

CRACKING THE CODE

HOW TO ACHIEVE CODE LEVEL THREE AND ABOVE



SUSTAINABLE
HOMES

BE PART OF THE CHANGE

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Osborne
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Zed Factory

Hastoe Housing Association set up Sustainable Homes in 1996, becoming Sustainable Homes Ltd in 2007.

The team provides training and consultancy services on improving sustainability and environmental performance to anyone involved in the housing sector.

Please note that information and opinions have been gathered together in this document to give general guidance on the Code for Sustainable Homes. They are believed to be correct but Sustainable Homes, Hastoe Housing Association, the Housing Corporation and the other organisations participating in the project cannot accept any liability arising from them. Housing associations and others will need to obtain their own professional advice when implementing schemes or contemplating new arrangements.

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FOREWORD

The Housing Corporation has long been committed to sustainability and is steadfast in ensuring that the homes it funds are built with minimum impacts on the environment, and contribute fully to the well being of current and future communities. It is with this in mind that the Corporation welcomed the launch of the Code for Sustainable Homes in December 2006, as the new environmental standard for new-build homes. The Code provides a clear signpost of the route towards low and zero carbon homes, and is part of a suite of measures to achieve the Government's target of all new homes being zero carbon by 2016.

In supporting the Government in this aim, the Corporation has adopted Code level three as a minimum standard for the 2008 - 11 National Affordable Housing Programme, requiring it on more than 40,000 homes that it will fund annually from 2008.

As with the adoption of the EcoHomes environmental standard in 2003, the Housing Corporation is proud to continue to lead the way in sustainable design and build. However, it is recognised that the move from EcoHomes to Code level three will be demanding, especially with the introduction of new minimum standards for energy and water. In addition the new standard will need to be delivered in a climate of increased cost efficiency.

In order to assist the sector in meeting the challenges posed, the Corporation has commissioned Sustainable Homes to develop this best practice guide on the Code for Sustainable Homes. The guide aims to be a useful resource for social landlords in meeting Code level three and beyond, acting as a companion guide to the formal Code Technical Guidance. The guide explores the rationale, structure and coverage of the Code in a user friendly way, focusing on key issues for compliance. It also provides a series of exemplars of schemes already accredited against the Code, or incorporating Code equivalent standards. These include the first homes to achieve Code levels five and six.

We hope that this guide provides valuable support to those involved in making the Code a reality.

Richard Hill
Director of Investment
The Housing Corporation



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EXECUTIVE SUMMARY

The Code for Sustainable Homes is a new tool to assess the environmental performance of new-build homes. It enables housing developers from the public and private sectors to measure and improve the design specification and construction quality of schemes against a unified nationally recognised rating, providing impetus for a step-change in sustainable home building practice.

The Code contributes to the achievement of sustainable development, which aims to provide a better quality of life, now and for future generations. The Code assists this by reducing the environmental impacts of the construction and use of our new homes, particularly the reduction of CO₂ emissions and climate change. The global and policy context for the Code is constantly changing, with the introduction of many legislative drivers for increasing sustainability in the construction sector from the international community, Europe and central Government. In particular, the Code will play a role in achieving the Government's commitment to the Kyoto Protocol which requires a 20% reduction in CO₂ by 2010 and the Energy White Paper target of a 60% reduction in CO₂ by 2050.

The Code is a major tool in the delivery of the Government's target for all new homes to be zero carbon by 2016. From April 2008 all schemes funded by the Housing Corporation will need to be compliant with Code level three, and English Partnerships is also requiring this level as a minimum for schemes. The Homes and Communities Agency is due to be established in late 2008/2009. Code level three will continue to be a minimum for homes built to the HCA. Some sites, the

zero carbon sites, will be built at the far higher standards of zero carbon. Communities and Local Government has given the HCA a role in trailblazing zero carbon.

For the private sector, central Government is driving uptake by encouraging assessment against the Code, and are expected to require compliance with key aspects of the Code through amendments to the Building Regulations in future years. From May 2008 all homes will need to state whether a Code rating has been sought.

This guide can help housing associations and developers to kick-start the process of attaining Code ratings, and complements the formal Code for Sustainable Homes Technical Guidance. It provides:

- an overview of the key issues covered by the Code standard and the major changes it poses relative to EcoHomes standards;
- recommendations and prompts for compliance with the Code process at different Code levels;
- indicative costing information for meeting Code requirements, particularly in attaining Code level three; and
- case studies for the first homes in the country to be accredited against the Code, and some examples of existing schemes that meet the equivalent of Code levels for energy.

