

CIOB BUILDINGS IN OPERATION AND MAINTENANCE

4.0

CARBON ACTION 2050 WHITE PAPERS FROM THE CHARTERED INSTITUTE OF BUILDING

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INTRODUCTION

In the UK, the built environment is estimated to contribute 47% of all of the country's carbon emissions.¹ The vast majority of this is in the form of operational carbon, as opposed to embodied carbon (i.e. that produced as a result of original construction, manufacturing, and any other work such as refurbishment and retrofit).

Whether buildings are well-equipped to function in a carbon efficient way due to their original attributes, or as a result of retrofit or refurbishment, the means by which they are operated and maintained can have a profound effect on their carbon efficiency and on their overall sustainability.

If the investment of a building's embodied carbon is to be protected, then it should be ensured that buildings last as long as possible without any large carbon producing interventions, such as major repairs. This means that they have to be maintained and operated with this in mind.

The operations involved with managing and maintaining buildings are vast and wide ranging. They involve the everyday use, designated uses of different spaces within buildings and are affected by the complexity of plant and equipment installed.

It is important that the end-user of a building is fully conversant on how to use and maintain installed plant and equipment within a building. The issuing of a log book is critical and it should contain sufficient information about the building, including fixed building services and their maintenance requirements so that such buildings can be operated in such a manner to use no more fuel and power than is reasonable in the circumstances.

¹ Making the Case for a Code for Sustainable Buildings, The UK Green Building Council (UKGBC), 2009

POLICY CONTEXT

The Kyoto Protocol of 1997 was the starting point in terms of carbon reduction, and this led to the European Energy Performance of Buildings Directive in 2002. In time, UK government legislation was brought into place, which in practical terms has been the major force behind carbon reduction policy. The Climate Change Act 2008 committed the UK government to ensure a 30% reduction in carbon production by 2020 and 80% by 2050 from a 1990 base level.

This Act has resulted in numerous initiatives and regulation that affects the UK building stock. This includes Building Regulations Part L, which is aimed at improving the energy performance of buildings, and Energy Performance Certificates (EPC) ratings as part of the EU's Energy Performance of Buildings Directive.

Current building regulations set prescribed thermal efficiency standards and it is the Governments intention to improve the requirements and by 2016 all new dwellings will achieve a zero carbon rating with all buildings achieving a similar rating by 2019.

Specialist guidance has also been issued, in particular for new homes, and although compliance is voluntary such codes/guides play an important part in driving forward with the zero-carbon agenda. Amongst these are the Code for Sustainable Homes (CSH) and Passivhaus Standards.

BEST PRACTICE GUIDANCE

General description

In the context of carbon reduction, the operation and management of buildings is about making the use of buildings achievable with a minimum use of energy, whilst also focusing on the long term and therefore making buildings sustainable in the process. Whilst there is a lot of common ground between domestic and non-domestic buildings, the latter is more complex and involves a much greater range of issues. It principally concerns the following:

- Optimum use of internal spaces.
- Maintenance: building fabric and services.
- Operational management involving building elements, components and energy.

Understanding Buildings is Critical

A Building Manual containing information on optimum use, operation and maintenance of a building is critical. This provides information about the building and how it should be operated and maintained. If this information is not available, then it should be obtained.

Optimum expertise is also required along with good management. It should, for example, always be ensured that suitably skilled operatives are used for the operation and maintenance processes. For example, maintenance of traditional building fabric which was built in lime mortar should not be repaired in cement mortar as these are incompatible materials.

Energy Performance Certificates (EPCs) are produced following an energy audit. These are displayed and provide information to the building occupier on the overall energy efficiency of the building.

Display Energy Certificates (DECs) are currently mandatory for all public buildings with floor areas of more than 1000m². They differ from EPCs by displaying the actual energy use and energy efficiency of the buildings, and must be displayed in the building in an area visible to the public. They are updated annually and, as they measure the actual energy efficiency of a building, encourage better energy management of buildings, resulting in carbon and cost savings.

As EPCs do not measure actual building energy use, they cannot motivate change in public buildings to the extent DECs do. An emphasis should be placed on measuring the actual energy performance of buildings, meaning that, without further review of the role of EPCs, they could become redundant.

Consider the use of buildings

In the management and operation of buildings, change in the uses of spaces can often result in a change in the performance of the building which could affect its sustainability, carbon emissions, the health of the building and the health of its occupants. Well informed changes in use can result in minimising the need for heating and forced ventilation and maximise the feasibility for passive controlled internal environments. The analysis will usually form part of a building pathological investigation and involves environmental monitoring of internal spaces which indicates the suitability of each space for a given use.

