermodynamics and energy conversion.

Prof Brian Ford has taken part in a high profile seminar on “Energy Efficiency and Climate Change” as part of an EU/Brazil collaborative project ‘Dialogos Setoriais’ looking at policy and research priorities in Brasilia on the 24th & 25th April 2013. The project is coordinated jointly by the Brazilian Ministry of Planning, Budget and Management and the Delegation of the European Union to Brazil (DELBRA). He gave an invited presentation on"Projects developed under the stimulus of EU programmes and policies" as well as having meetings with various potential research partners.

Prof Brian Ford also gave a keynote presentation at a Symposium on Energy Efficiency in Buildings (Santiago, November 2012), organised by the Chilean Agency for Energy Efficiency (AChEE) and contributed to a workshop on Sustainable Design in Educational Buildings at the University of Bio-Bio, Concepcion, Chile.

Prof Mark Gillott was an invited keynote speaker at the important Launch of the ‘Nottingham Climate Change Strategy’ and the ‘Nottingham Energy Calculator’ organised by the Nottingham City Council in 2012. Included in the Nottingham city Climate Change strategy is the Creative Energy Homes project as it represents innovative sustainable housing solutions.

In 2012 Prof Mark Gillott was also invited to presented the award winning paper 'Low-carbon housing design informed by research' co-authored by Dr Lucelia Rodrigues and Dr Catalina Spataru, at the Institute of Civil Engineering (ICE), part of the Thomas Telford Prestigious Lecture series. The talk outlined the proposed line of research which is being undertaken at the Creative Energy Homes project.

Dr Mohammed Gadi has given a guest lecture at Zawia Univeristy in Libya and a keynote speech at the International Engineering Conference at the Institute of Libya Engineers and Architects 2013.

Dr Lucelia Rodrigues was invited to Sao Paulo, Brazil to give a keynote speech at the International Real Estate Federation and Sinduscon Brazil business meeting 2012. Her talk discussed whether sustainable buildings attract premium prices.

Dr Blaise Mempouo was invited to a series of Global Round Tables in Paris, London, Edinburgh, Frankfurt and Milan from 11-26 March 2013 organised by the United Nations Environment Programme (UNEP) and the European Energy Centre (EEC) , which aimed to facilitate public private partnerships for clean energy technology applications in developing economies. His role as an expert in Low Carbon Buildings was to highlight how Energy efficiency in buildings offers a great opportunity for developing countries in term of economic and health.

Media and Press Coverage

The Nottingham HOUSE featured on the BBC Radio 4 Environmental Programme *‘Costing the Earth’* as ‘The House That Heats Itself’. Miranda Krestovnikoff looked at new building materials for environmentally-friendly houses and asked Prof Mark Gillott where you should start if you want to build your own eco-home.

Creative Energy Homes featured on the BBC news programme and website, including an interview with Prof Mark Gillott. Green Party politicians, who were holding their Spring Conference on the University of Nottingham campus, visited the project and described it as “world-leading research on eco-friendly homes” that "will shape future home design and help meet the 2016 deadline for Britain's carbon reduction targets." Cllr Richard Mallender said "This is the standard of housing we need to see for the whole of the UK".

The opening of the Mark Group EcoHouse featured in the Nottingham Post newspaper and website, on the BBC East Midlands Today news and website and in numerous other media vehicles.

Architecture, Climate and Environment

Research Group

Figure 2: Architecture, Climate and Environment Research Group members

Position

Our Architecture, Climate and Environment (ACE) Research Group is part of the Infrastructure, Geomatics and Architecture Research Division within the Faculty of Engineering of the University of Nottingham. Our Faculty has in total five Research Divisions and our Division has in total six Research Groups. The Faculty conducts research that has been recognised by the Research Assessment Exercise in 2008 as being world-leading or internationally excellent, placing Nottingham in the UK's top five universities for engineering.

Description

The ACE research group aims to inform the sustainable practice of architecture and engineering in order to enhance the quality of the built environment through world leading fundamental and applied collaborative research. The work undertaken by the group is predominantly related to mitigating the impacts of, and adapting to, climate change, reducing energy use in the built environment and enhancing comfort, productivity and wellbeing of building users.

This group was formed by combining the strengths of the well-established Sustainable Energy Technology Group and the newer Environmental Design in Architecture Group to form a group with a comprehensive range of expertise in sustainability in the built environment. The research undertaken focuses on two broad priority areas:

Sustainable Energy in the Built Environment (technology focus) and

Climate Responsive Architecture (design focus).

ARCHITECTURE, CLIMATE AND ENVIRONMENT

Collaboration with partners in academia, the construction industry and with the Centre for Sustainable Energy Technologies (CSET) at the University's Ningbo Campus underpins much of this group's work. Progress is evidenced by a growth in funding from the Research Councils, Technology Strategy Board (TSB), European Union (incl. Marie Curie), Royal Society, Carbon Trust, Department of Energy & Climate Change (DECC), and industry. Group members have been involved since 2008 in numerous high-impact projects and have had a research income just shy of £7M, in addition to a further £1.9M invested by industry partners in the Creative Energy Homes.

The Creative Energy Homes project, developed and managed by the group, is a key resource to study micro-smart grids, energy storage, demand-side management and occupants' acceptance of innovative technologies. The project is yielding results that inform both national policy and high quality research outputs, recognised recently through the ICE's Trevithick Prize. The group has also received several other awards (e.g. Rushlight, UK Engineer Technology and Innovation), two new technology transfer licences and three new patents.

Group members are involved in a number of significant events and have co-organised and hosted the UK Passivhaus Conference 2012 and the Beyond Zero Carbon Housing. The group also continues to organise the well-established International Sustainable Energy Technologies conference, now in its 12th edition, and has representation on the board of directors of the Passive and Low Energy Architecture (PLEA) international conference, running for 29 years this year.

Research Team and Advisory Board 2012/13

These are summarised profiles; for complete profiles of our staff including complete list of publications please follow the link:

www.nottingham.ac.uk/research/groups/architecture-climate-and-environment-research-group

Academic Staff:	Saffa Riffat, Brian Ford, Mark Gillott, Hao Liu, Mohammed Gadi, Siddig Omer, Yuehong Su, Lucelia Rodrigues, Ed Cooper, Benson Lau, Guillermo Guzman, Patrizia Riganti
Research Staff:	Andrew Rollinson, Auwal Muktar Dodo, Benjamin Martin, Blaise Mempouo, Chris Wood, David Tetlow, Faidon Nikiforiadis, Haoyang Liu, Mark Worall, Robert Shipman, Sean Casey, Wenbin Zhang, Xiaofeng (Ken) Zheng, Xiaoli Ma
Visiting Fellows:	Hongfei Zheng, Thomas Rogers, Xiaojia Wang
Administrator:	Zeny Amante-Roberts, Sophie Bailey
PhD Candidates:	Adham Makki, Ahmed Ali Shohan, Ako Samad Jalal, Ayse Pinar Mert Cuce, Daniel Afilaka, David Bailey, David Parra Mendoza, Devrim Aydin, Elamin Awad Ramadan Mohamed, Eldar Naghiyev, Erdem Cuce, Eunice Akyereko Adjei, Faisal Albatati, Farooq Sher, Haipeng Xu, Hang Zhou, Hong Wang, Irfan Ul Hai, Jennifer White, Jindong Wu, Jingjing Liu, Jinxing Li, Jitiporn Wongwatcharapaiboon, Kadhim Magdid Braim, Laura Alvarez, Lin Liu, Lorna Kiamba, Mahmoud IM Shatat, Mahmut Sami Buker, Mamdooh Alwetaishi, Mark Langdon, Mingwei Sun, Mohamed Mahmoud Fageir Hussein, Mohammed Awadh Jasim, Md Mohataz Hossain, Mohd Anas Mohd Sabri, Muhyiddine Jradi, Norhayati Mat Wajid, Noura Ghabra, Omar Ibraheem, Omar Ramadan, Owajionyi Lysias Frank, Pervin Abohorlu, Renata Tubelo, Rozia Haji Adenan, Sabrina Afrin, Sara Abdalmouniem Mahmoud Mohamed, Sultan Sanat Alotaibi, Theo Elmer, Thomas Richard Whiffen, Tom David Bennet, Vasileios Sougkakis, Xu Yu, Yanqi Cui, Yanti Chen, Yaseen Salih Hama, Yate Ding, Yu Fu.
Advisory Board:	Alistair Guthrie, Andrew Cunningham, Brian Hacket, David Reay, David Strong, Dean Hawkes, Dick Powell, Mario Cucinella, Mark Whitby, Nick Ebbs, Peter Clegg, Robin Nicholson, Roger Bullivant, Tony Marmont, Zafre Ure,

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Academic Staff

Professor Saffa Riffat | Chair in Sustainable Energy

Group Head

Prof Riffat holds the posts of Chair of Sustainable Energy, Head of Department of Architecture & Built Environment, and University of Nottingham. Professor Riffat is also the President of the World Society of Sustainable Energy. Prof Riffat has a wide range of experience of renewable energy, sustainable buildings, refrigeration (ejector, absorption, etc), heat transfer, heat pumps, ventilation and air quality. He has obtained grants in excess of £50 million from the EPSRC, EU and industry and published over 550 refereed papers. Professor Riffat has been awarded the degree of Doctor of Science (DSc) from the University of Oxford for his research contribution in the field of heat pumps and ventilation technology. He is named as the inventor on 20 International Patents.
Prof Riffat is one of the world's leading experts in sustainable technologies/eco-buildings. He has established several major sustainable buildings including the Millennium Eco-House, the Marmont Centre for Renewable Energy, the Environment Centre for Education and Creative Energy Homes, as well as played an important role in the development of the world largest Sustainable Energy HE Campus, 'The Jubilee Campus'. He has a continuing involvement with eco-building projects in China including developments in Shandong, Beijing and Shanghai.

Professor Brian Ford | Chair in Bioclimatic Architecture

Current research includes post-occupancy evaluation of the 'Green Street' housing development in Nottingham by Marsh Growchowski architects, funded by the Technology Strategy Board as part of their Building Performance Evaluation Programme. This project is in collaboration with the developer 'Blueprint' (Part of Igloo properties) and also involves Mark Gillott (co-investigator) and David Bailey (PhD student). It is due for completion in February 2014.
Further research in passive and hybrid downdraught cooling (previously funded by the European Commission) includes the development of a domestic evaporative cooling system in collaboration with the Spanish company Frialia Microclimas, and the testing of a new porous ceramic component (the 'ECOOLER') which has been developed by StudioKahn in Israel. BF is also working on developing collaborative research projects (in relation to building performance evaluation) with partners in Colombia, Chile and Brazil. Professor Lyu Aimin from Shanghai Jiao Tong University will be working with BF in Nottingham from July 2013 to July 2014

Professor Mark Gillott | Chair in Sustainable Building Design

Deputy Group Head

Past research has focused mostly in low carbon sustainable energy technologies and low/zero energy building design/technologies. Prof Gillott manages the research and development of the "Creative Energy Homes Project", a research test facility and educational showcase of seven sustainable homes. Current research includes linking the houses together to form a micro-smart grid test platform with experimental demand-side management technologies through ERDF funding. He has also worked on six TSB 'Retrofit for the future' evaluation stage projects as well as a current TSB 'Performance Evaluation of Buildings' project. He is currently an investigator on the high profile TSB funded 'EcoIsland' project which aims to radically transform the Isle of Wight's sustainability credentials. He was an investigator working on the £2.1 million EPSRC/E.ON CALEBRE research project aimed at substantially reducing the energy use in the UK's existing housing stock by investigating 'Consumer-Appealing Low Energy Technologies for Building Retrofitting'. He was the lead investigator on the E.ON International Research Initiative Project 'SWITCH - Smart Wireless Integrated Technology Control in Homes' which investigated consumer acceptance, appliance/behaviour modelling and demand-side management scenarios utilising smart home controls. In addition he is an investigator on three 'Transforming Energy Demand Through Digital Innovation' EPSRC research projects (total value total value £1.33 million) and is part of the UoN Vertical Farming and Urban Agriculture Research Group.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Hao Liu | Associate Professor and Reader

Dr Hao Liu's expertise is in the areas of clean fossil fuels and biomass technologies. Before he joined the University of Nottingham in 2004, he had been studying/working at the University of Leeds (where he got his PhD in Fuel & Energy) since 1991. He is a Chartered energy engineer and a member of the UK Energy Institute. He has over twenty-five years' research experience in coal combustion, power plant engineering, fluidized bed technology, biomass combustion and gasification, and combined heat and power (CHP). He has designed and tested a number of laboratory-scale and pilot-scale combustion facilities in sizes ranging from a fraction of a kW to 20 MW and has extensive research experience in modelling of combustion, gasification and power plant power generation. His current research mainly focuses on the following aspects: (1) Clean fossil fuels and carbon capture technologies; (2) Biomass/waste gasification; (3) Biomass combustion/co-firing; (4) Biomass heating and CHP/cooling for building applications. He has a number of research collaborations within the University (Faculty of Engineering, Schools of Biosciences, and Geography etc.) and the UK biomass/power generation industries and international institutions.

Dr Mohammed Gadi | Associate Professor

Current Research: Computer modelling of building thermal and solar radiation performance using existing commercial software and developing new computer tools (using the Visual Basic Programming Language).
Future Research: Investigating Thermal Response of Hospital Patients with Certain Illnesses. Field research on user response to outdoor thermal environment in residential & public courtyards.