A brief summary of the recommendations

- Above all, ensure that you are familiar with the Code process.
- A key factor of the Code process is early planning. It should be incorporated at the start of the design and specification process.
- The team established to deliver the development is also a critical factor. Ensure that the team is established early and includes all the skills and understanding necessary to deliver the scheme. The appointment of the Code Assessor is particularly important.
- Ensure that high levels of communication are maintained throughout the development.
- The scheme should be underpinned by a strong design brief, which states explicitly the requirement to achieve the desired Code rating, and specifies the Code credit areas you wish to cover.
- The achievement of Code ratings is reliant on the quality of your supply chain. Invest some time early on in sourcing the right suppliers and products, and requesting the correct documentation to provide evidence for the assessment.
- The cost for achieving Code ratings is an important factor; however a definitive cost for compliance cannot be established, due to the varying factors affecting each and every organisation in delivering the Code. Indicative costs have been established for use as a benchmark.
- Costs will come down and availability of products will become easier as the Code is more widely used.



Introduction

Sustainable Homes has been commissioned by the Housing Corporation to develop this guide, with the aid of an Innovation and Good Practice Grant. The guide aims to provide a detailed overview of the new environmental standard for new-build housing, the Code for Sustainable Homes. The guide is designed to complement the formal Code for Sustainable Homes Technical Guidance from the Building Research Establishment (BRE), providing the key issues covered, and simple recommendations and prompts for compliance. In addition the guide provides a series of case studies on the first homes in the country to be accredited against the Code, along with a couple of examples of existing schemes which meet the equivalent of Code levels for energy.

The latest version of the Code for Sustainable Homes Technical Guidance can be downloaded from www.planningportal.gov.uk.

What is the Code for Sustainable Homes?

The Code for Sustainable Homes originated out of the Sustainable Buildings Task Group of November 2004, which identified the need for a stronger, unified national standard. Originally to have the broader remit of all buildings (new-build and existing), it was gradually pared back to finally launch as the 'Code for Sustainable Homes' in December 2006. Simultaneous with its launch the Government announced the target for all new homes to be zero carbon by 2016, with the Code forming one of the main tools to deliver this. The Code technical guidance was launched in April 2007. The Code is owned by the Communities and Local Government (CLG) department, with the authorship, accreditation and the administration of the Code sitting with BRE.

Why is the Code Important?

By redesigning our homes and how we live in them there is a significant opportunity to reduce the damage we do to the environment. In reducing this damage the Code assists Government to meet national and international objectives. These include the Kyoto Protocol which requires a 20% reduction in CO₂ by 2010 and the Energy White Paper target of a 60% reduction in CO₂ by 2050.

Who Needs to Meet the Standard?

From April 2008 the mandatory environmental standard, for all schemes funded through the Housing Corporation's National Affordable Housing Programme 2008-11, will be compliance with the Code for Sustainable Homes level three. English Partnerships is also requiring Code level three as a minimum for schemes.

The Homes and Communities Agency is due to be established in late 2008/2009. Code level three will continue to be a minimum for homes built to the HCA. Some sites, the zero carbon sites, will be built at far higher standards. Communities and Local Government has given the HCA a role in trailblazing zero carbon.

The Private Sector

Central Government is driving uptake by the private sector by encouraging assessment against the Code, and in future years requiring compliance with key aspects of the Code through those sections which are able to be incorporated into Building Regulations.

In terms of private sector assessment against the Code, the Housing and Regeneration Bill requires that from May 2008 all new homes will need to state whether a Code rating has been sought, as follows:

“A person who is selling a residential property as a new property must supply the purchaser with:

- (a) A sustainability certificate, or
- (b) A written statement to the effect that there is no sustainability certificate for the property”

It is hoped that this will drive some consumers to demand a Code for Sustainable Homes certificate or move developers to seek the certificate in anticipation of demand. The Bill is available to view at: www.communities.gov.uk/housing/strategiesandreviews/housingandregenerationbill/

Government is also progressing with the uptake through compliance with Building Regulations. The following is the projected increase in Building Regulations requirements:

- 2010 - 25% more energy efficient and 50% more water efficient than 2006 standards (Code level three).
- 2013 - 44% more energy efficient and 50% more water efficient than 2006 standards (Code level four).
- 2016 - zero-carbon and 80% more water efficient than 2006 standards (Code level six).

