

Date: Wednesday 19th November
Time: 12:30 – 16:15
Venue: Heriot-Watt University
Room: ECG34 / ECG01 Edwin Chadwick Building,
 Riccarton Campus, Heriot-Watt
Event Resources: [Available here](#)
JISCMail List: [Please email scotland@eauc.org.uk if you wish to join this network](mailto:scotland@eauc.org.uk)



Sustainable Construction Topic Support Network Low Carbon Building Design and Refurbishment

Attendees:

David Somervell	(DS)	University of Edinburgh	Convenor
Rebecca Petford	(RP)	EAUC	Coordinator
Prof Phil Banfill	(PB)	Heriot-Watt University	Host and Speaker
John Easton	(JE)	SUSTaim	Speaker
Dr Mehreen Gul	(MG1)	Heriot-Watt University	Speaker
Dr David Jenkins	(DJ)	Heriot-Watt University	Speaker
Maha Cheikh Sulaiman	(MCS)	Heriot-Watt University	
John Curry	(JC)	Scotland's Rural College (SRUC)	
Graham Esplin	(GE)	Edinburgh Napier University	
Grant Ferguson	(GF)	Edinburgh Napier University	
Mansour Gemie	(MG2)	Dumfries & Galloway College	
Emma Turnbull	(ET)	Heriot-Watt University	

1	<p>Welcome from the Convenor</p> <p><i>David Somervell, TSN Convenor, University of Edinburgh (DS)</i></p> <p>DS welcomed everyone to the meeting and discussed the importance of linking research with practice to achieve carbon ambitions. Today provides an opportunity to learn from the research group here at Heriot-Watt and from a project John Easton is involved with.</p> <p>Introductions from the group.</p> <p>This is one of nine Topic Support Networks run by the EAUC in Scotland to support Estates and Academic teams, and others from within the tertiary education sector, to develop and share their sustainability practices. A list of all nine networks is attached to this note.</p>
2	<p>Summary of the work of the Urban Energy Research Group, within the Royal Academy of Engineering Centre of Excellence in Sustainable Building Design</p> <p><i>Prof Phil Banfill, Heriot-Watt University (PB)</i></p> <p>The team from Heriot-Watt presenting were from the School of Energy, Geoscience, Infrastructure and Society – formerly School of the Built Environment – which has around 160 academics and 200 researchers. There are 4 Institutes within this, one of which is part of one of only four groups in the UK to be a Royal Academy of Engineering Centre of Excellence in Sustainable Building Design. The Urban Energy Research Group (UERG) sits within this, and consists of around 20 people. Their website can be found here.</p> <p>UERG has undertaken a large number of projects over the last 10 years, including some we heard about (see slides for a longer list). A range of different research methods are used by the Group, including building modelling, life cycle assessments, economic modelling and focus groups and interviewing.</p>

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Low Carbon Refurbishment and New Build in Future Climates: The Tarbase and Low Carbon Futures Project *Dr David Jenkins, Heriot-Watt University (DJ)*

The TARBASE project was funded as part of Carbon Vision Buildings Programme by Carbon Trust and EPSRC to look at technologies to reduce carbon emissions by existing building stock by 50-80%. The project involved costing low carbon retrofits for a range of buildings and undertaking user acceptance analysis.

Education buildings have specific issues and have changed a lot recently, migrating to an office-like environment, which affect the services required. The project modelled a hypothetical school (quite similar to some campuses) and used a dynamic simulation package to model the baseline for 2005 (using climate, technologies and regulations of that time) divided into the different areas of energy use resulting in emissions.

They then modelled a scenario where they improved efficiency of small power equipment and lighting, which had a significant carbon reduction but meant more heating was needed as less was being released by inefficient lighting and technologies, which is often forgotten.

The project then modelled for a 2030 climate based on climate scenario predictions, then applied some fabric interventions and a condensing boiler, reducing the emissions still further to between 50 and 60%.