Dr Siddig Omer | Associate Professor

Current research: design and modelling of compressed air energy storage for large-scale renewable energy integration into grid, innovation cooling technologies for pv systems, solar operated desiccant cooling systems for hot and humid climates, micro encapsulated phase change materials (mepcm) panels for domestic building applications
Past research: investigation into application of thermoelectric refrigeration for desktop fridges, investigation into application and performance analysis of solar operated ejector refrigeration for building cooling - a case for mediterranean climate, siting and performance assessment of micro wind turbines in the built environment, focusing on the effect of turbine turbulence on the performance of building mounted wind turbines and yaw analysis of micro-scale horizontal axis wind turbines and noise investigation, wind energy in the built environment, design analysis using cfd and wind tunnel modeling, a novel clear foil cushion construction incorporating water layer for building cooling
Future research: development of methodology for mapping uk building stock for building integrated pv systems, self-cleaning pv technologies for dusty, hot and arid climates, solar water desalination and dew collection as a source of fresh water supply

Dr Yuehong Su | Associate Professor

Dr Yuehong Su has experience in air conditioning, adsorption/absorption/ejector cooling, energy efficiency, heat storage, daylighting, solar concentration, CFD modelling and building simulation. Dr Su has a current research focus on daylighting and natural ventilation in a close collaboration with UK companies to develop various renewable energy solutions for daylighting and natural ventilation in low/zero emissions buildings. Dr Su is experienced in experimentation and simulation of daylighting systems and solar concentration systems.
Research Summary:
PV: building-integrated solar concentration PV; Daylighting: RADIANCE and PHOTOPIA simulation, measurement and monitoring of Monodraught lightpipes; Natural ventilation: evaluation and simulation of Monodraught windcatchers; Building insulation: evaluation and EnergyPlus simulation

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Lucelia Rodrigues | Lecturer in Architecture

Lucelia's main research focus is the thermal performance of buildings and its influence on energy use and human comfort. She is particularly interested in the resilience of low-energy buildings in a warming climate. Past and current research revolves around thermal performance of low-energy housing, offsite construction and high performance building envelopes and materials. In addition, she has worked on passive heating and cooling techniques, earth-air heat exchangers and phase change materials.

Examples of current research are the Network Rail funded project to investigate life-cycle assessment and carbon impact of the British rail station building stock, and two projects focused on the climate resilience of dwellings. Other examples include the applicability of Passivhaus in Brazil, energy efficiency in developing countries with warm humid climates, facade design for energy efficiency in the Golf Region, natural ventilation in office buildings in China and the 'Future-Proof Integration of Sustainable Communities into the Urban Fabric'.

She is also the UoN principal investigator in the €6.8million EU funded 'Transitioning towards Urban Resilience and Sustainability' in collaboration with the Nottingham City Council, and on a £632k TSB funded housing retrofit project. Future research will expand in these areas and look into energy use and comfort in social housing in developing countries, off-site construction and custom build solutions, self-build and independent living.

Dr Edward Cooper | Lecturer in Environment Engineering

Dr Ed Cooper's principle on-going research interest is in the theory and measurement of building airtightness. Specifically, uncertainties associated with low pressure leakage measurement, the development of a novel low-pressure leakage tester, and the development of an airtightness design tool. The research into accurate airtightness measurement at the pressures typically found in infiltration has been funded by grants from the EPSRC and more recently the TSB, under the Scaling Up Retrofit call. The concept has also been taken up for use by a team at the University of Gavle in Sweden, funded by the Swedish Energy Agency. He has also carried out research in the wider field of building performance evaluation and sustainable energy technologies, including a current project on the development of fourth generation district heating with Sasie Ltd. Future projects include developing current areas further, also real time building energy evaluation and management, plus developing a control algorithm for integrating community scale heating, power and storage with building energy management systems.

Benson Lau | Lecturer in Architecture

Benson Lau is a chartered architect (RIBA) with expertise in integrated environmental design. His current academic roles include Course Director for the MArch in Environmental Design Course and Postgraduate Student Advisor and Progression Board Representative for Architecture and Urbanism.

Current research interests primarily address the integrated environmental design approach, environmental performance prediction of building and related issues of occupant comfort and behavior. This design approach is a key component in his practice and teaching activities in the UK and Far East and the selective use of building performance prediction tools to support and enhance architectural decision-making has been adopted in his building projects worldwide.

Other research interests are: 1) the poetics of light in architecture and 2) the luminous environment in light weight fabric structure. Recent research projects included the investigation of Light in Le Corbusier's religious buildings and his experimentation on Brise-Soleil in Chandigarh, India and a Knowledge Transfer partnership (KTP) grant (£124k) focused on the design, development and implementation of a modular self-supporting structural/construction system comprised of linked Ethylene tetrafluoroethylene (ETFE) foil encapsulated panels.

Guillermo Guzman | Lecturer in Architecture

Guillermo's specific research interests are in the areas of participative architectural education, user centred sustainable design and identity & technology transfer in a globalized world.

His current work enhances the involvement of students in live projects, reciprocal collaboration with industrial sponsors and communications & marketing strategies to promote collaboration and innovation in design.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Patrizia Riganti | Lecturer in Architecture

Dr Riganti is an appointed member of ICOMOS (International Council on Monuments and Sites) Italy. She seats on 2 ICOMOS International Committees: on Economics of Conservation and on Energy and Sustainable Development. She is a member of the UN-Habitat Partner University Initiative (HPUI) and one of the 40 signatories of the UN-Habitat Tampa Declaration, 2013. Her research focuses on urban sustainable development and on the assessment of urban policies related to cultural heritage conservation, cultural diversity, sustainable cultural tourism and energy efficiency. She is a World Bank consultant and has carried out several research projects, funded by Governmental Agencies, International Research Centres and the European Union on the assessment of sustainable management strategies for archaeological and urban heritage sites, using stated preferences valuation techniques, such as Contingent Valuation and Conjoint Analysis. Future research themes involve the assessment of retrofitting strategies at both the building and urban districts' scales.

Research Staff

Dr Andrew Rollinson

Current Research: Small-scale Biomass Gasification. I am experimenting with small-scale energy systems that can turn waste wood/agricultural residue into a gas which will then produce electricity for remote off-grid applications (in the UK and India). This is a collaborative inter-faculty, inter-university, and inter-national project which involves assessment of process kinetics and thermodynamics aimed at optimising the system to promote uptake. Integration with solar thermal and anaerobic digestor technologies is planned.
Past Research: Urea steam reforming (assessment, reactor design, thermodynamic modelling, process control, fuel and catalyst characterisation). Urea (from urine or plants) is a non-toxic and stable sustainable source of hydrogen. When supplied to fuel cells it can produce clean and non-polluting electricity without noise, suitable for off-grid applications. Solar thermal reactor design for the cracking of natural gas.

Dr Auwal Muktar Dodo

Dr Auwal Muktar Dodo is a Research fellow within the Architecture, Climate and Environment Research group, University Of Nottingham. He is currently working on a Thermochemical energy storage system, a project funded by the Department of Energy and Climate Change. His research experience is on Desiccant dehumidification / cooling, Magnetic refrigeration and Thermal energy storage technologies. He has previously worked on a project funded by the Pilkington Energy Efficiency Trust, which investigates a Magnetic desiccant ventilation system, and has research interest in the development of new sorption materials for potential use in adsorption and energy storage systems.

Benjamin Martin

Current Research: I am currently working as the KTP research associate and Project Manager in partnership between the University Of Nottingham and Holscot Fluoroplastics. My research looks into the structural and environmental design of ETFE lightweight structures and how they can be designed, developed and analysed for use within the construction industry. My research will look into the optical, thermal and structural performances of the materials as well as their impact upon the environment so that the outcome is a marketable product.
Previous Research: Related to sustainable design and renewable technology. I worked within a housing association as their Retrofit Project Officer and developing a new sustainable agenda for their existing housing stock which included research into the UK Governments Feed in Tariff system and the subsequent Spending Review. I have also completed research in the impact of the Code for Sustainable Homes on social housing in the UK and the economic and carbon impact of this legislation. Further to this I have also completed research into how vernacular architecture can be developed for use within the Code for Sustainable Homes in the modern climate.
Future Research: I hope to build my future research based on the research I have already completed and I am developing at the moment. I would love to complete further research into the development of vernacular architecture for use in the modern climate and also researching new materials for sustainable construction.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Blaise Mempouo

My current research work aims to design, construct and test a high- performance Thermochemical Energy Storage Pumping Pipe combined with a heat pump that uses off peak power or renewable energy for building application. My work involves modelling and simulation, designing commercial prototype, integrating the system in the Creative Energy Homes, and conducting field trials of the prototype system.

I am actively involved in developing research proposals with Professor Saffa Riffat in collaboration with industry in the UK, China and Africa. We have successfully obtained research grants with a total value in excess of £1 million from iNet Sustainable Construction, Department of Energy Climate Change (DECC), Technology Strategy Board (TSB) and Industry. I am currently a Co-investigator (CI) on the DECC funded project on a High Performance Vacuum Tube Window, and a CI on the Royal Society-DFID funded project: Research Network for Sustainable Cooking, Cooling & Power Generation and Knowledge Transfer between the UK and Africa.

My future research interest focuses on various aspects of sustainable low cost building materials, services and envelops for developing countries with the aim of achieving affordable, high efficient and low/zero carbon technologies/products and contributing to slums eradication and development of effective and low carbon economic and energy systems.

Dr Chris Wood

My current research involves the retrofitting of the 1930's Eon house with novel near to market solutions. This work amounts to a third phase in the Eon house retrofit project, which is looking at more advanced solutions as compared to conventional retrofit options. The purpose of the research is to identify new materials and/or technologies which have the potential to make the greatest energy savings versus the costs of installation. Through a process of assessment and elimination, one or two technologies are chosen for installation in the house. The current work has been split into stages, with the first year looking at the in-situ performance of aerogel insulation and vacuum tube windows and a second stage which will investigate an 'active' external wall insulation solution.

The use of the Eon house to perform this type of research extends beyond that of performance testing of product, but also encompasses further research in the areas of building performance assessment. For instance one method of whole house thermal performance testing is via a technique known as the co-heat test. In the process of testing the new retrofit solutions a number of co-heat tests are performed and it is a research aim to investigate the appropriateness of this test and to look at the robustness of the underlying physics with a view to improving the methodology. Further research involves investigating other areas applicable to retrofit such as impact upon thermal bridges and fabric U value measurements.

Dr David Tetlow

Dr David Tetlow specialises in Building Physics, Energy Efficiency & Technology. Summarised, this involves taking the materials and building envelope and studying how it behaves under specified conditions. Energy inputs (solar, people, building services) and losses (material, air, etc.) are analysed, quantified, and methodologies / technologies are selected to increase efficiency and sustainability. This is incorporates study and research into building material technology (insulations, PCMs, etc.), renewable technology (solar thermal, PV, heat pumps, etc.), and analysis with building simulation.

His current position is based upon the project management of the Holistic Energy-efficient Retrofit of Buildings (HERB) project. I am working with a consortium of 17 European partners from industry and academia, and we are researching a range of technologies that will be used for domestic retrofit both theoretically and laboratorily. In addition we are intending to retrofit 12 buildings, 6 in the UK, and one in: Switzerland, Holland, Spain, Portugal, Italy, and Greece. Monitoring shall be undertaken before and after to see what improvements are made and how effective the technologies are that are.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Faidon Nikiforiadis

Faidon Nikiforiadis studied his PhD in Architecture (Building Simulation) at the University of Sheffield under Prof P. Tregenza and Prof. A. Pitts (PhD thesis title: " Daylighting Environmental Modelling and Simulation in Mediterranean Urban Environments", 2007). He also worked (2004-2005) as a Research Associate in the Sheffield School of Architecture, in a project entitled "Up-skilling Designers of Buildings in Sustainable and Low Energy Design".
Since his first graduation (1996) his practice teaching and research interests are focused in the interlinked areas of architectural, structural, environmental and digital design.
Dr Faidon Nikiforiadis works under Dr Lucelia Taranto Rodrigues, the Principal Investigator, in the research project entitled "The Climate Resilience of Modern Methods of Construction Dwellings". They investigate the climate resilience of Modern Methods of Construction systems in order to support decision making for housing design, construction and adaptation in a low carbon climate change future.

Dr Haoyang Liu

Hermes fellowship programme- Innovative vacuum tube windows
This is a collaborative project between the University of Nottingham and an industrial partner. The project aims to demonstrate the performance of a novel vacuum tube window system in one of the dwellings in the Creative Energy Homes project. My responsibility is to investigate a novel vacuum tube window system for domestic buildings. The work programme involves computer modelling of the vacuum tube window, design of a window unit suitable for a domestic dwelling, installing and testing it in real life conditions. The project also involves the engagement with industrial partner who has a licensing agreement with the University of Nottingham. A commercialisation strategy will be developed in collaboration with the University of Nottingham and the industrial partner.

