

Research Review

Issue 11, Winter 2010–11

Sustainability

The changing built environment

Security: automated CCTV | A day in the life of an MRI | Language, text and power

Research at Reading

Contents

INTRODUCTION

- 2 Research at Reading
- 3 New research grants and contracts

NEWS

- 4 Science
- 5 Life Science
- 6 Social Science
- 7 Arts and Humanities
- 8 Queensland floods

FEATURES

- 9 Sustainability: The changing built environment
- 12 Security: automated CCTV
- 14 A day in the life of an MRI
- 16 Language, text and power

OVER COFFEE

- 17 Sustainability



Welcome to the Winter 2010-11 edition of Research Review. The past few months have been particularly successful for Reading in terms of winning major research grants and contracts.

The page opposite highlights just a few of the major awards won. As can be seen, our awards come from a diversity of national and international funders. Despite an increasingly competitive funding environment, our success rate when applying for funding from the UK Research Councils has increased over the past few years and we are now in the top 20 for UK research institutions.

At the end of last year we were one of 10 UK universities to receive the first 'HR excellence in research' accreditation for adopting the European Charter for Researchers and the Code of Conduct for their Recruitment. We are delighted that Reading has been recognised by the

European Commission for its work in improving working conditions and career development opportunities for research staff. In addition, we have recently held our second annual Research Staff Conference, which was a great success.

Each year we award Faculty Output Prizes for the best research outputs from each of the faculties, and these are funded through the Research Endowment Trust Fund. For this academic year, the prizes been awarded to: Dr Rebecca Bullard from English Language and Literature; Dr Ronan McCrea from Law; Professor Howard Colquhoun from Chemistry; Dr Gundula Mueldner from Human and Environmental Sciences; and George Alexandridis from the ICMA Centre, Henley Business School.

Particular highlights within this issue include features on sustainability within the construction industry, using automated CCTV to help security in public places, and a day in the life of an MRI scanner, in addition to news from across the faculties.

I hope you enjoy reading about our research in this Review. As always, Research Review can only feature a small selection of our research, and much more information can be found on our website.

Professor Christine Williams
Pro-Vice-Chancellor
(Research and Innovation)

www.reading.ac.uk/research

New research grants and contracts

Some of the larger recently-awarded grants from May 2010 to end of October 2010 include:

AHRC

Professor Jonathan Bignell from Film, Theatre and Television has been awarded £592,902 for research entitled 'Spaces of television: production, site and style'.

EPSRC

Professor Douglas Saddy from the Centre for Integrative Neuroscience and Neurodynamics has been awarded £202,333 for research entitled 'NeuroCloud: Developing a hybrid cloud architecture for neuroscience research'.

ESRC

Dr David Stack from History has been awarded a Mid Career Development Fellowship for £174,985 to investigate 'Botany and birth control: elements of social science'.

MRC

Dr Che Connon from Pharmacy has been awarded £443,436 for a research project entitled 'Therapeutic corneal stem cell delivery using a bioadhesive in situ gelling system'.

NERC

A grant of £151,904 has been awarded to Professor Pier-Luigi Vidale in Meteorology for research entitled 'Integrated carbon, water and land management for poverty alleviation'.

Two grants totalling £797,434 have been awarded to Professor Pier-Luigi Vidale in Meteorology for a research project entitled 'Hydrological cycle understanding via process-based global detection, attribution and prediction'.

£259,732 has been awarded to Professor Pier-Luigi Vidale in Meteorology for research entitled 'Soil water - climate feedbacks in Europe in the 21st Century'.

Dr Andrew Wade from Geography and Environmental Sciences has received a grant of £231,012 for research into 'Hydrological extremes and feedbacks in the changing water cycle'.

Dr David Brayshaw from Meteorology has received a £245,913 Postdoctoral Fellowship for research entitled 'Understanding past, present and future climate change in the Greater Mediterranean area: Building confidence in uncertain climate projections'.

Professor Geoff Wadge from the Environmental Systems Science Centre has been awarded £258,035 for research into 'Short-period

deformation at a lava dome volcano'.

£313,602 has been awarded to Lesley Gray, a visiting Professor in Meteorology, for research entitled 'Climate change predictions with a fully resolved stratosphere'.

Dr Andrew Turner from Meteorology has been awarded a £263,993 Postdoctoral Fellowship investigating the future of the Indian monsoon.

Dr Sarah Dance from Mathematics and Meteorology has been awarded £294,579 for research entitled 'Developing enhanced impact models for integration with next generation NWP and climate outputs'.

Professor Mark Hodson from Geography and Environmental Sciences has been awarded £358,477 for research investigating 'Earthworm secreted calcite granules - constructing a new terrestrial palaeo-environment thermometer and quantifying carbon sequestration potential'.

Dr Hilary Weller from Meteorology has been awarded a £446,214 Postdoctoral Fellowship for research entitled 'Adaptive mesh modelling of the global atmosphere'.

£698,223 has been awarded to Dr Leonard Shaffrey in Meteorology for research entitled 'TEMPEST: testing and evaluating model predictions of European storms'.

Dr John Methven from Meteorology has been awarded £1,009,059 for research investigating 'Diabatic influences on mesoscale structures in extratropical storms'.

NERC and European Space Agency

£268,061 has been awarded to Professor Alan O'Neill from Meteorology for a project entitled 'Group for high resolution sea surface temperature'.

DEFRA

Dr Simon Mortimer from Agriculture has been awarded £133,757 for research entitled 'Improving effectiveness of grassland restoration and creation options: development of a methodology for setting indicators of success and assessing progress'.

A grant of £146,495 has been awarded to Professor Tim Wheeler in Agriculture for research 'Addressing vulnerabilities and building capacity for adaptation of agriculture to climate change in China'.

Professor Ian Givens from Agriculture has received a grant for £157,649 for a research project entitled 'Estimation of ruminant energy and degradability values of maize silage using Near Infrared Reflections Spectroscopy'.

European Commission

Dr Valerio Lucarini from Mathematics and Meteorology has been awarded £1,071,877 for research entitled 'NAMASTE: thermodynamics of the climate system'.

£1,109,015 has been awarded to Professor Jonathan Gregory from Meteorology for research investigating sea-level changes due to climate change.

British Heart Foundation

Dr David Leake from Biological Sciences has been awarded £202,285 for research into 'Atherogenic effects of the lysosomal oxidation of low density lipoprotein'.

Cocoa Research UK Ltd

£230,000 has been awarded to Professor Paul Hadley from Biological Sciences for research into 'Variation in uptake and partitioning of cadmium within contrasting cocoa genotypes'.

Dr Andrew Daymond from Biological Sciences has received £246,000 for a project entitled 'Identification of selection traits to maximise cocoa productivity and quality in a changing environment'.

GW Pharmaceuticals

Dr Ben Whalley in Pharmacy has been awarded two grants for a combined value of £732,630 for research investigating the potential anticonvulsant activity of candidate phytocannabinoids.