Basic ways to reduce energy

- Upgrading thermal elements to achieve energy cost savings.
- Upgrading existing plant and improvements to building services.
- Reduce indoor temperatures by turning down thermostats. A Building Management System for large buildings will pre-programme this.
- Reduce hot water temperature. A Building Management System for large buildings will pre-programme this.
- Make sure external doors and windows are shut to prevent draughts.
- Make sure that draught proofing to windows is working and arrange for maintenance as appropriate. A management procedure could help achieve this.

- Close curtains, blinds and window shutters when artificial lighting is required. In large building a management procedure could help achieve this.
- Always turn lights off when leaving a room. Occupancy sensors would make sure that this happens.
- Installing energy saving lamps.
- Advanced metering (e.g. smart metering) can allow real time energy use data and help make informed choices. The UK Government is currently proposing (as of April 2011) that all homes are to have smart metering installed beginning in 2014, and that businesses and public sector users should also have smart or advanced energy metering installed that is suited to their needs.
- Take every opportunity to make improvements when plant and equipment needs replacing, to upgrade to greater fuel efficient systems. The process of producing the EPC concludes with recommendations that can be undertaken as a retrofit or refurbishment operation.
- Ensure that those responsible for maintenance and other operations do not have to travel too far, thus minimising their carbon emissions in the process.
- The process of producing the EPC concludes with recommendations.

Sustainability

Sustainability must be about ensuring that buildings last as long as possible with minimum carbon generating work being necessary throughout their life span, whilst at the same time being as energy efficient as realistically possible. Ultimately, this is a balancing act that requires a great deal of understanding in order to get this balance right. Existing buildings already have an investment of embodied carbon and securing this investment is part of the equation in finding the balance.

The materials and components used in maintenance and refurbishment are also part of this equation. The components and materials that are incompatible and have inferior performance and lifespan characteristics are not sustainable. There are a number of guides that help with the choice of materials and components, but there is also disagreement on the merits of some major content.

When retrofitting existing homes to enable them to better cope with impacts of climate change, it is important that such buildings continue to be healthy, comfortable places to live and do not suffer from the effects of flooding, water shortages, droughts and overheating.

When considering the effects of overheating, passive measures of reducing internal temperatures should be considered in lieu of using air conditioning, as the environmental costs of such systems such as carbon emissions, noise and waste heat must be avoided.

² Existing Homes Alliance, 2010

³ *Making the Case for a Code for Sustainable Buildings*, The UK Green Building Council (UKGBC), 2009

⁴ *Estimates of Home Insulation Levels in Great Britain (October 2010)*, Department of Energy and Climate Change (DECC)

An effective package of passive measures to control overheating could include external awnings, night purging using natural ventilation and ceiling fans and painting external walls to increase reflectivity.

RECOMMENDATIONS

When bearing in mind the investment of carbon (i.e. embodied carbon) already made in the construction of existing buildings; that up to 85% of existing buildings will be standing in 2050²; and that existing homes are responsible for 27% of the UK's current carbon emissions³; the emphasis should be placed on improving existing buildings.

In addition, the training and upskilling of all building trades and professionals is essential if we are to meet the government's current energy saving targets. All craftsmen and women as well as all professionals must receive training and education in understanding and maintaining buildings. Some form of badging and/or registration scheme should be introduced to increase public awareness.

This particular paper looks at the operation and maintenance of buildings and by inference this relates to all existing buildings whether domestic or commercial; however, it does also contain recommendations relating to new domestic and non-domestic buildings as, when such projects are completed, they should operate in a manner so as to use no more fuel and power than is absolutely necessary.

Existing domestic buildings

- By 2015 all existing domestic properties should have, where possible, cavity wall insulation and loft insulation installed meeting current (2010 Building Regulation standards) – in 2010, DECC estimated that 56% of all homes with cavity walls in the UK had cavity wall insulation, and over 54% had at least 125mm of loft insulation, so this is not as extreme a task as it first appears.⁴ Since the late 1980's, the vast majority of homes have been built with pre-insulated cavity walls, whilst since the mid-1990's most new homes have had loft insulation thicker than 250mm ready-installed.
- By 2050 all remaining housing stock should be upgraded to include solid walls and the installation of micro-renewable energy generation.
- By 2014 introduce Smart Metering Display - all consumers therefore manage their own energy use.
- By 2013 the Building Regulations should incorporate a requirement to improve energy performance of existing homes when they are significantly altered or extended.
- Produce clear guidance similar to the Code for Sustainable Homes for alterations and extensions to existing dwellings to aid compliance (i.e. a Code for Sustainable Existing Homes).