Dr Mark Worall

Research expertise and interests: I am experienced in heat powered refrigeration and air-conditioning technologies, thermoelectric heating, cooling and power generation, and solar-thermal and solar-photovoltaic systems. I am interested in thermoelectric refrigeration systems and have been investigating electrically conductive polymers that might be useful in such devices. I am also interested in biomimetics and am researching thermoelectric/photovoltaic/energy storage mechanisms in nature.
Current research: I am involved in an EU project, "Durable Solid Oxide Fuel Cell Tri-Generation System for Low Carbon Buildings" (TriSOFC - http://trisofc.com), which will develop a novel single component solid oxide fuel cell that integrates a novel desiccant dehumidification/cooling system for summer cooling and winter heating. My work involves modelling and simulation, developing the dehumidifier/cooler, testing it in laboratory conditions, integrating the fuel cell, dehumidifier/cooler, and conducting field trials of a prototype system. I am developing a hybrid vapour-compression/jet-pump refrigeration system for the refrigerated transport sector. Carbon dioxide is the refrigerant in a vapour-compression system. The jet-pump system is driven by waste heat from the exhaust gases of an internal combustion engine and sub-cools the CO2 system. The hybrid system can use bio-fuels to power the engine and environmentally friendly refrigerants as working fluids, so reducing environmental impact.

Dr Robert Shipman

Rob's research background centres on complex, nature-inspired and intelligent systems. He has utilised this techniques within a number of different sectors in R&D, consultancy and managerial roles. He has been involved in several research projects since joining the University including "Wireless Behaviour Information Systems", which aims to produce fine-grained disaggregated energy behaviour feedback through the coupling of energy and occupancy data and "SWITCH: Smart Wireless Integrated Technology Control in Homes", which aims to explore customer's perceptions of Smart Home technology through the deployment of a demand response platform that controls washing appliances.
His current focus is on the Intelligent Smart Energy Community (iSEC) project that is combining the Creative Energy Homes properties to form an energy community with its own micro-generation, storage and intelligent control capability. His research includes drawing inspiration from biological homeostatic systems to help develop strategies to balance supply and demand in the community and novel methods of interaction with members of the community to implement these strategies.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dr Sean Casey

Sean worked for 13 years in the fields of production engineering and building renovation following completion of his undergraduate degree. He returned to academia to complete an MSc in Energy Conversion and Management in 2009 and completed his PhD in Materials Science in 2012.
His PhD research was focused on humidity buffering in enclosed, airtight domestic environments that have been retrofitted with solid wall insulation and vapour barriers. His key areas of interest were moisture transfer and storage mechanisms within the porous building materials, materials characterisation, dynamic hygrothermal numerical simulation, occupant comfort and energy usage.
His current research project, started in January 2013, focused on INterseasonal Thermochemical Renewable Energy STorage Systems (INTRESTS). A TSB funded project being carried out in conjunction with industrial partners in the UK, it involves the development and up scaling of nano-composite adsorbent systems for the capture and storage of low temperature heat. Developing suitable storage systems to store and shift the summer heat energy to the winter period could drastically reduce space heating demands on both electrical and fossil fuel supplies.

Dr Wenbin Zhang

The Intergovernmental Panel on Climate Change (IPCC) has concluded that a significant reduction of worldwide greenhouse-gas (GHG) emissions is required in order to stabilize the global average temperature increase at 2.0°C to 2.4 °C above pre-industrial levels. Carbon Capture and Storage (CCS) uses a combination of technologies to capture the CO_2 released by fossil fuel use, transport the CO_2 to a suitable storage location, and store it typically deep underground. Currently, vase efforts have been made on the development of solid adsorbents due to their advantages in lower material heat capacity and lower heat of reaction. Applying the sorbents to practical and commercial applications requires comprehensive knowledge of their capture efficiency, durability and stability when scaling up to the industrial scales. This research provides an attempt of applying Polyethylenimine (PEI) based adsorbents in a bench-scale fluidized bed reactor to investigate their performance in CO_2 capture. The fluidized bed is operated under variable parameters including initial bed temperature, mass of load, and presence of moisture and CO_2 partial pressure to clarify their effects on adsorption capacities. The obtained results are essential for optimization of the process design and operation of fluidized beds for post combustion carbon capture of flue gases.

Dr Xiaofeng (Ken) Zheng

My past research experience includes the experimental and numerical studies on the air supplying system, heating system and smoke movement in high speed trains, nature-inspired viscous drag reduction method for drag reducing in aerodynamic and hydrodynamic vessels and domestic thermoelectric cogeneration system for power generation and hot water production for residential houses. Currently, I am committed to a European house retrofitting project which aims at improving the energy performance of existing energy inefficient houses, working on modelling of Phase-Change material and thermal comfort analysis using Computational Fluid Dynamic methods. My research interest lies in the development and utilisation of renewable and sustainable energy technologies in domestic and industrial sector, related with heat transfer, fluid dynamics and lighting.

Dr Xiaoli Ma

I am experienced in building services technology, refrigeration technology, air cleaning and ventilation technology, dehumidification technologies, sustainable/renewable energy technologies, power generation and energy efficiency technology. Examples of my past research projects including a solar powered ejector cooling system for Mediterranean countries funded by EU, investigation into a novel pressure-exchange binary fluid ejector funded by May-Ruben Technologies, Inc, Canada, a photocatalytic mop fan air cleaner funded by EPSRC, a desiccant cooling and dehumidification system funded by EU and a novel thermoelectric cooling system funded by Thermoelectric Device Ltd, etc. Currently, I am working on an EU funded research project to develop an innovative, environmentally friendly CO2/lubricant absorption power system for highly efficient power generation from low temperature industrial waste heat to reduce emissions and costs. My future research interests are to improve the efficiency of renewable/sustainable energy system and waste energy recovery.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Visiting Fellows

Professor Hongfei Zheng | Beijing Institute of Technology

Prof. Hongfei Zheng is a Marie Curie research fellow (March 2012 ~ September 2013) to investigate a Multifunctional PV/Thermal/Daylighting Roof Panels for Atrium Buildings and Large Green Houses. He has a wide range of experience in solar energy applications including hot water, desalination, air conditioning, solar concentration and daylighting. He is now a full professor at Beijing Institute of Technology. His research has mainly been focused on three areas: 1) solar desalination, 2) solar concentration and 3) optical fibre daylight guiding. Prof. Zheng has published over 100 refereed papers and 4 monographs.

Associate Professor Aimin Lyu | in Shanghai Jiao Tong University

Dr. Aimin Lyu, a visiting scholar in the University of Nottingham, associate professor in Shanghai Jiao Tong University in China. He has always been focused on green building, especially on building forms following special climates. Aimin Lyu graduated at the Southeast University with doctor degree on green building, and worked in Tongji University as a post-doctor。 He published a professional book “Climate-Responsive Building for China’s Continental Climate “ (Tongji University Press ,2003) which was specialized on how the buildings follow both hot summer and cold winter conditions. He also published around 20 academic peer-reviewed papers.

Aimin Lyu teaches several regular courses for master students and undergraduates on green buildings and relative technologies at Shanghai Jiao Tong University. At same time he is an architect and designed buildings such as the Faculty Restaurant (2011) and the Center of Science School (2012), both located at the Shanghai Jiao Tong University Minhang Campus.

Aimin Lyu will keep his focus continually on the issues emerging about relations between buildings and climates as a member of Architecture, Climate and Environment Research Group.

Dr Tom Rogers | Lecturer at the University of the West Indies

I am an early career lecturer at the University of the West Indies’ Cave Hill Campus in Barbados. To date, my main focus has been on developing teaching and research capacity in the sustainable energy sector. The Caribbean region has some of the highest energy prices in the world and energy security has a major impact on the region’s economy.

I am currently based at the University of Nottingham as a visiting research fellow, where I am exploring the potential for the transition of passive design principles to the Caribbean’s construction sector. It will incorporate the use of building simulation software to analyse the thermal performance of typical buildings found in the Caribbean. The output of the research will aim to inform the region’s construction sector, as well as feed into the teaching of MSc students on the University of the West Indies’ Renewable Energy Management programme.

Xiaojia Wang | Exchange researcher from Southeast University, China

Mr. Xiaojia Wang (Exchange researcher from Southeast University, China; supported by Chinese Scholarship Council; Jan 2013 – Dec 2013): current research at the University of Nottingham focuses on: (1) the kinetic testing of one kind of natural iron ore as the oxygen carrier for the chemical looping combustion (CLC) of coal (2) Three-dimension simulation of a coal-fired chemical looping combustion process including gas-solid flow and reactions in the CFB fuel reactor.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Research Administrators

Zeny Amante-Roberts

Has unique combination of skills being a practising geologist in the early stage of her career and has now over 20 years of experience working with senior management as personal assistant and administrator in a scientific environment, academic and industry. Has a role of managing, overseeing and coordinating the delivery of various research group activities in the Department of Architecture and Built Environment including research funding, grant applications, etc. Provides direct support to the Head of Department in teaching and learning aspects of the role and as administrator for various research projects. Also acts as key point of contact for the Department in various projects and initiatives. Enjoys and thrives well working in a team in a complex and busy environment and implementing efficient administrative processes, to ensure a highly effective support service. Has the ability to work independently and proactively, sourcing critical information to support the department.Zeny is currently responsible for the management, planning and co-ordination of administrative tasks for the HERB project working with PI Professor Saffa Riffat. Highly efficient and competent, an extremely valued and essential member of the team.

Sophie Bailey

Sophie held the position of Research Administrative Support for our Research Division. Since Sophie joined us, she has given invaluable help to the Group members, always with a smile and superb efficiency.
Sophie's competent help in the past year was fundamental to the success of the events the group help.
Sophie has unfortunately left us for a full time job at RIBA in London.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Current PhD Candidates

Forename	Surname	Year	Thesis title
Adham	Makki	2	· Investigation of Hybrid Photovoltaic-Thermoelectric Generator (PV-TEG) Solar System
Ahmed A.	Shohan	3	· Thermal Comfort and Energy Demand of Small and Large Mosque Buildings in Saudi Arabia
Ako S.	Jalal	1	· The political implications of cultural diversity in the management of conflicts
Ayse P.	Mert Cuce	2	· Roof heat recovery cooling system
Daniel	Afilaka	3	· Avoiding Sintering in a Coal Fired Shallow Fluidised Bed
David	Bailey	4	· Post Occupancy Evaluation of Sustainable Timber Framed & Traditional Masonry Construction in the UK
David	Parra Mendoza	4	· Optimum Community Energy storage for end user\utility applications
Devrim	Aydin	1	· Open energy storage system
Elamin A.	Ramadan M.	1	· Investigation into affordable building design in hot-dry climate
Eldar	Naghiyev	4	· Improving Domestic Energy Efficiency using Device-Free Localisation
Erdem	Cuce	2	· Building retrofit using innovative cladding
Eunice A.	Adjei	2	· Materials optimization for improving energy, environmental and economic efficiency of selected air-conditioned office building envelop properties at tropical climate
Faisal	Albatati	3	· Power generation using CO2 lubricant
Farooq	Sher	2	· Oxy-fuel combustion of biomass in fluidized bed reactor
Haipeng	Xu	2	· The use of Phase-change materials blister pack
Hang	Zhou	2	· PV modelling and testing for a lens-walled compound parabolic concentrator (Lens-walled CPC) PV/T system
Hong	Wang	5	· Post occupancy evaluation in Chinese housing
Irfan	Ul Hai	4	·

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Jennifer A.	White	4	· Design vs. Reality: Why Do Our Houses Underperform?
Jindong	Wu	3	· Natural ventilation in office buildings in South-East China: occupant thermal comfort and window control
Jingjing	Liu	2	· Development and performance of Novel porous adsorbent materials for efficient carbon capture under low CO2 partial pressures
Jinxing	Li	4	· Development & Evaluation of a small-scale woody and non-woody biomass boiler with low NOx and particulate emissions
Jitiporn	Wongwatch arapaiboon	2	· Innovative techniques for particle removal
Kadhim M.	Braim	1	· Tourism management and policy strategies in post conflict countries
Laura B.	Alvarez	1	· Future-proof integration of sustainable communities to the urban fabric
Lin	Liu	4	· Thermoelectric solar water heating
Lorna	Kiamba	2	· Thermal Regulation Strategies in Warm Humid Climate
Mahmoud IM	Shatat	3	· Solar powered water desalination
Mahmut S.	Buker	3	· Solar roof heat pump system
Mamdooh	Alwetaishi	2	· Thermal comfort and energy performance in school buildings with reference to Saudi Arabia, Jeddah
Mark	Langdon	3	· Sustainable Intervention in Rail Assets
Mingwei	Sun	5	· Integrated Environmental Design in Hot and Humid Climates: An Approach to Low-Carbon Office Building Design in South-Eastern China
Mohammed A.	Jasim	2	· Conservation of World Heritage Sites in post-conflict areas: the case of Iraq
Md Mohataz	Hossain	1	· Lighting and ventilation in the workplace environment – with particular reference to garment factories in Bangladesh
Mohd Anas	Mohd Sabri	1	· Rotary desiccant cooling system
Muhyiddine	Jradi	3	· Numerical and Experimental Investigation of a Hybrid Solar-Biomass Tri-Generation System
Norhayati	Mat Wajid	1	· Thermochemical energy storage heating pipe
Noura	Ghabra	1	· The future of glazed facades for tall buildings in the Gulf region: culture, environment and technology

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Omar	Ibraheem	4	・The application of Passive Downdraught Evaporative Cooling to high rise office buildings in Cairo, Egypt
Omar	Ramadan	3	・Energy storage using compressed air
Owajionyi L.	Frank	4	・Exploring a best practice approach to operability and maintainability of low carbon buildings in the UK
Pervin	Abohorlu	2	・Ceramic evaporative cooling in Northern Cyprus
Renata C. S.	Tubelo	2	・The application of the 'Fabric First' approach to achieve thermal comfort and energy efficiency in Brazilian housing
Rozia	Haji Adenan	3	・Vernacular housing on water in Brunei Darussalam
Sabrina	Afrin	2	・The Application of ETFE foil in energy efficient building design
Sara A. M.	Mohamed	1	・New Parameters For Low Energy Educational Building Design
Sultan S.	Alotaibi	3	・Vacuum Insulated Panels for Low Carbon Buildings
Theo	Elmer	3	・Tri-generation solid oxide fuel cell for low carbon building applications
Thomas R.	Whiffen	3	・Thermal Energy Storage Solutions in Commercial Buildings
Tom David	Bennet	4	・Increasing the efficiency of biomass combustion processes in power plants
Vasileios	Sougkakis	2	・Using Modern Methods of Construction to Deliver Climate Resilient Low-Energy Housing
Xu	Yu	3	・Using dielectric compound parabolic concentrator (CPC) for combined daylighting and PV/T application
Yanqi	Cui	4	・Passive cooling using phase-change-materials
Yanti	Chen	5	・The relationship between 'design excellence' and building performance with particular reference to award-winning schools in the UK
Yaseen S.	Hama	2	・The governance of ethnic conflicts in multicultural cities
Yate	Ding	4	・Energy storage system for buildings
Yu	Fu	4	・Heat pump/PCM system

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Advisory Board

The Group is grateful for the supporting role that our industry/academic advisory group provide. They help us in our pursuit of research excellence and help steer us to address the grand challenges required by industry and society in an ever changing world.