Knowledge Transfer Partnership (KTP)

A KTP Agreement with Lucy Electric UK of £137,870 has been awarded to Dr Fred Davis in Chemistry.

A KTP Agreement with Ella's Kitchen (Brands) Ltd of £150,662 has been awarded to Dr Carmel Houston-Price in Psychology and Clinical Language Sciences.

A KTP Agreement with Guide Dogs for the Blind Association has been awarded to Dr Gerard McKee from Systems Engineering for £153,041.



Cover image from a solar panel - Hemera/Thinkstock
Pages 4, 6, 9 and 10 - iStockphoto/Thinkstock
Page 10 - Hemera/Thinkstock
Page 11 - Brand X Pictures/Thinkstock

Forensic science success



Dr Stuart Black from Archaeology has been assessed by the Chief Scientist of the Forensic Science Service and accepted as part of the Natural Justice Portfolio. This will involve acting as a consultant and being called as an expert witness in criminal cases. Currently only six non-Forensic Science Service people are part of this team worldwide.

Science news

Understanding trends in atmospheric temperature

A major review paper on the evolution of our understanding of trends in atmospheric temperature over the past 30–40 years has recently been published. This subject has been an area of sometimes bitter controversy, as there have been claims that disagreement between observations and calculations from climate models indicated that climate models were not trustworthy.

The research found that when uncertainties in both observations and climate model calculations were properly taken into account, there was no reasonable evidence for a fundamental disagreement. This work was done collaboratively between the University of Reading, the Met Office and partners at the National Oceanographic and Atmospheric Administration in the USA.

Reference: Thorne P.W., Lanzante J.R., Peterson T.C., Seidel D.J., Shine K.P. 2011. Tropospheric temperature trends: history of an ongoing controversy. *Wiley Interdisciplinary Reviews: Climate Change*. In press. doi: 10.1002/wcc.80

Professor receives Meteorology award

Professor Anthony Illingworth from Meteorology has been awarded the Mason Medal of the Royal Meteorological Society. The Mason Medal is the premier award bestowed by the Society for 'outstanding contributions to the understanding of the fundamental processes that determine the variability and predictability of weather and climate'.



Reading Professor recognised in New Year's Honours List

Michael Fulford, Professor of Archaeology and Director of the Silchester Town Life Project, received a CBE in the New Year's Honours List announced on 31 December 2010. Professor Fulford has been recognised for services to scholarship. He chairs the University's Committee for the Museum of English Rural Life, the Committee for Museums, Archives and Collections, and the Forum for Rural Research. His principal research interests are in Roman archaeology, particularly in the fields of urbanism, economy, material culture, technology and trade.



Evolution of earthworms

Professor Mark Hodson from Geography and Environmental Science has recently been involved in filming for a Horizon documentary on evolution. This has resulted from work with his PhD student Jane Andre and colleagues Pete Kille and John Morgan at Cardiff University on the evolution of earthworms at metal-contaminated former mine sites. Part of this work is discussed in a recent paper that revealed that the genetic structure of an earthworm population at Cmystwhyth Valley (Wales) has resulted from complicated interactions between historical population expansions, recent directional selection and local adaptation to soil pollution.

Reference: Andre J., King R.A., Stürzenbaum S.R., Kille P., Hodson M.E., Morgan A.J. 2010. Molecular genetic differentiation in earthworms inhabiting a heterogeneous Pb-polluted landscape. *Environmental Pollution*. 158: 883 – 890

Reading academic appointed to second term on NERC Council

Professor Mike Lockwood from Meteorology has been appointed to a second term on the Council of the National Environment Research Council (NERC). He also became the cross-member for the Science and Innovation Strategy Board and the Training Review at NERC.

The Digital Society

Professor Pete Grindrod from Mathematics has recently co-authored a paper on 'The Digital Society' for the Mathematics Matters case studies produced by the Institute of Mathematics and its Applications (IMA) and the Engineering and Physical Sciences Research Council (EPSRC). This is one of a series of briefings on the modern impacts of maths to be launched at the House of Lords.

Maths is good for the heart

Researchers in Mathematics are involved in a British Heart Foundation New Horizon grant: 'The virtual platelet – the development of a predictive mathematical model for the complex regulation of platelet function'. The University of Reading is leading the mathematical modelling in collaboration with colleagues in Biological Sciences and Food Biosciences, and colleagues at the University of Leicester and Sanger Institute.

Life science news

Water for agriculture: implications for future policy and practice

UK agriculture and horticulture face major water shortages in coming decades due to climate change, concludes a new joint report commissioned by the Royal Agricultural Society of England (RASE) and carried out by University of Reading scientists in the Walker Institute for Climate System Research and the School of Agriculture, Policy and Development. The report calls for adaptation across the whole industry in order to meet the impending challenge.

The report is available at: www.rase.org.uk/what-we-do/core-purpose-agricultural-work/index.asp

Food and Nutritional Sciences graduate receives prestigious science award

Tina Eggers, BSc Nutrition and Food Science, received the Kraft Award for the best Food Science, Technology and Nutrition student at the Science, Engineering and Technology (SET) Student of the Year Awards. Tina received this award for her project on 'Using the theory of planned behaviour to investigate fruit and vegetable intakes'. The SET awards are established as Europe's most important awards for science and engineering undergraduates, and two of the finalists for the Kraft Award were from Reading.



Research explores what makes brains of business leaders tick

Ground-breaking research will scan the brains of influential people to explore how they make decisions, using often complex and conflicting information.

The University of Reading's John Madejski Centre for Reputation, within Henley Business School, and its Centre for Integrative Neuroscience and Neurodynamics (CINN) are working together to examine what sets leaders apart and how they make their judgements. The research will be used to help business leaders make better decisions.

The study will look at functional systems in the brain that are associated with and support decision-making and strategic planning. The analysis will help give an understanding of how different expert groups make decisions and how these decisions are similar or different.



A long history of conserving plant biodiversity

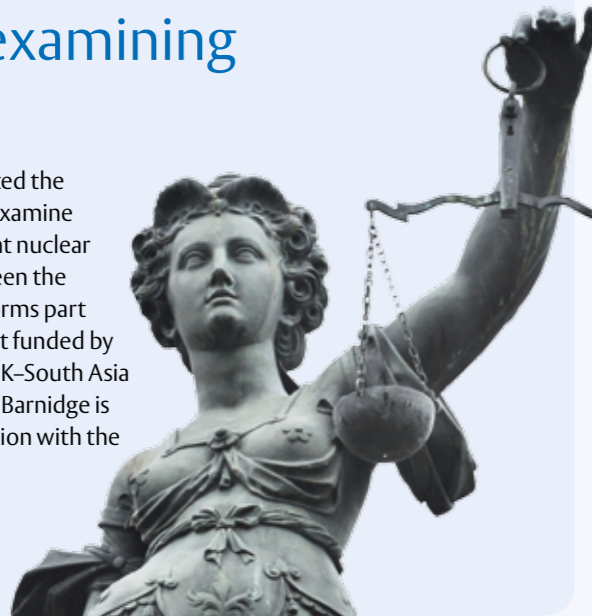
Professor Richard Ellis, Dean of the Faculty of Life Sciences, is one of the world's leading authorities on seed genebanks for ex situ plant biodiversity conservation. Such genebanks are vital for future food security in order to ensure that crop plant breeders have diverse material from which to breed new crop varieties. Genebanks are also important for conserving wild plant seeds.