Local authorities are also encouraged by the Government to adopt the Code through the housing allocations of their Local Development Frameworks and through Supplementary Planning Guidance. For instance Havant, a South Hampshire local authority, is preparing to specify Code levels for private sector homes as their preferred option in their Local Development Framework. The following proposals are out for consultation in March 2008:

Up to 2012	Code level three
2012	Code level four
2016	Code level six

What About EcoHomes?

Up until the Code was launched in April 2007, the BREEAM EcoHomes standard from BRE had been the core environmental standard for domestic dwellings. Since 2003 EcoHomes had been the mandatory environmental standard for all social housing schemes accessing Housing Corporation funding. From its launch the Code replaced EcoHomes as the main environmental standard for England, and from April 2008 the mandatory environmental standard for social housing schemes built with Corporation funding will be the Code for Sustainable Homes. However, the Code very much has its roots in EcoHomes.

Schemes that are funded via the Housing Corporation's National Affordable Housing Programme 2006-08 will still be built to EcoHomes Very Good standard. The same applies to those schemes registered with BRE under EcoHomes 2006 by the 5 April 2007 deadline.

EcoHomes will continue in the devolved administrations of Wales, Scotland and Northern Ireland; however they are also considering, or in the process of, working up their own versions of the Code.



Structure and Issues Covered

The Code covers nine categories of environmental sustainability as outlined in Table 1.

TABLE 1: Code categories and weightings

Code category	Weighting	Weighting strength
Energy	36.4%	High
Water	9%	Medium
Surface water run-off	2.2%	Low
Materials	7.2%	
Waste	6.4%	
Pollution	2.8%	
Health & well-being	14%	Medium
Management	10%	
Site ecology	12%	

The Code follows a similar format to EcoHomes in that credits are assigned to each credit area within the categories. To calculate the final score, percentage environmental weightings are applied, devised by a BRE stakeholder group to indicate environmental importance, to turn the credits into points, providing a score out of 100. In this guide credits will denote the value obtained at the first stage. Points denote the total end score.

In Table 1 the weightings have been labelled as a rudimentary indicator of how strong the multiplication factor is. This is not to say that low credit areas should not be addressed, some of them will be cost effective points, however it is a reminder that weightings should be considered when designing schemes.

TABLE 2: Code/EcoHomes rating comparison

Code levels	Total points score out of 100 (equal to or greater than):	EcoHomes score equivalent
Level three	57 points	Very Good
Level four	68 points	Excellent
Level five	84 points	
Level six	90 points	

Table 2 demonstrates the comparison in terms of total scores. As the table shows, there is a similarity between the Code level three and EcoHomes Very Good, in that the total score required is 57 points for the Code, and EcoHomes requires 58 points. This comparison however does hide some changes. The minimum improvements in energy efficiency make the Code significantly more demanding. Code level three requires a 25% improvement over Building Regulations 2006. This significant increase in energy efficiency was encouraged but not required by EcoHomes 2006. The requirement within the Code for these substantial energy reductions makes Code level three homes technically more demanding to build.

Minimum Standards

A key difference from EcoHomes is the inclusion of minimum standards for some categories, as shown in Table 3.

TABLE 3: Increases in energy and water minimum standards to achieve varying Code levels

	1	2	3	4	5	6
Energy (improvement on 2006)	10%	18%	25%	44%	100%	Zero
Water (litres/person/day)	120	120	105	105	80	80
Other credits needed	34	43	47	54	60	65

In addition to minimum energy and water standards, which increase in difficulty with each increase in Code level, the Code has minimum requirements at entry level - Code level one. These requirements are investigated in further detail in chapter three:

- materials;
- surface water run-off; and
- site waste management and household waste management.

The remainder of credit areas are flexible, and can be drawn upon to make up the remainder of the score to achieve Code compliance. There are also additional credits available for going beyond the minimums required in certain categories, such as energy and water.

Main Differences to EcoHomes

The Code is grounded in the EcoHomes methodology, but whilst some credit areas remain unchanged, some significant changes have been made. Table 4 summarises the key differences.

TABLE 4: Key difference between EcoHomes and the Code

EcoHomes	The Code
Site assessment	Individual dwelling assessment
Usually 'design stage' only	Assessed in two stages - design stage and upon completion
Flexible standards in all categories	Fixed minimum standards (thresholds) for some categories
Absolute carbon levels	Energy based on % improvement over Building Regulations
	New points for 'Lifetime Homes'
	Locational credits related to transport and amenities omitted

It is important to note that location credits are no longer included. As a result, this means sites away from public transport or amenities are no longer disadvantaged.