Alistair Guthrie (Honorary Professor)

Arup Director and Global Sustainable Buildings Design Leader and Arup Fellow. He is an Arup Fellow, a life-long, honorary title awarded to exceptional individuals. Alistair is also a founder member of the UK Green Building Council. He joined Arup in 1979 and has been involved in the design of arts & culture, education, commercial and transport buildings worldwide. His particular expertise is the application of building physics and micro climate design in finding sustainable solutions for the built environment.

Andrew Cunningham (Honorary Associate Professor)

Founder and Owner of George Green Power Ltd. with subsidiary company Geo Green Power Ltd (Solar PV research, design and installation) which is now a significant installer of solar PV technologies in the UK. Andrew is a recipient of the Prince of Wales Award for Innovation (1992), he is a chartered engineer (MIET) and inventor of numerous patented technologies. Previously positions include - founder and owner of DawnFresh, founder and MD of Microsystems Engineering Ltd, Technical Director AVT (AVT/Reuters FX trading software) and Global Head of the Reuters Trading Platform Division.

Brian Hackett (Honorary Associate Professor)

Brian Hackett is the Chairman of Vale Window Co. Ltd and an Honorary Associate Professor of Glazing Technology. He is responsible for conceiving and delivering a successful business with the introduction of new products into the glazing industry and window market. Brian is a passionate inventor and innovator who is currently setting up an 'Innovation Centre of Excellence' to develop and commercialise new ideas in conjunction with Universities and Industry.

David Reay (Honorary Professor)

David Reay is a Consulting Engineer & Principal Consultant David Reay & Associates. Professor Reay has over 30-year experience of research into energy-efficient processes, including heat pumps and heat pipes. He is co-author of standard texts on both these topics and is Founding Editor and Editor in Chief of the Journal of Applied Thermal Engineering, now in its 20th volume. David is an honorary life member of the Heat Pump Association, past president of the Heat Transfer Society, co-ordinator of the Heat Exchanger Action Group, co-ordinator of the Process Intensification Network and joint recipient of the Brennan Medal by the Institution of Chemical Engineers for his book on Process Intensification.

David Strong (Honorary Professor)

Managing Director David Strong Consulting, Chairman of the Energy Efficiency Partnership for Buildings, Chair of Green Deal Installer Accreditation and Qualification Ministerial Forum. Previous positions include - Managing Director of BRE Environment, Chief Executive of Inbuilt Consulting Ltd. Prior to the BRE, he was an Executive Director of E A Technology (formerly the Electricity Research Centre, Capenhurst), Emstar (formerly Shell's contract energy management company/ESCO, now Dalkia) and an Executive Director of Atkins Energy (a Division of WS Atkins and Partners). In 2007 David was awarded the Building Sustainability Leadership award for establishing the UK Green Building Council, with the judges describing him as "one of the most influential figures in the drive to make the industry sustainable".

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Dean Hawkes

Dean Hawkes was in practice with Stephen Greenberg as Greenberg & Hawkes between 1983 and 1994. His projects were widely published and won a number of RIBA Architecture Awards. For many years, he combined practice, teaching and research. He taught and researched at the Department of Architecture at Cambridge University between 1965 and 1995 where he was a founder member and, later, Director of the Martin Centre for Architectural and Urban Studies. He held the Chair of Architectural Design at the Welsh School of Architecture, Cardiff University, between 1995 and 2002. He is Emeritus Professor of Architectural Design at Cardiff University, Emeritus Fellow at Darwin College, University of Cambridge, and a Fellow of the Royal Society of Arts. In 2010 he was winner of the RIBA Annie Spink Award for Excellence in Architectural Education - the judging panel chair described him as "one of the most pre-eminent thinkers in architectural education" who had "an exceptional commitment to the environmental agenda from a time when this was not fashionable or mainstream thinking".

Dick Powell (Honorary Professor)

Professor of Refrigeration - a research and development chemist by education and experience. Dick is a Fellow of the Royal Society of Chemistry and a Chartered Chemist. He has been continuously involved with industrial chemistry for 40 years mainly in the ICI Fluorochemicals Business. A major part of his work is focused on the development of refrigerants with reduced environmental impact. Over the past 12 years Dick has worked as a consultant for Refrigerant Solutions Ltd (RSL) helping them to develop its REFSOL range of HFC blends that can be retrofitted into existing CFC and HCFC to accelerate the phase-out of remaining ozone depleting substances.

Mario Cucinella (Honorary Professor)

Founder of MCA (Mario Cucinella Architects). MCA are recognised for their extensive experience in architectural design and urban planning with particular attention to energy issues and the environmental impact of buildings. In 2012 Mario founded the non-profit organisation “Building Green Futures” that promotes sustainable development through green architecture and urban regeneration. Previous positions include - project manager for Renzo Piano in Genoa and Paris. Awards include - Outstanding Architect, World Renewable Energy Congress 2004; MIPIM Architectural Review Future Projects Award 2005; Energy Performance + Architecture Award 2009; MIPIM Green Building Award 2009 & 2011.

Mark Whitby

Co-founded and led engineering consultancy Whitbybird, co-founder and Director of Whitby & Mohajer (UAE) and Davies Maguire & Whitby. He is a member of the National House-Building Council. Mark is a Fellow of the Royal Academy of Engineers and former President of the Institution of Civil engineers (ICE) and former Vice President ICE (education). Mark is also chairman of engineering timelines, he remains closely involved in the Engineering Club and is a member of the built environment think-tank the Edge.

Nick Ebbs (Honorary Professor)

Nick is a Director of Igloo Regeneration and Chief Executive of Blueprint, Igloo's public/private partnership with the Homes and Communities Agency, undertaking sustainable mixed-use regeneration in the East Midlands. He is a Chartered Surveyor by background and was previously a founder member of Innes England chartered surveyors where he was responsible for regeneration and development consultancy. Igloo and Blueprint are specialists in the development of sustainable places and buildings and are responsible for a wide range of award winning projects across the UK including Nottingham Science Park, Green Street Meadows, Phoenix Square in Leicester, Bermondsey Square in London and Roath Basin Cardiff.

RESEARCH TEAM AND ADVISORY BOARD 2012/13

Peter Clegg (Honorary Professor)

Peter Clegg is a Founding Partner with Feilden Clegg Bradley Studios, having established the practice with Richard Feilden in 1978. The firm has an international profile for design quality, pioneering environmental expertise and its radical architectural approach. That has been recognised with numerous construction industry awards, most notably as Winner of the RIBA's Stirling Prize in 2008 - Accordia, Cambridge, is a project that is regarded as setting a new benchmark for sustainable housing in the UK. Peter is widely regarded as a key pioneer in the field of environmental design, he has more than 30 years' experience in low energy architecture and is actively involved in research, design and education. He was made a Royal designer for Industry (RDI) in 2010. He is Chair of the Cabe affiliated South West Design Review Panel and a trustee of the Yorkshire Sculpture Park. He has served as a member of the National Trust's Architecture Panel and is a founder member of the British Council for School Environments.

Robin Nicholson (Honorary Professor)

Robin Nicholson is a senior partner of Cullinan Studio, which he joined in 1979. He is Convenor of the inter-disciplinary Construction Industry think-tank, The Edge, and chairs the Cambridgeshire Quality Panel. Robin is a Board Member of the National House Building Council and one of the Design Council CABE's Design Review Chairs. Previously he was a Vice-President of the RIBA (1992-94), Chairman of CIC (1998-2000) and founder member of the Movement for Innovation Board (1998-2001. He was a CABE Commissioner (2002-10) and chaired the DCSF Zero Carbon (Schools) Task Force (2009-10). He was awarded CBE in 1999 and made and Hon Fellow IStructE in 2002 and Hon Fellow CIBSE 2013.

Roger Bullivant

Roger Bullivant is the Chairman of Drakelow Developments Ltd. He was the founder, owner and Chairman of Roger Bullivant Ltd for 40 years where he developed the company into a dynamic specialist civil engineering business based on award winning innovation such as the multi-award winning System First foundations (e.g. Innovation Prize, 2008 Sustainability Awards).

Tony Marmont (Honorary Professor)

Tony Marmont is Director of Beacon Energy Ltd which he formed in 1992 as a not-for-profit organisation. He has been awarded an honorary Doctor of Science Degree from the University of Nottingham and an Honorary Doctor of Technology Degree from Loughborough University, Tony is on the Board of Trustees for the National Energy Foundation and is also a Director of 'Environ' in Leicester. In 2008 Tony Marmont inspired the formation of the UK Sustainable Development Association, an association for businesses that provide products and services to help reduce the UK's carbon footprint. In 2009 Tony Marmont was presented with the 'Individual Achievement Award' by the Energy Institute, in recognition of 30 years of dedication to averting man-made climate change.

Zafre Ure

Zafre Ure is Group President of Phase Change Material Products Ltd. He is a chartered engineer and a member of CIBSE, ASHRAE and the Institute of Refrigeration. As a refrigeration engineer by training he is now a world leader on the use of Phase Change Materials (PCM) for Domestic and Industrial applications with the main function of bridging the gap between energy availability and energy use in order to reduce waste and improve efficiency.

Research Projects Highlights

The research undertaken focuses on two broad priority areas: **Sustainable Energy in the Built Environment** (technology focus) and **Climate Responsive Architecture** (design focus).

It is structured according to eight overlapping themes explored across a range of building types, including dwellings, schools, offices, hospitals and others. Collaboration with partners in the construction industry underpins much of this, and the group has research partners across Europe, Middle East, Asia and Latin America.

Highlights this year include major projects that overlap in most themes such as:

HERB (Holistic Energy-efficient Retrofitting of Residential Buildings), a €8.6M international collaborative project between 17 European academic institutions and industry led by ABE supported by the Seventh Framework Programme of the EU. It has been established to develop and demonstrate new and innovative energy efficient technologies and solutions for retrofitting older buildings. These shall be installed and performance monitored in a number of typical residential buildings in EU countries. More information available at http://www.euroretrofit.com/; contact: Prof Saffa Riffat.

TURAS (Transitioning Towards Urban Resilience and Sustainability), a €8.9M initiative supported by the Seventh Framework Programme of the EU bringing urban communities and businesses together with local authorities and researchers to collaborate on developing practical new solutions for more sustainable and resilient European cities. More information available at http://www.turas-cities.org/; contact: Dr Lucelia Rodrigues.

Figure 3: One of the design proposals for the Nottingham Waterside Regeneration – Trent Basin, one of the case studies in TURAS (more at http://www.turas-cities.org/)

Creative Energy Homes (CEH), a £1.9M project that is a key resource particularly with respect to micro-smart grids, energy storage, demand-side management and occupants' acceptance of innovative technologies. The seven-house development provided a living test-site for leading firms, including E.ON, David Wilson Homes, BASF, Roger Bullivant, the Mark Group, Tarmac and Saint Gobain to work with the University of Nottingham to investigate the integration of energy efficient technologies into houses. This

high profile project attracts over 3000 visitors every year including, the Chancellor of Exchequer, Climate and Housing Ministers, MPs, Vice Chancellors, industry, government departments and schools/colleges. The research findings have fed into the UK government's "Green Deal" strategy, the Nottingham Community Climate Change Strategy and received widespread acclaim through a number of public engagement activities reaching out to over 5 million people. More information available at http://www.nottingham.ac.uk/creative-energy-homes; contact: Prof Mark Gillott.

Figure 4: The Creative Energy Homes project partners (more at http://www.nottingham.ac.uk/creative-energy-homes)

The great majority of the projects listed here are being developed in collaboration with industry partners.

