

# An exploration of low carbon and ecological dwellings, for the social housing sector in Wales, UK.



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## Summary

This paper introduces a European funded research project to develop design guidance for low carbon and ecological social housing in Wales. From September 2010, all new dwellings in Wales must meet code Level 3, of the Code for Sustainable Homes (CfSH) with an additional requirement to achieve a reduction in CO<sub>2</sub> emissions with 31% improvement over Part L, Building Regulations 2006, and with the aim of moving towards zero carbon as soon as possible. Higher standards of ecological building practice required to meet Code levels 4 and above demand a fundamental rethink of existing approaches to design, construction and integration of renewable energy systems. The main issue is how to identify and utilise best practice in achieving these targets within the framework of existing cost constraints. Methodology adopted in evaluating the ecological credentials of existing and proposed schemes within the built asset base of the industrial partner focuses on the design approach for low carbon dwellings in primarily urban locations. This paper will be useful to Registered Social Landlords, Local & Regional Government Agencies, and Private Sector organisations engaged in the planning, design and procurement of residential buildings.

**Keywords:** low, carbon, ecological, housing, social, economic, environmental, Wales, UK.

## 1. Introduction

This paper introduces the background and context to a research project which addresses the issues presented by low carbon and ecological building practice in the context of social housing in Wales. Environmental assessment tools aim to quantify the impact of building at the design stage, and to set targets for improvement. Some are being adopted as regulatory standards, driving forward an increase in environmental benefits, but does this amount to a sustainable approach to domestic construction and how will such improvements be seen in terms of added value by potential occupants?

Innovative social housing projects can be seen as exemplars, influencing development of successful ideas and promoting wider up-take. In collaboration with United Welsh Housing Association (UWHA), this study will build upon this concept, examining case-studies from the built asset base of the industrial partner, and examples of best practice, identifying both ecological design opportunities and barriers to sustainable practice in the design and procurement of social housing in South Wales. The key themes will be identified, the research methodology outlined, and 'The Code for Sustainable Homes' a widely adopted environmental assessment tool, provides the main topic for discussion and the subject of objective review and detailed analysis.

## **2.0 Context**

Social housing constitutes in excess of 20% of the total UK housing stock[9], and the domestic sector, in general, accounts for more than 30% of total national energy consumption[10]. The design and procurement of social housing has traditionally been subject to greater regulation and specifically for Wales, the 'Design Quality Requirements'. Changes in the economic climate, and decline in private sector house construction, present an opportunity for Registered Social Landlords to lead innovation in this area. United Welsh Housing Association is a forward-looking, not-for-profit organisation, providing social housing in South Wales, UK, and with an interest in leading innovation. The Association has in excess of 4,200 properties geographically spread across a number of local authorities, including Cardiff, Caerphilly and Blaenau Gwent.

This study will consider low carbon and ecological building practice for social housing, in the context of the UK Government's strategic framework for sustainable development, which underpins the Welsh Assembly Government's (WAG) 'One Wales, One Planet' policy. A holistic approach will include social, economic and environmental considerations, reflecting key strategic goals.

A review of literature, best practice, and case studies, from Europe and the UK, provides an opportunity to review current practice, identifying the merits and shortcomings of currently used regulatory tools and legislative frameworks. Together with data from the baseline study, this will provide a 'bank of ecological knowledge, and form the basis of design guidance and decision assistance in the design and procurement of future developments for UWHA and other Registered Social Landlords. Its effectiveness will be tested in relation to existing sites and developments within the portfolio of the industrial partner, and as a key design tool in a notional development based upon a 'live' development opportunity.

## **3.0 The Code for Sustainable Homes**

Ecohomes[12], introduced in the UK as an environmental assessment tool for housing, was superseded in April 2007 by the Code for Sustainable Homes (CfSH's)[13]. The Code sets standards which extend beyond current Building Regulations, and which provides a framework for the introduction of higher standards in the future. Originally intended to operate on a voluntary basis, it is now being adopted as a legislative standard, and in Wales, from September 2010, all new dwellings must meet code Level 3, with an additional requirement to achieve a reduction in CO2 emissions with 31% improvement over Part L, Building Regulations 2006, with the aim of moving towards zero carbon as soon as possible[14]. The CfSH's represents a key document in terms of benchmarking current practice and warrants detailed consideration.

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The main issue is how to identify and utilise best practice in achieving these targets within the framework of existing cost constraints. Methodology adopted in evaluating the ecological credentials of existing and proposed schemes within the built asset base of the industrial partner focuses on the design approach for ecological and low carbon dwellings in primarily urban locations. This paper will be useful to Registered Social Landlords, Local & Regional Government Agencies, and Private Sector organisations engaged in the planning, design and procurement of residential buildings.