Assessment Process

The Code covers nine categories of environmental sustainability as outlined in Table 1.

Table 4 also illustrates two changes to the assessment process. The assessment process for the Code is essentially the same as the EcoHomes methodology, apart from two key differences:

1. The Code has a mandatory requirement for a post construction review, in addition to the design stage assessment.
2. Each dwelling in a scheme needs to be assessed against the Code criteria, as opposed to the whole site assessment under EcoHomes.

It is important that a licensed Code Assessor is appointed as early as possible onto the design/development team for the scheme. Ideally this should occur at the planning/design stage so that Code compliance can be designed for from day one. The Code Assessor is a valuable member of the team, who will not only be responsible for completing the Code compliance process for the development, but can also assist on which credits should be aimed for and how they can be achieved. A list of current licensed Code Assessors can be obtained from BRE at www.breeam.org or www.greenbooklive.com.

Code Dwelling Types

The change to require all dwellings to be assessed against the Code will significantly increase the number of assessments required for each scheme. To help reduce the number of assessments required, and therefore the cost incurred, the Code does allow dwellings that share identical criteria to be grouped together as **Code Dwelling Types**.

Each type is defined by a unique combination of specifications/credits against each issue, each of which has an individual identification number, known as the 'SPEC ID'. Issues which can be shared include materials used, provision of cycle storage and water efficiency measures. Code Dwelling Types must share the same Ene 1 and Ene 2 credits and share the same specifications for each credit. Some issues will be site level based, and therefore will have one SPEC ID which applies to all dwellings on the site; such issues include local ecology, and construction site issues.

All other issues are either 'Credit Defined' or 'Detail Defined'. The Code Dwelling Type is defined by a unique combination of 'SPEC IDs'. The same Code Dwelling Types means the same combination of SPEC ID must be shared for, amongst others: day lighting; acoustic performance; materials used; water features; and cycle storage facilities.

Design Stage Assessment

The design stage comprises the identification and registration of the site, initial identification of Code Dwelling Types, and assessment of the designs against each credit area with the compilation of evidence required for the credits aimed for. The Code Assessor will assemble this information and submit it as the design stage report to BRE for quality assurance and confirmation of rating. The report can be submitted for an individual unit or a collection of units. At this stage an Interim Certificate of Code Compliance can be issued.

Post Construction Review (PCR)

This is the new compulsory element required under the Code. At this stage the Assessor will check that the credits identified as being obtained at the design stage have been achieved on site. If there are any changes these will be identified and reassessed. The PCR is evidence focused to ensure a fully auditable process. In addition to the collection of evidence there will also be visible inspection through site visits. Examples of evidence include:

- surveys;
- photographs; and
- manufacturers' information.

It is vitally important that the design team compiles evidence of compliance throughout the process. This will save valuable time and cost later. Once the evidence has been assessed and checked by BRE the final Code Compliance Certificate will be issued.



CATEGORY 1 - ENERGY

Structure of Code Energy Requirements

Energy is the most important category in the Code. The 29 credits available under energy are the highest number of credits available of any category. The weighting factor is also high at 36.4%. The next most important category is Health and Well being, with a weighting factor of 14%. The Energy category has nine sub categories, as shown in Table 5.

