INNOVATION REVIEW

ISSUE 7, June 2011

SUSTAINABLE BUILDING DESIGN AND REFURBISHMENT IN SCOTLAND

RESILIENCE OF BUILDINGS, NEIGHBOURHOODS AND CITIES
SKILLS FOR SUSTAINABLE BUILT ENVIRONMENT
RESEARCH ON URBAN CLIMATE IN GLASGOW
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FUNDING AVAILABLE THROUGH CIC START ONLINE FOR:

- **27 FEASIBILITY STUDIES** – up to £5,000 each
- **9 ACADEMIC CONSULTANCIES** – up to £3,000 each

European Structural Funds

Best Practice Awards 2010

CIC Start Online was shortlisted in two categories:

BEST PARTNERSHIP WORKING

BEST CONTRIBUTION TO A “GREENER” SCOTLAND

European Regional Development Fund
Investing in your Future

Funding available through CIC Start Online for:

- **27 Feasibility Studies** – up to £5,000 each
- **9 Academic Consultancies** – up to £3,000 each
RESILIENCE OF BUILDINGS, NEIGHBOURHOODS AND CITIES
FREE interactive online conference, 14-17 June 2011

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What is CIC Start Online?

- A three-year project of seven Scottish universities funded by European Regional Development Fund and Scottish Government’s SEEKIT programme
- AIM: To embed sustainable building design and refurbishment into practice
- OBJECTIVE: To support academic/industry collaboration in developing and testing innovations, and to disseminate the outcomes in order to facilitate the application of innovations in practice
- WHY?
  - To reduce CO₂ emissions and other negative environmental impacts from buildings
  - To reduce fuel poverty and improve indoor climate
  - To create jobs and support competitiveness of Scottish construction industry through innovation
  - To remove the barriers to the application of innovation in practice
- HOW?
  - Through competitions for academic/industry feasibility studies and for 10-days free academic consultancy on sustainable building design and refurbishment
  - By testing innovations at the testing facilities of the project partners’ institutions
  - By publishing guidelines for the application of innovations in practice
  - By developing and publishing database of design solutions for sustainable refurbishment
  - By providing assistance and advice on sustainable building design and refurbishment to Scottish small to medium sized enterprises
  - By disseminating the project outcomes through the project website, seminars, interactive webinars, webcasts and three whole-day online events that will include an exhibition, a conference and networking facilities
  - By publishing information on products and services for sustainable building design and refurbishment offered by Scottish small to medium sized businesses registered with CIC Start Online.

BENEFITS OF FREE MEMBERSHIP

- Publish information on your company’s products or services for sustainable building design and refurbishment
- Receive a set of headphones with a microphone, monthly E-News and quarterly Innovation Review
- Ask for advice/assistance

Please click here to access the registration page at the project website [www.cicstart.org](http://www.cicstart.org)
Welcome to the 7th issue of Innovation Review!

Our members will soon receive CIC Start Online progress report and information on our forthcoming online conference. The project now has over 730 members. Some of them have been successful in applying for a feasibility study or academic consultancy through our competition. Please see the list of winners of the May call on page 6. As the next submission deadline for applications is 15 September 2011, we would like to invite the members from Scottish small to medium size enterprises to apply for the remaining 27 awards for feasibility studies (up to £5,000 each) and 9 academic consultancies (up to £3,000 each) to test or improve products or services for sustainable building design and refurbishment. Please see the call for applications on page 7.

The CIC Start Online members can now access five new video recordings of our seminars (see page 8). Sponsorship of seminars, webinars and our forthcoming online conference are welcome – please contact Craig.Bishop@gcu.ac.uk, 0141 273 1401, for more information on sponsorship opportunities.

Our interactive online conference Resilience of Buildings, Neighbourhoods and Cities will take place from 14-17 June 2011. The conference programme and summaries of all videos are published in this issue (pages 9 - 19). Following each video, an interactive 45-minute session will enable online viewers to ask questions and receive replies from the videos’ authors.

As airtightness testing was introduced to the Scottish Building Standards on 1st October 2010 as part of the drive to cut carbon emissions from buildings, BSRIA has published a guidance document ‘Airtightness: Scotland – The essential guide to Section 6 of the 2010 Scottish Building Standards’ (more on pages 20-21).

A new Master’s programme, Carbon Management in the Built Environment, has been launched at Heriot Watt University in Edinburgh. Graduates will gain the knowledge and skills needed to become an expert in the consulting, planning and execution of low carbon architecture and engineering (more on pages 22-23).

The Centre for Energy and the Built Environment (CEBE) of the School of Built and Natural Environment (BNE) of the Glasgow Caledonian University is currently conducting a study of the microclimate variations in the city of Glasgow in an attempt to gauge its energy, carbon and global/regional climate change implications (more on pages 24-28).

We welcome the members’ in-depth articles on sustainable building design or refurbishment projects, or the products manufactured or services offered to achieve more sustainable built environment. The articles for the next issue should be submitted by 15th August 2011. If you would like to discuss the contents of your article, please contact me at Branka@cicstart.org, 0141 273 1408. I look forward to receiving your articles for the future issues of Innovation Review.