**Keywords:** low, carbon, ecological, housing, social, economic, environmental, Wales, UK.

## 2. Introduction

This paper introduces the background and context to a research project entitled 'A study to develop design guidance for use by Registered Social Landlords in the design and procurement of low carbon and ecological dwellings and micro-communities, in Wales and the UK', which addresses the issues in aspiring to low carbon and ecological building practice in the context of social housing in Wales. Environmental assessment tools aim to quantify the impact of building at the design stage, and to set targets for improvement. Some are being adopted as

regulatory standards, driving forward an increase in environmental benefits. The authors are exploring whether this amounts to a sustainable approach to domestic construction. Improvements could be seen in terms of added value by potential occupants. Evidence shows that 87% of home-buyers would like more information about the environmental performance of a house before purchase [1]. Further evidence of an increase in perceived value, is presented in a report by the Royal Institution of Chartered Surveyors [2], which associates 'green practices' with an increase in market values, and characteristics which will be of interest to both private sector and Registered Social Landlords:- tenants can be secured more quickly, a case to charge higher rents or prices, reductions in tenant turnover, lower operating and maintenance costs, assistance with capital expenditure via additional grants and financial incentives, and intangible benefits to occupants which may not be reflected in financial on-costs. Reduced fuel poverty, a key driver for providers of affordable housing, is an added benefit [ibid]

Table 1: Project Work Plan

Work Package	Description
1.	<p>Base-lining of United Welsh schemes</p> <p>Outline project methodology and procedure for establishing a benchmark for existing practice. Appraisal of UW built asset base, and identification of key schemes.</p> <p>Or Develop interview format UWHA Development Team</p> <p>Collate and analyze results of semi-structured interviews with UWHA Development Team.</p> <p>Develop site appraisal /data collection procedure for selected UWHA sites /schemes.</p> <p>Semi-structured interviews with Design Team / Local Authority /Contractors /Suppliers/Tenants.</p>
2.	<p>Undertake a literature review to investigate best practice schemes in the UK, or Europe, using benchmark data as an analysis mechanism to compare United Welsh schemes.</p>
3.	<p>Explore and develop an Ecological Decision-ing Tool for sustainable, low carbon dwellings from the single building to the micro-community, based on the analysis of Social, Economic and Environmental factors.</p>
4.	<p>Apply and test the tool in relation to a notional development of a number of vacant sites, within the United Welsh land-bank. Testing dwelling mixes and micro-community configurations; refining and improving the decision-ing tool.</p>

Recent studies have largely been focused upon the up-grading of existing housing stock [3], the potential benefits presented by the adoption of renewable energy technologies [4], supply-side policy issues relating to existing centralised energy distribution [5], and demand reduction in terms of in-use management[6]. Innovative social housing projects can be seen as exemplars, influencing development of successful ideas and promoting wider up-take [7]. In collaboration with United Welsh Housing Association (UWHA), this study will build upon this concept, examining case-studies from the built asset base of the industrial partner, and examples of best practice, identifying both ecological design opportunities and barriers to sustainable practice in the design

and procurement of social housing in South Wales. (See Table 1.) The key themes will be identified, the research methodology outlined, and 'The Code for Sustainable Homes' a widely adopted environmental assessment tool, provides the main topic for discussion and the subject of objective review and detailed analysis.

## 2.0 Context & Methodology

In the UK, responsibility for social housing and development controls in Wales have been devolved to the Welsh Assembly Government. In 2009, the words of the First Minister of Wales RT Hon. Rhodri Morgan AM, succinctly articulate the rationale for sustainable development:

*'Continued unsustainable development, globally and locally, will have a profoundly negative impact on our economic, social and environmental wellbeing. Those who are the least well able to cope are likely to be hit the hardest. Sustainable development, as the process by which we must become a sustainable nation, is therefore as much about social justice as it is about securing economic resilience and living within environmental limits' [8].*

Social housing constitutes in excess of 20% of the total UK housing stock [9], and the domestic sector, in general, accounts for more than 30% of total national energy consumption [10]. The design and procurement of social housing has traditionally been subject to greater regulation. Specifically for Wales, the 'Design Quality Requirements' add to regulatory pressure. Changes in the economic climate, and decline in private sector house construction, present an opportunity for Registered Social Landlords to lead innovation in this area. United Welsh Housing Association is a forward-looking, not-for-profit organisation, providing social housing in South Wales, UK, and with an interest in leading innovation. The Association has in excess of 4,200 properties geographically spread across a number of Unitary Local Authorities, including Cardiff, Caerphilly and Blaenau Gwent [11]

This study will consider low carbon and ecological building practice for social housing, in the context of the UK Government's strategic framework for sustainable development, which underpins the Welsh Assembly Government's (WAG) 'One Wales, One Planet' policy. A holistic approach will include social, economic and environmental considerations, reflecting the key strategic goals:

- *Sustainable consumption and production - working towards achieving more with less.*
- *Natural resource protection and environmental enhancement - protecting natural resources on which we depend.*
- *From local to global - building sustainable communities & creating places where people want to live and work, now and in the future.*
- *Climate change and energy - confronting the greatest threat.*

In addition to these four priorities, changing behaviour also forms a large part of the Government's thinking on sustainable development.

A procedure for base-lining existing UWHA practice has been developed, with reference to established environmental assessment tools. Current practice in general, focuses largely upon the application of renewable energy systems, but attainment of higher levels of environmental performance and sustainability requires a more fundamental approach to design and procurement.