Summary of Changes Compared to EcoHomes 2006

TABLE 5: Main changes to Energy section

	EcoHomes	Code for Sustainable Homes
Category total	Weighting: 30%	Weighting: 36.4%
Ene 1 Dwelling Emission Rate	Credits available: 15 No mandatory levels. Credits awarded on the basis of improvements in average CO ₂ emissions compared to SAP 2005 standards, measured in kg/m ² /year.	Credits available: 15 (No change) Mandatory levels. There are six mandatory levels, applicable at the following credit ratings rising in difficulty up through the Code. Whereas EcoHomes awarded credits based on a Dwelling Emission Rate (DER) reduction on SAP 2005 standards expressed in kg/m ² /year, Code credits are awarded based on the percentage improvement in the DER over the Target Emission Rate (TER)(defined in Approved Document L1A 2006 Edition of the Building Regulations).
Ene 2 Building fabric	Credits available: 2	Credits available: 2 (No change)
Ene 3 Internal lighting	Credits available: 2 Was Drying Space.	Credits available: 2 (No change) Moved from Ene 5.
Ene 4 Drying space	Credits available: 1 Was EcoLabelled Goods.	Credits available: 1 (No change) Moved from Ene 3.
Ene 5 Energy labelled white goods	Credits available: 2 Was Internal Lighting.	Credits available: 2 (No change) Moved from Ene 4 (EcoLabelled Goods).
Ene 6 External lighting	Credits available: 2	Credits available: 2 (No change)
Ene 7 Low or zero carbon energy technologies	Credits available: 3 Was Pol 4 (Renewable and Low Emission Energy Source)	Credits available: 2 There has been a reduction in credit points available for this issue. Previously EcoHomes awarded one credit for demonstrating and implementing a feasibility study considering renewable and low emission energy, Code standards require a 10% reduction in carbon emissions as a result of this method of supply to attain the first credit. A second credit is awarded for a 15%+ reduction.
Ene 8 Cycle storage	Credits available: 2 Was Tra 2	Credits available: 2 (No change)
Ene 9 Home office	Credits available: 1 Was Tra 4	Credits available: 1 (No change)

Sub-categories Ene 3, 4, 5, 6, 8 and 9 provide relatively uncomplicated credits that could be prioritised. The guidance on these categories is available from the Code for Sustainable Homes Technical Guidance. This guide will focus on the Code categories that are proving to be the most technically demanding - reducing the DER, heat loss parameter and the incorporation of low or zero carbon technologies (Ene 1, Ene 2, and Ene 7).

Ene 1 - Dwelling Emission Rate (Credits Available: 15)

Within the energy category the most important sub-category is Ene 1 where more than half the credits for the entire category can be obtained. This is also the category which has minimum standards at each Code level. For instance, at Code level one, it is compulsory for the home to be 10% more energy efficient than Building Regulations 2006 as shown in Table 6, (one credit is obtained in Ene 1). For Code level two the home needs to be 18% more energy efficient than Building Regulations 2006 (three credits obtained). This process continues up through the Code levels. An increasingly demanding score is required from Ene 1 as designers seek higher Code levels.

It is important to understand a number of definitions in order to come to fully grasp Ene 1. Credits are awarded based on the degree to which the homes estimated CO₂ emissions in kg per m² per annum (the Dwelling Emission Rate - DER) are above the maximum emission rate permitted by Building Regulations (the Target Emission Rate - TER). The 2006 edition of the Building Regulations defines the target emissions rates based on the design of homes. Credits are then awarded in accordance with Table 6.

TABLE 6: Ene 1 Criterion and credits

Criterion		
% improvement of DER over TER	Credits	Mandatory levels
10%	1	Level one
14%	2	
18%	3	Level two
22%	4	
25%	5	Level three
31%	6	
37%	7	
44%	8	Level four
52%	9	
60%	10	
69%	11	
79%	12	
89%	13	
100%	14	Level five
'True Zero Carbon'	15	Level six
Default cases None.		



Code Level Three

A 25% improvement in the DER over the TER is required at Code level three. This is the minimum level required for homes built with Housing Corporation and English Partnership funding. EcoHomes did not have minimum energy standards, this makes Code level three considerably more challenging than EcoHomes Very Good.

Whichever Code level is being sought it is important to improve the performance of the fabric before considering the use of renewables. A very good source of information for improving the fabric performance is the Energy Saving Trust (EST) Best Practice programme, which suggests the following three options:

1. The use of house or multi-house based micro generation including solar thermal, photovoltaics, biomass heating, and air source or ground source heat pumps.
2. For more than 200 homes, consideration should be given to biomass or gas fired combined heat and power systems.
3. Where there is adequate wind available there is a variance on the above two options. For small to medium sized schemes, micro wind may be able to assist with Code levels. For larger schemes a large or medium sized wind turbine on or near the site, where connected with a private wire, may assist. Both these options can achieve competitive or better costs over other solutions for Code compliance.¹ In both instances it is important to monitor for adequate wind prior to development.

This guide will now examine the EST Best Practice Programme recommendations:

1) Energy Efficiency First

One way to significantly reduce the energy load of a house is to follow the EST Best Practice Programme. Three areas that can be focused on to improve the efficiency of the building are: improving air tightness; providing adequate ventilation; and reducing thermal bridging.

Air tightness - reducing the heating load

Air leakage is the uncontrolled flow of air through gaps and cracks in the fabric of dwellings (sometimes referred to as infiltration, exfiltration or draughts). This is not to be confused with ventilation - the controlled flow of air into and out of the dwelling through purpose-built ventilators - that is required for the comfort and safety of the occupants.