Kind regards,

Branka
COMPETITION WINNERS IN MAY 2011

FEASIBILITY STUDIES

1. “Optimization of economic, environmental and energy savings in buildings” by Edinburgh Napier University and Eurocapita Investment Group

2. ”Developing a template for quick start user guides” by The Glasgow School of Art and The Property Log Book Company Ltd

3. ”Tool to Calibrate Cost Effectiveness of Energy Efficiency” by Glasgow School of Art, University of Sheffield and NRGSTYLE Ltd

4. ”Energy Efficiency Improvements in Tenements” by Edinburgh Napier University and Lanarkshire Housing Association

5. ”Retrofitting Solar Photovoltaic Panels in Existing Housing Stock” by Edinburgh Napier University and Easthall Park Housing Co-operative Ltd

6. ”Retrofitting Solar PV in Housing Stock” by Edinburgh Napier University and Malcolm Homes Ltd

7. ”Benefits and options for retrofit of an 18th century traditional Scottish house using the Passive House standard” by Edinburgh Napier University and SA Estates

ACADEMIC CONSULTANCY

1. ”Environmental Design Teaching Model” by Edinburgh College of Art and IES Ltd

2. ”Testing and Evaluating Recycled Plasterboard Prototypes to assess Thermal and Moisture Performance for Suitability as Insulation Material” by Glasgow Caledonian University and First Option Services

The outcomes of the completed feasibility studies and academic consultancy are presented at our seminars and interactive webinars.

Video recordings of these events and related Power Point slides are published on our website in the section Webcasts.
CALL FOR APPLICATIONS
FOR
FEASIBILITY STUDIES
AND
ACADEMIC CONSULTANCIES

Submission deadline: 15 September 2011

- 27 awards for feasibility studies (up to £5,000 each)
- 9 awards for academic consultancy (up to £3,000 each)

Please see information on how to apply and download the application forms at our website in the sections Feasibility Studies and Academic Consultancies at www.cicstart.org. You can also watch a video on ‘How to Apply?’ at the same pages.

If you do not know what university could assist you or have any questions regarding the application, please send an email to

branka@cicstart.org.

We look forward to receiving your applications!
VIDEO RECORDINGS OF SEMINARS

Since the March issue of Innovation Review five new video recordings of seminars and interactive webinars have been published on our website. To access them, please register as a member of CIC Start Online through the home page of our website. Registration is free.

Speakers:

Dr David Moore, Robert Gordon University
Dr Seonaidh McDonald, Robert Gordon University
Johnathan McQuillan, Anderson Bell & Christie Architects

Speakers:

Dr Tim Sharpe, The Glasgow School of Art
Matt Bridgestock, The Glasgow School of Art
John Gilbert, John Gilbert Architects

Speakers:

David McEwan, IES Ltd
Dr Rohinton Emmanuel, Glasgow Caledonian University

Speaker:

Dr Fan Wang, Heriot Watt University

Speakers:

Prof. Sue Roaf, Heriot Watt University
David McEwan, IES Ltd
A Resilient Built Environment

Dr Branka Dimitrijevic

What threats and risks should be considered in creating a resilient built environment and improving the resilience of existing built environment? The list could be compiled from answers provided by insurance companies, fire fighters, police, doctors, building occupants, building owners, communities, environmentalists, historians of architecture and other interest groups. Planning policies and building standards aim to reduce the risks to the owners and users of the built environment, to the natural environment and built heritage. However, as new threats and risks arise, and the users’ needs change due to different physical abilities, social requirements and economic circumstances, there is a need to understand the nature of changes and to build resilience of the built environment through mitigation and adaptation.

In the last decade, the list of potential threats to the resilience of the built environment has been extended with the global issues such as the prediction on climate change caused by the rising emissions of greenhouse gases, the increased risk to energy security due to the peak oil reserves, and the limits of natural resources in relation to the housing and other needs of rapidly growing global population. The built environment can also be under threat if it does not adapt to changing social and health needs of building users.

In the afternoon, at 2.00 pm, interviews with the planners of Scotland’s Housing Expo 2010 and designers of some of the buildings at this exhibition will explain design options for resilient housing and neighbourhoods in Scotland. One of the strengths of the Expo is that it features a wide spectrum of approaches to sustainable housing design. *(Learning from Scotland’s Housing Expo: Making resilient buildings and neighbourhoods, John Brennan, University of Edinburgh)*.

The conference continues on Wednesday, 15th June, at 11.00 am, with the consideration of the issues related to the risk of flooding in built up areas in Elgin, Scotland, which could increase with climate change *(Flooding resilience: avoidance, resistance and recovery, Prof. Sue Roaf, Heriot Watt University)*.

At 2.00 pm, the internal threats to the quality of built environment, arising from the way in which some recently built housing in Scotland is used, are explored and recommendations on some potential areas for improvement provided *(Resilience to Occupancy: Findings from recent Post Occupancy Evaluation projects, Dr Tim Sharpe, Glasgow School of Art)*.