Professor Ellis has recently returned from Rome where he took part in an expert consultation on Genebank Standards for the Food and Agriculture Organisation (FAO) of the United Nations, Bioversity International, and the Global Crop Diversity Trust. Professor Ellis has provided academic support to FAO, Bioversity International, and the global network of crop genebanks for more than three decades at the interface between science and technology. In addition to his scientific research outputs, he has written several major handbooks for genebank managers to assist them in their role of both storing seeds safely over the long term and subsequently being able to germinate them. His advice has supported the development of the global network of over 1,000 crop genebanks.

The University of Reading plays a strong role in crop biodiversity conservation worldwide. In addition to seed conservation, the University maintains the National Fruit Collection at Brogdale in Kent and the International Cocoa Germplasm Database, Quarantine, Multiplication and Distribution Centre.

Workshops examining legal issues

The School of Law recently hosted the second of three workshops to examine legal issues relating to the recent nuclear co-operation agreement between the USA and India. The workshop forms part of an ongoing three-year project funded by the British Academy under its UK-South Asia Partnership Scheme. Dr Robert Barnidge is leading this initiative in association with the Dr Ambedkar Law University in Chennai, India.



Social science news

Exploring the impact of international interventions in post-conflict countries

A major international research group has been examining the impact of international statebuilding interventions on political and economic structures in countries emerging from war, such as Iraq, Afghanistan, Kosovo and Burundi. The research group, funded by the Carnegie Corporation of New York and co-directed by Dr Dominik Zaum from Politics and International Relations and Professor Mats Berdal from Kings College London, have met regularly over the last two years. Amongst the key findings of the research has been that the efforts of outside actors to rebuild effective state institutions after conflict, generally seen as a condition for peace and stability, can be deeply divisive and at times lead to renewed violence. In addition, while most international efforts have focused on strengthening the role of formal state institutions, so-called informal structures, many of which have developed during conflict, continue to play important political and economic roles, and are central to understanding the trajectories of post-war countries. The findings will be presented to audiences of policymakers from both post-war and donor countries, and international organisations in early 2011, and will be published by Routledge in 2011 under the title 'The Political Economy of Statebuilding'.

Lessons learnt from East Timor

Dr Oisín Tansey from Politics and International Relations has returned from two weeks in East Timor in September conducting fieldwork and interviews with national and international political elites. The research trip was funded by the British Academy to support a project that seeks to evaluate the legacies of international state-building, and that examines the role of successive United Nations post-conflict state-building missions in East Timor since 1999.

Prestigious lecture

The school of Politics and International Relations's second annual Peter Campbell Memorial Lecture was delivered by Shami Chakrabarti CBE, Director of civil rights organisation Liberty, on the topic 'Liberty and rights in Britain today'.

Second language listening comprehension

Professor Suzanne Graham and Denise Santos from the Institute of Education have received funding from the Esmée Fairbairn Foundation New Approaches to Learning Fund for a two-year project investigating second language listening comprehension in England. The first phase of research will investigate teachers' beliefs about, and understanding of, the teaching of second language listening comprehension. The second phase of the research will be to develop and evaluate materials to improve teachers' ability to teach listening as a skill.

Sharia law

Dr Samia Bano from the School of Law conducted a review of family-related dispute resolution in Sharia Councils in England and Wales funded by the Ministry of Justice in the summer of 2010. The review provided an overview of empirical evidence relating to the way in which family-related disputes are handled in Sharia Law and Sharia Councils in our jurisdiction.

The relationship between science and religion

Researchers from the Institute of Education at Reading have started a new research project which seeks to explore how secondary school pupils perceive the relationship between science and religion, and how this influences their thinking about the science they are taught in school. This project is funded by the Faraday Institute for Science and Religion involving Dr Berry Billingsley and Helen Newdick from the Institute of Education in collaboration with the University of Cambridge's Faculty of Education.

Awards for Classics

Dr Annalisa Marzano from Classics has been awarded a prestigious fellowship to spend the academic year 2010/11 as Visiting Research Scholar at the Institute for the Study of the Ancient World at New York University. As part of this fellowship, she will complete her monograph *The exploitation of marine resources in the Roman Mediterranean*, and give research seminars and public lectures.

Annibale Carracci

Professor Clare Robertson in History of Art has been awarded the 2010 Salimbeni Prize for her book, *The invention of Annibale Carracci. Studi della Bibliotheca Hertziana, 4* (Silvana Editoriale, 2008). The prize is awarded annually by the Fondazione Salimbeni per la Storia e la Critica d'Arte for the best book on Italian art from early Christian times to the nineteenth century. The prize, which is open to scholars of any nationality, is held under the auspices of the President of the Italian Republic, the Ministro per I Beni Culturali and the Ministro degli Affari Esteri.

Early Bengali books

Dr Fiona Ross from Typography has successfully applied to an AHRC/ British Library funded Digital Knowledge Exchange workshop in Early Bengali Books online: 1778-1914. The workshop, based at the National Library, Kolkata, in January 2011 will bring together research organisations with interests in Bengali language, history and culture.

Global signs

Gerry Leonidas from Typography has won a Knowledge Transfer Partnership (KTP) with the company Merson Signs, which has an established presence in sign design and manufacturing with specific focus on large infrastructure projects. They have identified a niche in relation to wayfinding and signage design for large passenger transportation projects in the Gulf area. From the University's perspective, this partnership provides an opportunity to focus on dual language sign design, and bridge two core areas of expertise (information design and typeface design) in response to growing commercial activity in this area.