Excess air leakage leads to unnecessary heat loss, discomfort from cold draughts and increased energy costs. With more stringent Building Regulations requiring mandatory pressure tests on all new-build dwellings, reducing air leakage, or improving 'air tightness', is an increasingly important issue. The overall air tightness of the finished dwelling depends heavily on getting the original design and specification right. The designer's role is therefore critical.

The Best Practice Programme advises to aim for three air changes per hour when measured at 50 pascals of pressure. This compares with ten air changes per hour for Building Regulations 2006. To achieve this level of performance air tightness has to be considered at every stage of a project's life, inclusive of design, procurement, construction and handover. At an early stage the designer should use construction drawings to identify a physical line through the envelope of the dwelling where the barrier to air leakage will be: this is the dwelling's air barrier. Details that are vital to achieving good air tightness need to be identified at this point. Careful thought must be given to ensure the continuity of the air barrier between all junctions, and that mechanical and electrical sub-contractors' details are also dealt with and provided in sufficient detail (scale of drawing) for interpretation on site.

Some well researched case studies have recently been compiled by EST into a useful guide 'Achieving air tightness in new dwellings: case studies (CE248)'. There are some useful lessons learned from homes built by Osborne Homes and Taylor Woodrow/Redrow Homes to greater air tightness.

Ventilation - providing adequate fresh air

There are two main ways in which ventilation 'uses up' energy. The major one is the continual need to heat up the incoming air (during the heating season) and its subsequent loss as it leaves the building via the purpose-provided openings and air leakage. In addition, any form of mechanical ventilation requires electrical power to operate.

There are various systems that provide ventilation such as passive-stack ventilation; intermittent extract fans/background ventilators, and single room heat recovery ventilation. While these systems are useful they will not provide enough ventilation for a home at three air changes per hour required of EST's Best Practice Standard.

Systems that meet the Best Practice Standards include mechanical extract ventilation and whole house mechanical ventilation with heat recovery. Further information on ventilation systems can be obtained from the EST Guidance 'GPG268: Energy efficient ventilation in dwellings - a guide for specifiers'.

Thermal bridging - reducing the heat load

Thermal bridging occurs when the continuity of the building fabric is broken by the penetration of an element allowing a significantly higher heat loss than its surroundings. These 'bridges' commonly occur around openings such as lintels, jambs, sills, at wall/roof junctions, wall/floor junctions and where internal walls penetrate the outer fabric. Thermal bridges provide a ready passage of heat transfer to the outside air and allow a heat flow entirely disproportionate to their surface area resulting in excessive heat losses.

In order to meet the Best Practice Standard is important to reduce thermal bridging in homes. Thermal bridging can be avoided by: exterior insulation; removing or insulating unnecessary structural elements; and more compact windows. Further guidance on reducing thermal bridging can be found from the BRE information paper IP17/01 'Assessing the effect of thermal bridging at junctions and around openings'.

2) Renewables Second

Following energy efficiency strategies it is important to choose a micro-generation or heat generation technology that works for the scheme. Options include: solar thermal; photovoltaic; wind turbines (following adequate monitoring); ground source heat pumps; biomass stoves; and air source heat pumps.

Flats face a particular issue as they have less space with which to collect renewable energy. Suitable solutions for flats include: community biomass boilers; communal heat pumps; and communal combined heat and power or electric storage heating with photovoltaic shared across storeys.

It is expected that learning will increase in relation to these technologies. Although there is not currently significant widespread knowledge in this area, it is expected that understanding of combined heat and power systems and effective integration of such systems will improve over time in England as the sector grapples with the issue of lower carbon homes. Certainly where over 200 homes are being developed, combined heat and power should be considered.

It is important to consider fuel sources and the storage required for systems such as biomass and combined heat and power. Sometimes this can have a significant impact on the design of the site. A large storage area, sometimes as large as 5m³ can be required for large schemes. The scheme will need access to a large source of fuel into the future and will need to be accessible to large vehicles.