On Thursday, 16th June, at 11.00 am, the interviews with representatives of Scottish organisations that are seeking to go beyond the minimum (as established by the legislative ‘push’) level of response to carbon will be presented along with the examples of ecology ‘pull’ such as the Woodland Carbon Code *(The theory of self-organising built environments as a response to carbon levels, Dr David Moore, Robert Gordon University)*.
In the afternoon, at 2.00 pm, the opportunities to use the mitigatory potential of urban fabric to reduce the effects of urban warming are examined through a study on the influence of urban morphology on local/micro-climate changes in Glasgow within the context of global climate change and efforts to adapt cities to such changes. *(Urban Heat Island: Managing local climate change to enhance resilience of cities, Dr Rohinton Emmanuel and Dr Craig Thomson, Glasgow Caledonian University, and Prof. Eduardo Krüger, Federal Technological University of Paraná, Brazil).*

On Friday, 17th June, at 11.00 am, the presentation provides a snapshot of the barriers inherent to the design of urban environments for individuals with different types and degree of visual field loss. Enhanced guidelines are presented that incorporate the findings of the research results. The research contributes to an understanding that designing urban environments should be less about architectural fashion trends and more about creating practical spaces that cater for the needs of all users *(Towards a Visible City for Visually Impaired Users, Dr Robert White and Dr Mike Grant, University of Strathclyde Glasgow).*

At 2.00 pm, the co-operative approach to renewable energy is examined in terms of scale, risk management and capital raising whilst maintaining the benefits locally. The presentation includes examples of renewable energy co-operatives such as Boyndie Wind Farm in Aberdeenshire, Eaga in Newcastle, the Edinburgh Community Energy Co-operative, and the Isle of Eigg, a model community for renewable energy. *(Energy co-operatives as a means of achieving sustainability within the housing sector, Sarah Borthwick and Prof. Tariq Muneer, Edinburgh Napier University).*

**Interactive Questions and Answers sessions**
Following each presentation, there will be an opportunity to ask questions and get answers from the speakers who will be in the seminar room K505 in Buchanan House at the campus of Glasgow Caledonian University.

**Attending the Seminars in Person**
You are welcome to attend the conference presentations and Q&A sessions in person. To attend in person, please book a place by registering on our website at www.cicstart.org – under the Events -> 2011 Conference Section.

**Attending the Seminars Online**
To attend online, please become a member of the project by registering online at www.cicstart.org – You will then receive an email on each morning of the conference with the relevant login details. Online viewers can use the chat facility to ask questions at any time during the presentation.

*We look forward to welcoming you at the conference!*
# RESILIENCE OF BUILDINGS, NEIGHBOURHOODS AND CITIES

**ONLINE CONFERENCE**

**14th-17th JUNE 2011**

## Tuesday, 14 June

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Principles and Processes Related to Sustainable Building Design

Dr David Grierson and Carolyn Moultrie, University of Strathclyde Glasgow

Tuesday, 14th June 2011, 11.00-11.50 am + Q&A session until 12.30

The presentation aims to provide an insight into the many facets of the sustainable design process and comprises a series of one-to-one interviews with practitioners from Hypostyle Architects, Page\Park Architects, Assist Architects, Gaia Architects, Archial, Arup and Haa Design (in order of appearance).

All will describe their practice sustainable design philosophy/ethos and underlying principles. The practice case study buildings are used to show how sustainability is embedded into design methodology and mapped onto, or has transformed, the design process. The projects are from a variety of sectors including social housing, private developer housing, commercial office and education and both new build and retrofit.

One of the case study buildings – the retrofit and extension of Arup’s office Scotstoun House, in Dalmeny South Queensferry, is shown in more depth with interviews from the designers Haa Design and Arup. In operation once more for Arup, since July 2010, end users give their view on the new working environment.

The practices reveal common approaches and divergences in their principles and processes for sustainable building design.

The presentation follows on from ongoing research and in particular a study undertaken as dissertation work within the Masters of Research programme in Building Design and Management at the Department of Architecture, University of Strathclyde during 2010.

The objectives of the study were to investigate the design principles and processes for sustainability and to explore them in action within current practice. This was achieved by engaging with the architectural and multi-disciplinary practices of the presentation. A context was established by reviewing literature focusing on the global environmental perspective, UK and Scottish legislation, sustainable principles, blueprints, sustainable processes and evaluation. The outcomes were a process model developed to provide a framework for discussion and case study review and the beginnings of a methodology for refining practice ethos and developing a set of guiding principles.

The study supports the proposal that a new framework can help inform a move towards a typology of sustainable building design that in turn can help practitioners develop and refine their approaches to sustainability. Ideas for future research are suggested.
Scotland’s Housing Expo held in August 2010 showcased over 50 new houses that represent how high quality sustainable homes should be designed. This webcast looks at how the Expo was realised and examines in detail some of the individual buildings.

The Expo features a diverse selection of approaches to design, with a collection of homes that address both affordable and private housing sectors. It is based on a well-established Scandinavian model that has seen regular fairs that over time has raised the standard for design in the housing sectors. A critical foundation to the Expo was the masterplan prepared by Cadell² Architects and Urban Designers. This set the framework for the demonstration buildings and was based around traditional highland settlement patterns. The masterplan addresses shelter, microclimate and sunlight to optimise the new housing’s passive response. A good masterplan also addresses social sustainability criteria through the creation of engaging and useable public spaces. We hear from Johnny Cadell of Cadell², about the challenges and delivery of the project physical and planning infrastructure.