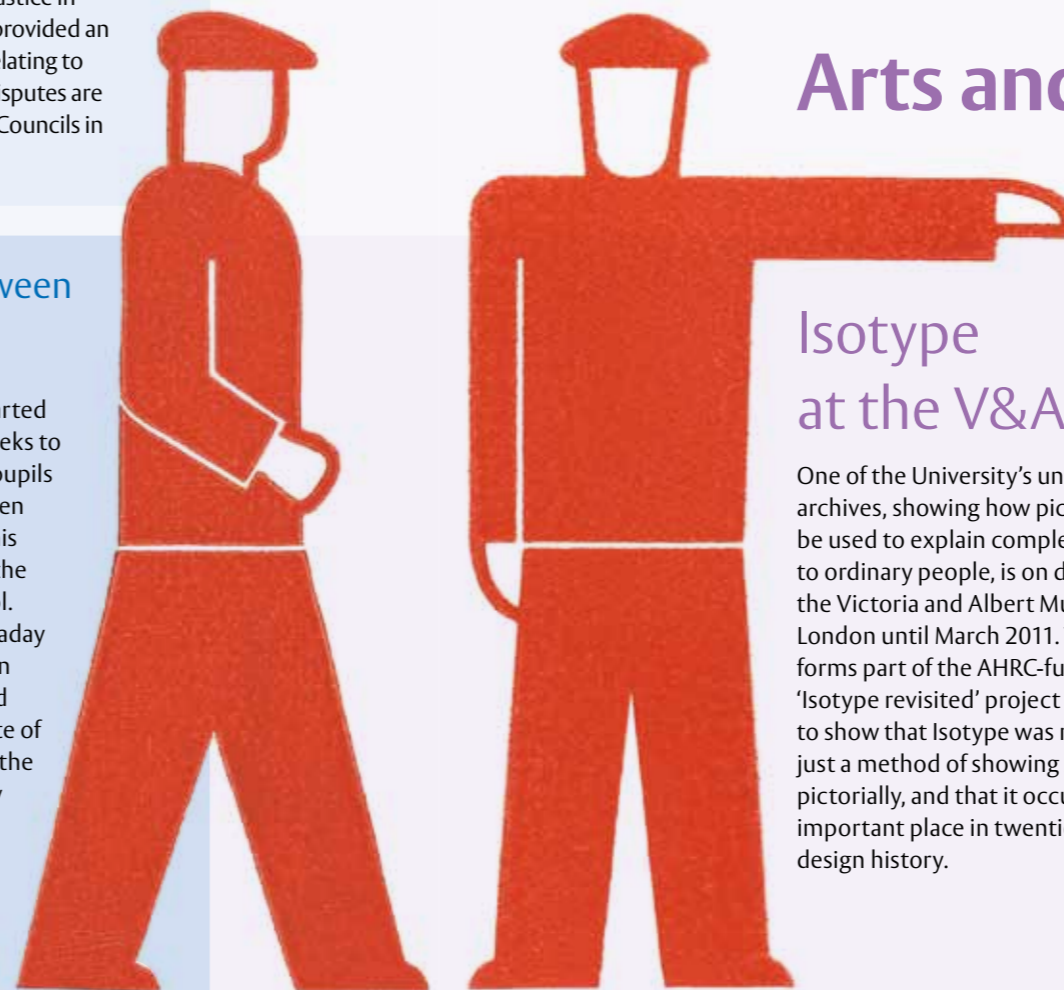
Arts and Humanities news

New grant for medieval studies

Dr Catherine Leglu from Modern Languages has been awarded a two-year research grant by the Leverhulme Trust. She will be working with two Research Fellows, Dr Nick Chare and Dr Alex Ibarz, to edit and study the iconography of a very rare illuminated manuscript from the early fourteenth century. The manuscript contains the only copy of a translation into Occitan (the language of the southern regions of France) of a Latin universal history told through a combination of word and illustrated genealogies that was composed for Pope John XXII by a Franciscan friar and diplomat, Paolino da Venezia. The project analyses the manuscript's importance in terms of medieval translations into the dialect, as well as of conceptions of time and history.

Isotype at the V&A

One of the University's unique design archives, showing how pictures can be used to explain complex issues to ordinary people, is on display at the Victoria and Albert Museum in London until March 2011. The display forms part of the AHRC-funded 'Isotype revisited' project and aims to show that Isotype was more than just a method of showing statistics pictorially, and that it occupies an important place in twentieth-century design history.



Queensland floods

Dr Nicholas Klingaman from the Walker Institute is working with the Queensland Government to better understand the causes and improve predictions of variations in the region's rainfall. Over the last 100 years, Queensland has experienced years of crippling drought followed by years of flooding rains, of which the recent severe storms are only the latest examples.

Satellite image processed by the Bureau of Meteorology from the geostationary satellite MTSAT-1R operated by the Japan Meteorological Agency; image provided by the Bureau of Meteorology under the Copyright Act 1968.

Sustainability

The changing built environment



Professor Martin Sexton discusses the implications of sustainability on the built environment and on the industries which support it.

The built environment is where we live, work and play, and it affects how we do these things. The design and function of buildings in terms of their support and impact on people have always been an important part of this. However, until recently not much thought has been given to the impact this has on the wider environment. As society is becoming more aware of environmental issues, sustainability in all aspects of life is rising on the agenda.

Societies and governments are now asking for fundamentally different sustainable built environments which will require the construction and property sectors to radically change. This is certainly the case in the UK, where currently our buildings significantly impact the environment throughout their life. For example, our buildings are responsible for 45% of total carbon emissions; 32% of all landfill waste comes from their construction and demolition; and households alone account for 58% of all public water consumption. In response to this immense environmental burden, there is a growing raft of legislation, regulation and user demand requiring that buildings and settlements become far more environmentally sustainable.

The importance of this is recognised by the UK Government, and consequently the Climate Change Act 2008 has placed a target of reducing carbon emissions by 26% by 2020 (compared to a 1990 baseline) and by a minimum of 80% by 2050. There are many different ways of working towards achieving this, but due to the impact that our built environment has on carbon emissions, looking at how to reduce emissions through the life of buildings is a high priority. For example, there is a target that all new homes will need to be zero-carbon by 2016, public sector buildings by 2018 and private buildings by 2019.

The requirements placed on built environment are systemic; they do not just include buildings, they involve whole communities and environments. The scale, complexity and urgency of the sustainability challenges we face require radical complex changes in the regulation, design, delivery and operation of buildings and infrastructure.

Transition

The process of transition to more sustainable built environments brings about many questions, and integrated research has a big role to play in developing appropriate solutions.

Energy companies are investing in renewable energy generation and exploring new ways to optimise the interplay between

supply and demand through smart grid infrastructure, which is a form of electricity network using digital technology. New tools are being developed to assist designers, clients and users in determining the environmental performance of buildings and settlements. Construction and property companies and global supply chains are developing digitally-enabled service delivery capabilities to produce sustainable buildings, as well as embedding sustainability in their own businesses through corporate social responsibility. Finally, users are being asked to play a part in adopting sustainable technologies and practices which reduce energy consumption.

Individuals and organisations are not guaranteed to always make changes by choice, and any policy to encourage change needs to be appropriate. So how do we best design and implement appropriate regulations that support innovation and investment? It is also important to investigate how users respond to policies, practices and technologies and how they shape behaviour and energy consumption in reality. One way of doing this is to analyse consumption data and use this to better understand and predict behaviour.

Economic considerations play an important role in the transition to more sustainable built environments. Who will pay for new incentives and changes? Major purchasing decisions, such as buying a house, value for money and location are seen as more important than sustainability by the vast majority of the population. The transition to a sustainable built environment will therefore require a redesign of current business models and value propositions. Capital cost and value models which work through the life of buildings will need to be considered, and how these actually work in real-world situations.