It is also important to fully consider the legal requirements where energy is generated and sold to customers and the associated issues of billing. The London Energy Partnership has recently completed 'Making Energy Service Companies Work'. This may prove a useful reference:

<http://www.london.gov.uk/mayor/environment/energy/partnership-steering-group/docs/making-escos-work.pdf>

The case studies at the end of this guide demonstrate some of the scenarios that will need to be considered at higher levels of the Code. The Greenoak example shows that significant improvements in the fabric (1.5 air changes per



Code Level Three continued.

hour) can achieve the equivalent of Code level three for energy without the need for renewables. The Kingspan and Stewart Milne homes illustrate on the other hand that at higher Code levels it is about an integration of multiple renewable technologies, following extreme air tightness and high efficient ventilation systems. Kingspan for instance utilised:

- 10kW automatic wood pellet boiler (note only 2kW was needed but the smallest on the market at the time was 10kW. This means this boiler could heat four or five homes);
- wood store, filled three times a year;
- 4m² solar hot water to reduce wood resource used in summer; and
- 46m² photovoltaics.

Due to the Code standard still being in its infancy there are no examples of large scale developments fulfilling the standard. It is therefore important to note that flats and sites with wind would provide different solutions. As demonstrated in the costings section of this guide, where wind is available, micro, medium or large scale wind can offer cost effective Code solutions.

For a full summary of the issues to cover when considering renewables you may like to utilise the London Renewables Toolkit - <http://www.lep.org.uk/projects/skills-and-planning.htm>.

Code Level Four

Achieving Code level four requires a significant improvement from Code level three requirements. The minimum requirement for Ene I jumps from a 25% to a 44% improvement over Building Regulations 2006. The different strategies that can be adopted to achieve this level include further improving air tightness or a focus on increasing the size or number of renewables on site. For larger schemes it is useful to note that although there is a large capital cost and significant infrastructure needed, the right combined heat and power systems will enable the automatic reaching of Code level four.

Code Level Five

The step up to Code levels five and six is even larger with a step up from 44% to 100% over Building Regulations. At this point all of the energy needed to power the lights, heat space and water needs to be reduced or generated. This is all the energy that SAP calculates.

Code Level Six

Code level six (a true zero-carbon home) requires the reduction or generation of the energy for cooking and electrical appliances, in addition to those measured by SAP (space heating, hot water heating and lighting).

The definition of a true zero-carbon home is therefore: where net carbon dioxide emissions resulting from **ALL** energy used in the dwelling are zero or better. This includes the energy consumed in the operation of the space heating/cooling and hot water systems, ventilation, all internal lighting, cooking and all electrical appliances. The calculation can take account of contributions from on-site renewable/low carbon installations or off-site renewable contributions where these are additional to existing plans **and** are directly supplied to the dwellings by private wire arrangement.

A 'zero-carbon home' is also required to have a Heat Loss Parameter (covering walls, windows, air tightness and other building design issues) of 0.8W/m²K or less, and net zero CO₂ emissions from use of appliances in the homes (i.e. on average over a year). This is the area that Kingspan found particularly demanding when building their Code level six home.

SAP does not contain any provision for energy consumption of appliances but is likely to be updated to do so in due course. Until SAP is updated, the appliances element of the qualification will be calculated using the formula in the calculation procedures in the Code for Sustainable Homes Technical Guidance to approximate the average appliance energy consumption.

The Government has also announced that they will offer Stamp Duty relief on newly constructed zero-carbon houses. Given the level of technical demands required to build zero-carbon homes it is currently unlikely that many homes will qualify for this relief.

Ene 2 - Building Fabric (credits available: 2)

This credit assesses the thermal performance of the building envelope on its own. Although innovative systems for provision of services to the building may reduce the energy consumption, it is the building envelope that can have the most significant long-term effect, as the envelope is unlikely to be radically altered during its life, other than where extensions are added.

The Heat Loss Parameter (HLP) is a statistic obtained from SAP worksheets, which combines the impact of both external surface area, insulation value of construction and air tightness. Rewarding a lower value for HLP encourages the design of efficient built forms such as flats and terraces as well as increased levels of insulation and air tightness.

Ene 7 - Low Zero Carbon Technologies (credits available: 2)

Where low or zero-carbon technologies are utilised to achieve Ene 1 or meet local authority planning requirements, it is important to note that they are also likely to be attributed one or two credits through this credit area.

Cost Analysis

Cyril Sweett's initial cost analysis for the CLG (April 2007) focused on the development of cost effective solutions to Code level three and Code level four. However, they have undertaken further research and modelling of options for achieving the energy requirements of Code levels three, four, five and six in a paper entitled 'Cost analysis of the Code for Sustainable Homes'.