Often building design does not consider future climate change. All three scenarios above were winter modelling, so the project modelled for summer to see how comfort in summer would be affected, and found that in both Edinburgh and London there would be summer overheating without a mechanical cooling system, which could be limited with shading and increased ventilation.

But these are all models and should be used appropriately, just used to point the designer in the right direction and not to predict the future.

An important question is: are we producing lower energy buildings or lower energy certificates? Jones Lang Lassalle / BBP's 'A Tale of Two Buildings' showed that real and modelled energy consumption are not well correlated, and EPCs are therefore often highly inaccurate once the buildings are actually in use. This is an issue and we need to place less reliance on models.

The TARBASE project report can be found [here](#).

The Low Carbon Futures Project was also ESPRC funded and presented a model-based risk analysis of building failure due to climate change, specifically overheating, cooling loads and heating/cooling systems. A tool was produced that emulates thousands of building simulations following a single simulation.

The problem being addressed was how simulations can use the latest Climate Projection database as these are given in likelihoods, and then how can this information be used for designing adaptations for future buildings? Industry feedback was sought at several stages to ensure the project addressed the problem. The project report is available [online](#).

The tool accesses future climate information for a set timeline and location and scenario, then uses the emulator to take a single climate file and simulate the building, and then measure the relationship between the original file and the simulation so that relationship can be directly applied to other climate files. The tool was designed to be useful to designers.

The modelling produces a graph of future climates – for the building on the slide with medium emissions scenarios for 2030, 2050 and 2080 without adaptation there is very likely to be failure (overheating), but with adaptation there is less likely to be failure until 2050 or 2080 (20-40%). The tool assists in the production of a detailed output report for the buildings assessed.

Key learning:

- Modelled building is not real – don't completely trust EPCs
- A low carbon building must be adapted for a future climate – don't underestimate the required action when retrofitting to a current low-carbon standard

	- For non-domestic buildings, internal activity is key to overall energy performance
4	<p>Electrical Consumption in an Academic Building <i>Dr Mehreen Gul, Heriot-Watt University (MG1)</i></p> <p>This project was a pilot EPSRC funded study which took place over 9 months to explore electrical energy demand profiles, user activities and occupancy for a university building. There is a need to reduce CO2 emissions from buildings, and with the Postgraduate Centre at Heriot-Watt University the actual energy consumption was twice as much as predicted due to human factors and a lack of energy management strategy.</p> <p>University buildings are significant consumers of energy but there is little research on this, but research is difficult due to Universities and Colleges often having complex buildings with many functions and behaviours.</p> <p>The Post Graduate Centre here at Heriot-Watt was studied. The building opened in 2008 and won an architectural award for being an iconic building. It is north facing and multi-purpose with 4 floors, including a cafeteria, exhibition space, main entrance, glazed space, lecture space, open plan study area, seminar rooms and offices. There is a glazed and stepped roof to maximise daylight to lower lighting energy consumption.</p> <p>The study utilised real energy data exists from Estates department and some data collected by Undergraduates on behaviour within the building. The building was selected because it has half hourly data available and is multi-purpose, and so fitted the study requirements.</p> <p>The newly constructed building was given an EPC rating of D, and it had been suggested that it could be upped to D+ by adding renewable technologies. However the study wanted to find out how consumption could be lowered by using knowledge of behaviour within the building. An electronic counter at main entrance recorded users entering the building each half hour of the day – allowing a measure of building users / activity to be gathered.</p> <p>Data was collected through two interviews, questionnaires on why people used the building and what technologies they used while there, occupancy data and room activity. The interviews were particularly useful as they allowed some more useful and descriptive information, such as that there was a midnight shut-off for AV equipment automatically, and the glazed staircase is not used in summer as too hot, and it's too cold in the winter, so the lifts are often used.</p> <p>Estates energy data shows a significant drop in energy consumption between 11.30pm and 12.00am, probably due to the AV automatic shut-off, suggesting a lot of equipment is left on unnecessarily. There is not a particularly strong correlation between occupancy, room activity and electricity use, with high energy use even with low numbers, and even in the summer when there are no Undergraduates and few classes.</p> <p>The research showed that building users have a small influence over the electrical consumption of this building as high electrical consumption observed with no occupants and no activity. This implies automatic systems are running irrespective of the occupancy and activity status.</p> <p>Data from the Building Management System was not used to make operational changes because of the time requirement to assess the learning and implement changes.</p> <p>The link between occupancy and energy patterns needs to be considered in energy performance, but user behaviour is still very important in saving energy by turning off AV equipment, lights, PCs etc., and using the stairs. An Energy Strategy would help address this.</p>
5	<p>Construction Scotland's Low Carbon Demonstrator Project Database <i>Mr John Easton, SUSTaim (JE)</i></p> <p>JE is trained as an architect and now works as a sustainability consultant with ties with estates having undertaken lots of work with colleges and universities on business cases for development and planning etc. He also has research and teaching commitments as an honorary professor at Heriot-Watt and speak at other organisations. He also acts as an Advisor for the Carbon Trust and Resource Efficient Scotland.</p>