This webcast looks at a selection of the Expo houses that have different responses to what a sustainable home of the future might be. We examine the fast growing phenomenon of PassivHaus technologies where buildings undergo a step change in performance, with a massively reduced energy demand. This is achieved through super insulation and very high standards of construction to enhance air tightness. Passivhaus is a mature and demanding standard; many of its principles look set to be incorporated into future regulatory frameworks. This Webcast gives the opportunity to look at how PassivHaus is realised in a Scottish context.

One of the strengths of the Expo is that it features a wide spectrum of approaches to sustainable housing design. Reducing carbon emissions from a building’s operational energy consumption is just one approach. We look at how a major challenge especially in the private housing sector lies in the unsuitability of housing stock for the complex household structures we have today. People that need to move or alter their homes have resource and consumption implications. This webcast features the WholeLife house by Brennan and Wilson architects that looks both at energy reduction in the home as well as making private sector housing more adaptable and useable over the lifetime of the building.

Finally, we look at the real social, economic and environmental advantages of resourcing, building and procuring locally. Alan Dickson of Rural Design Architects operates on the basis of producing sustainable buildings rooted in their site. His building ‘a secret garden’ reinterprets traditional highland houses and gardens and reinforces the role outside space can play in a modern sustainable lifestyle.
Prof Sue Roaf of Heriot Watt University takes a visit to Elgin, a former cathedral city in the North of Scotland, to examine the different approaches to flood management. Elgin has suffered a great deal in recent years with repeated flooding, forcing residents out of their homes and damaging local businesses. Other general aspects of flood resilience are also discussed, including the different approaches to planning, the use of SUDS, and the importance of building recovery after a flooding event.

In this webcast we interview David Gowans and Peter Haslam of the Moray council's flood alleviation project who explain the engineering approaches of diversion and attenuation. They introduce the concept of flood risk, defining it as a function of probability and impact, and describe the specific measures being taken in Elgin to try and mitigate against future flooding episodes.

Mike Donaghy is an environmental consultant who explains how councils such as Aberdeenshire, and also Moray, are now moving towards Natural Flood Management. Natural Flood Management involves working with the natural landscape to turn moorlands and farmlands into more efficient water stores, to reduce local flooding.

Gavin George from Floodguards describes products that offer building level flood protection, including a “floodguard” seal systems to stop the flow of waters in through doors, windows and vents of properties – empowering homeowners to add flood resilience to their own properties.

He explains the need for a holistic approach – taking into consideration the strength of concrete foundations, sealing access points (doors, windows, vents), reverse-flow valves on drainage and the need for neighbours and party walls to be included in an individual assessment.

We visit one local businessman who has invested over £200,000 in flood mitigation measures including a peripheral levee and wall, a moveable floodgate, drainage valves and a pumping system – all in response to his last insurance claim for over £1,000,000. In the most recent flood in his area, his business continued without damage.

Climate Change is already causing us to experience more and more extreme weather events, with heavy flooding being one of the most lethal, expensive and frequent. Elgin has suffered from several catastrophic floods in recent years. The financial, and the human cost of flooding are seen here to be very high and a strong message from all sides in the film is that no future developments in the flood plain should be allowed without very good reasons.
Resilience to Occupancy: Findings from recent Post Occupancy Evaluation projects

Dr Tim Sharpe, Glasgow School of Art

Wednesday, 15th June 2011, 2.00 – 2.50 pm + Q&A session until 3.30 pm

This presentation is concerned with the nature of occupancy in dwellings. It draws on monitoring and evaluation projects undertaken over the last 14 years by the Mackintosh Environmental Architecture Research Unit (MEARU), but also presents new data emerging from recent Post Occupancy Evaluation projects in Glasgow, Aviemore, Dunoon and Edinburgh; a comparative analysis of two different construction systems used side by side in the Glasgow House; and current work examining the environmental effects of domestic laundry practices.

These projects have identified a number of challenging internal conditions that are occurring in a range of different house types. These include high temperatures and humidity, poor air quality, lack of daylight and sunlight.

These problems frequently relate to the sometimes complex and difficult nature of building occupancy and its effect on building performance and environment. Is this ‘bad behaviour’ or is it just real life?

While it is easy to ascribe conditions to occupant behaviour, other common factors emerge, including poor controls and understanding of controls; reduced volumes, floor areas and window areas; lack of drying facilities; security; and lack of passive environmental control.

The trend in increasingly energy efficient housing has been for increasingly sophisticated solutions for optimum performance, and appear to be a move toward a ‘tight fit’ systems which may be less tolerant of variable occupancy. At the same time, the idea of behavioural change is gaining currency as a means of improving performance.

However, it may be that unless dwellings - both new-build and refurbished - can be designed to be robust enough to cope with a range of different occupancy regimes, they may remain at risk of a series of ‘side effects’ of unintended negative consequences, including higher rates of energy consumption, or poorer internal conditions. The question that arises is, how buildings can be designed to be resilient to these conditions?