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Many of the above measures can only be introduced by forming partnerships between local authorities and energy generation companies.

Financial incentives to encourage building owners to improve their existing properties could include low cost loans, reduction in VAT and stamp duty.

New dwellings

- Strengthen the requirements of building regulations incrementally and link current published guidance (e.g. Code for Sustainable homes, Passivhaus Standards) to the regulations. This would produce clear requirements for compliance and avoid the confusion that currently reigns.
- In order to improve existing dwellings consider off-setting zero-carbon requirements against improvements to existing housing units.
- Document the methods by which such buildings are to be operated and managed. This will highlight comparative requirements of different buildings and allows such comparisons to be costed and promotes the importance of designing buildings which are efficient from both carbon and economic perspectives.

Non domestic buildings (new and existing)

Similar requirements to those for new and existing dwellings, although the time frame for new non-domestic buildings to be zero-carbon has been set for 2019 by the current government.

Included within the measures should be:

- By 2015 upgrading of existing thermal elements to comply with 2010 Building Regulation requirements.
- By 2014 introducing Smart Metering Display.
- Including, within 2013 revisions to building regulations, the requirement to improve existing building when altered and extended.

The Building Regulations must be strengthened in order to ensure they are the main standards for compliance. Linking them to all other guidance (see below) could, as with domestic buildings, avoid confusion for developers and provide clear requirements for low carbon buildings.

Radical reductions in carbon emissions from private sector non-domestic buildings will not be achieved unless we have consistent and robust data together with a clear, comparable rating system that works for all building types. This could be achieved by extending the roll-out of Display Energy Certificates (DECs) to all non-domestic buildings from 2012. Currently DECs are mandatory for public buildings over 1000m², but not for private sector buildings.

The introduction of guidance equivalent to the Code for Sustainable Homes for the erection and renovation alteration of non-domestic properties to aid compliance (i.e. a Code for Sustainable [Existing/New] Non-Domestic Buildings must be a priority, especially as non-domestic buildings contribute 18% to total UK carbon emissions.⁵)

Building Users

So much depends on how buildings are used and managed. Optimum ways in which buildings are used and managed should be developed which should then be conveyed to end-users and owners of buildings.

⁵ Making the Case for a Code for Sustainable Buildings, The UK Green Building Council (UKGBC), 2009

USEFUL REFERENCES AND FURTHER GUIDANCE

- Chartered Institute of Building – www.ciob.org.uk/
 - Society of Chartered Environmentalists – www.socenv.org.uk
 - BRE – www.bre.co.uk
 - Building Control Northern Ireland – www.buildingcontrol-ni.com
 - Centre for Alternative Technology (Machynlleth, Wales) – www.cat.org.uk
 - Northern Ireland Planning Service – www.planningni.gov.uk
 - Planning Portal – www.planningportal.gov.uk
 - Scottish Government (for planning and building standards) – www.scotland.gov.uk
 - Northern Ireland Environment Agency – www.ni-environment.gov.uk
 - Sustainable Development Commission – www.sd-commission.org.uk
 - Building Services Research and Information Association (BSRIA) – www.bsria.co.uk
 - Chartered Institution of Building Services Engineers (CIBSE) – www.cibse.org
 - Carbon Trust – www.carbontrust.co.uk
 - Committee on Climate Change – www.theccc.org.uk
 - Communities and Local Government – www.communities.gov.uk
 - Department of Energy and Climate Change – www.decc.gov.uk
 - Generation Homes – www.generationhomes.org.uk
 - Gentoo Group – www.gentooogroup.com
 - T-Zero – www.tzero.org.uk
 - Local Government Association – www.lga.gov.uk
 - Wolseley Sustainable Building Centre – www.wolseleysbc.co.uk
 - Construction Industry Research and Information Association – www.ciria.org
 - Flood Support microsite – www.floodresilienthome.com
 - Environment Agency – www.environment-agency.gov.uk.floodresilienthome.com
 - Climate Change Act (2008) – www.opsi.gov.uk
 - Energy Performance Certificates – <http://epc.direct.gov.uk>
 - Climate Change and Your Home: www.climatechangeandyourhome.org.uk
 - WUFI building performance simulation software - www.wufi-pro.com/
 - Energy Saving Trust – www.energysavingtrust.org.uk
 - Historic Scotland – www.historic-scotland.gov.uk
 - Department of Energy and Climate Change – www.decc.gov.uk
 - Feed-in tariffs – www.fitariffs.co.uk
 - Microgeneration Certification Scheme – www.microgenerationcertification.org
 - Renewable Energy Association – www.r-e-a.net
 - Renewable Energy Centre – www.therenewableenergycentre.co.uk
 - Renewable Heat Incentive Scheme – www.decc.gov.uk
 - Solar Trade Association – www.solar-trade.org.uk
 - Building Research Housing Group – www.brhg.org.uk
 - Existing Homes Alliance – www.existinghomesalliance.org.uk
 - Generation Homes – www.generationhomes.org.uk
 - Good Homes Alliance – www.goodhomes.org.uk
 - Great British Refurb Campaign – www.greatbritishrefurb.co.uk
 - Old Home SuperHome – www.sustainable-energyacademy.org.uk
 - Boiler Efficiency Database (SEDBUK) – www.boilers.org.uk
 - National Energy Foundation – www.nef.org.uk
 - UK Green Building Council – www.ukgbc.org
 - Green Book Live – www.greenbooklive.com
 - Retrofit Buildings for Climate Change – www.retrofitbuildings.com
 - *Low Carbon Transition Plan*, Innovation and Growth Team, 2010: www.bis.gov.uk/constructionigt
- Websites useful for sustainable building maintenance:**
- English Heritage – www.english-heritage.org.uk,
 - Historic Scotland – www.historic-scotland.gov.uk
 - Society for the Protection of Ancient Buildings – www.spab.org.uk