RESEARCH PROJECTS HIGHLIGHTS

Sustainable Building Design

Post occupancy evaluation, demand side management technologies (BMS & BEMS), smart buildings, building performance evaluation including energy use, users comfort, productivity and well-being. This focuses on both, new buildings and retrofit projects. Contacts: Prof Mark Gillott, Prof Brian Ford and Dr Ed Cooper.

Highlights include the Technology Strategy Board funded Building Performance Evaluation of Green Street Project (£42k) [Ford and Gillott], CALEBRE (Consumer Appealing Low Energy Technologies for Building Retrofitting) a £2.1M EPSRC collaboration with Loughborough, Oxford, Ulster, Herriot-Watt & Warwick Universities [Gillott]; Wi-BE (Reduction of Energy Demand in Buildings through Optimal Use of Wireless Behaviour Information Systems) an EPSRC funded £598k project in collaboration with Reading, Queen Mary and De Montfort Universities [Gillott] and SHINE, a £85k EMDA iNET collaboration with BRE, Loughborough & Northampton Universities [Gillott]; the 'Building Retrofit' funded by E.On (£350k) [Gillott and Riffat]. In addition, the 'Greening the Box: retrofit of hard to treat housing', a collaborative project with Nottingham Trent University and SEArch Architects funded by Sustainable Construction iNET (£15k) [Ford]; the 'Climate Resilience of Modern Methods of Construction Dwellings', a £58k RKTB funded project developed to support decision making for housing design, construction and adaptation in a low carbon climate change future [Rodrigues]; the EPSRC funded 'A novel low pressure technique for measuring the air tightness of buildings' (£124k) [Cooper] and the 'Development of a novel low pressure technique for measuring the air tightness of buildings', a Technology Strategy Board funded project (£592k) [Cooper, Gillott and Riffat].

Energy

Development of renewable energy technologies, integration of low-carbon energy technologies, energy distribution and smart grids. Contacts: Dr Hao Liu and Prof Saffa Riffat.

Highlights include the 'Small-scale biomass-fired CHP' a £134k project funded by EPSRC [Liu and Riffat]; the 'Integrated Biomass-fuelled CHP/cooling system', a £286k project funded by TSB (DTI's Technology Programme) [Liu and Riffat]; the 'Mop fan and electrofilter - an innovative approach for cleaning product gases from biomass gasification' a £174k project funded by EPSRC [Liu and Riffat]; the 'Small-scale woody and non-woody biomass pellet boiler with low NOx and particulate emissions' (£230k funded by the Carbon Trust) [Liu and Riffat]; the EPSRC project 'Effective Adsorbents for Establishing Solids Looping as a Next Generation NG PCC Technology' (£756k) [Liu] the £204k EPSRC/UKCCSRC project 'Experimental investigation with PACT facility and CFD modelling of oxy-coal combustion with recycling real flue gas and vent gas of compression and purification units' and a number of other joint projects in carbon capture and storage and bioenergy such as the 'Innovative adsorbent materials and processes for integrated carbon capture and multi-pollutant control for fossil fuel power generation', a £983k project funded by EPSRC [Liu]; the EPSRC/China NSFC project 'The Next Generation of Activated Carbon Adsorbents for the Pre-Combustion Capture of CO2' (£694k) and the EPSRC/DST-India £2.7M project 'Rural Hybrid Energy Enterprise Systems' [Liu]. Focusing on smart grids, the E.On funded 'Community Energy Battery Project' [Gillott] and the E.On EIRI 'Switch – Smart Wireless Intelligent Control in Homes' (€220k0 [Gillott and Shipman], in addition to the ERDF Accelerating a Low Carbon Economy 'Smart Energy Communities' project [Gillott]. Other two projects funded by DECC are the £128k 'Thermochemical Energy Storage Pumping Pipe' [Riffat] and the £230k 'Versatile energy storage system for the built environment' [Riffat]. In addition, the EU funded 'Absorption/power generation cycle' (€11M) [Riffat and Su] and the iNet funded 'Solar Heat Pump' (£62k) [Riffat]. Funded PhD studentships in the area include the 'Managing the uncertainty of occupancy behaviour through real time building energy evaluation and management' (EPSRC DTG case award with Laing O'Rourke) [Gillott and Cooper] and the '4th generation district heating' with Sasie Ltd [Cooper].

Cooling

HVAC, low energy ventilation technologies, passive cooling including evaporative cooling and natural ventilation. Contacts: Dr Dr Yuehong Su and Prof Brian Ford.

Highlights include the 'ICUK Optimal Study of a Dew Point Air Cooler' (£65k) [Su]; the 'Novel Dew Point Air Conditioning System' (£70k) [Su]; the 'Novel Dew Point Cooling Technology in UK and China Building Air Conditioning' (£15k) [Su]; and the Passive and Hybrid Downdraught Cooling (PHDC), a €907k EC FP6 project involved architects, engineers, academics and industry representatives from Europe, China and India in a three year project to undertake post-occupancy evaluation of exemplar PHDC projects and to develop design guidance and performance evaluation tools [Ford].

Materials

Development of smart /innovative materials, application of smart/innovative materials. Contacts: Prof Mark Gillott and Dr Lucelia Rodrigues.

Highlights include the 'EnvirUP' a Technology Strategy Board funded project (£612k) addressing the production, performance and installation methods required to scale up the adoption of a modular, factory produced external wall insulation system for future retrofit projects [Rodrigues and Gillott]; the 'Spot the Difference', a £30k gift from industry partners for research used to investigate issues of thermal mass in buildings [Rodrigues and Gillott]; the 'Innovative adsorbent materials and processes for integrated carbon capture and multi-pollutant control for fossil fuel power generation' a £983k project funded by EPSRC [Liu (CI)]; the 'High Performance Vacuum Pipe Windows' project funded by DECC (£334k) [Riffatt]; and the 'Development of heat insulation glass for low carbon buildings' £225 Marie Curie Fellowship (funded by EU) [Riffat].

In addition, a Hermes Fellowship (£12.5k) supported the creation of the 'Prototyping Architecture' Exhibition and matched £12.5k in cash sponsorship from industry + over £40k of 'in-kind' sponsorship [Ford (CI)]. It formed part of our strategy to promote the facility of the Prototyping Hall and to encourage further industrial collaboration in R&D both with the Architecture, Climate and Environment and the Architecture and Tectonics research groups.

Figure 5: Fluidized bed reactor for carbon capture with solid sorbents(left) and 10kWe biomass-gasification based power generator (right)

RESEARCH PROJECTS HIGHLIGHTS

Figure 6: Vacuum glazing (left) and aerogel blanket internal wall insulation solution (right) tests at the E.ON retrofit research house

Daylighting

Daylighting technology, daylighting in architecture, new materials, impact of daylighting in productivity. Contacts: Dr Yuehong Su and Benson Lau.

Highlights include a Knowledge Transfer partnership (KTP) grant (£124k) focused on the design, development and implementation of a modular self-supporting structural/construction system comprised of linked Ethylene tetrafluoroethylene (ETFE) foil encapsulated panels [Lau (CI)]; and the COST funded (€674k) collaborative network 'Novel structural skins: Improving sustainability and efficiency through new structural textile materials and designs' [Lau (CI)].

Education

Environmental design and sustainability in education. Contacts: Prof Brian Ford and Guillermo Guzman.

Highlights include the EDUCATE, a €1.6M EU project led by University of Nottingham combining experts in architecture, engineering, computer science and education to promote the integration of sustainable environmental design. Supported by a further HEA and HEFCE grant the EDUCATE project has developed an interactive online Portal on sustainable environmental design [Ford and Rodrigues (CIs)].

Other highlights include the Nottingham H.O.U.S.E. at SDE ten act10n funded by Intelligent Energy Europe (Euro15k) [Gillott, Ford, Rodrigues and Guzman] and the 'Nottingham Shipping Shelter: A Fleeting Retreat' sponsored by industry [Guzman].

Simulation

Computer fluid dynamics (CFD) simulations, building energy/environment simulations including climate resilience. Development of new computer tools using the visual basic programming language. Contacts: Dr Mohammed Gadi and Dr Lucelia Rodrigues.

This is mostly developed through PhD studentships such as two EPSRC DTG Funding for HEU Students (£53k each), looking at the climate resilient of low-energy housing [Rodrigues] and the PhD Scholarship for Research Excellence from Brazil (£78k), looking at the application of the fabric first approach in Brazil [Rodrigues].

Tradition

Cultural heritage, vernacular / empirical tradition. Contacts: Prof Brian Ford, Benson Lau and Dr Patrizia Riganti.

This is mostly developed through PhD studentships such as the one sponsored by the High Commission of Brunei Darussalam looking at vernacular houses on water in Brunei [Rodrigues], and the 'Environmentally responsive site planning and building design: the Xidi Village in South-East China' [Ford and Lau]. Benson Lau has also developed and published 'The poetics of sacred light in Le Corbusier's religious building: a comparative study of the luminous environment in Ronchamp Chapel and the Monastery of La Tourette' funded by the Royal Institute of British Architects.

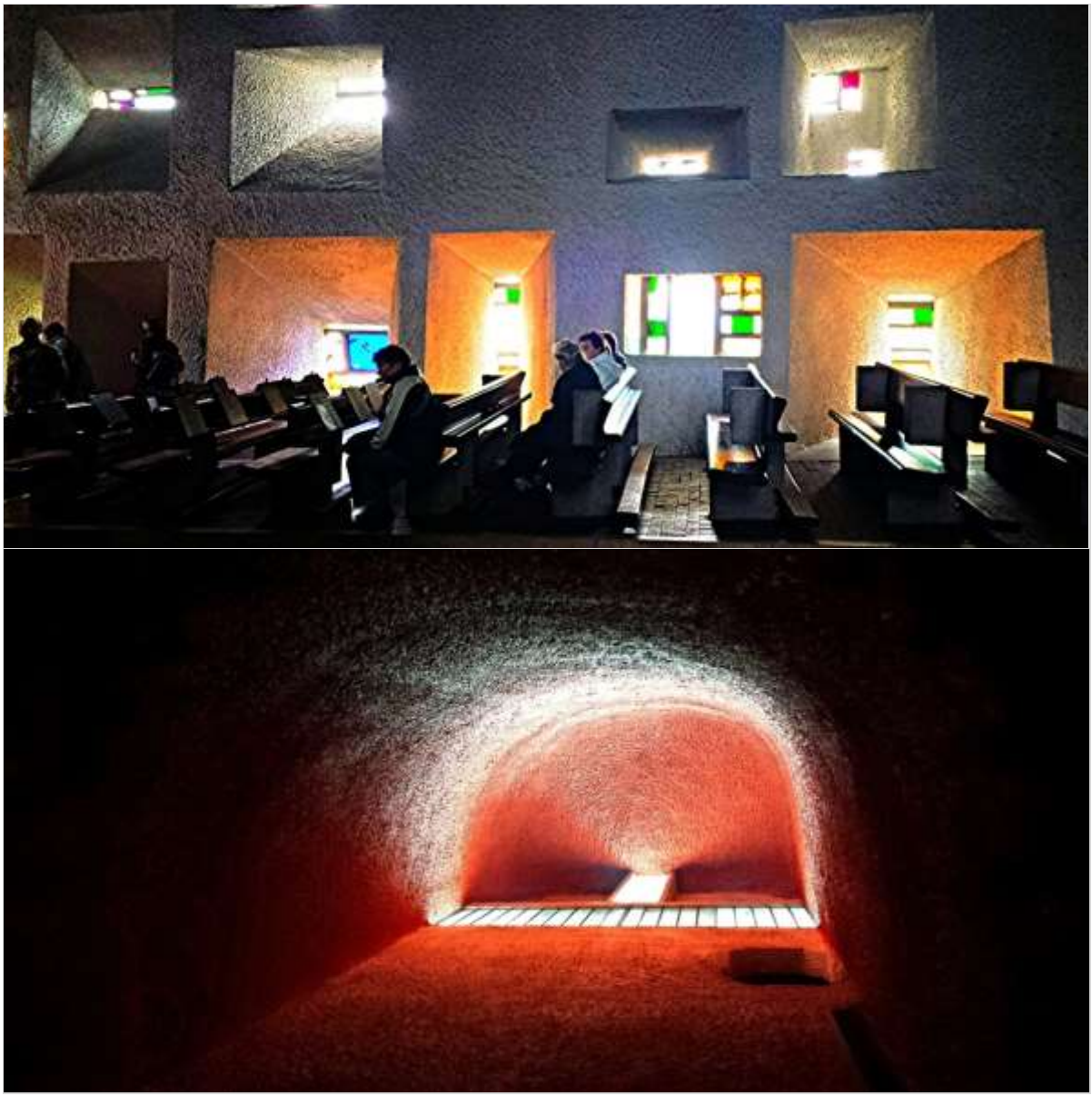


Figure 7: The luminous environment in the Ronchamp Chapel and the Monastery of La Tourette (photos by Lucelia Rodrigues)

Facilities

The University of Nottingham offers fantastic facilities that group members make full use of. Those that are most explored by our group, are listed below:

The Creative Energy Homes

Figure 8: The Creative Energy Homes Project (photo by Mark Gillott)

Developed and managed by the Architecture, Climate and Environment Research Group, the project is a research and educational showcase of innovative state-of-the-art energy efficient homes. The project aims to stimulate sustainable design ideas and promote new ways of providing affordable, environmentally sustainable housing that are innovative in their design.

