Is the housing association sector truly engaged with Sustainable Construction

Green Building Marketplace

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http://greenbuild.wales/programme/
Cardiff Metropolitan University & Schools (Departments)
Cardiff Metropolitan is based in the centre of Cardiff, Wales and has two campuses in the city: http://www.cardiffmet.ac.uk/Pages/home.aspx.

In 2014, Cardiff Metropolitan was rated the **Highest in UK Research Excellence** for post 1992 Universities – *Applied Research*. **For impact, the proportion rated as 3* or 4* is 83%**: http://www.cardiffmet.ac.uk/research/Pages/REF-2014.aspx.

The University in 2016 celebrates 150 years, with five schools:

- Art & Design;
- Sport;
- Education;
- Health Sciences;
- Management.

Plus, Product Design Research.

12,000 students, 5000 international students.
Disciplines in Architecture, Energy & Environmental consultancy and research are conducted within the Ecological Built Environment (EBERE) group, led by Dr John R Littlewood.

EBERE’s ethos is to undertake applied research & enterprise following ecological principles to reduce the use the impact of planetary resources and which interacts with industry in Wales and beyond to inform learning, teaching and scholarship & the key foci:

- Assessment, benchmarking, recording & testing building design, construction, & systems performance through: design, construction, commissioning and Operation phases;
- Impacts upon building users’ energy use, comfort and wellbeing;
- Recording and mapping architectural and cultural heritage;
- Professional change for a Sustainable Built Environment;
- Offsite manufacturing for construction;

http://cardiff-school-of-art-and-design.org/research-enterprise/research/
Examples of How the Housing Association sector engages with Sustainable Construction in Wales

Through collaboration with a Welsh University: Cardiff Metropolitan: *a Welsh University for the Welsh Economy*.

1. Seconded staff projects;
2. InnovateUK projects;
3. EU Projects – ERDF & ESF (KESS I) projects;
4. Knowledge Transfer Partnerships projects.
Seconded Staff – UNITED Welsh Housing Association

From 2009 to 2012, Dr Littlewood seconded as a Sustainability Consultant to Development:

Panel Member for the Ebbw Vale Passivehaus Design Competition (2009-2010);

Developed/Embedded POE process into development team - assessing innovation in heating systems (2011-2012). Resulted in Head of Development presenting paper at SB11.

Littlewood et al., (2011a); United Welsh, (2011)
2011-2012, Dr Littlewood worked with the Head of Development: United Welsh awarded a Post Occupancy & In-Use Building Performance Evaluation grant success, for Y Llaethdy from the Technology Strategy Board (InnovateUK).

The BPE programme funded 53 DOMESTIC projects 2010-2015, £8 Million UK-wide programme. United Welsh only Welsh housing association led with BPE study.

Y Llaethdy is a low impact and partially low carbon micro-community of 13 households in Abertridwr.

Littlewood et al. (2014), United Welsh, (2014)
• Houses CfSH level 3+, Flats CfSH level: 4.
• Flat construction - 0.18, 0.15 and 0.25 W/m²K U values for exterior walls, roof and ground floor, timber frame, sheep wool insulation, cedar clad, triple glazing, 1 kW PV;
• House Construction: 0.18, 0.1 and 0.2 W/m²K U values for exterior walls, roof and ground floor; brick/block cavity construction, double glazing, no PV.
• Heating/Ventilation: electric only: NIBE EASHPs + underfloor heating.

Some key questions for the BPE study:
1. How does timber frame versus brick/block construction effect dwelling internal comfort conditions, space heating energy use and carbon emissions?
2. Do NIBE EASHPs lead to high energy usage/associated costs/carbon emissions for space/water heating, and how do occupants engage with such systems?
3. How can the handover/tenant education be developed and used on other schemes and can any lessons be learnt from the contractor's direct supply approach?
4. How can United Welsh enhance their design, procurement, commissioning and handover strategies?