Strategic decisions made during the earliest stages of a project can have the potential to significantly influence both the environmental performance in-use of the completed development, and its sustainability credentials. Independent site appraisals will be made in relation to selected schemes within the asset base of the industrial partner, and 'triple bottom line analysis,' [12] is being adopted to appraise social, economic and environmental factors. Geographic Information System (GIS), digital mapping, and socio-economic data, is being collated to fully appraise the context and extent of ecological design opportunities. Semi-structured interviews utilising a standardised questionnaire have been held with key members of the Housing Association's Development Team, and further interviews with members of the Design & Procurement Teams for each project, will identify successful take up of ecological design opportunities, and areas in which barriers to a wider consideration of sustainability need to be overcome. Data on performance in-use and the opinions and views of occupants also form part of the baseline study.

A review of literature, best practice, and case studies, from Europe and the UK, provides an opportunity to review current practice, identifying the merits and shortcomings of currently used regulatory tools and legislative frameworks. Together with data from the baseline study, this will provide a 'bank of ecological knowledge, and form the basis of design guidance and decision assistance in the design and procurement of future developments for UWHA and other Registered Social Landlords. Its effectiveness will be tested in relation to existing sites and developments within the portfolio of the industrial partner, and as a key design tool in a notional development based upon a 'live' development opportunity.

### **3.0 The Code for Sustainable Homes**

Ecohomes [13], introduced in the UK as an environmental assessment tool for housing, was superseded in April 2007 by the CfSH [14]. The CfSH sets standards which extend beyond current 2010 Building Regulations, and which provides a framework for the introduction of higher standards in the future. Originally intended to operate on a voluntary basis, it is now being adopted as a legislative standard, and in Wales, from September 2010, all new dwellings must meet code Level 3, with an additional requirement to achieve a reduction in CO<sub>2</sub> emissions with 31% improvement over Approved Document Part L, Building Regulations 2006, with the aim of moving towards zero carbon as soon as possible [15] The CfSH represents a key document in terms of benchmarking current practice and warrants detailed consideration.

The CfSH considers opportunities to reduce environmental impact within nine categories: Energy /CO<sub>2</sub>; Water; Materials; Surface water run-off; Waste; Pollution Health and Well-being; Management; Ecology and Land Use. The initial design stage assessment awards credits on the basis of evidence presented on drawings, and specifications, with code levels determined by total scores. Categories are not weighted equally, and for each Code Level, a minimum number of points must be achieved within the Energy /CO<sub>2</sub> and Water categories, giving an indication of the relative urgency of energy and CO<sub>2</sub> emissions. An interim Code Certificate is issued recommending a sustainability rating, which is verified by post-completion checks prior to issue of a final certificate of code compliance.

#### **3.1 The Code for Sustainable Homes: Energy /CO<sub>2</sub>**

More than a third of the total maximum credits available fall within this category. In spite of increased efficiencies and higher levels of insulation, energy savings within the UK domestic

sector have been outweighed by increases in the use of electrical goods, artificial lighting and appliances, resulting in a net rise in energy consumption since the 1970's [16]. Carbon emissions from housing have been estimated to be 100% greater than predicted levels. Research by the Association of Environmentally Conscious Builders (AECB) [17] suggests this is due to three factors:

- 1) The Standard Assessment Procedure (SAP) 2005, when used as a prediction tool, makes assumptions in relation to the calculation of the Dwelling Emission Rate (DER), which result in misleading figures. The procedure is non 'site specific', taking no account of different parts of the UK, where local weather conditions, altitude and degree of exposure, impact upon patterns of energy use [18].
- 2) Construction skills necessary to achieve the required standards are not widely available within the UK.
- 3) Assumptions made in relation to predicted use underestimate the impact of occupant behaviour.

The lack of construction skills and associated poor quality workmanship, could be addressed in part by the introduction of 'Post-Completion Testing and Certification'. Occupant behaviour provides a key focus to Section 8 of the Code, which endeavours to promote efficient operation. Half of the total credits available within Category 1 are awarded for predicted improvements over and above the Target Emission Rate (TER), calculated with reference to the Dwelling Emission Rate (DER) for energy used for space heating, domestic hot water and artificial lighting. Allowances are made for CO<sub>2</sub> savings resulting from the use of low carbon fuels and sources of renewable energy.

Other sections within this category are concerned with the building fabric, the provision of internal /external lighting, laundry drying spaces, eco-labelled domestic appliances and low or zero carbon technologies. Two further sections, Cycle Storage, and Home Office, address the reduction of energy used in relation to car use, and the potential for emission reductions by promotion of sustainable transport and 'working from home'. This seems appropriate when considering that 71% of the working population travel by car, and that 25% of car journeys are of distances less than two miles [19]. This fails to account for availability and access to public transport, travel distances, or access to commonly used services and amenities. Information collated by the Department for Transport indicate that in 2008, 90% of households in Great Britain were within a thirteen minute walk of an hourly, (or better) bus service. Additional information suggests time taken to complete journeys is a key factor influencing the mode of transport chosen for particular activities [20].