What is clear from all of this is that no one part of society or single activity can bring about the required transition to sustainable built environments. There needs to be a co-ordinated transition management approach which galvanises these multiple strands of activity into an integrated whole. The unanswered question is whether or not we have the knowledge capital, technologies, systems, processes and skills to make it happen? This challenge has been distilled into stark terms for the construction industry, for instance, by the UK Government's Low Carbon Construction Innovation and Growth Team, in the simple question: 'is the construction industry fit for purpose for the transition to a low carbon economy?'. There is a compelling need for a multidisciplinary research agenda to ensure the answer to this question is a credible, enduring 'yes'. ➡



Integrated approaches to low carbon built environments

Dr Runming Yao, Construction Management and Engineering

Delivering a low carbon built environment requires an in-depth understanding of energy consumption in buildings and its mitigation and adaptation strategies in built environment design and management. During the past four years, our research has been focusing on integrated approaches to link the urban climate with indoor environments, energy consumption, building energy system control, and occupant behaviour and adaptation.

We have recently developed a coupled thermal and airflow mathematical model to simulate microclimate. This model can perform real-time simulations using a range of data including urban air temperature, external wall surface temperatures, ground surface temperatures, and solar radiation falling on the facades of buildings and the ground. Investigations using real locations compared against simulation results show that the model provides a very good indication of microclimate. This is a useful strategic tool for sustainable architectural design and urban planning. It links microclimate with building energy models enabling assessment of the impact of urban form and texture (such as vegetation, and building and road materials) on building energy consumptions.

We are also developing domestic energy predicting models, which take into account the impact of occupants' behaviour. One of these is a multi-criteria decision-making method for building energy system design and operation. We are also investigating

workplace thermal comfort, occupants' adaptation and its impact on energy consumptions in a building.

The Technologies for Sustainable Built Environments (TSBE) Centre is an industrial doctorate centre whose programme offers the expertise of internationally-renowned researchers to UK industry in order to develop industry-based research. One of the aims of the Centre is to aid in the development of an industrial knowledge-base capable of responding to the challenges of sustainability and climate change issues by reducing the environmental impact of construction and its carbon footprint.

As part of the TSBE programme, we work closely with industry and stakeholders to investigate how integrated solutions including building design, energy system design, implementation of renewable energy technologies, and occupants' adaptations can be used to achieve the Code for Sustainable Home level 6, a UK national standard for assessment and certification of housing sustainability. Since much of the work to move towards more sustainable built environments will require retrofit processes, we have also recently completed a report on carbon abatement options to listed buildings.

The control and management of the integration of the complex interactions between climates, buildings, energy systems and humans is vital when designing and managing sustainable built environments. The integrated approach to the research in low carbon built environments will need to apply a system thinking method (which is the process of understanding how things influence one another within a whole) to link urban climate, building design, energy management and end-user performance assessment as whole.



Sustainable design in the digital economy

Dr Jennifer Whyte, Construction Management and Engineering

To create sustainable built environments, we need to radically change the processes through which buildings and infrastructure are designed and re-designed. Sustainability is not achievable if design and operation are disconnected. Yet, too often designers start with 'a blank sheet of paper' and end up giving too little information about their design back to end-users, owners and facility managers.

Our research has a vision of a new mode of design in the digital economy. We are working with leading projects and firms: those that are beginning to use integrated software to create the models and rich data-sets that are vitally important to ensuring transition to sustainable built environments. This work involves designers, engineers, construction contractors, software suppliers and clients. What is shared is a commitment to generating, maintaining and making available relevant data right through the life of buildings and infrastructure.

At the start of design there are opportunities to use data about the environmental performance of the existing built environment to inform its modification. Here our research is investigating new ways of visualising data for shared design inquiry. We want to transform the focus of projects, so that what is measured and

monitored is not only performance in terms of cost, budget and time, but also performance in terms of sustainability and design quality.

At the end of design there are opportunities to use design models and data to improve longer-term use and maintenance of buildings and infrastructure. Here our early research on data-handover to clients is investigating why data is often either not transferred, or transferred and not used in operations.

Yet there are substantial new challenges in using integrated software, and hence the connection between digital data and sustainable performance is the focus of a long-term research agenda. At the design stage, our research is beginning to examine a range of unintended consequences of attempts to transition to sustainable practices, such as how the increased use of computers adds to the carbon footprint of the design process itself; and how showy renewable solutions may be added to projects for legitimacy and status reasons, rather than as an integral part of a sustainable solution.

By examining what works and what does not work, our research is informing government policy, management practices, and design processes. The UK construction industry is globally leading in this area, and as the UK Government sets out a five-year strategy to implement 'Building Information Modelling and Management' to meet sustainability targets, research at Reading will continue to have a significant impact on policy and practice.



Sustainability, climate change and spatial planning

Professor Gavin Parker, Real Estate and Planning

There has been much attention paid to how spatial planning may aid the aim of sustainability and sustainable development.

In many countries sustainability has become the touchstone or the explicitly primary aim for planning policy and practice over the last two decades. In the UK the Royal Town Planning Institute recently placed climate change as a key issue for planners to engage with. Indeed the longstanding aims of planning in terms of place-making and efficient land use sit very well alongside the associated goals and challenges of sustainable development and CO₂ reduction.

As such, questions of sustainability have lain at the heart of planning rationales for well over a century. Early planners were social engineers responding to market failure and highlighting the need to consider the appropriate relationships between land uses and place, people and work. Understanding and supporting the needs of industry and of communities are integral, and the appreciation and understanding of the ecological dimension is central.

While planners in practice develop and use plans and strategies to guide action, they also need underpinning evidence and research. Academic planners perform a pure and applied research function here in terms of understanding the impacts of development, and the most efficient use of resources and juxtapositioning of activities. There is also an

important structuring role in drawing together knowledges, other researchers and multidisciplinary approaches that, in combination, are needed to provide fuller understandings and which can form more holistic and sometimes new interdisciplinary perspectives.

Thinking long-term and acting to mediate between interests are other features of planning concern and action. This thinking is applied across the key elements which have become more commonly discussed, for example, concerns over the resilience of settlements and ecosystems. Questions of mitigation, or how to minimise impacts, and the linked challenge of adaptation are pressing. These need to be planned and, crucially, the likelihood of implementation understood. Some of the changes that can be brought about are linked to behavioural changes and to policy adjustments that are both shorter and longer term. Some measures rest primarily at the micro or individual level, while others are more macro and require national impetus and international co-operation. Planners are very much interested in how to combine and adjust policy and regulation to help attain societal goals across scales and using different tools.

At Reading, we have a long history of pure and applied research and multidisciplinary research projects that help with the sustainability agenda. For example, some recent work has looked at: the re-use of Brownfield and barriers to development on such land; domestic energy use; examination of global flows between cities and the implications of this in terms of investment and resource use; developing awareness and engagement with processes; and public participation, water and waste management issues in India.