Littlewood et al. (2014), United Welsh, (2014)
EU Projects – Coastal Housing Group

From 2009, Dr Littlewood led three EU funded projects in collaboration with Coastal Housing Group.

1. ERDF/LCBE – WP6 (2010-2014);
2. Knowledge Economy Skills Scholarship I (2009-2014);

**ERDF/LCBE**: Embedded critique of detailed designs;
Construction stage diagnostic thermal performance assessment process - iCT process;
POE – occupant behaviour, internal comfort & energy use

EU Projects – ERDF & KESS I: iCT process

• Traditionally building **performance** is assessed and monitored once a building is **completed** and occupied during POE studies.
• Since 2010, Cardiff Metropolitan University have developed a diagnostic methodology for assessing the performance of buildings during the construction process, entitled: **in-Construction Testing (iCT)**.

• **2nd fix site inspection**, potential thermal performance issues not visible (photo);
• Using In-Construction Testing, problems identified and prevented on other flats

EU Projects – ERDF: POE

Embedded evaluation of heating & ventilation systems & impact upon performance & carbon emissions into 12 months dlp;

Enhanced handover process: Occupant interviews – comfort, energy use, behaviour

<table>
<thead>
<tr>
<th>Variable</th>
<th>Instrument</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature</td>
<td>Vent check plus</td>
<td>±0.1 °C</td>
</tr>
<tr>
<td>CO₂ levels</td>
<td>Vent check plus</td>
<td>±30ppm, ±5%</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>TM-206 Solar power Meter</td>
<td>±10W/m² or ±5% (highest value is correct)</td>
</tr>
<tr>
<td>Air movement</td>
<td>PCE-TA-30</td>
<td>±3%, ±0.2 m/s</td>
</tr>
<tr>
<td>Daylight</td>
<td>Testo 540</td>
<td>±3%</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Vent check plus</td>
<td>±3% (10–90%), ±5% (others)</td>
</tr>
</tbody>
</table>

Nooraei et al, (2013)
EU Projects – KESS I: Assessing ARBED I schemes

• Developed inspection and survey technique of dwellings undergoing retrofit during ARBED I, Swansea, UK, circa 1900;
• Assessed how choices for materials and construction process affected thermal performance, energy usage, carbon emissions, occupant comfort and fuel poverty;
• Reviewed how occupant attitudes, behaviour and lifestyle choices affect thermal performance before and after improvement measures;
• Methodology includes qualitative and quantitative techniques.

Pre-Retrofit Thermography        Post-Retrofit Thermography

Assessment of Construction Details

KESS projects developing Sustainability Champions of the future: Dr Jo Atkinson – Wales Manager Carbon trust

EU Projects – Pembrokeshire Housing Association (PHA)

PHA funded a KESS I (2010-2015) project to investigate and test the optimisation of housing to meet DQR and future climate change scenarios from 2010 to 2050, with a specific focus on rural development and occupants thermal comfort.

Design critique of standard house types

Dynamic Thermal Modelling

Assessment of narrow and compact terraces

Hatherley et al. (2011, 2012a, 2012b)
KTP – Morganstone Ltd & Cardiff Community Housing Association

2016-2017, Morganstone have funded a KTP working in collaboration with Cardiff Community Housing Association on two case studies.

1. Detailed Design Review: Buildability, Thermal Bridge Analysis & Construction Execution;
2. Construction quality and implementation assessment (adapting iCT);
3. Prefabrication assessment;

Royal Hamdryad

Implementation of dynamic thermal modelling for optimisation & climate change scenario Analysis;
Application of refined construction details;
Application of Morganstone iCT process.
Application of prefabricated components.

The Future: Continued Collaboration for Sustainable Construction

Coastal Housing Group: Research Enterprise Innovation Fund (2015-17);
Melin Homes: KESS II (2016-2019);
Bron Afon: KESS II (2017-2020);
United Welsh – Consultancy (2016 onwards).
2010: Year of Biodiversity – Butterfly observed at 2650 mts., August 2010, Le Parc de Mercantour, France/Italy
REFERENCES


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