Seven homes on the University Park Campus have been designed and constructed to various degrees of innovation and flexibility to allow the testing of different aspects of modern methods of construction, energy efficient design and renewable energy systems such as solar thermal/PV, air source heat pumps, micro-CHP (1kWe fuel-cell CHP and 1kWe Stirling engine CHP), natural ventilation and heat storage with phase changing materials and waste water collection/recycling etc. Equipped with various advanced monitoring and smart metering equipment, they provide the ideal infrastructure for research on energy demand reduction, user behaviour, retrofit and zero-carbon emission housing.

The houses include: the David Wilson Millennium House, the Mark Group EcoHouse, the BASF Research House, the E.ON 2016 Research House, the two Tarmac Homes Projects and the Saint Gobain Nottingham H.O.U.S.E.

More information available at www.nottingham.ac.uk/creative-energy-homes. Follow us on facebook to keep up-to-date with the project: www.facebook.com/CreativeEnergyHomes.

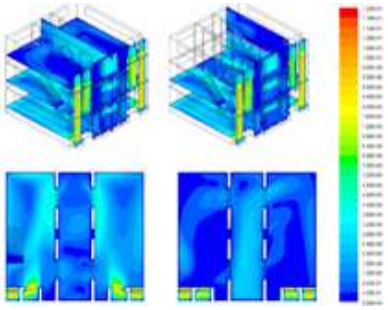
FACILITIES

Other Facilities

The group have contributed to the development of new facilities to promote industrial collaboration, including the University's new Energy Technologies Building. The group also has available a number of the latest technology and equipment, such as thermo imaging cameras and specialised facilities for digital fabrication technologies with laser cutting and 3D printing equipment.

Prototyping Hall

The Prototyping Hall is a unique facility part of the Energy Technologies Building, a building that has been specifically designed for continuing and developing world-leading energy research. Opened in October 2012, it has a 400sqm and 12m high chamber for the testing of low-energy technologies and building components.

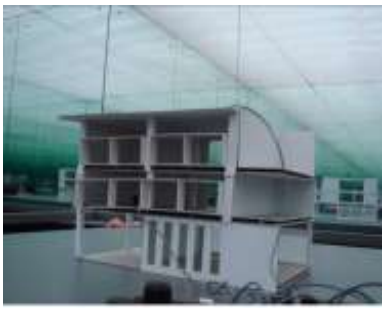


Computer Packages

Our CAD suites have an extensive range of design and simulation software. Members of the group use those to develop research and inform building design, ranging from the simulation of energy use in buildings and the influence of users, to visual and thermal comfort prediction. This is done through self-developed simulators and commercial packages.

Workshops and Labs

Our workshop facilities are vast and well-equipped, including model making workshops, rapid prototype equipment, plastic forming press, 3 dimensions printers, dedicated laboratories with specialised environmental chambers and photographic studios. Dedicated technical staff is available to help. PhD students have a dedicated space in the Sustainable Research Building.

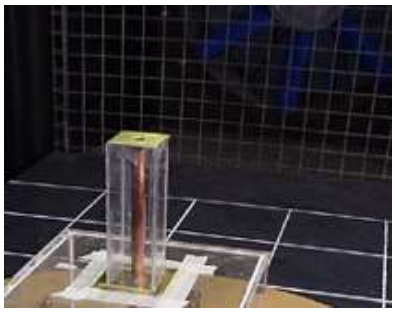


Artificial Sky

The artificial sky can be used to test the daylighting performance of a scale model under a standard overcast sky conditions. It is made of a box with mirrors and diffuse lighting, and is typically used for daylight factor analyses.

Heliodon

The heliodon simulates the path of the sun and so it is used to analyse sunlight penetration and glare in buildings. It is made of a moving table where a scale model is placed and a light source. The user controls the geographic latitude, time of the day and season of the test.



Wind Tunnel

There are a large number of wind tunnels of different sizes and configurations available for our department. They can be used to study the airflow around and/or within a building and are typically used to test wind behaviour and ventilation strategies.

Scholarly Events 2012/13

What a busy year it was! We have organised a number national and international events this year. Some highlights:

Beyond Zero Carbon Housing

A symposium took place on the 24th of October 2012, attended by 100 external delegates and 120 2nd year students. It offered construction industry professionals a unique opportunity to explore solutions for sustainability issues "beyond" the zero carbon agenda. The event followed on the successful 'Towards Zero Carbon Housing' symposium hosted by the University five years previous. Supported by the European Commission Intelligent Energy Europe and organised by Mark Gillott (chair), Lucelia Rodrigues, Sophie Bailey, Brian Ford, Robin Wilson, Guillermo Guzman and Michael Stacey. Full presentations for download at www.slideshare.net/CreativeEnergyHomes.

PLEA 2012 (Peru) & 2013 (Germany)

PLEA is an organisation created in 1982 engaged in a worldwide discourse on sustainable architecture and urban design through annual international conferences, workshops and publications. It is the longest and most established organisation in the field, with a membership of over 2500 professionals, academics and students from over 40 countries. PLEA has 6 elected directors, including Professor Brian Ford. PLEA plays a central role in providing a forum for reviewing the state-of-the-art of the research in low energy architecture. In 2013 our students Yanti Chen and Mingwei Sun got awards for Best Overall Poster and the Jeffrey Cook PLEA Travel Scholarship respectively. More at plea-arch.org.

SET 2012 (Vancouver) & 2013 (Hong Kong)

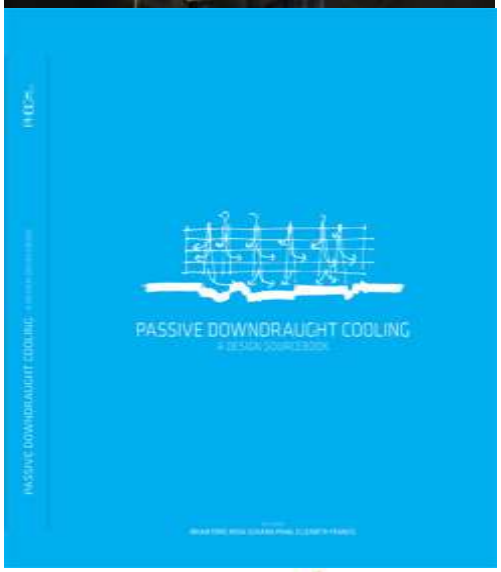
Professor Saffa Riffat, our Head of Department, has been chairing and running the International Conference on Sustainable Energy Technologies (SET) since 2002. SET is a multi-disciplinary international conference on sustainable energy sources and technologies, and provides a forum for the exchange of latest technical information, the dissemination of the high-quality research results on the issues, the presentation of the new developments in the area, and the debate and shaping of future directions and priorities for better environment, sustainable development and energy security. Our research group had one of the largest presences at the 2013 conference with many paper contributions. More at wsset.org/news-events/.

SCHOLARLY EVENTS 2012/13

The UK Passivhaus Conference 2012

A major national conference was held at the University of Nottingham, in November 2012, gathering some of the UK's leading experts in the design of energy efficient buildings and around 500 delegates. The conference was aimed at all construction and built environment disciplines ranging from architects, planners, building control officers, energy managers, builders and housing associations and researchers. It also featured tours of the Nottingham H.O.U.S.E. Organised by the Passivhaus Trust and the BRE under the guidance of the conference steering committee which was chaired by Mark Gillott (also conference chair) and included Lucelia Rodrigues. More at www.ukpassivhausconference.org.uk.

Passive Downdraught Evaporative Cooling Workshop

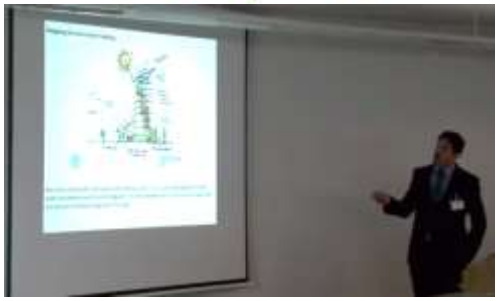


Since 1996 Prof Brian Ford has been investigating the application of passive downdraught evaporative cooling (PDEC). His research has led to the publication of a book (2010) summarising the state of the art of PDEC, and a number of keynote speeches and workshops in the last decade. This year Brian was invited to give workshops in Santiago, Chile in November 2012 and in London in March 2013. They were half day events at which the principles were presented and the issues of design integration were explored. The participants were also introduced to simple predictive/analytic tools. More at www.phdc.eu.

Fleeting Retreat Project

'The Nottingham Shipping Shelter: A Fleeting Retreat' was a purposely built pavilion for Ecobuild 2011, were it got the runner up prize for sustainable stands awarded by the Green Building Council UK. A team of 15 students coordinate by Guillermo Guzman led the design that used shipping pallets as the main building material. The Nottingham City Council invited the team to rebuild the pavilion in the Nottingham Castle grounds and to be part of its "Light Night" event. Guillermo Guzman has since presented the project at two national conferences. More at www.thefleetingretreat.co.uk.

Vertical Farming & Urban Agriculture Workshop



The University of Nottingham Vertical Farming and Urban Agriculture Team has been set up to develop a network of excellence to examine the potentials benefits of urban and vertical farming in the UK. As part of the team Prof Mark Gillott helped organise the Vertical Farming Workshop in 2012 where he also gave a keynote talk addressing building energy and urban/vertical farming. More at vft.org.uk/.

Alumni Catch-up

Dr Alexandra Albuquerque Maciel

BArch DipArch. MSc PhD

Energy Bureau Coordinator, Secretariat of Climate Change and Environmental Quality, Brazilian Ministry of the Environment

PhD Thesis: Bioclimatic integration into architectural design (2007)

PhD Supervisors: Prof Brian Ford and Prof Roberto Lamberts (Federal University of Santa Catarina- Brazil)

Alexandra graduated as an architect in 1998 in Brasilia, Brazil, where she designed a range of projects and residential buildings in particular. During this period in practice Alexandra started to develop an especial interest for bioclimatic architecture ad energy efficiency, area that she studied in her MSc in 2002. This led to a fruitful collaboration with the Laboratory of Energy Efficiency of Buildings (LabEEE- in Portuguese), from the Federal University of Santa Catarina, and she became part of the team developing the celebrated 'Casa Eficiente' (efficient house). Alexandra developed her PhD based half at the University of Nottingham and half at the Federal University of Santa Catarina, and soon after became a lecturer at the University Centre of Brasilia. She now works as an infrastructure analyst at the Brazilian Ministry of Environment where she helps steer the future of Brazilian policies on energy efficiency and sustainability.

What have you been up to since you left us?

Initially, I carried on practising architecture and teaching at the University Centre of Brasilia. After going through a stringent selective process, I started working as an infrastructure analyst at the Ministry of Planning and Budget and eventually relocated to the Ministry of the Environment to work on a national plan for the protection of water sources in Brazil. Soon I was working on programmes focused on energy efficiency in the built environment and this year I was appointed as a coordinator for the Energy Bureau dealing with renewable energy and energy efficiency. I haven't stopped teaching though and I'm still a lecturer at post-graduation courses. And since I left I also had two beautiful kids!

What do you do in your job in a regular day?

I analyse programmes, laws and regulations proposals and projects related to energy efficiency and renewable energy. The core part of my job is to help my country to have a more sustainable future by steering the direction of policies and the focus of projects.

How was your PhD important to your career?

I wouldn't be able to do what I do today without what I have learnt during my PhD. Now I have the opportunity to work directly with my areas of interest and not only use all I have learnt but also have the chance to interact with many professionals I had contact through my studies.

Why did you choose the University of Nottingham?

I chose Nottingham because of the internationally recognised work of the research group and in particular because of distinguished work of Professor Brian Ford who is a well-known as a leading authority when it comes to the integration of bioclimatic concepts to the practice of architecture.

Any advice for current PhD students?

Choose a theme that is really one of your passions because it will be part of your life during many significant years. And try to establish a programme of work with your supervisor, be always open to changes and to different points of views that can make your work richer, more rigorous and of higher impact.

ALUMNI CATCH-UP

Dr Kevin Hard

BEng(hons) CEng MEI MCIBSE PhD

Managing Director/ CEO of EvoEnergy

PhD Thesis: Proton Exchange Membrane (PEM) fuel cell multi-phase system (2005)

PhD Supervisors: Prof Saffa Riffat and Dr Robin Wilson

Kevin graduated with Nottingham of Nottingham in 2002 (BEng Architectural Environment Engineering) and in 2005 with his PhD, shortly after becoming a chartered engineer. An entrepreneur, an expert in his field and an inspirational leader, Kevin founded EvoEnergy in 2007 and, in a short space of time, has grown the business to become the leading independent solar installer in the UK. Kevin's incredible achievements have been recognised at several awards ceremonies. In 2011 Evo Energy won the big three industry awards for solar power systems - the Renewable Energy Association: Installer of the Year; the Renewables Awards: Solar Installer of the Year and the Renewable Energy Infrastructure awards: Solar Energy Provider of the Year. The Institute of Directors (IoD) also named Kevin as its Director of the Year, 2011, for Environmental Leadership. This personal ward was in addition to the 2010 IoD award he won for East Midlands Young Director of the Year. Kevin was also named as the Entrepreneur of the Year by the business news magazine The Insider, and has received the University of Nottingham Alumni Laureate Recent Graduate Award in 2012.

What have you been up to since you left us?