➔ Multidisciplinary, multi-actor, multi-level, multi-phase problems require multidisciplinary, multi-actor, multi-level, multi-phase solutions. There is a need to integrate economists, planners, technologists, sociologists, psychologists and meteorologists. At Reading, in collaboration with national and international academic and industry partners, we are making strong contributions to this. We are drawing upon and integrating research from across the physical and social sciences' spectrum to develop the construction and property industry capacity to deliver high-value, sustainable built environments.

For more information please see:

www.reading.ac.uk/cme | www.reading.ac.uk/tsbe | www.reading.ac.uk/designinnovation

SECURITY: automated CCTV

Dr James Ferryman from Systems Engineering discusses the role that automated CCTV can play in keeping us safe.



Security has always been an issue, but the types of threats that security needs to protect against are constantly changing and evolving. There has been

considerable national and international urgency in the use of identification and threat assessment technologies to tackle crime and terrorist threats. Recent incidents where terrorist organisations have caused disruption to mass transportation networks and other areas of critical infrastructure have brought this to our attention.

Therefore the need to survey public facilities to improve our personal security is widely understood and recognised by society.

Maintaining both perceived and actual levels of personal and infrastructure security is a major concern for governments, local authorities, transport operators, law enforcement agencies and society in general. Putting measures and systems in place to monitor situations and interactions can help to provide security in public places. These systems do require a lot of trained people to operate and examine them though, and it is unrealistic to expect that resources will be increased enough to provide this 'manpower', as it would not be cost-effective. Some degree of automation of these systems could have a real impact in the quality of service.

Building intelligent automated security systems requires a better understanding of how to effectively use current technologies and also involves the development of new technologies. What is possible and how to achieve it are questions for research.

At Reading, we are actively working in areas including cyber security and imaging. Security research is multidisciplinary including key aspects of extracting useful information from data and how it relates to human behaviour. This data is often visual data, but this is changing as

our understanding of this field evolves. Research in this area combines technology, behavioural science and application of domain expertise. It's important that we make sure our research is useful and applicable to the real world, so we work closely with a number of organisations including government agencies such as UK Home Office Scientific Development Branch and Office for Security and Counter Terrorism, as well as infrastructure operators (e.g. Network Rail, British Airports Authority) and organisations including Security Innovation and Technology Consortium.

Research

The Computational Vision Group, which I lead, is concerned with the computational issues of perception and reasoning in relation to image interpretation. Our research has a present focus on automated CCTV analysis for safety, security and threat assessment. CCTV systems are regarded as a major tool in security. They have the technical means to deal with large amounts of visual data, which is vital when considering security in public places. However, successfully detecting and preventing crime, to a large part, depends on being able to either proactively monitor scenes of interest or to rapidly search large volumes of CCTV imagery in a forensic capacity during investigations. Most CCTV monitoring is currently done manually. For example, public transport sites in all major cities are covered by CCTV, resulting in some 2,000 control centres. Similar technology can be used in other environments such as stadia, shopping complexes and urban centres. Automating such technologies allow officers to monitor scenes in real-time, and to detect and react to crime in progress; they assist the collection of video evidence relating to an offence, leading to a significant improvement in the volume of crime detection and intervention.

Therefore, any method of automatically monitoring CCTV in a proactive manner is currently a big priority for technological development in crime detection and prevention capabilities.

The main aim of the research I am currently involved in is to develop and evaluate robust computer vision techniques to support people monitoring tasks in situations where personal and infrastructure security might be compromised. These types of systems monitor visual data for significant events or behaviour, and alert security officers when they occur.

Although significant advances have been made in computer vision, there is a clear need to advance our technological capability if we are to manage and exploit the vast amounts of data that digital systems can generate. In particular, there is a real need to intelligently filter a large number of video streams to alert security officers to offences taking place.

For a computer vision system to be useable, it must be shown to be robust, which means it must provide a high level of reliability and accuracy in detecting significant 'events' during monitoring. A non-robust system is effectively unusable.

The computer vision research at Reading focuses on situations that involve the 'making sense' of interactions between people, and between people and their environment, and the ways in which people can make use of such observations. We are working to develop innovative and robust computer vision algorithms to perform event detection and behavioural analysis, able to operate with minimal manual reconfiguration on variable environments.

This robustness includes automatic adaptation to cope with changes, such as in lighting, scene geometry and scene activity.

The projects we are currently involved in are quite wide-ranging, including airport apron monitoring, security checkpoints, and detection of unattended baggage.

For example, the SUBITO project is an EU funded project in which we are involved. This looks at developing an automated system to spot unattended luggage in public spaces, such as airports and train stations, and to alert operators immediately. The operators will then be able to identify and determine who placed the luggage and where they have come from and gone to.

A separate project, known as Co-Friend, aims to design a framework for understanding human activities in real environments, through an artificial cognitive vision system, identifying objects and events, and extracting sense from scene observation. At Toulouse-Blagnac airport, we are developing an artificial intelligence system for understanding activities on airport aprons. Both people and vehicles moving around aircraft are tracked and the information is used for checking service scheduling as well as potential security infringements.

Another project we are working on involves developing an automated CCTV surveillance system for monitoring land and maritime checkpoints, improving the efficiency and security of the transit of pedestrians and vehicles. This work, with 16 European partners, involves working closely with border guards throughout the EU.

The projects we are involved in have a real application for countering terrorism in the global arena. We feel our research has the potential to have a big impact on wider security issues in general which will bring many benefits to society.

Social, legal and ethical considerations

It's also important to understand the social, legal and ethical context within which CCTV monitoring takes place to ensure that the automated processes that monitor human behaviour and interaction are carried out fairly, legally and in a non-discriminatory manner, and that the use of such systems promotes social inclusion.

In recent years, academic research in a number of areas (including urban and regional studies, criminology, computer science, law, social science and philosophy) has started to address the issues of privacy of surveillance. This covers very different aspects of the work, but often focuses on the privacy and social justice elements missing from considerations of increased 'security'.

When researching and developing surveillance technologies, there is a significant risk that development and testing of the new technologies requires a broader collection and transmission of personal data than usual during operation of a deployed system. The inclusion of the consideration of ethical and policy issues in research projects enables policy makers and the general public to have confidence that such systems would be introduced with full account being taken of implications for human rights and other pertinent legislation.

Recent work in Canada and Australia has led to the development of the Privacy Impact Assessment (PIA), based very much on the concept of Environmental Impact Assessment which has now been standard practice for over 30 years in many countries. Recognising the importance of the PIA process, research at Reading has embedded ethical and legal advice into the development of the most significant technological development work packages as well as a broader overview on privacy and legal aspects.

For more information please see:
www.reading.ac.uk/sse
www.cvg.reading.ac.uk

We all want to, and expect to, feel safe from harm in public places. Security is what we use to describe the scale of protection against danger, damage, loss, and criminal activity.



