**ECCI: The Edinburgh Centre for Carbon Innovation**

**About us**

The Edinburgh Centre for Carbon Innovation (currently located at **15 South College St**, University of Edinburgh) is fast becoming hub for the knowledge, innovation and skills required to create a low carbon economy.

Hosted by the University of Edinburgh, in partnership with Heriot-Watt University and Edinburgh Napier University, the ECCI provides the place and space for 'low carbon leaders' and networks from business, finance and the public sector to work together to deliver a low carbon future.

In brief, **ECCI supports Government policy implementation; enhances business enterprise and innovation; and delivers professional skills training.**

**Our new building at High School Yards**

Work began on the construction of our new home in February 2012. The build involves the refurbishment and remodelling of space in the University of Edinburgh’s Old High School in High School Yards and will comprise an innovation suite, lecture theatres, seminar rooms, exhibition and social space.

**What makes it innovative?**

The building complies with the University of Edinburgh Estates & Building Sustainability Strategy, which includes commitments to social responsibility and sustainability and requires environmental standards higher than legal requirements. The architects, contractors and sub-contractors undertaking the building work have all been carefully chosen to ensure the resulting building stands by with these principles.

**Building Design**

The objective is to create a low energy, highly efficient building targeting a minimum industry sustainability standard (BREEAM) rating of ‘Excellent’ and an aspirational rating of ‘Outstanding’ - if achieved, the building will be the first listed or refurbished building to be awarded this rating.

At the design and build stage this commitment has involved careful consideration of building materials, building methods, energy use & transport choices (for visitors and contractors), which has been led by award winning architects Malcolm Fraser Architects and contractors Graham.
Edinburgh Centre for Carbon Innovation, Project Details

Location: Old High School, 12 Infirmary Street, Edinburgh, EH1 1LT

Type of Project: Higher Education

Client: University of Edinburgh

Architects: Malcolm Fraser Architects

Structural Engineers: Elliott and Company

M&E consultant: Harley Haddow

Quantity surveyor: Thompson Gray

Planning supervisor: David Adamson & Partners Limited

Acoustics: Sandy Brown Associates

Building Fabric Consultant: Bob Heath

BREEAM assessor: AECOM

Fire Engineers: FEDRA, Buro Happold

Soft Landscape design: Ironside Farrar

Archaeology: Headland Archaeology

Main contractor: Graham Construction

Selected subcontractors:

M+E: Vaughan

Stonework: GHM Masonry

Window repairs/ upgrading: Draft seal

Joinerwork, window installation, Partitions, Ceilings: Keyes Brothers

Metalwork: Metal tech

Bronze cladding: NJM Roofing
Selected Suppliers:

Structural CLT: Metsawood

Insulation, paint internal plaster: Natural Building Technologies

Marmoleum Flooring: Forbo Nairn

Timber floor: Boen

Carpet: Desso

Windows: Olsen and Schuco Jansen

Rooflights: Vitral

Bronze Cladding: KME

Inverted flat roof: IKO

Cullalo stone: Tradstock

Ironmongery: Allgood

Airtightness products: SIGA

Timber ceilings: Hunter douglas

Wall linings: Fermacell

Funding: University of Edinburgh

Tender date: 14th September 2011

Start on site date: 30th January 2012

Completion date: 11th September 2013

Contract duration: 82 weeks

Gross internal floor area: 2223 sqm.

Form of contract and/or procurement: Traditional JCT 2011 with Quantities

Total cost: £6.1 M

Annual predicted CO₂ emissions: 52,605kg.CO₂ per annum

Air tightness levels tested: 6.84 m³.h⁻¹.m⁻² @ 50 Pa
**Predicted energy demands:** 147,785 kWh per annum

**Environmental targets:** BREEAM Outstanding (design stage) Construction stage to be confirmed

**Design**

The Edinburgh Centre for Carbon Innovation is a world class interdisciplinary research and teaching facility focused on key climate related challenges facing society. The ECCI will: bring together and direct high-quality research; address the significance of climate change at the science-society interface; inform political decision making; and establish Edinburgh as a leading university in the field.

The ECCI involved a major alteration and extension of the Category B listed Old High School building, Infirmary Street. The brief included consideration of adjoining buildings, and proposals to reinvigorate the land within the High School Yards, to the boundary of Infirmary Street at the front (of the Old High School) and the enclosed space of Surgeon’s Square to the rear.

The accommodation includes refurbished teaching/seminar space, lecture/conferencing facilities; meeting rooms; staff offices; a Masters student hub; café and external landscaped areas.