	<p>For this project his client is Construction Scotland, one of the brands of Scottish Enterprise, who are supporting the construction sector to getting back on its feet after the recession. It involves mapping the low-carbon built environment in Scotland, both physically and in terms of data.</p> <p>There is a perception that with Scotland's low-carbon agenda there are a lot of people and organisations who have built and learned a lot of good stuff, and we can look within Scotland for knowledge on this rather than looking elsewhere.</p> <p>Construction Scotland wants to catalogue existing examples of good practice in low carbon construction, and provide a resource online about these projects, how they were done and why, and what the successes and failures were.</p> <p>The project was originally designed to collect data from these buildings from the outset, but realised there was a risk that people could interpret that data badly due to a lack of understanding.</p> <p>The approach was modified, and the project is now asking case study projects what were their ambitions for the building in terms of carbon – heat, cooling, electricity use, waste, building materials – and if they have data on those things, and would be willing to share it if people got in touch.</p> <p>Scottish Enterprise plan to use this as a reference source, perhaps ultimately providing income for businesses which have done it well to support others to also produce high-quality low-carbon buildings. The database to be used internationally with open access for academics and anyone else around the world who is interested.</p> <p>The project is currently at first stage of this process, asking for people to get involved with a short first-stage data capture, including information on developments of the building post-build, the opportunity for building visits etc.</p> <p>The project will then later collect more information, and then design the website with free searches around different keywords. It is the intention to develop a map linked to Google which will allow each project to be mapped. The launch is anticipated to be in late Spring next year.</p> <p>A number of good academic projects are getting involved, along with other sorts of buildings, and this is an opportunity to advertise your successes.</p> <p>If you have any projects for inclusion please email John at johneaston@SUSTaim.com.</p>
<p>6</p>	<p>Question and Answer Session</p> <p><i>All Speakers</i></p> <p>DS – It was surprising that calculated EPCs correlated so badly with measured energy consumption reported in Display Energy Certificates (DECs)</p> <p>DJ – DECs and Energy Performance Certificates don't measure exactly the same thing - this happens in domestic buildings too. There is what is known as a Performance Gap between a model and actual consumption. Usually the assumption is then that the model was inaccurate, but a zero performance gap is not possible as the energy data from a model is not a crystal ball, and should only be used to inform design. Huge gaps mean something is wrong but zero is unrealistic. There is no standard systematic error except that most under-predict consumption. More unusual buildings are more difficult to model. There is an over-standardisation of models, but the larger issue is that people use models as if they are real.</p> <p>DS – What should practitioners be looking for when procuring a building?</p> <p>DJ – Don't just consider "regulated energy" (heating, cooling, ventilation and lighting), which are really important but need to be treated separately to activity within the building, such as use of IT equipment, and then linked to consider the combined effects.</p> <p>MG1 – Updating lighting and technologies to lower consumption is important, but so is the behaviour within the building and BMS controls.</p> <p>JE – Bringing Your Own Devices [ie laptops and smart phones] can save a lot of energy, if</p>