The presentation will identify some potential areas for improvement emerging from research by MEARU, including sunlight, thermal mass, controls, post occupancy studies and occupant guidance.
The theory of self-organising built environments as a response to carbon levels

Dr David Moore, Robert Gordon University

Thursday, 16th June 2011, 11.00 – 11.50 am + Q&A session until 12.30 am

Through considering the focus on carbon within the built environment in terms of Legislative ‘push’ rather than in terms of Ecology ‘pull’, aspects of the built environment such as the relevance of autopoietic systems (particularly in terms of Intelligence and self-organisation within the city context) are considered regarding recognition as relevant responses to carbon levels.

This in turn leads to consideration of how the environment may recognise the need to respond to carbon on the basis of it being either ‘good’ carbon or ‘bad’ carbon.

There is a need to consider if the complexity of cities means that a focus on ‘bad’ carbon through legislation represents a belief that self-organisation (within the city system) cannot be effective, and that imposed organisation (legislative ‘push’) is the only viable approach.

If so, can we be sure that the ‘push’ approach does not miss significant amounts of ‘bad’ carbon?

Does the push approach demand high quality data, and does such data allow for a better understanding of the ‘pull’ approach?

The presentation incorporates relevant literature with regard to cities as self-organising systems, interviews with representatives of organisations that are seeking to go beyond the minimum (as established by the legislative ‘push’) level of response to carbon, and examples of ecology ‘pull’ (such as the Woodland Carbon Code).
Urban Heat Island: Managing local climate change to enhance resilience and sustainability of cities

Rohinton Emmanuel and Craig Thomson (Glasgow Caledonian University) and Eduardo Krüger (Federal Technological University of Paraná, Brazil)

Thursday, 16th June 2011, 2.00 – 2.50 pm + Q&A session until 3.30 pm

Although cities account for less than 3% of the global land area they are home to over half of the world’s population. The current growth trajectories indicate that by 2050, nearly 70% of humanity will live in urban areas. The importance of cities in the global fight against climate change is increasingly being recognised. Even though cities are major consumers of energy and materials as well as generate vast amounts of waste, they are also major centres of innovation and finance – which could enable them to be at the forefront of climate mitigation actions. At the same time, the nature of climate change with its long lag-times mean that major centres of population will have to prepare themselves to act as the first line of defence against catastrophic effects of local and global changes expected in the near future. Given these twin realities of potential innovation in mitigatory action as well as adaptive capacity and need, urban areas are beginning to receive a long overdue attention from climate change scientists and policy makers. In these efforts, the role of urban climate change in both contributing and augmenting global change is a key unknown that needs careful attention.

Could there be opportunities to use the mitigatory potential of urban fabric to reduce the effects of urban warming with a view to providing some relief to the wider and more extreme weather events spawned by global climate change?

A further reality confounding the issue is urban decay. Major centres of urban population have already begun to lose population and even those that are yet growing continue to sprawl, leading to lowering urban densities in many parts of the world. What effects will shrinking cities as well as de-densification have on local climate change? What lessons can we learn from the local climate change trajectories of mature cities to plan better the still growing cities of the world?

In this presentation, we present our efforts to study the influence of urban morphology on local/micro-climate changes in Glasgow and set it within the context of global climate change and efforts to adapt cities to such changes. We then explore the sustainability dimensions of such urban planning and design actions.
Towards a visible city for visually impaired users

Dr Robert White and Dr Mike Grant, University of Strathclyde Glasgow

Friday, 17th June 2011, 11.00 – 11.50 am + Q&A session until 12.30

This webcast (based on the PhD findings of Dr Robert White, University of Strathclyde) presents a snapshot of the barriers inherent to the design of urban environments for individuals with different types and degree of visual field loss. According to the Royal National Institute for the Blind (RNIB), there are an estimated 2.3 million visually impaired people living in the United Kingdom. This figure is expected to increase to 4 million by 2030, due to the effects of an ageing population and the obesity epidemic. It is therefore essential to invest in the design of safe, accessible and sustainable environments, which are sympathetic to the needs of the visually impaired user. The urban landscape in its current state resembles an obstacle course. This results from a lack of mandatory regulations available to designers and planners, which specifically address the navigational needs of the visually impaired pedestrian beyond the curtilage of a building.

This work embarks from the hypothesis that commonalities exist in the manner in which individuals with different types and degree of visual field loss experience barriers in the built environment. Furthermore, it is hypothesised that the nature of these commonalities can be measured and incorporated into the – presently insufficient – building regulations. The question that arises is: How can design regulations integrate the specifications to collectively accommodate the varying needs of different visual impairments for seamless navigation in urban streetscapes?

This question is explored through a nationwide survey targeted at visually impaired users of the built environment. The survey is followed by an access audit, which aims to quantify the number and type of hazards present within a typical city centre. The research is complemented by a series of user-based navigational experiments, which situate the problem through comparison of experiences between visually impaired and fully sighted cases.