A day in the life of an MRI

The University's MRI facility is housed in the Centre for Integrative Neuroscience and Neurodynamics (CINN), where it is used in conjunction with other bioimaging equipment. Although CINN is particularly interested in neuroscience, the MRI scanner is used across the University for a variety of different research projects.

10am–11am

Neural networks underlying the visual control of steering

Research using the MRI is trying to understand the neural mechanisms underlying steering a car on a twisting road. It is widely accepted that this is achieved by two distinct processes, one to match the curvature of the road, and one to maintain the correct distance from the road edges. We isolate these processes experimentally using a virtual reality simulation of steering, while simultaneously monitoring brain activity in the MRI scanner. This project is an ESRC-funded studentship supervised by Dr David Field in Psychology.

9am–10am

The physical correlates of emotional response in the brain

This project is investigating the neural circuitry of emotion regulation when participants are presented with emotion-laden images. Transcranial magnetic stimulation (TMS) is used to isolate the regions of the brain which are thought to be necessary for such regulation. MRI and peripheral physiological measures enable us to assess the impact of TMS on neural and physiological responses to emotional material. This research is led by Dr Tom Johnstone from Psychology, and is funded by the BBSRC.

8am–9am

Aphasia

Aphasia refers to language problems resulting from brain damage caused by stroke or injury. MRI scans investigating the impact of different therapeutic strategies on the brain are being carried out by Clinical Language Sciences in conjunction with University College London and with Northwestern University in the USA. A related study, combining expertise from Clinical Language Sciences and Engineering, is aimed at developing new tools for language therapists to use in word retrieval therapy based on a brain biofeedback loop.

11am–12pm

Scanning ancient finds

CINN are working with Dr Mary Lewis from Archaeology to explore what use the scanning facilities might be with various specimens in their collections. It is hoped that the MRI could supplement traditional imaging techniques used in the field.

12pm–1pm

Counting fat cells in the liver

Professor Julie Lovegrove from the Institute for Cardiovascular and Metabolic Research is using the MRI scanner to measure the distribution of fat in the body and determine the quantity of fat deposits in the liver. Accumulation of fat in the liver is associated with the development of metabolic disorders. These are pilot scans which are being used to calibrate sequences, so that subsequent scans can be used to quantify fat deposition in liver cells. This pilot work will be used to apply for funding for further research in the areas of obesity, diet and metabolic disorder.

1pm–2pm

The ageing brain

As part of an on-going project, the MRI is being used to measure changes in brain activation whilst individuals from a large age range (25–75 years) perform an emotion regulation task. The high-resolution structural scans provided by the MRI help to assess the extent to which age-related decline of cognitive functions is predictive of brain function underlying emotion regulation, and the extent to which patterns of brain function are related to age and cognitive performance. This research is being led by Dr Carien van Reekum in Psychology and is funded by an FP7 Marie Curie International Reintegration Grant.

2pm–4pm

What makes someone a good decision maker?

This project will be scanning the brains of influential people to explore how they make decisions, using often complex and conflicting information. CINN and the John Madejski Centre for Reputation, within Henley Business School, are working together to examine what sets leaders apart and how they make their judgements. The research will be used to help business leaders make better decisions.

4pm–6pm

Neural field study

With a view to developing a model of how the brain's consumption of oxygen relates to neural activity, a multidisciplinary research team led by Professor Douglas Saddy from CINN are running a multi-method imaging study, measuring neural activity, blood perfusion and diffusion in a simple visual task. The research, funded by the EPSRC, uses simultaneous EEG (electroencephalography) and MRI scanning along with the application of innovative analysis techniques. This partnership between Engineering, Mathematics and CINN will lead to detailed computer models of brain functions.

In addition to the specific research projects mentioned here, the MRI facility is currently involved in research in the following areas:

Neurodynamics	Cellular and molecular neuroscience
Diet, ageing and cognition	Perception and action
Imaging technologies	Psychopathology and affective neuroscience
Typical and atypical language	

Funding for these projects comes from a variety of sources including research councils, charitable organisations and industry.

For more information about the MRI facility and the research involved, please see www.reading.ac.uk/CINN



Language, text and power



Dr Peter Kruschwitz from Classics discusses how language brings us together, divides us and helps us to better understand our past, present and future...

One of the most irritating figures of speech in the English language is the notion of something being 'mere words'.

It seems to imply that something is irrelevant as it constitutes no more than an idle utterance of little or no consequence. But words never are 'mere words'. Words hurt, words please, words irritate, words bring people together, words separate individuals, and words can split entire nations: Oscar Wilde, one of the most famous (if involuntary) inhabitants of Reading, famously wrote that 'we have really everything in common with America nowadays except, of course, language'.

There seems to be a popular belief that language is a tool of unity. Nothing could be further from the truth: not a single element in the human nature contributes more to the lasting divide between humans than language. Why is it easier for someone to communicate with a pet dog than someone speaking a foreign language? Do parents speak the same language as their children? Does the 'ruling class' speak the same language as the vast majority of the people? Does academia manage to communicate its research to the wider public?

It is through language, verbal and non-verbal, that human power relationships are negotiated. Languages, themselves objects of design, shape realities in ways that are harder to overcome, or to change, than what has been created by more physical forms of human action.

We seem to live in a global village, a world in which geographical distances can be overcome by inexpensive, quick means of communication. Yet this village is characterised by a multitude of languages that are spoken and written, languages which embody

concepts, ideas, history, realities, ethics, and magic: the roots of all misunderstandings. Is there such a thing as a universal language? Can there even be such a thing?

The study of the role of language in human societies is at the very heart of all arts and humanities disciplines, and it must be the focus of close attention for every society in a globalised world. It is through the study of language, in all its multifaceted manifestations, that we can understand our past, present, and future.

Language, Text, and Power began its life in the Department of Classics, building on the strengths of its staff and promoting innovative, cross-disciplinary approaches to the role of languages in ancient societies. It soon became clear that the language theme had far greater applications, and must involve colleagues from all arts and humanities disciplines, given its relevance and its potential for impact-bearing, collaborative, and competitive research. In 2010, Language, Text, and Power became a Faculty Research Theme, and it since has played a key role in academic events and grant applications, discipline-based as well as cross-disciplinary.

We understand ourselves as an open platform, bringing together and enabling researchers across traditional disciplinary boundaries, to pool Reading's distinctive strength in this area across departments and schools. Key researchers involved in this project are Dr Peter Kruschwitz, the project leader, as well as Professor Ian Rutherford (Classics); Dr Anne Lawrence-Mathers and Dr Matt Worley (History); Dr Federico Faloppa and Dr Melani Schröter (Modern Languages); Ms Clare Furneaux (Applied Linguistics/English).

For more information please see www.languageandtextpower.tk



Dr Ben Potter,
Systems Engineering



Dr Libby Schweber,
Construction Management and Engineering



Phil Coker,
Construction Management and Engineering

Over coffee: Sustainability

Join Phil Coker, Dr Libby Schweber and Dr Ben Potter for a chat over coffee about their interests in sustainability

On their research...