After graduating with my PhD, I joined Faber Maunsell where I worked on environmental design building services projects and gained my chartered engineer status. During this period I realised the potential growth area for photovoltaic technology in the UK and left Faber Maunsell to establish Evo Energy in 2007. I was only 27 years old and had £30k. Within a very short space of time Evo Energy has become a national leader in solar power system, design, financing, installation and monitoring. Evo Energy achieved a £30M turnover in 5 years from a standing start and now employs over 300 staff across six UK offices.

What do you do in your job in a regular day?

The day to day running of the Evo Energy business includes the provision of strategic direction and leadership. As a business it is important that we adapt to the current economic and policy drives to stay ahead of the competition so I need to keep up-to-date with all aspects relevant to the company and not just technical innovation. It is hard work!

How was your PhD important to your career?

My PhD was an excellent arena and freedom for learning and experimentation. I was also learnt about myself, and about self-motivation, discipline and drive. Despite the interest it generated and the job offers I got, I couldn't see how I could make money with fuel cells, albeit there are lots of people who make lots of money with them. So I decided to start my own business. My PhD was a launch pad to business opportunities.

Why did you choose the University of Nottingham?

I chose Nottingham because of the reputation of the University and the academic staff with whom I have worked, who are now part of this Group. In addition, the research facilities and the links with industry were critical in my decision.

Any advice for current PhD students?

If you want to start a business, pick something you enjoy doing and be prepared for relentless hard work. Study the market and make sure you can really commercialise your ideas.

If you haven't yet finished your PhD, get it done as fast as possible: being a Dr is a powerful thing!

Journals and Societies

World Society of Sustainable Energy (WSSET)

WSSET is a non-profit organisation led by Prof Saffa Riffat that plays an important role in consolidating practical partnerships between academic and industrial organisations, as well as promoting sustainable development/technologies worldwide to help minimise the impact of climate change. Its role is becoming increasingly important as the world seeks new solutions to problems arising from climate change, energy shortages and economic crisis. Through a newsletter it promotes information on membership activity, latest news on sustainable technologies, research/ development and demonstration projects, funding/ collaboration opportunities and events (e.g., conferences/ seminars/ workshops).

Membership is free. For Information on becoming a member please e-mail: info@wsset.org or access http://wsset.org/.

International Journal of Low-Carbon Technologies

Editor-in-Chief Professor Saffa B Riffat Editorial Board Member: Professor Mark Gillott

International Journal of Low-Carbon Technologies is concerned with the application of technology to the challenges created by climate change. All areas of the field are considered with sections focusing on: renewable energy technologies, CO2 reduction and low carbon technologies, sustainable energy technologies in the built environment, and renewable energy management and environmental impact. It is our aim that International Journal of Low-Carbon Technologies will provide a forum for the cross-fertilization of ideas across all areas of the field. The journal publishes research articles, technical notes, review papers, book reviews and focus issues. More information at http://ijlct.oxfordjournals.org/.

Sustainable Cities and Society

Editor-in-Chief Professor Saffa B Riffat Editorial Board Member: Dr Lucelia Rodrigues

Sustainable Cities and Society publishes a wide range of original high quality papers covering fundamental and applied research, critical reviews and case studies. It focuses on research and multi-disciplinary work aiming to reduce the environmental and societal impact of future cities and covers topics including design, modelling, analytical tools, testing/experimental work, optimization, environmental assessment, new codes, regulations, policy, economics, monitoring, post occupancy evaluation and legislation related to sustainable cities. More information at http://www.journals.elsevier.com/sustainable-cities-and-society.

International Journal of Renewable Bio-resources

Editor-in-Chief Professor Saffa B Riffat

As global energy requirements change and grow, it is crucial that all aspects of the bio energy production process are streamlined and improved. Renewable Bioresources publishes articles on all aspects related to the study of advanced applications of biotechnology, to improve biological ecosystems through renewable energy derived from biological sources.

More information at http://www.hoajonline.com/renewablebioresources.

New publications

Refereed scientific journal publications

CHANEY, J., LIU, H. AND LI, J., 2012.
An overview of CFD modelling of small-scale fixed-bed biomass pellet boilers with preliminary results from a simplified approach.
Energy Conversion and Management. 63, 149-156.

CHEN, X, WORALL, M, RIFFAT, S, OMER, S, 2013.
Theoretical studies of a hybrid ejector CO2 compression cooling system for vehicles and preliminary experimental investigations of an ejector cycle.
Applied Energy, 102, 931-942.

CHEN, X, WORALL, M, OMER, S, 2013.
Recent developments in ejector refrigeration technologies.
Renewable and Sustainable Energy Reviews. 19, 629-651.

DING, Y., RIFFAT, S., 2013.
Thermochemical energy storage technologies for building applications: a state-of-the-art review.
The International Journal of Low-Carbon Technologies, 8 (2): 106-116 doi:10.1093/ijlct/cts00.

EAMES, I W, WORALL, M, WU, S, 2013.
An experimental investigation into the integration of a jet-pump refrigeration cycle and a novel jet-spay thermal ice storage system.
Applied Thermal Engineering, 53(2), 285-290.

ERNEST, R. AND FORD, B., 2012.
The role of multiple courtyards in the promotion of convective cooling.
Architectural Science Review. 55(4), 241-249.

FAZELI A AND GILLOTT M., 2012.
Analysing the Effects of Seasonal Variation of Occupancy in an Electricity Demand Model.
International Journal of Low Carbon Technologies. (In Press.).

FILIPPESCHI, S., SU, Y., AND RIFFAT, S., 2012.
Feasibility of periodic thermosyphons for environmentally friendly ground source cooling applications.
Intl Jnl of Low-Carbon Technologies. doi: 10.1093/ijlct/cts002 First published online: April 29, 2012.

FORD, B., WILSON, R., GILLOTT, M., IBRAHEEM, O., SALMERON, J. AND SANCHEZ, F.J., 2012.
Passive downdraught evaporative cooling: performance in a prototype house.
Building Research & Information. 40(3), 290-304.

JI, Z., SU, Y., AND KHAN, N., 2012.
Performance Evaluation and Energy Saving Potential of Windcatcher Natural Ventilation Systems in China.
International Journal of Architecture, Engineering and Construction. 1(2), 84-95.

HAN, H. J., RIFFAT, S., LIM, S. H., OH, S. J., 2013.
Fiber optic solar lighting: Functional competitiveness and potential.
Solar Energy Volume 94 pp 86-101, Elsevier.

HE, W., SU, Y., WANG, Y.Q., RIFFAT, S.B. AND JI, J., 2012.
A study on incorporation of thermoelectric modules with evacuated-tube heat-pipe solar collectors.
Renewable Energy. 37(1), 142-149.

IBRAHEEM, O., FORD, B., 2012.
The Application of Passive Downdraught Evaporative Cooling to High-rise Office Buildings in Cairo.
Architectural Science Review. 55(4), 307-319.

IYER, M., FORD, B., 2012.
Passive Downdraught Cooling for Schools in India:: A Study on Iira International School in Baroda, Gujarat, India.
Architectural Science Review. 55(4), 287-306.

JRADI, M., GILLOTT, M. AND RIFFAT, S., 2013.
Simulation of the Transient Behaviour of Encapsulated Organic and Inorganic Phase Change Materials for Low-Temperature Energy Storage.
Applied Thermal Engineering Journal, First Published online 20 May 2013.

JRADI, M., RIFFAT, S., 2013.
Year-round numerical simulation of a parabolic solar collector under Lebanese conditions: Beirut case study.
International Journal of Ambient Energy, First Published online 9 May 2013.

NEW PUBLICATIONS

HAO, L., CHANEY, J., LI, J., AND SUN, C., 2013.
Control of NOx emissions of a domestic/small-scale biomass pellet boiler by air staging.
Fuel. 103, 792-798.

LI, G., SU, Y., PEI, G., YU, X., JI, J., RIFFAT, S., 2013.
Preliminary experimental comparison of the performance of a novel lens-walled compound parabolic concentrator (CPC) with the conventional mirror and solid CPCs.
International Journal of Green Energy. 10(8), 848-859.

LIU, P. C., FORD, B. AND ETHERIDGE, D., 2012.
A modelling study of segmentation of naturally ventilated tall office buildings in a hot and humid climate.
International Journal of Ventilation. 11(1), 29-42.

NCUBE, M., RIFFAT, S., 2012.
Developing an indoor environment quality tool for assessment of mechanically ventilated office buildings in the UK: a preliminary study.
Building and Environment. 53(July), 26-33.

PARRA, D., WALKER, G., GILLOTT, M., 2013.
Modelling of PV generation, battery and hydrogen storage to investigate the benefits of energy storage for single dwelling.
International Journal of Sustainable Cities and Society. DOI 10.1016/j.scs.2013.04.006 [in press].

PEI, G., LI, G., ZHOU, X., JI, J., SU, Y., 2012.
Experimental study and exergetic analysis of a CPC-type solar water heater system using higher-temperature circulation in winter.
Solar Energy. 86(5), 1280-1286.

PEI, G., LI, G., SU, Y., JI, J., RIFFAT, S., AND ZHENG, H., 2012.
Preliminary Ray Tracing and Experimental Study on the Effect of Mirror Coating on the Optical Efficiency of a Solid Dielectric Compound Parabolic Concentrator.
Energies. 5(9), 3627-3639.

QIU, G., SHAO, Y., LI, J., LIU, H. AND RIFFAT, S.B., 2012.
Experimental investigation of a biomass-fired ORC-based micro-CHP for domestic applications.
Fuel. 96(June), 374-382.

RIGANTI, P, STRIELKOWSKI W AND WANG J., 2012.
Tourism, cultural heritage and e-services: using focus groups and in-depth interviews to assess consumers' preferences
Tourismos. (In Press.)

RODRIGUES, L. AND GILLOTT, M., 2013.
A Novel Low-Carbon Space Conditioning System Incorporating Phase Change Materials and Earth-Air Heat Exchangers
International Journal of Low Carbon Technologies doi: 10.1093/ijlct/ctt023. First published online: July 2, 2013.

RODRIGUES, L. AND GILLOTT, M., 2013.
The climate resilience of a low-energy prototype house.
Proceedings of the Institute of Civil Engineering - Engineering Sustainability (2013). DOI 10.1680/ensu.12.00009 [in press].

RODRIGUES, L., GARRATT, T., EBBS, N., 2012
Is added sustainability equal to added value?
Energy Conversion and Management 63, 2012: 203-207.

RODRIGUES, L., GILLOTT, M., TETLOW, D., 2013.
Summer overheating potential in a low-energy steel frame house in future climate scenarios.
International Journal of Sustainable Cities and Society 7: 1-15.

ROGERS, T. AND OMER, S., 2012.
The effect of turbulence on noise emissions from a micro-scale horizontal axis wind turbine .
Renewable Energy. 41(May), 180-184.

ROGERS, T. AND OMER, S., 2013.
Yaw analysis of a micro-scale horizontal-axis wind turbine operating in turbulent wind conditions .
International Journal of Low-Carbon Technologies. 8(1), 58-63.

SHATAT M., MAYERE A., RIFFAT, S., 2013.
A standardized empirical Method of Testing Solar Simulator Coupled with Solar Tube and Concentrator Collectors.
International Journal of Thermal and Environmental Engineering (IJTEE). 5 (1), 13-20.

SHATAT M., OMER S., RIFFAT S., 2013.
Theoretical simulation of small scale psychometric solar water desalination system in semi-arid region.
Applied Thermal Engineering Journal, Volume 59, Issues 1–2, 25 September 2013, Pages 232–242.

SHATAT, M., RIFFAT, S., AND AGYENIM, F., 2013.
Experimental Testing Method for Solar Light Simulator Attached With an Evacuated Solar Collector.
International Journal of Energy & Environment; 2013, Vol. 4 Issue 2, p 219.

NEW PUBLICATIONS

SHATAT, M., WORALL, M., AND RIFFAT, S., 2013.
Economic Study for an Affordable Small Scale Solar Water Desalination System in Remote and Semi-Arid Region.
Renewable and Sustainable Energy Reviews journal. Volume 25, September 2013, Pages 543–551.

SHATAT, M., WORALL, M., AND RIFFAT, S., 2013
Opportunities for Solar Water Desalination Worldwide: Review.
Sustainable Cities and Societies. Volume 9, December 2013, Pages 67–80.

SU, Y., PEI, G., RIFFAT, S.B. AND HUANG, H., 2012.
A novel lens-walled compound parabolic concentrator for photovoltaic applications.
Journal of Solar Energy Engineering. 134(2), 021010.

SU, Y., PEI, G., RIFFAT, S., HUANG, H., 2012.
Radiance/Pmap simulation of a novel lens-walled compound parabolic concentrator (lens-walled CPC).
Energy Procedia. 14, 572-577.

SU, Y., KHAN, N., RIFFAT, S., GARETH, O., 2012.
Comparative monitoring and data regression of various sized commercial lightpipes.
Energy and Buildings. 50, 308-314.

SU, Y., RIFFAT, S., PEI, G., 2012.
Comparative study on annual solar energy collection of a novel lens-walled compound parabolic concentrator (lens-walled CPC).
Sustainable Cities and Society. 4, 35-40.

SU, Y., YU, X., ZHANG, L., KARAGIANNI, M., KHAN, N., 2012.
Energy saving potential of MonodraughtTM sunpipes installed in a supermarket.
Energy Procedia. 14, 578-583.