The collected data have been used to inform the creation of an evaluation tool, which measures both the adequacy of mandatory regulations and the degree that best practice guidelines are embraced by local authorities. When applied to the audited city centre, the tool reveals deficiencies in both the content of the regulations and in the adoption of the guidelines. Enhanced guidelines are presented that incorporate the findings of the research results. The overall conclusion is that visually impaired people are not disabled by personal factors but by the design and physical influence of features within the built environment. The research contributes to an understanding that designing urban environments should be less about architectural fashion trends and more about creating practical spaces that cater for the needs of all users.
Our dependency on energy is threatened by two realities: dwindling supplies of fossil fuels and rising levels of environmental pollution. With this in mind, alternative sources of energy are increasingly being turned to, including the technologies to harbour these. Various national and international targets have been set, focusing upon the limiting of climate changing greenhouse gas emissions and increasing the uptake of renewable sources of energy – and Scotland is no exception.

The use of both solar and wind power are first of all considered as a means to facilitate the above scenario, focusing upon the application of solar photovoltaic panels and wind turbines for the generation of electricity and thermal water heaters for the provision of hot water in our homes and buildings. These systems are evaluated in terms of their dynamics, structure types, strengths and weaknesses, plus a reflection of their current levels of adoption and potential for future application. The financial incentives offered at Government level to help encourage the uptake are also assessed, including that of the feed-in tariff and renewable heat incentive.

Leading on from this, the co-operative approach to renewable energy is thoroughly examined in which to achieve scale, manage risk and raise capital – whilst maintaining the benefits locally.

A co-operative entity is one which is owned and controlled by the members, who can be employees, businesses or consumers. It has been observed that those countries adopting the co-operative approach, with individuals and societies getting involved and working together, have the greatest success with regards to renewable energy (Energy4All 2010). The three main business models which can be best applied to this sector are subsequently detailed; namely the co-operative consortium, employee owned business and the community co-operative. The line of reasoning for the co-operative movement is strengthened by real life applications of the three models, including the Boyndie Wind Farm Co-operative in Aberdeenshire, Eaga in Newcastle, and the Edinburgh Community Energy Co-operative. Further consideration is given to the Isle of Eigg as a model community for renewable energy. Discussion is also accompanied by interviews with two business associates currently operating in the co-operative sector.

The co-operative model can be adapted to suit all types of situations, regardless of only two or two-thousand people being involved. The video concludes with some final food-for-thought, in which to engage with the audience and help with the identification of areas within their own lives (business and personal) where co-operation could apply.
Airtightness and the new Scottish Building Standards
Gordon Park, BSRIA Airtightness

Airtightness testing was introduced to the Scottish Building Standards on 1st October 2010, as part of the drive to cut carbon emissions from buildings. Testing is required to prove that the building achieves or surpasses the levels stated and used in the energy calculations for the design of the building. There are three main wins from reducing air leakage:

- Lower energy use
- Increased owner and user comfort
- Lower building operating and running costs

About the Standards

As part of Scotland’s move to zero carbon development, in line with the Climate Change (Scotland) Act 2009, the energy section (Section 6) of the Building Standards changed on 1st October 2010. The new standards set the following compared with the 2007 standards:

- Domestic – 30% reduction in CO₂
- Non-domestic – 30% reduction in CO₂
- Extensions and refurbishments – enhanced minimum U-values

Airtightness will become significant in construction and mandatory airtightness testing has already started to be phased in as follows:

- For flats and maisonettes – from 1st May 2011
- For all other dwellings – from 1st October 2011
- For non-dwelling buildings – from 1st May 2011

This staggered introduction is intended to allow the capacity of the testing industry to grow. There are already some testing companies, such as BSRIA, operating in Scotland.

Dwellings will require testing and there is a maximum allowable air permeability of 7 m³.h⁻¹.m⁻² @ 50 Pa.

In non-dwellings a maximum air permeability value has not been set. However, in practice, for the building to achieve the required energy targets, a value of less than 10 m³.h⁻¹.m⁻² @ 50 Pa will normally be required and a test will be needed to prove this.

Choosing an airtightness tester

To comply with the standards the test must be carried out by an approved testing organisation, either a BINDT registered tester for dwellings alone or an ATTMA member for non-dwellings and dwellings. Tests should be carried out in accordance with the requirements of CIBSE TM23: 2001, which all ATTMA members and BINDT registered testers will comply with as a matter of course. Using a non-accredited airtightness tester runs the risk of the test certificate not being recognised by building control.

BSRIA uses a ‘Fan Rover’ to test large commercial buildings. Blower doors which test smaller buildings and dwellings can be transported in a small van.

Causes of air leakage

Air leakage commonly occurs in the following locations:

- Interfaces between materials and building elements, e.g. windows to wall
- Penetrations through the building envelope
- Wall to roof junctions
- Across cavities

and for the following reasons:

- Poor design
- Poor build quality
- Lack of responsibility for sealing between elements or round penetrations
- Area is to be hidden by internal finishes that do not form part of the air line (suspended ceiling tiles hide many a faux pas)
Avoiding the common pitfalls

Avoiding all these problems is not difficult and does not in many cases require additional spending. The key to this is considering airtightness from the early design, throughout the entire process and involving all the relevant parties:

- The airline and target air permeability should be established at an early stage of the design
- Construction details should then be developed to ensure that the airline is continuous around the entire building
- Details should be buildable with the sequence considered (in built-up roof and wall systems, the air line must be accessible when the penetrations are made)
- The number of penetrations through the envelope should be minimised and common details used for them
- Responsibility for sealing details should be assigned
- A quality assurance system should be used to check for the construction of airtightness details in addition to all the normal checks carried out.