	<p>it stops people using plugged-in equipment. There are some obstacles to lowering consumption built into the sector however, such as teaching kitchens which have to have old technology as that is what is in the market where the students will work, or pilot lights in cooker meaning the cooker hood needs to be on 24/7.</p> <p>DJ – Overall issue is what are people doing and how can it be measured and addressed, making common sense decisions on the basis of knowledge, rather than assumptions. Data is easy to access, it just needs to be used.</p> <p>GF – Then sub-metering can be used to figure out more details.</p> <p>GF to MG - Did you look at the BMS and how it was being used?</p> <p>MG1 –The engineers who designed the systems have gone, and the current staff don't know how to use them. There is a general lack of communication, and single issues are fixed but whole building never considered. Some of the BMS settings may have been set by an external company.</p>
7	<p>Group Discussions and Reporting Back</p> <p>1) How has the specification of buildings changed in recent years in relation to climate change and low-carbon agendas? Think particularly in respect to dialogue between the design team (i.e. building engineers and architects) and client (e.g. University Estates). How are topics of sustainability and future climate discussed (if at all?) within such building projects?</p> <ul style="list-style-type: none"> • There is a need for more flexibility and adaptability in buildings – at design it tends to narrow down one route – need adaptable spaces that can be adjusted to user needs as they change • Keep things simple – often design and control systems are too complex • Consider the materials used and how they can be used to control temperature • Often life cycle ideas fall off of the design process and the energy systems suffer, so the building is not properly configured with the right systems once it is completed • Carbon Management Plans are a big drive to work on lower-carbon estate • Part of the flexibility in core services must be to see if there are ways in which they can be enabled and disabled dependent on occupancy. There are many different uses of occupancy with exams, lecturers, holidays etc, so automation should not just be on a time clock but on people being in there • The value of sensors to change conditions according to occupancy is low to the designer so they often get cut, but it's not low to the occupier • Decisions need made not just around the financial initial cost but the cost over life of the building. There is still a long way to go on whole-life costing – we need to deliver buildings we can afford to run, with kit that won't soon become obsolete • Future costing rarely considered by Design Teams at design stage • The challenge is to get people to design buildings now prepared to deal with overheating in the future, so to do the low carbon strategy then consider whether the design will still be enough with the future climate. <p>2) As a client (or user) for such buildings within a University / College Environment, what tools and information do you require to achieve confidence that the buildings will be low-carbon and sustainable?</p> <ul style="list-style-type: none"> • Conversation focused on Napier's Sighthill Campus which was designed to be BREEAM Excellent but didn't quite get there in construction – but the fact that BREEAM can drive the Estates team to work beyond the standard is interesting • Non-educational organisations often want low-energy buildings more for promotional purposes, as their bills aren't amongst their highest costs • There needs to be more connection between academics researching low energy buildings and people looking to build low energy buildings from the same institution

– it's the same across most Estates and academics failing to link their topics. There can be some issues with short timescales, but some links do exist with students for research projects and design ideas

- Evaluating estates strategies around carbon implications as well as financial implications is really important
- Typical buildings need to run for 25 years to pay off the carbon embedded within them, which has implications on needing to keep old buildings or reconfigure sections of the building rather than demolish and rebuild
- New Campus Glasgow set budgets in Carbon and Cash and can spend up to limit of whatever they reach first – and that could be cash. This should become normal.

3) What should be the focus for the efforts to reduce energy consumption within the built environment of a typical campus? What might an effective energy awareness strategy look like for a university/college campus, which would actually result in energy savings?