WEILING, L., WENQI, Z., BAOSHENG, J., RUI, X., YINGJUAN, S., AND HAO, L., 2012.
Study on Black Liquor Low-temperature Gasification in Fluidized Bed by Eulerian Multiphase Computationally Fluid Dynamics Modelling .
International Journal of Chemical Reactor Engineering. Volume 10, Issue 1, A48

WOOD, C. J. , LIU, H. AND RIFFAT, S., 2012.
Comparative Performance of 'U-tube' and 'Coaxial' Loop Designs for Use with a Ground Source Heat Pump.
Applied Thermal Engineering. 37, 190-195.

XIE, J., ZHONG, W., JIN, B., SHAO, Y. AND LIU, H., 2012.
Simulation on gasification of forestry residues in fluidized beds by Eulerian–Lagrangian approach.
Bioresource Technology. 121, 36-46.

XUAN, H., FORD, B., 2012.
Climatic Applicability of Downdraught Cooling in China.
Architectural Science Review. 55(4), 273-286.

YIN, S., JIN, B., ZHONG, W., LU, Y., SHAO Y., LIU, H., 2012.
Experimental Gas-solid Flow Characteristics in Pressurized Circulating Fluidized Bed I：Solid Holdup Distribution.
Journal of Southeast University (Natural Science Edition). 42(2), 308-312.

YIN, S., JIN, B., ZHONG, W., LU, Y., SHAO, Y., LIU, H., 2012.
Solid holdup of high flux circulating fluidized bed at elevated pressure .
Chemical Engineering & Technology. 35(5), 904-910.

ZHANG, W., LIU, H., UL HAI, I., NEUBAUER, Y., ET AL., 2012.
Cleaning strategies for biomass gasification product gas.
International Journal of Low Carbon Technologies. 7(2), 69-74.

ZHENG, H., TAO, T., MA, M., KANG, H., SU, Y., 2012.
Experimental test of a novel multi-surface trough solar concentrator for air heating.
Energy Conversion and Management. 63, 123–129.

ZONGCHENG, D., LAU, B. AND FORD, B., 2012.
Environmentally responsive site planning and building design: A Case Study: Xidi Village in South-East China.
Architectural Science Review. (In Press.).

Published Conferences Proceedings

BESSER, D., RODRIGUES, L. AND BOBADILLA, A., 2013.
Comfort and Occupancy: New Chilean Building Regulations and Energy Efficient Housing in Disaster Zones.
In: Juan Reiser, Cecilia Jiménez and Susana Biondi Antúnez De Mayolo, Eds., Opportunities, Limits & Needs: Towards an environmentally responsible architecture: 28th International PLEA Conference Proceedings, LIMA, 7 - 9 November 2012 Pontificia Universidad Católica del Perú. ISBN: 978-612-4057-89-2.

NEW PUBLICATIONS

RODRIGUES, L. AND GILLOTT, M., 2013.
Chapter 43: Building for Future Climate Resilience: A comparative study of the thermal performance of eight constructive methods.
In: ANNE HAKANSSON, MATTIAS HOJER, ROBERT J. HOWLETT and LAKHMI C. JAIN, eds., Sustainability in Energy and Buildings: Series Smart Innovation, Systems and Technologies Proceedings of the 4th International Conference in Sustainability in Energy and Buildings (SEB'12). 22. Springer, pp. 453-460. ISSN: 2190-3018.

Refereed Scientific Conferences Papers

BESSER, D., RODRIGUES L., BOBADILLA, A., 2012.
New Chilean Building Regulations and Energy Efficient Housing in Disaster Zones.
In PLEA 2012 - 28th Conference on Passive and Low Energy Architecture: Opportunities, Limits & Needs Towards an environmentally responsible architecture. Lima, Peru. (2012).

CHEONG, Y. K., LAU, B., 2013.
Creative Retrofitting Through Meaningful Testing.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

DAO, M., RODRIGUES, L., 2013.
Visual and thermal performance balance in façade design.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

DEOGUN, I., RODRIGUES, L., GUZMAN, G., 2013.
Learning from the Swahili Architecture in Mombasa, Kenya.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

DUAN ZC, FORD, B AND LAU, P.H., 2012.
Thermal comfort of vernacular dwellings in south-eastern China.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

DUAN, Z.C, LAU, P.H., AND FORD, B, 2012.
Daylighting performance of vernacular dwellings in south-eastern China.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

ELMER, T, WORALL, M, RIFFAT, S, 2013.
A Novel Solid Oxide Fuel Cell Tri-Generation System for Low Carbon Buildings.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

GHABRA, N., RODRIGUES, L., LAU, B., 2013.
Architecture Excellence and Environmental Performance: The Case of Broadcasting Tower, Leeds, UK.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

GUZMAN, G., 2013.
Learning by doing: an immersive manufacturing experience with undergraduate architecture students.
In: Prototyping Architecture Conference. 156-165, 2013

GUZMAN, G., 2013.
The Fleeting retreat, a learning facilitator.
Association of Architectural Educators Conference 2013. Nottingham, UK.

JAIME, A.C AND LAU, P.H., 2012.
Daylight performance in Capuchinas Sacramentarias del Purísimo Corazón de María Chapel designed by Barragan.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

JAIME, A.C AND LAU, P.H., 2012.
Light in Seinäjoki Library, Rovaniemi Library and Mount Angel Library designed by Alvar Aalto- A Critical Review.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

KACEL, S AND LAU, B., 2012.
The 'Poetics of Space' by Daylight in the Frame of Environmental Design Principles for a Mixed-Use Dwelling .
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

KACEL S., LAU B., 2013.
Investigation of the Luminous Environment in Louis I. Kahn's Kimbell Art Museum - A qualitative and quantitative study.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

NEW PUBLICATIONS

LAU, B. AND KACEL, S., 2013.
Light in the Kimbell Art Museum of Louis I. Kahn
In LUX EUROPA 2013, 12th European Lighting Conference, 17 – 19 September 2013, Auditorium Maximum Building, Jagiellonian University, Krakow, Poland.

LIU, L, RIFFAT, S, WORALL, M., MEMPOUO, B, 2013.
Investigation on Solar/Thermoelectric Tube for Heating and Generation.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

LOO KH., LAU B., 2013.
The other way of designing a tropical Taoist Academic Centre.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

MAHMUT S. B., MEMPOUO, B. AND RIFFAT, S., 2013.
Theoretical Investigation of the Thermal Performance of a Novel Building Integrated PV/Thermal Roof Collector
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

MEMPOUO, B., RIFFAT, S. AND SU, Y., 2013.
A Study on Heat Storage Capacity Performance of Thermochemical Materials
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

MOHANTY PO., FORD B., LAU B., 2013.
Effectiveness of Natural Ventilation in Tall Residential Building in Tropical Climate - A critical analysis & Design Review.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

PATHERYA, M AND LAU, P.H., 2012.
Assessment of the behaviour of 'courtyards' as a design element in India and its implication as an environmental solution.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

PHILIP T., LAU B., 2013.
Passive Downdraught Evaporative Cooling - The Applicability for residential space cooling in Riyadh, Saudi Arabia.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

RODRIGUES, L. AND GILLOTT, M., 2012.
Building for Future Climate Resilience.
Sustainability in Energy and Buildings SEB'12, 3 - 5 September 2012 Stockholm, Sweden.

RODRIGUES, L. AND GILLOTT, M., 2012.
Modern Methods of Construction in British Housing: Drivers, Barriers and Acceptance.
The 7th International Conference on Innovation in Architecture, Engineering and Construction (AEC) São Paulo, Brazil.

RODRIGUES, L., GILLOTT, M., SOUGKAKIS, V., 2013.
The Use of Thermal Mass to Mitigate Overheating in an Affordable Low-Energy Pre-fabricated Timber House..
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

RODRIGUES, L., KACEL, S., 2013.
Energy Efficient Retrofit of a Protected Building of Historical Significance.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

RODRIGUES, L., NIKIFORIADIS, F., 2013.
A Comparative Study of the Climate Resilience of Timber Frame and Masonry Homes of Similar Designs in the UK.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

RODRIGUES, L., TETLOW, D., GILLOTT, M., SOUGKAKIS, V., 2012.
The Application of Phase Change Materials to Improve the Climate Resilience of a Low-Energy Prototype House.
In SET 2012 - 11th International Conference on Sustainable Energy Technologies. Vancouver, Canada.

SEKAR, D AND LAU, P.H., 2012.
The application of integrated environmental design approach in the design of Jouberton nursery school at South Africa.
In: International Conference on 'Architecture: Education, Practice and Research' organized by the Department of Architecture, Bangladesh University of Engineering and Technology (BUET), 2-4 February 2012.

SHAO, L., COLEMAN, M., FOSTER, R., SHIPMAN, R., GILLOTT. M., HAO, Y., IRVINE, K., LEMON, M., MUNOZ, M., ZHANG, L., 2013.
Reduction of energy demand in buildings through optimal use of wireless behaviour information (wi-be) systems.
5th International Conference on Applied Energy, ICAE 2013.

NEW PUBLICATIONS

SHATAT M., RIFFAT S., AND WORALL M., 2013.
Experimental Investigation of A Novel Solar Powered Psychometric Low Grade Water Desalination System.
Proceedings of the International Conference on Energy, Water, and Environment (ICEWE 2013), April 23-26, 2013. Amman, Jordan.

SHIPMAN, R., GILLOTT, M., 2013.
A Study of the Use of Wireless Behaviour Systems to Encourage Energy Efficiency in Domestic Properties.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

SHIPMAN, R., GILLOTT, M., 2013.
A Wireless Sensor and Actuator Network for Domestic Automated Demand Response.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

SHIPMAN, R., GILLOTT, M., NAGHIYEV, E., 2013.
SWITCH: Case Studies in the Demand Side Management of Washing Appliances.
5th International Conference in Sustainability in Energy and Buildings (SEB'13).

SUN MW., FORD, B., LAU B., 2013.
The Applicability of the Bio-Climatic Facade in a Hot and Humid Climate - A Study of Geoffrey Bawa's Architectural Works.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

SUN MW., LAU B., FORD., B., 2013.
The Bio-climatic Design Strategies for Medium-Rise Office Building in South-East China within a Hot and Humid Climate Zone.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

TUBELO, R, RODRIGUES, L., GILLOTT, M., 2013.
A Parallel between the Brazilian Energy Labelling System and the Passivhaus Standard for Housing.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

YIANNAKOU,S AND LAU, P.H., 2012.
Luminous Environment in Le Corbusier's Museum: An investigation of light in Chandigarh Museum in India and the Museum of Western art in Tokyo.
In: PLEA2012 - 28th Conference, Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima, Perú 7-9 November 2012.

WORALL, M, RIFFAT, S, 2013.
Recent developments in the refurbishment of non-domestic buildings.
In: CIB World Building Congress, Brisbane, Australia, 5-9 May.

XIE, B., MEMPOUO, B. AND RIFFAT, S., 2013.
Earth Power Generation System –Soil battery.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

XU R., LAU B., 2013.
The Environmental Performance of Crab-eye Light well in Suzhou Scholar Gardens of China.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

YANTI C., BRIAN F., 2013
How do occupants perceive building performance of the award-winning schools in the UK.
In PLEA 2013 – 29th Conference on Passive and Low Energy Architecture: Sustainable Architecture for a Renewable Future. Munich, Germany.

ZHANG, HR AND LAU, P.H., 2012.
Building green architecture in China: Xinzhuang complex building - an example of environmentally responsible building in China.
In: 4th CIB International Conference 2012 - Smart and Sustainable Built Environments. São Paulo, Brazil, June 28th and 29th 2012, at the Architecture and Urban Planning Faculty, University of São Paulo, Brazil.

ZHANG HR., LAU B., WU H., 2013.
Designing A Green Library Among Trees.
In SET 2013 - 12th International Conference on Sustainable Energy Technologies. 26th – 29th August 2013 Hong Kong, China.

Books and Book Chapters

LAU, P.H., FORD, B. AND ZHANG, H.R., 2013.
The environmental delight of traditional courtyard housing in China.
In: YANNAS, S AND WEBER, W, ed., Lessons from vernacular architecture: achieving climatic buildings by studying the past Taylor & Francis. (In Press.).

NEW PUBLICATIONS

SPATARU C AND GILLOTT M, 2012.
Using a RTL system based on RFID technology for monitoring occupant's domestic energy use and behaviour.
In: M'SIRDI N, NAMAANE A, HOWLETT R J and JAIN L C, eds., Sustainability in Energy and Buildings Springer Verlag.

WORALL, M, 2013.
Chapter 2, A Building Owners Perspective.
In. ed, Clements-Croome, D, J, Intelligent Buildings: an Introduction, Routledge, London, UK. ISBN: 0415531136.

WORALL, M, 2013.
Chapter 8, Passive and active environmental quality control.
In. ed; Clements-Croome, D, J, Intelligent Buildings: an Introduction, Routledge, London, UK. ISBN: 0415531136.

WORALL, M, 2013.
Chapter 15, Case Study: Post occupancy evaluation: Jubilee Campus, The University of Nottingham.
In. ed; Clements-Croome, D, J, Intelligent Buildings: an Introduction, Routledge, London, UK. ISBN: 0415531136.

The University of Nottingham

UNITED KINGDOM • CHINA • MALAYSIA

Architecture, Climate and Environment Research Group

www.nottingham.ac.uk/research/groups/architecture-climate-and-environment-research-group