More than just energy

Air leakage is not just important for reducing energy bills and increasing user comfort, it can be highly important in specialist applications. In data centres, the cost of failing to deliver the required cooling because of excessive leakage will be high in terms of down time and the requirement for additional plant, which will ramp up the costs of installation, operation and maintenance. In hospitals and biological labs it is also important to control air leakage to ensure that infections and pathogens do not spread into or out of particular areas.

BSRIA in Scotland

BSRIA is an ATTMA member and provides nationwide airtightness testing and consultancy and has recently opened a Scottish office to provide a local service for clients in Scotland.

Their range of services now available in Scotland include consultancy for design and compliance with Section 6 of the Scottish Building Standards, UKAS accredited testing to CIBSE TM23, BS EN13829, and ATTMA TSL1(Dwellings) and ATTMA TSL2 (Non-dwellings), as well as Thermal imaging, Acoustic testing, and Smoke Surveys. They held a series of events in November 2010 which were attended by many varying members of the Construction Sector in Scotland, and are now closely working alongside individual bodies and companies to assist with further information and guidance in advance of the airtightness testing coming into force under the Scottish Building Standards.

Among recent jobs, BSRIA provided onsite assistance and testing for and on behalf of Balfour Beatty Ltd at the new University of Edinburgh Vet School at Easter Bush Campus, nr Penicuik, Edinburgh.

Further guidance and information

BSRIA has published a guidance document ‘Airtightness: Scotland – The essential guide to Section 6 of the 2010 Scottish Building Standards’, which is free to download from www.bsria.co.uk/goto/at-guides.

To discuss your airtightness requirements, contact BSRIA’s Scottish office manager, Gordon Park:

T: 07951 716683
E: gordon.park@bsria.co.uk
W: www.bsria.co.uk/airtightness

Or contact BSRIA Airtightness head office on 01344 465616 or airtightness@bsria.co.uk.
The biggest contributor to greenhouse gas emissions is the built environment, accounting for up to 50% of global carbon dioxide emissions. In the UK buildings consume around 40% of all energy, while the construction industry is the highest consumer of materials globally, using around 6 tonnes of material per person per year. There is a growing understanding by the general public of the need to conserve energy both for security of future supply, and to protect the environment. In times of financial uncertainty the general public are acutely aware of energy costs and are particularly eager to cut fuel bills. The 2010 BP Statistical Review of World Energy revealed a decline in the amount of energy used throughout the recession; the first decline since 1982.

The economics of energy supply, operational carbon management, legislation, policies and incentives, dynamic design, effective decision making and efficient engineering to produce low carbon buildings for the future need to be understood, strategically planned for, and conscientiously applied while understanding the compromises and critical needs of building owners, users, and stakeholders.

Energy is not only needed to operate and manage buildings, but to design, build and upgrade them. Energy is needed and carbon is emitted during extraction and processing of raw materials, manufacture of finished products and components, during construction, and to transport materials and products to site. Life cycle thinking is essential in measuring the energy, carbon and associated environmental impacts of materials, components and activities over their lifecycle; a cradle to cradle, or cradle to grave analysis. Analysing the energy, carbon and monetary benefit of building specifications is critical to building a sustainable built environment for a low carbon future.
According to a recently published discussion paper by Scotland’s Futures Forum, there is tension between producing clear, simple messages about climate change and a tendency for sloganizing; there is a need for people to actively engage with the issues of climate change rather than passively receive information. Meeting the need for a low carbon society requires continued education, so that the awareness of climate change is embedded into career paths. The discussion paper also declares that strategic planning must be integrated at national and local scales, so that low-carbon planning is enabled and facilitated at every level.

A new Master’s programme, Carbon Management in the Built Environment, has been launched at Heriot Watt University in Edinburgh, and is designed to produce graduates with the skills needed to reduce built environment carbon emissions; to improve sustainability; and to adapt to a changing climate. Graduates will gain the knowledge and skills needed to become an expert in the consulting, planning and execution of low carbon architecture and engineering.

The programme can be completed on campus via full or part-time study, or by a fully distance learning syllabus, and is designed for a wide variety of built environment professionals including: facilities managers; construction project managers; architects; architectural engineers; quantity surveyors; building surveyors; structural engineers; interior designers and others. Eight courses cover a wide range of built environment topics including climate change and adaptation, spatial planning, corporate social responsibility, building user comfort, low carbon building design, low carbon systems and technologies, dynamic simulation, energy economics, and professional practice.

For an informal chat, please contact the programme leader, Dr. Gill Menzies, g.f.menzies@hw.ac.uk, Tel: 0131 451 4663. For more details and to access the application process please visit http://www.postgraduate.hw.ac.uk/courses/view/368/. 
Urban microclimate study in Glasgow

Rohinton Emmanuel, School of Built & Natural Environment, Glasgow Caledonian University
&
Eduardo Kruger, Department of Civil Construction, Technological University of Parana, Brazil

The Centre for Energy and the Built Environment (CEBE) of the School of Built and Natural Environment (BNE) of the Glasgow Caledonian University is currently conducting a study of the microclimate variations in the city of Glasgow in an attempt to gauge its energy, carbon and global/regional climate change implications. This work showcases CEBE’s expertise in the so-called heat island research. We are currently mapping out the local climate variations in and around the city of Glasgow to achieve the above aims.