**History**

There is a very rich palimpsest of significant cultural buildings and uses revealed here; but what is also interesting is the important educational thread running through them, for High School Yards was founded here because of Blackfriars Monastery.

High School Yards has always been a significant architectural site and has gone through many incarnations since its beginnings as Blackfriars Monastery (from 1230). In 1578 the first school building was built on the site to replace the educational function of the monastery. A larger Royal High School was then rebuilt in the same location in 1777 by Alexander Laing at the cost of £4000. Its pupils included Sir Walter Scott (his initials can be seen today amongst the 18th century graffiti on the wall by the entrance to the building).

As great numbers of people moved out to the New Town in the early 19th century, the old school was closed and in 1832 the building re-opened as a Surgical Hospital, in which the University of Edinburgh held its Anatomy classes. At this time a rear building, square in plan, was added containing the surgical lecture theatre. The Surgical Hospital then formed part of the Edinburgh Royal Infirmary, (at the time located on the site of Dovecot Studios on Infirmary Street), which had become short of space.

By the latter stages of the 19th Century, the old hospitals were reaching the end of their useful life and throughout the 20th century the University acquired the Old High School building to house a number of different disciplines, including Engineering and Science, Geography and the Dental School.

**Engaging with the City**

The repair and renewal of a significant building in the city centre is appropriate for the ECCI, but the further improvement of the sites permeability and engagement with the city is brings greater value to this historic site.

To the front of the Old High School the existing school courtyard in recent years has been used largely as a car park, as is case within ‘Surgeon’s Square,’ to the back of the Old High School. Since the construction of the neighbouring 17th C. Surgeon’s Hall a series of buildings have gradually developed around the square, creating a rich architecture of varying forms and ages.
The renewal of the landscape to both the front and rear courtyards remove all but the accessible parking and the opportunity for renewed external spaces which have similarities to the culture of the internal spaces where interaction and communication is encouraged. The Old High School now forms new connections with the neighbouring University buildings.

A pedestrian route through Surgeon’s Square is introduced by the reopening of a redundant entrance as well as the repair of an adjacent public access stair. This reintroduces a significant link between the Old High School (ECCI), as well the University’s High School Yards campus, in the direction of the Cowgate, leading on to the University’s Holyrood Road sites, Waverley Station, the Parliament and Dynamic Earth.

Where a pair of historic 18th C. buildings had been lost, to the west of the rear building to ECCI, (Royal Medical Society Hall and Anatomy Lecture Hall) a new Café building has been created, with meeting/office spaces above, establishing ECCI’s physical connection with Surgeon’s Square and creating a social hub/meeting space for the building and the wider campus. Similarly a generous opening is introduced to the lecture/teaching space to reinforce this new connected courtyard.

A Cohesive Building

The existing linking stair between the older school building (front building) and the lecture hall building (rear building) we found to be unfriendly, confusing and not conducive to the kind of knowledge sharing demands of a Centre for Innovation. Due to the piecemeal fashion of the many changes that had occurred since 1777, the existing building as a whole was also lacking a sense of cohesion and its circulation was not clear. Other than the ground floor, all floor levels vary between one another (2 levels to the front and 3 levels to the rear).

By removing the linking stair which connected the two significant front and rear buildings, it has been possible to create a generous central heart and circulation space. From this atrium, all accommodation spaces have a direct connection and their presence is visually legible. In response to the clients brief, this circulation space is a focus for interaction between a variety of building users (academic research/staff/student/SME) and will provide informal break out space for small post graduate student groups, staff and businesses. The ability for building users to communicate and exchange ideas is key to the client’s function and this central space responds to this.

The accommodation spaces throughout the building were then reconfigured to provide well-proportioned and suitably sized spaces which can be used as flexibly as possible, as office, teaching or meeting spaces. Specific decisions were made to provide a varying degrees of services for ventilation and IT within different spaces, such that the building as a whole can suit changes in the future (such as office to teaching) and also cater on a day to day basis for a variety of events such as conference, workshops, breakout, video conferencing, lectures etc.

Sustainability

ECCI has been designed to achieve an exceptionally low energy demand, in particular given that it is the refurbishment of an existing and listed building. It has been designed with the ambition of achieving BREEAM Outstanding (with Excellent as a minimum). Currently the BREEAM is being assessed by BRE. This would be the first refurbished or listed building to achieve the Outstanding rating.