### **3.2. The Code for Sustainable Homes :Water**

The focus is on demand reduction, with credits awarded for the specification of efficient appliances, flow restrictors and rainwater harvesting [21]. Expected benefits include resource protection and reduced processing costs in both financial and environmental terms. The supply-side issue of using potable grade water for all activities is clearly a structural problem requiring a major shift in strategic service supply.

### **3.3 The Code for Sustainable Homes :Materials**

The primary objective is to minimise the impact of building materials, based upon an assessment of the environmental cost of manufacture and disposal. Credits are awarded with reference to

'The Green Guide To Specification' [22]. Published by the Building Research Establishment (BRE), and designed to be an integral part of the assessment process, this document provides A to E ratings for materials and products on the basis of environmental credentials. Designers and specifiers need only cursory knowledge of the document to recognise fundamental difficulties in its use. An analysis carried out by the 'Good Homes Alliance', (GHA) identifies several key issues, the most significant being a critical lack of transparency related to sources of data and the methodology used to calculate ratings, and generic profiles. The GHA claim this results in 'unintended negative consequences', in design, product innovation, and the overall environmental impact of buildings [23]. A specific area of concern lies in the calculation of embodied carbon, which BRE acknowledge can result in a broad range of values according to the assumptions and criteria used. In a cradle-to-cradle analysis, future use of recyclable materials could be more significant than recycled content. In the case of timber, widely used in construction, or other bio-renewables, their ability to absorb carbon dioxide during the growing period, locking-up carbon and suspending its effect within the carbon cycle, must be accounted for. Assumptions regarding future use, recycling options, decomposition, or combustion, are important if values for embodied carbon are to be meaningful.

This lack of transparency extends to ratings for manufactured components and composites. Once recognised, this raises doubts as to the efficacy of the entire system. An example being the manufacture of double and triple glazed windows and the choice of inert gas for cavity infill, which is not considered. Xenon is expensive and unlikely to be used in domestic situations, however Argon and Krypton, commonly used gases, incur hugely different levels of energy use in manufacture. Argon requires 0.0023% of the energy required to produce Krypton for an equivalent area of double glazing [24].

### **3.4 The Code for Sustainable Homes :Surface Water Run-Off**

The aims of this section are to minimise flood risk and reduce pollution of water courses, reflecting an increased tendency to flooding in the UK, and growing concern regarding contamination. In excess of 7 % of land area in England & Wales could be subject to flooding, and statistics indicate that floods in the UK are, on average, twice as likely as they were at the beginning of the twentieth century [25]. Code entry level criteria for minimum standard requires that peak run-off rate into water courses for the newly developed site does not exceed the value prior to development. This requirement appears onerous, but the code fails to reflect this in the number of credits available, and falls short of recognising the full social and economic impacts of flooding. Levels of personal stress and the social disruption created by loss of home, together with the waste of resources utilised in remediation seem unlikely to have been considered. Research in this area has been limited. Evidence presented at the RICS Cobra 2004 Conference, concerned with the social as well as economic aspects of flooding, identified that loss of home, earnings, and personal effects contributed to feelings of insecurity and general loss of wellbeing [26]. Further evidence is presented by Tunstall et al [27], in the results of a study to investigate the physical and psychological effects of flooding on individuals within 30 locations in England and Wales, using established metrics. Results indicated that 64% of interviewees provided responses normally associated with psychological distress. Perhaps more significantly, the data also showed 20% of individuals went on to display symptoms of 'Post Traumatic Stress', indicative of longer term psychological and emotional damage.

### **3.5 The Code for Sustainable Homes :Waste**

Three sub-sections detail credits available in relation to household recycling facilities, construction waste and composting facilities. The construction industry in England is a major source of waste, using the highest tonnage of solid material resources of any sector, over 400 million tonnes [28]. Household recycling and composting have shown significant increases over recent years, although this must be offset by an increase of approximately 26% per person in the amount of domestic waste generated over the last fifteen years [29]. The code acknowledges collaboration with Local Authority Refuse Collection & Recycling departments, ensuring the provision of basic facilities. The UK produces 592 Kilograms (kg) of waste per capita, more than many of its European neighbours (European average 577kg). It also lags behind in terms of the amount of waste recycled, 18%, well below the EU average of 36.4% [30].

### **3.6 The Code for Sustainable Homes :Pollution**

The heading to this section is misleading, as its provisions are restricted to air contaminants, and potential impact upon global warming. Insulation products are awarded credits where the use of ozone depleting substances are avoided whilst maintaining a global warming potential of less than 5. This relates to a comparative scale of Global Warming Potential (GWP) in which CO<sub>2</sub>= 1 [31]. Additional points are available where specified heating and domestic hot water systems, traditionally reliant upon the burning of fossil fuels, limit emissions of Nitrous Oxides, which have a GWP more than three hundred times greater than CO<sub>2</sub>.