Phil: I've come over relatively recently from industry, so my previous career was in the gas industry. One of the big questions I am interested in is how far can we go with renewable energy; and the challenge there is not so much what resource is available, but more when is it available? So does the wind actually blow when you want to turn the kettle on or when you are using lights in the house? It's the whole issue with variability that got me interested in the first place. I've been looking at trying to understand, well, what does variability even mean, how do you define it, and how do you categorise it? What are the characteristics of the different resources that we could harness and what are the impacts of that on the energy system? Which then leads on to, how much wind can the system absorb, are there advantages to tying wind and tidal and solar together? To which the answer is 'yes', incidentally.

Libby: My background is in sociology, and for about 20 years I worked in what's known as sociology of knowledge and comparative historical sociology, so I was interested in how people reason, how they think; in some ways about policy and problems and also in the way that organisations shape the way in which people think. Then I was offered a research fellowship in Construction Management, to take some of the issues and questions I was interested in and apply them to the construction industry. At the moment, I'm working on a couple of projects, but they all have to do with the challenges that the call to move towards more sustainable construction is posing for the industry.

Ben: I've been a lecturer here since September 2009 and before that I was working in industry. I think there is such a contrast going from being tied to my desk in one part of the office for every hour of every day, to suddenly being in an environment where, sure, that happens occasionally, but there

is so much more space to think, there is access to all kinds of people and it's an environment that I think just facilitates and encourages creativity. I really like that.

I suppose my research at the moment could be best described as smart energy management. Last year, I put together a research proposal looking at the technology behind smart meters. I was interested to see how smart meters, which are being rolled out into people's homes, could achieve the most that they could achieve. And then quite rapidly, I began to appreciate some more subtleties in this area. For example, what do home users make of these meters and how are they going to use them? And what role is that going to play in any future smart grid? I'm still interested in what smart meters can do, and what role they can play in the smart grid, but I think I'm looking a bit broader now. At the neighbourhood or town-level, you can imagine having some micro-generation, some energy storage and



some electric vehicles perhaps, and then you have smart appliances in the home. How do you best manage all of the energy in that kind of environment – both from the point of view of hardware that can facilitate moving energy around efficiently, but also control strategies that best use it?

On change and behaviour...

Ben: Working out how change is going to be implemented in terms of energy use, consumption and management in the future is key. And understanding how people are going to be incentivised to change behaviour is really interesting. For instance, my understanding is that the rolling out of smart meters and developing the smart grid is going to be paid for by increasing bills now. So people are going to be aware that their bills are going up, but with no return yet. And I think in other countries where this has happened there is this sort of resentment to some of the technology, which is counterproductive. Given that we agree that we want to reduce energy or use it more efficiently, how on earth do we incentivise people to come with us on that journey?

Libby: There seems to be a tendency to make this a problem of individuals; of good people and bad people; people

who care and people who don't care; rather than looking at what are the conditions that make this kind of behaviour reasonable. What we try and look at in the Innovative Construction Research Centre is the nature of the whole, the relationship between suppliers and manufacturers and housing developers, and the kind of business models that these different firms and organisations are working under, and what would then make it reasonable for them to support moves to start integrating these types of technology and to have more feedback loops between users and manufacturers and suppliers. So, I'd like to focus on how to make it a reasonable behaviour.

Phil: There is a whole awareness issue behind this too. Energy is not going to get any cheaper, and there are issues around how that's communicated. So it may be a rational and sensible thing to do to invest and protect yourself against energy rises in the future now – it's very easy to have that conversation in this environment. But then when you're at home and you are making all the decisions you make about how you manage your finances – it's difficult.

On technology...

Phil: Something that seems to be happening is that sustainable technologies are more need-specific than other technologies we have got used to. So with electric cars, for example, we have got very used to the fact that we will all have a car that we put petrol in that will have a range of, for instance, 500 miles. And we will use it for commuting and we will use it for our holidays. But actually, if you want to get the best use out of a technology, you want a different tool to do your commuting to how you travel long distances.

Libby: I was talking to an architect the other day who was saying that they had built this brilliant, excellent building, it was beautiful, sustainable. It had a whole variety of different technologies in it to help manage energy consumption and provide electricity and heat and cooling. They handed it over to the client, which was a school, and two years later they had to call the architect in. All the systems had been shut down, none of them had been used, and the school had to ask the architect to explain what the building could do, because they had absolutely no idea. It wasn't out of lack of will, but nobody understood what the different systems in the building required. And

some of these technologies do require more regular maintenance to get the maximum out of them than the more traditional kinds of systems.

Phil: Technically we are now trying to move on, away from a simple gas boiler to better, more clever, technologies; but they are challenging, because they are very specific to where the building is and what is it doing. And then we dump a technology into a building that the existing owners and operators don't understand.

Ben: And I think this is partly why some people in industry don't really want the end-users to be involved. Even if the goal is that technology runs by itself, you are always going to have problems. So what happens when technology goes wrong and how is the user going to understand even the simplest of faults?

On solutions...

Libby: Sustainability is one of those issues that actually determines and encompasses an enormous number of things. What's sustainable for one kind of project or business, or one kind of building, isn't necessarily for another. And that poses a real policy issue, because if you over-regulate, you will end up with a totally unsustainable solution. One thing that might have

been exactly the right thing to do in one place makes very little sense using the same criteria in another location or building. So I think that this is what's known as a 'wicked' problem in the sense that it's moving, it's complicated, it involves lots of stakeholders, and it has enormous, redistributive consequences. So it poses a very particular type of policy challenge.

Ben: I think that regulation levels the playing field, and that has to be established before anything can really happen. But it's a tricky one because there's always going to be these new ideas coming forward and at some point you just have to draw a line and go for it. You have to try as hard as you can to get it right, and have captured enough of the good ideas, so that what you go for is going to be successful.

Phil: You can get good and scared about the real challenges behind sustainability, and it probably needs a completely different business model. The businesses that are going to thrive in the future are ones that recognise that now and get ahead of the game. And they're going to be banging on the door of government saying 'we want this thing to happen so we can put this new business model in place'. We have got an interesting dialogue with the construction industry because they are

starting to recognise this, and they are starting to recognise the challenges of a carbon-constrained world, and what a building needs to be like in that world.

Libby: If you compare different areas of the construction industry you see that some are responding more than others, and this raises questions about why. And I think it's a mistake to think that there's more caring people in one part than the other. There are some amazingly creative, committed people championing sustainability, but it's not easy.

Phil: The thing I think we are getting wrong is timescale of incentives: we need to start taking a long-term view. I teach a bit about systems approaches and modelling, and within that you think about timescales. And being a systems guy, Ben will know more about this stuff than me, but the whole business framework is about responding to quick incentives that don't line up to the nature of sustainability. What are the business models that allow industry to take longer-term decisions? That's a question for the business guys.

For more information please see www.reading.ac.uk/research

Research Review

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