While there is always a balance between environmental concerns, conservation issues, access and other user requirements, it is possible, with careful consideration, to work with the historic fabric and provide a building which accommodates ‘current day’ user requirements, while acknowledging the importance of sustainable materials and low energy demand. We have endeavoured to look at every detail of which the following are the principle examples:
**Location, Reusing and Transport**

We need to focus on maintaining and upgrading our existing building stock before creating new. Significantly ECCI is the reuse of an existing building in a historic city centre location. This brings challenges to achieve a ‘state of the art’ building for innovation, but the benefits of reuse in a location where local and national public transport facilities, as well as many relevant organisations, are walkable. ECCI has a very limited car policy, with only accessible parking and an electric car changing point.

**Primary + Renewable Energy Supply**

District Combined Heat and Power (CHP) allowing 38% decrease in Co2 emissions.

30m2 Photo Voltaic (PV) with feed in tariff. PV is strategically placed only on the south facing sides of the rear building pop ups to the north facing existing rooflights. The building model highlighted these surfaces as collecting the highest level of solar gain on the building.

Air source heat exchanger supplies limited chilled beam cooling to the rooms with greater occupant density (lecture/immersive teaching spaces).

**Energy Efficiency**

- Energy Performance Certificate (EPC) A rating for new build areas
- Energy Performance Certificate (EPC) B rating for refurbished areas
- Air tightness improved to 6.5 (m3/h)/m2 at 50Pa
- Existing building fabric insulated to achieve:
  - Wall 0.25 W/m2K
  - Floor 0.3 W/m2K
  - Roof 0.163 W/m2K
  - Glazing 1.4 W/m2K
- New building fabric insulated to achieve:
  - Wall 0.13 W/m2K
  - Floor 0.3 W/m2K
  - Roof 0.15 W/m2K
  - Glazing 1.4 W/m2K

**Material considerations**

Windows:

Existing sash windows have been retained and repaired with additional draft proofing and installation of slim line double glazed units

Structure:

The primary structure, inserted within the atrium and to all new construction, is a Cross Laminated Timber frame (CLT) and CLT floor panels system. This was considered an innovative solution using a CLT timber structure within an existing building. The CLT is said to lock in (approx.) 4-5 x more Carbon than it takes to produce. Where steel structure was removed from the existing building, all appropriate steel beams were assessed by the Structural Engineer and many were able to be reused as supports to new openings being formed in the existing masonry.
Stonework:
The existing Cullaloe and Blaxter stone has been carefully and conservatively repaired. The ‘base’ course to new construction is constructed in Cullaloe stone from Fife. Locally sourced stone is also used for external landscaping. A local and natural material, stone, when supplied and worked locally, is an exceptionally low energy and durable material which can be repairable and recyclable.

Bronze Cladding:
The upper levels of new construction are Bronze (80% Copper and 20% Tin). Light in weight reduces demand on structure and Copper is a material which itself can be made of up to 80% recycled Copper from telephone wires etc. It is also a durable and a recyclable material.

External and Internal Wall build ups:
The external wall construction is supported by deep composite timber studs. The internal partitions are also timber stud.

Insulation and Vapour Open Construction:
Insulation is a combination of flexible woodfibre batts and rigid fibreboard with an OSB airtight layer internally. The wall construction is vapour open, with an internal to external pressure difference to allowing moisture to move from both inside the building, and from within the wall construction, to the outside. This benefits health of users (in relation to asthmatic related conditions internally) and the health of the construction. All external wall construction is specified as low VOC and all timber is FSC.

Internal finishes:
Timber finishes are used to floors, ceilings and many wall linings. Other floors are in lino (from natural sources) and environmentally rated carpet products. All internal products are low VOC and all timber FSC. Paint finishes are waterbased and low VOC and have an especially high breathability to work with the vapour open external wall construction.

Ventilation:
The ventilation strategy is primarily passive natural ventilation with displacement air and cooling only to high occupancy rooms (lecture/ immersive teaching). Where chilled beams are used, they are connected to the Air Source Heat Exchanger.

Lighting
Internal and external lighting is low energy (including LED where appropriate) throughout, with zoned control and sensor to reduce usage. Daylight studies were carried out to maximise natural light and reduce areas of summer overheating.

Metering
One of the client’s aspirations is that, as an energy efficient refurbishment, the building can be used as a learning resource in the future in a frank and open manner, to understand what has been successful or not. All energy supplies are therefore metered and sub-metered in order to monitor lighting, small electric, water, heating, cooling in separate areas of the building. This is monitored using specialist software (Meterology) which can present the information in a suitable and sophisticated manner for analysis. A post occupancy analysis will also be carried out.