The work consists of four data collection regimes: historic climate trends in the city; fixed weather station data in and around the city; microclimate variations at the street canyon level within the city core, and thermal perception of street users in the heart of the city centre. In this note, we present some of our current work with respect to the fixed weather stations in and around the city of Glasgow. Six fixed weather stations have been established in and around the city of Glasgow (Figure 1).

Figure 1: Location map of the six weather stations (blue dots)
We used six Tinytag dataloggers (Tinytag Plus 2 Dual Channel Temperature/Relative Humidity, -25 to +85°C/0 to 100% RH – TGP-4500), enclosed in a standard solar radiation shield (Figure 2) and placed at different locations in a North-South axis across the core area of Glasgow.

Stations were chosen according to their urban features and distance to the city centre. The following list provides basic characteristics around each weather station:

- COR1 – City centre location 1, at the Macintosh School of Architecture, located at about 3m from ground level.
- COR2 – City centre location 2, at 42 Miller Street, outside a historic building of at approximately 0.5m from ground level.
- GRN1 – Located in Glasgow Green, near the boat house at approximately 1.8m from ground level.
- RES1 – City centre residential area, south side of the River Clyde at approximately 1.2m from ground level.
- SUB1 – Suburban tenement residential area near Queen’s Park, at approximately 1.5m from ground level.
- SUB2 – Single family residential housing area, just outside the city limits at approximately 1.5m from ground level.

Figure 2: Instrumentation, a) data logger, b) screen
Data gathered from February – April 2011 show a large temperature difference between the more distant stations, located in greener locations, relative to the more central locations.

Figure 3 presents a temperature graph based on the first data collection, encompassing one week of data in February/March 2011.

A significant difference can be noticed between the rural-like and the central locations. The maximum differences were observed at night time, as expected and the highest urban heat island intensity (UHI) was verified for Miller Street (COR2), the most constrained environment (urban canyon), when compared to SUB2 data, the station farthest from the city centre.
Figure 4 shows a comparison on a clear sky day (April 27/28). We verified the sky conditions from an independent station in Renfrewshire (Lat: 55.784°, Lon: 4.422°, elevation 452 ft) by looking at the amount of incoming solar radiation (660 W/m²), typical for a clear day in high latitudes.

The most distant location (SUB2) shows higher diurnal and lower nocturnal temperatures relative to the most central ones (COR1 and COR2). Sky openness under such conditions allows stored heat to be more easily dissipated at night and at a faster rate than more urban locations (Table 1). During the day, however, warming rates are quite related to the solar access and façade orientation (COR1 is exposed to the east, showing higher warming rate in the morning than west-facing COR2).

The location closer to the river (GRN1) presents an interesting pattern: it warms up almost at the same rate as the rural-like site; however it does not release heat as fast. This is possibly related to the higher heat capacity of water bodies, compared to soil.
Table 1: Cooling and warm-up rates

<table>
<thead>
<tr>
<th>Logger</th>
<th>Cooling rates from sunset till sunrise</th>
<th>Heating rates from start of data till 5pm (April 27th)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COR1</td>
<td>-0.7°C/h</td>
<td>0.8°C/h</td>
</tr>
<tr>
<td>COR2</td>
<td>-0.8°C/h</td>
<td>1.1°C/h</td>
</tr>
<tr>
<td>GRN1</td>
<td>-1°C/h</td>
<td>1.6°C/h</td>
</tr>
<tr>
<td>RES1</td>
<td>-0.9°C/h</td>
<td>0.6°C/h</td>
</tr>
<tr>
<td>SUB1</td>
<td>-0.9°C/h</td>
<td>0.9°C/h</td>
</tr>
<tr>
<td>SUB2</td>
<td>-1.2°C/h</td>
<td>1.8°C/h</td>
</tr>
</tbody>
</table>

Figure 5 shows the local air temperature difference between one of the central spots (COR1) and the most distant location (SUB2). A maximum heat island intensity over 6K is reached around 4am. During the day, shading within the urban canyon in Miller Street provides a cool island.

Summary
Thus, preliminary results suggest that the city of Glasgow is considerably warmer than its rural-like surroundings and there are significant intra-urban temperatures differences within the city core. These facts have both planning and energy implications. Unlike most cities with a significant heat island problem, Glasgow may be able to benefit from its local warming and this may have implications on how planners need to respond to global climate change. One of the proposed approaches to a low carbon Glasgow (District heating systems) could take advantage of the local warming in the city core, as indicated by our work. Work is currently in progress to explore these implications.
New Transport Museum in Glasgow by the architect Zaha Hadid
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Articles

Submission deadline for the articles for the sixth issue of Innovation Review is 15th August 2011. To discuss the article that you would like to submit, please contact us by email or telephone on the contact details provided below.

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New Transport Museum in Glasgow