The significance of air contaminants, such as diesel particulates and other transport related pollution is not considered either in relation to the construction process, or the location of residential development relative to the sources of pollution. The likely travel activity of the occupants is also disregarded. Data produced by Friends of The Earth, entitled '*Road Transport , Air Pollution and Health*', identifies road transport as a major source of air pollution in the UK, and considers the percentage contribution of transport to total air borne pollution from five key pollutants: carbon monoxide, benzene, nitrogen oxides, hydrocarbons, dust and soot particles. Projected figures for premature death due to short term exposure to commonly found levels of pollution suggest that 12,000 to 24,000 deaths per annum could be expected, and that a further 14,000 to 24,000 hospital admissions and re-admissions would also be likely to occur. One in five people within the UK could be particularly at risk from air pollution. High risk groups include young children, pregnant women, the elderly and those suffering from heart and lung disease [32].

### **3.7 The Code for Sustainable Homes :Health & Wellbeing**

This section addresses three areas in which improvement in quality of life for occupants can be achieved: good day lighting; sound insulation; provision of private outdoor space. Exposure to daylight has been found to assist in the regulation of hormone levels, and sleep patterns, and to generally enhance psychological wellbeing [33]. Credits are awarded where good day lighting levels, and 'view of the sky' can be demonstrated in relation to the main living spaces. Sunlight penetration, also thought to be of psychological benefit [34], is not included within the assessment criteria. The benefit of outdoor activity is reflected in the award of credits for the provision of private outdoor space, but the code fails to encourage and promote the use of shared external space.

Credits available for compliance with the requirements of 'Lifetime Homes' standards, are contentious, and relate to access to the dwelling, accessibility within the dwelling, and potential for

future adaptation to meet changing occupant needs. Ageing, infirmity or change in circumstances could present difficulties in accommodating physical requirements, and credits are awarded where designs make appropriate provision. It seems reasonable to suggest that only a percentage of dwellings within a development should be required to meet this standard. Occupant requirements are likely to change in a variety of ways, all of which may contribute to the need for alternative facilities. Within the social housing sector, the proposed abolition of 'lifetime tenancies' seems likely to make this provision less relevant [35].

### **3.8 The Code for Sustainable Homes :Management**

This term is used to address a disparate collection of three topics, concerned with encouraging occupants to operate their homes efficiently, contractors to operate 'considerate construction sites', and to promote the design of safe and secure developments. Credits are awarded within four sub-sections : Home User Guide, Considerate Constructor Scheme, Construction Site Impacts, and Security.

The provision of a 'Home User Guide' represents an area in which further development, drawing together occupant awareness, education and changing behaviours, could result in increased benefits. Research shows that 66% of people purchasing a new home are not given adequate information regarding technical specification and operational requirements [36]. This is given added significance where new technologies or unfamiliar approaches are taken and applies equally to both social and private housing. A social housing development at Marsbachöhe, Kassel, Germany, built to Passivhaus standards, and subject to post occupancy evaluation as part of the European Union funded Cepheus Project, demonstrates the importance of occupant instruction in relation to the operation of mechanical ventilation heat recovery systems and the implications for window opening behaviour [37].

Safety and security is recognised to be an essential characteristic of a sustainable community. Reference is made to the 'Secured by Design' framework. This is a certification scheme administered by Police Authorities and operated through an advisory service providing guidance to design teams and developers. The scheme aims to reduce opportunities for crime to take place by creating places where people can mix, promoting community development and avoiding social exclusion. The active use of streets and public spaces decreases the opportunity for anti-social behaviour or criminal activity by increasing natural surveillance. Public and communal areas are designed to be overlooked by properties or travel routes, and the provision of adequate lighting is encouraged to both public and semi-public areas. Natural surveillance is further promoted by the adoption of good sight lines, while also creating attractive, and well landscaped environments [38]. Developments designed using the SBD principles of 'designing-out' crime, experience up to 67% less crime than equivalent non SBD schemes [39].

### **3.9 The Code for Sustainable Homes: Ecology & Land Use**

In the context of trends illustrating an increased amount of land used for urban development, and a decline in the number and population of wildlife species and habitats, this area of the code encourages the development of sites with limited ecological value, lessening the ecological impact of proposed development and promotes opportunity for ecological enhancement. Five sub categories are designed to approach different aspects of this issue, and recognise the benefit for specialist advice. In Wales, the 'Environment Strategy Annual Report' [40] provides a measure of

achievement against a framework of ecological indicators identified and defined within the UK Biodiversity Action Plan [41]. The code makes no explicit reference to this benchmark, but specialist knowledge could be expected to utilise this resource in the formulation of recommendations. Credits are awarded for the implementation of 30% of recommended actions. This arbitrary figure, could reasonably be increased. Concerns regarding the perceived costs of compliance with more demanding ecological standards seem likely to have been influential. The value of ecosystems and the services they supply represents an area of difficulty in terms of public perception and in relation to commercial enterprise. In his essay 'Natural Capital' [42], John Box suggests that realistic cost benefit analyses can only be truly meaningful, when the economic value of natural capital and biodiversity are accounted for in balance sheets and reflected in market values. Bamford et al [43], suggest the social value of bi natural ecosystems could be addressed by the development of market instruments such as biodiversity credits or the addition of cost premiums for goods dependant upon natural ecosystems in their production.