Cycle facilities
60 additional covered cycles spaces are provided with associated changing/ showers (including accessible changing/ shower), lockers and drying space.
Water

All sanitary appliances (WC's/ taps) are low water usage. A rainwater harvesting tanks was intended to be installed, until 14 Century archaeology discovered on site inhibited this. A tank to attenuate part of the RWHT was installed. Permeable landscaping and an increase of soft landscaping were also used to divert water.

The ECCI and Learning Resources

The Edinburgh Centre for Carbon Innovation (ECCI) aims to provide Scotland with a world-leading innovation and skills centre for developing a low carbon society. The ECCI building is a key enabler of this vision. The building is the hub which brings together the various activities and people in the Centre. These activities explicitly seek to bring together business, the public sector, civil society and researchers to tackle and overcome barriers to a low carbon economy, through enhancing business and social innovation and through developing and delivering professional skills courses. As such, the buildings engagement with local communities and wider interested parties is important.

A key component of the building plan is to embed the work of the Centre into opportunities for the local community. For example, the University is working with the City of Edinburgh Council and the Edinburgh World Heritage Trust to support the opening of the Cowgate Steps off High School Wynd as part of the ECCC building redevelopment, because of the positive impact the ECCC project will have on footfall through this area.

Future local community engagement will encompass local schools and community groups. Working with the Edinburgh Beltane Group for public engagement, the Centre will also support visits from local schools and community groups. Exhibition spaces exist within the ground floor level and will provide flexible space for exhibitions about the work of the Centre. More importantly, the Centre will seek to build specific learning resources with different stakeholders to support understanding of carbon accounting, management and financing to deliver a low carbon society. These activities will be a core component of the building activity.

During the design development consultation was held with the staff of Portobello High School as well as a contact with City of Edinburgh Council, Children and Families to discuss the organisations issues around proposed school visits to the building on completion. This considered drop off, accessible areas, areas of interest from the schools point of view, facilities the school would require and the logistics of such visits. Comments were fed back to the client and integrated into the design and ECCI management strategy.

In addition, the building design and real-time energy operational data will be displayed prominently in the ground floor public space, to encourage an understanding of good building design. The extensive metering within the building will facilitate the buildings ability to be learning resource for wider stakeholders (University Students and beyond). During the construction process we have conducted a series of lectures to students and interested stakeholders from Edinburgh, the UK and beyond, encouraging a wider engagement in the ECCI project.

Building Use

Sustainability principles also apply to the building’s use once completed. Energy use will be closely monitored, allowing for in-depth analysis and reporting and SMART monitors will be visible within the building, involving users and visitors in the building’s performance. The commitments can be summarized as:
• Lean - Reduce demand through passive design
• Clean - Achieve high energy efficiency levels
• Green - Low and carbon zero energy sources

 Lean - Passive Design
 Sustainable design methods will enable a 30% reduction in energy consumption compared to the former building’s performance, and 30% less than building regulations demand. Passive design methods include: Solar Gain; External microclimate; Solar shading; Day lighting; Thermal comfort.

 Clean - High Levels of Energy Efficiency
 • Air Tightness: 5 (m$^3$/h)/m$^2$ at 50 pa
 • Energy efficient lighting using infra-red sensor and dimmable controls.
 • High levels insulation achieved by replacing / upgrading windows; ‘sealed tight and ventilated right’
 • Building Management System

 Green – Low/Zero Carbon Energy
 District CHP Scheme (combined Heat and Power)
 The building will be connected to nearby Combined Heat and Power (CHP) and associated electrical and district heating networks (DHN), allowing a 38% decrease in CO$_2$ emissions and meeting 56% energy demand.

 30m$^2$ PV (photo Voltaic) south facing hub roof - Creating a 2% CO$_2$ reduction and meeting 1% energy demand.

 Key Phases
 • Start Date (Demolition stage): Feb 2012
 • Structural Timber Frame work begins: mid-May – end June 2012
 • Building Weather Protected: end Sep 2012
 • Heat On: early Dec 2012
 • Hard Landscaping: early Jan – end March 2013
 • Soft Landscaping: end Feb – early April 2013
 • Training & Demonstrations for staff: end May 2013
 • Completion Date: mid June 2013
 • Building Open: June 2013
Get in touch, arrange a visit

ECCI and all the stakeholders involved in the build are keen to share the knowledge and learnings from the project. If you think the building project could be of interest to you or your students please get in touch to arrange a briefing and/or visit. Visits will be timed with key construction phases and led by the lead architect and/or site manager.

Contact: Annabel Cooper, +44 (0)131 6509 811, annabel.cooper@ed.ac.uk

For more information visit: http://www.edinburghcentre.org

See a fly-through of the new building here: http://youtu.be/KiMnLh_xYVM

Appendix 1: BREEAM considerations

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