- Metering, monitoring and reporting so you know what is happening, then analysis, understanding and change
- Displays and campaigns are quickly forgotten if people don't take responsibility – particularly if they don't pay the bill
- There are two sections of people to consider, users and Estates people with energy management data who could use the data, so there is need for a two-fold approach
- An Oxford University building shows local building environmental controls on your computer screen when you log in for you to adjust your environment, then your preferences are remembered so when you next log in, taking into account external environmental factors. Individual consumption data is then displayed on the screen
- A further step could be to count the wifi signals and just account for them and ensure everything is off when there is no signal
- Need small scale environmental condition adjustments to be possible for the Oxford type model, whether it works by phones or computers
- Individual consumption information allows an opportunity for awareness raising campaign on phones or emails with graphs etc.
- Persistence value of interventions needs to be considered with a 9 months value for awareness raising campaign of occupants. However data coming back personally through devices would keep reminding users of their own behaviour
- Text to the last person to leave a room saying they forgot to switch off the projector would be effective and also change behaviour
- Universities and colleges have quite IT-savvy users who would engage with these technologies – there could be a system that worked across different Institutions and even public buildings
- There is a need to quantify the impacts in terms of things people can understand, such as the [Carbon Visuals](#)
- Student Unions do some behaviour campaigns around energy and can do more, but need bi-annual activities to get persistence value
- SRUC find it is the staff who waste the most energy, but it is about empowerment – could a student take responsibility for switching equipment off and would they feel it was their right to do so?
- Reminders on sticky notes work when first displayed but not for long
- Do we go back to an energy warden who turns everything off at the end of the day?!
- We have systems that capture detailed energy information but then Estates people don't have the time or perhaps the skills to interpret the data and then implement changes, meaning huge opportunities are lost

8	Closing Remarks <i>David Somervell (DS) and Professor Phil Banfill (PB)</i> Thank you to Heriot-Watt team for hosting us here. Wanted to expose some of the research going on to Estates professionals to try to make that link, and today has raised some very interesting points. The expectation on Estates Managers and institutions is only going to grow and University and College emissions are flat-lining not reducing. We are not doing as much as we need to, and the more straightforward and robust tools we can use to guide us the better. There are a number of other upcoming EAUC Topic Support Networks and the EAUC Scotland Forum, details of which can be found on the EAUC Events Page . Next Meeting will be Spring 2015
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Meeting followed by a visit to the adjacent Postgraduate Centre – the subject of Dr Mehreen Gul’s Presentation on Electrical Consumption in an Academic Building.

*Notes prepared by Rebecca Petford (EAUC-S Scotland Programme Coordinator)
19th November 2014*

Appendix: What JISCMail lists are available to me?

EAUC-UCCCFS@JISCMAIL.AC.UK This is for the entire EAUC-Scotland network and in general, professionals working in HE/FE in Scotland interested in or working directly on sustainability issues. If you're interested in anything EAUC-Scotland or the Scotland network is up to, this is the JISCMail list to join.

EAUC-UCCCFS-COMMENG@JISCMAIL.AC.UK This is for the Community Engagement Topic Support Network (TSN). So basically if you are in any way interested in community engagement or behaviour change, this is the JISCMail for you. As soon as you join this list, you become a member of the Community Engagement TSN. The same goes for the rest of the JISCMail lists and their topics.

EAUC-UCCCFS-SUSTPROC@JISCMAIL.AC.UK This is for the Sustainable Procurement Topic Support Network.

EAUC-UCCCFS-ESD-HE@JISCMAIL.AC.UK This is for the Education for Sustainable Development in Higher Education Topic Support Network.

EAUC-UCCCFS-ESD-FE@JISCMAIL.AC.UK This is for Education for Sustainable Development in Further Education Topic Support Network.

EAUC-UCCCFS-SUSTCON@JISCMAIL.AC.UK This is for the Sustainable Construction Topic Support Network.

EAUC-UCCCFS-WASTE@JISCMAIL.AC.UK This is for the Waste Management Topic Support Network.

EAUC-UCCCFS-TRAVEL@JISCMAIL.AC.UK This is for the Sustainable Travel Topic Support Network.

EAUC-UCCCFS-ENERGY@JISCMAIL.AC.UK This is for the Energy Management Topic Support Network.

EAUC-UCCCFS-SUSTICT@JISCMAIL.AC.UK This is for the Sustainable ICT Topic Support Network.

If you have any further questions on JISCMail or EAUC-Scotland please email info@eauc.org.uk .