#### **4.0 Discussion**

The CfSH builds upon concepts introduced by the Ecohomes initiative and sets new standards for environmental performance. It provides a framework for further improvements in Building Regulations and recognises the need to make energy and carbon emissions a priority. The introduction of post-completion checks as a means of compliance verification should present opportunity for significant improvement in standards of construction, promoting greater emphasis on quality control and the need for increased levels of skill. The integration of the 'Lifetime Homes' standard acknowledges demographic change and is evidence of a more socially inclusive approach to design. Likewise, the incorporation of 'Secured By Design' criteria reflects the evidenced-based success of this approach. The importance of occupant behaviour is evident in many of the issues discussed, and the provision of a home user guide represents positive action. Greater emphasis upon raising public awareness will require a more integrated, multi-lateral approach to ecological education and falls beyond the scope of the code. The failure of a national scheme to account for geographical variations in factors impacting thermal performance and predicted energy use suggests a more rigorous approach is required if these issues are to be treated as a real priority. Aspects of the CfSH appear at times to be primarily concerned with the capacity of existing publicly owned services. Avoidance of capital expenditure in relation to replacement, expansion and maintenance suggest possible motivation. Areas of overlap between sections of the CfSH and confusion in relation to different areas of legislation could be avoided by explicit cross referencing and definition. A reluctance to engage with the intractable difficulties of community development and shared facilities could be addressed by recognising the need for multi-agency involvement in development strategy and scheme design.

Transport and Materials represent perhaps the two least satisfactory aspects of the code. Reductions in the use of cars and associated air bourn traffic pollution is treated superficially with minimal consideration of context and reality. Any ambition to effect significant change would require major re-alignment of policy at government level and a co-ordinated and long term strategy shift. Reliance upon the Green Guide To Specification in the selection of materials is fundamental to the questionable value of the code in this area. Lack of transparency, the use of questionable data from unidentified sources, commercial bias and unrealistic or broadly based assumptions result in ratings of limited value. The document represents a proto-type which needs to be the focus of further development, and evidence-based scientific scrutiny [44]. Danger lies in it's incorporation in what has become a constituent part of statutory legislation. The dissemination of

mis-information and part truths could result in the adoption of ineffective or detrimental behaviour change, which may prove difficult to reverse.

The CfSH acknowledges changing agendas in relation to climate change and the concept of shared environmental equity. Integration with statutory controls for development will ensure it's survival and embed in the design professions and construction industry some of the principles on which it is based. The issues of obscure methodology, validation of data and general transparency raise serious questions in relation to its value and suggest that this is a foundation upon which further research and development could be built. Co-ordination with other areas of legislation and government standards, and the development of mechanisms to evaluate and promote the social benefits of sustainable housing must be addressed. The possibility of partiality and commercial or political bias suggest that independent scrutiny should replace private sector interest. Finally, and most significantly, if maximum benefit is to be derived from the implementation of this or future iterations of the code, it is essential that a collaborative approach to education and public awareness of sustainability and environmental issues should reflect the urgent need to change behaviours.

## 5.0 Conclusions.

This paper has introduced the background and context to a research project entitled 'A study to develop design guidance for use by Registered Social Landlords in the design and procurement of low carbon and ecological dwellings and micro-communities, in Wales and the UK', which addresses the issues presented by low carbon and ecological building practice in the context of social housing in Wales. It has critiqued the incorporation into regulation of the CfSH. It has sought to explore the direction in which a more fundamental step change needs to go to meet the needs of the knowledge bank and design tools based upon it.

## References

- [1] INSIGHT INVESTMENT, HALIFAX BANK OF SCOTLAND PLC /WORLD WILDLIFE FUND. "Investing in Sustainability" p.7 Sept.2005. Cited at [www.wwf.org.uk/filelibrary/pdf/investinsustainability.pdf](http://www.wwf.org.uk/filelibrary/pdf/investinsustainability.pdf) Accessed 14.03.11.
- [2] ROYAL INSTITUTION OF CHARTERED SURVEYORS, "Green Value" p.12. 2005 Cited at [www.rics.org/greenvalue](http://www.rics.org/greenvalue) Accessed 05.03.11.
- [3] REEVES.A, 'Achieving deep carbon emission reductions in existing social housing: the case of Peabody',2009. Institute of Sustainable Development, De Montford University.
- [4] BAHJA.A.S,JAMES.P.A.B. 'Urban energy generation: The added value of photovoltaics in social housing'.2007 Elsevier. *Renewable and Sustainable Energy Reviews*,Vol.11,Issue 9,December 2007,pp2121-2136.
- [5] BANFILL.P.F.G, PEACOCK.A.D.'energy-efficient new housing –the UK reaches for sustainability'. *Building Research & Information*. Vol 35,Issue 4, 2007.pp 226-236.
- [6] SUNIKKA.M,BOON.C.' environmental policies and efforts in social housing:the Netherlands', *Building Research & Information*, Vol.31,Issue 1,2003,pp 1-12.
- [7] SMITH.A. ' Governance lessons from green niches:the case of eco-housing'. *Governing Technology for Sustainability*. Ed. Murphy.J. Earthscan 2007,UK.
- [8] WELSH ASSEMBLY GOVERNMENT "One Wales: One Planet " May 2009 Cited at <http://wales.gov.uk/docs/desh/publications/090522susdevsdspace0115en.pdf> Accessed 01.03.11.
- [9] JOSEPH ROWNTREE FOUNDATION, Housing & Neighbourhoods Monitor, "Housing Stock By Tenure",2007 Cited at <http://www.hnm.org.uk/charts/housing-supply.html#one> Accessed 03.02.11.