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ACTION	BY WHOM?	“COULD”, “SHOULD”, OR “MUST”	IS THIS ACTION MEASURABLE? IF SO, HOW?	COMMENTS & POINTS FOR DISCUSSION
1. All buildings should have an operations and maintenance manual which is subject to regular updates.	Property owners/ developers/ contractors	Must	Set a target date for number of units required against number issued. Research is required to indicate that buildings with manuals perform better in terms of Kg CO ₂ . If so, the CIOB can use research to encourage best practice.	Building Regulation Approved Documents L1A @ L1B (section 6) L2A & L2B (section 7) now contain guidance on the operation and maintenance of all building types to limit the use of fuel and power to no more than that is reasonable
2. By 2015, where possible, all existing domestic/commercial properties should have cavity wall insulation installed and roof insulation meeting current 2010 Building Regulations. By 2050 all remaining housing stock should be upgraded to meet current 2010 Building Regulations – to include solid walls.	DECC	Should	EPC/DEC, Data from meter readings and U values – Kg CO ₂ e/m ² /yr. Measure against actual number of properties where work carried in relation to the number required to be upgraded. Set as a percentage. CIOB recognises that current methodologies are evolving according to the latest research available	National Impact Fiscal grants are available including those through energy providers. Finance through the governments “Green Deal” should be available and further details are awaited.
3. Strengthen the requirements of building regulations incrementally and incorporate current published guidance e.g. Code for Sustainable homes, Passivhaus Standards to the regulations.	DCLG	Must	Suggest set a target date to be measured against. Ref Zero Carbon Carbon Compliance 2010; Zero Carbon Hub uses Kg CO ₂ e/m ² /yr.	National Impact
4. Introduction of guidance equivalent to the Code for Sustainable Homes for the renovation /alteration of non-domestic properties to aid compliance.	DCLG	Must	Kg CO ₂ e/m ² /yr Suggest set a target date to be measured against.	
5. By 2013 introduce Smart Metering technology within all buildings.	DCLG, DECC, Utilities	Must – new buildings Should – existing buildings	Set a target for number of units required against number issued. Research early introduction Climate Change Act. 2008 metering by 2018? Kg CO ₂ e/m ² /yr.	National Impact
6. The training and up skilling of all building trade professionals is essential if we are to meet the government’s current energy saving targets. Some form of badging and or registration scheme should be introduced to increase public awareness.	CIC, Trade associations, Media (Commission Programming), All sector skill councils	Must	Measurable by number of schemes in place. Set objective and target date to measure whether industry performing.	Global Impact The introduction of the Green Deal will increase demand for skilled operatives to undertake energy saving work.
7. By 2012, extend annual Display Energy Certificates (DECs) to all non-domestic buildings	DCLG – to include enabling powers in the Energy Bill currently going through Parliament	Must	Kg CO ₂ e/m ² /yr and/ or kWh/m ² /yr. Suggest set a target date to be measured against.	National impact

Kevin Dawson FCI0B and John Edwards FCI0B, March 2011