- [10] DEPARTMENT OF ENERGY & CLIMATE CHANGE, 'Digest of United Kingdom Energy Statistics 2010'. Annexe : Long Term Trends. Cited at <http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx> Accessed 04.02.11.
- [11] UNITED WELSH HOUSING ASSOCIATION, Cited at <http://www.uwha.co.uk/>
- [12] SPRECKLY.F. 'Social Audit: A Management Tool For Co-operative Working', 1981, Beechwood.
- [13] BUILDING RESEARCH ESTABLISHMENT 'Ecohomes' 2006 Building Research Establishment Environmental Assessment Method for Homes. Cited at <http://www.breeam.org/page.jsp?id=21>, Accessed 14.03.11.
- [14] BUILDING RESEARCH ESTABLISHMENT 'Code for Sustainable Homes' 2007 Building Research Establishment Environmental Assessment Method for Homes. Cited at <http://www.breeam.org/page.jsp?id=21>, Accessed 14.03.11.
- [15] WELSH ASSEMBLY GOVERNMENT Sustainable Development, 'The Code for Sustainable Homes'. Cited at <http://wales.gov.uk/topics/sustainabledevelopment/design/code/?lang=en> Accessed 14.03.11.
- [16] UTLEY.J.I.; SHORROCK.D.L. " Domestic energy Fact file 2008" Building Research Establishment / Department for Energy and Climate Change/Energy Saving Trust. Cited at [http://www.bre.co.uk/filelibrary/pdf/rpts/Fact\\_File\\_2008.pdf](http://www.bre.co.uk/filelibrary/pdf/rpts/Fact_File_2008.pdf) CC ZZ Accessed 03.02.11.
- [17] ASSOCIATION OF ENVIRONMENTALLY CONCIOUS BUILDERS "Minimising CO2 Emissions From New Homes". May 2006 Cited at <http://www.aecb.net/PDFs/NewHomesCO2Savings25May06.pdf> Accessed 14.03.11.
- [18] Tebbit.J, " Don't Leave SAP Behind". Building, April 2009.
- [19] DEPARTMENT FOR TRANSPORT "Transport Trends", 2009 Edition Cited at <http://www.dft.gov.uk/adobepdf/162469/221412/190425/220778/trends2009.pdf> Accessed 14.03.11.
- [20] Ibid
- [21] BUILDING RESEARCH ESTABLISHMENT 'Code for Sustainable Homes' 2007 Building Research Establishment Environmental Assessment Method for Homes. Cited at <http://www.breeam.org/page.jsp?id=21>, Accessed 14.03.11.
- [22] ANDERSON.J, SHIERS.D, "The Green Guide To Specification", Wiley-Blackwell; 4th Edition Jan 2009
- [23] MAY.N " Environmental Assessment of Building Materials and The Green Guide; Where do we go from here ?". Good Homes Alliance 2009. Cited at [http://www.goodhomes.org.uk/downloads/pages/GHA%20Green%20Guide%20critique%20-%20where%20do%20we%20go%20from%20here%20\(April%2009\).pdf](http://www.goodhomes.org.uk/downloads/pages/GHA%20Green%20Guide%20critique%20-%20where%20do%20we%20go%20from%20here%20(April%2009).pdf) Accessed 04.03.
- [24] WEIR.G.F "Life-Cycle Assessment of Multi-glazed Windows", 1998 Napier University
- [25] BUILDING RESEARCH ESTABLISHMENT 'Ecohomes 2006 – The Environmental Rating For Homes – The Guidance – Issue 1.1 April 2006. Cited at <http://www.nhbc.co.uk/NHBCpublications/LiteratureLibrary/NHBCServices/SustainabilityServices/EcoHomesGuidanceDocuments/EcoHomesGuidanceDocument2006/filedownload,26652,en.pdf> Accessed 14.03.11.
- [26] SAMWINGA.V, PROVERBS.D.G, HOMAN.J. "Exploring the Experience Of UK Home Owners In Flood Disasters". School of Engineering and the Built Environment, University of Wolverhampton. COBRA 2004. Cited at [http://northumbria.openrepository.com/northumbria/bitstream/10145/121502/2/Samwinga,%20V.,%20Proverbs,%20D.%20G.%20and%20Homan,%20J.%20\(2004\)%20Exploring%20the%20experience%20of%20insured%20UK%20homeowners%20in%20flood%20disasters.pdf](http://northumbria.openrepository.com/northumbria/bitstream/10145/121502/2/Samwinga,%20V.,%20Proverbs,%20D.%20G.%20and%20Homan,%20J.%20(2004)%20Exploring%20the%20experience%20of%20insured%20UK%20homeowners%20in%20flood%20disasters.pdf) Accessed 07.03.11.

- [27] TUNSTALL.S,TAPSELL.S,GREEN.C,FLOYD.P,GEORGE.C. " The Health Effects of Flooding: Social Research Results from England and Wales". Journal of Water and Health. Vol 365 .04.03.2006.  
Cited at [http://www.mdx.ac.uk/aboutus/staffdirectory/Sylvia\\_Tunstall.aspx](http://www.mdx.ac.uk/aboutus/staffdirectory/Sylvia_Tunstall.aspx) Accessed 07.03.11.
- [28] DEPARTMENT FOR ENVIRONMENT,FOOD AND RURAL AFFAIRS " Construction Waste". Feb.2009.  
Cited at <http://www.defra.gov.uk/environment/waste/topics/construction/index.htm>  
Accessed 14.03.11.
- [29] TAYLOR.M "The Code for sustainable Homes" AEES MSc Practical Notes October 2009.
- [30] BBC NEWS UK."Household Waste: In Statistics". 09 July 2007.  
Cited at <http://news.bbc.co.uk/1/hi/uk/6222288.stm> Accessed 07.03.11.
- [31] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE " Third Assessment Report. Climate Change 2001: 6.12 Global Warming Potentials.  
Cited at [http://www.grida.no/publications/other/ipcc\\_tar/?src=/climate/ipcc\\_tar/wg1/247.htm](http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/247.htm)  
Accessed 14.03.11.
- [32] FRIENDS OF THE EARTH " Road Transport Air Pollution And Health.  
Cited at [http://www.foe.co.uk/resource/briefings/road\\_air\\_pollution\\_health.pdf](http://www.foe.co.uk/resource/briefings/road_air_pollution_health.pdf)  
Accessed 14.03.11.
- [33] Phillips,D. " Natural Light In Architecture" 2004, Amsterdam, Elsevier.
- [34] BOUBEKRI,HULL.R.B,BOYER.L.L. "Impact of Window Size and Sunlight Penetration on Office Worker's Mood and Satisfaction."Environment & Behaviour July 1991 vol.23 No. 4 pp 474-493.
- [35] BURY.R,HARDMAN.I "Lifetime tenancies to be axed" Inside Housing,22 Nov.2010  
Cited at <http://www.insidehousing.co.uk/news/housing-management/lifetime-tenancies-to-be-axed/6512604.article> Accessed 08.03.11.
- [36] INSIGHT INVESTMENT,HALIFAX BANK OF SCOTLAND PLC /WORLD WILDLIFE FUND. " Investing in Sustainability" p.7 Sept.2005.  
Cited at [www.wwf.org.uk/filelibrary/pdf/investinsustainability.pdf](http://www.wwf.org.uk/filelibrary/pdf/investinsustainability.pdf)
- [37] SCHNIEDERS.J,HERMELINK.A. "CEPHEUS results: measurements and occupants' satisfaction provide evidence for Passive houses being an option for sustainable building." Energy Policy. 34 (2006) pp.151-171. Elsevier.
- [38] STRATFORD ON AVON DISTRICT COUNCIL " Planning and Community Safety". March 2006.  
Cited <http://www.stratford.gov.uk/files/seealsodocs/4198/Planning%20and%20Community%20Safety.pdf> Accessed 08.03.11.
- [39] HOME OFFICE. " An Evaluation of Secured By Design Housing in West Yorkshire". Briefing Note 7/00.  
Cited at <http://www.popcenter.org/library/scp/pdf/04-Armitage.pdf> Accessed. 08.03.11.
- [40] WELSH ASSEMBLY GOVERNMENT, "Environment Strategy annual Report 2009/2010.Cited <http://wales.gov.uk/docs/desh/publications/101115environmentstrategyen.pdf>  
Accessed 18.03.11.
- [41] UK BIODIVERSITY PARTNERSHIP,"UK Bio diversity Action Plan 2007"  
Cited at <http://www.ukbap.org.uk/> Accessed 18.03.11.
- [42] BOX.J,"Natural Capital", WEM- The Environment Magazine.  
Cited at <http://www.wemmagazine.co.uk/hot-topics/2011/feb/natural-capital.aspx>  
Accessed 18.03.11.
- [43] Balmford,A,et al, " Economic reasons for conserving wild nature". Science 297.pp.950-953  
Cited at <http://www.envirosecurity.org/conference/working/ReasonsConservWildNature.pdf>  
Accessed 18.03.11.
- [44] HOME OFFICE. " An Evaluation of Secured By Design Housing in West Yorkshire". Briefing Note 7/00.  
Cited at <http://www.popcenter.org/library/scp/pdf/04-Armitage.pdf> Accessed. 08.03.11.
- [45] MAY.N " Environmental Assessment of Building Materials and The Green Guide; Where do we go from here ?". Good Homes Alliance 2009.  
Cited at [http://www.goodhomes.org.uk/downloads/pages/GHA%20Green%20Guide%20critique%20-%20where%20do%20we%20go%20from%20here%20\(April%202009\).pdf](http://www.goodhomes.org.uk/downloads/pages/GHA%20Green%20Guide%20critique%20-%20where%20do%20we%20go%20from%20here%20(April%202009).pdf) Accessed 04.03.11.