Analysis was carried out on the carbon savings achieved through application of different technologies to four different dwelling types, built in one of four development scenarios. For each dwelling type a suitable mix of technologies was selected to achieve the required reduction in carbon emissions on a Part L 2006 compliant baseline. The solutions in Table 7 were analysed.

TABLE 7: Carbon saving technologies analysed in the CLG Cost Analysis²

Technology option	Scale (if applicable)	£/unit (min.)	£/unit (max.)	Unit
Solar water heating	Generally 2.8m ² of flat panel collector per dwelling	£850	£850	m ²
PV	Scaled from 0.25kWp to 4kWp per dwelling	£4,200	£4,800	kWe
Biomass heating	Scaled on biomass boiler capacities from 25kW to 1,000kW	£200	£600	kWth
Ground source heat pumps	Scaled on GSHP capacities from 250kW to 500kW	£800	£2,750	kWth
Biomass CHP	Scaled for biomass CHP capacities (large sites)	£3,500	£3,500	kWe
	Scaled for biomass CHP capacities (small City Infill sites)	£16,000	£16,000	kWe
Gas fired CHP	Scaled on CHP capacities from 8kWe to 40kWe	£1,200	£3,400	kWe
	Scaled on CHP capacities over 400kWe	£650	£1,200	kWe
Micro wind	Generally based on 1.5kW unit per dwelling	£2,500	£2,500	kWe
Medium wind	Scaled on basis of units of size 150kW to 600kW	£1,250	£1,500	kWe
Large wind	Scaled on basis of units of size 600kW to 1,200kW	£900	£1,250	kWe

Following application of energy efficiency measures as noted above, the most effective solution on applicable sites was solar thermal systems, apart from flats and urban regeneration schemes which tended to utilise photovoltaics. For a summary of the impact on costs please see tables 25 and 26 of this guide.

² CLG, November 2007. Cost Analysis of The Code for Sustainable Homes Final Report, p.12



CATEGORY 2 - WATER

Summary of Changes Compared to EcoHomes 2006

Table 8 summarises the key areas of the Code Water section that have been amended since EcoHomes 2006.

TABLE 8: Main changes for Water section

Changes	EcoHomes	Code for Sustainable Homes
Weighting	10%	9%
Wat 1 Internal water use	<p>Credits available: 5</p> <p>Credit targets (l/p/d): 1 ≤ 142 2 ≤ 129 3 ≤ 115 4 ≤ 101 5 ≤ 88</p> <p>Flow rates for wash basins & kitchen sink taps: Taken as max flow rate as quoted by manufacturer.</p>	<p>Credits available: 5 (No change)</p> <p>Credit targets(l/p/d) & % reduction from EcoHomes target: 1 ≤ 120 (15.5%) 2 ≤ 110 (14.7%) 3 ≤ 105 (8.7%) 4 ≤ 90 (10.9%) 5 ≤ 80 (9.1%)</p> <p>Flow rates for wash basins and kitchen sink taps: Taken as two thirds of the max flow rate in calculations.</p>
Wat 2 External water use	Credits available: 1	Credits available: 1 (No change)

Please see the Code for Sustainable Homes Technical Guidance for advice on Wat 2.

Wat 1 - Internal Water Use

It is estimated that average consumption of water per person per day is 150 litres³. Credits are awarded as shown in Table 9.

TABLE 9: Water credit areas

Water consumption (litres/person/day)	Mandatory levels	Credits	Available points
≤ 120 l/p/d	one and two	1	1.5
≤ 110 l/p/d		2	3
≤ 105 l/p/d	three and four	3	4.5
≤ 90 l/p/d		4	6
≤ 80 l/p/d	five and six	5	7.5

As the table illustrates, extra credits are awarded for going beyond the requirements of the mandatory levels, for instance at 90 l/p/d, which is not required for Code levels three and four, an extra credit would be obtained, which could contribute towards the overall tradable points a scheme needs to obtain a Code level.

Water consumption is calculated using the 'Code Water Calculation Tool'. It is recommended that this is either created into your own Excel spreadsheet or obtained from a Code Assessor.

³ Source: European Environment Agency

Code Levels Three and Four

Table 10 is an example of how to achieve the Code level three for water.

TABLE 10: Water calculation example⁴

Fitting / installation	Standard spec.	High efficiency spec.	Example source
WC	6 litres/flush	Dual flush 4.5 / 3 litres/flush (4/2 also now WRAS approved)	Tribune SP, manufactured by Imperial Bathroom Products (WRAS approved).
Wash hand basin taps	12 litres/min	1.7 litres/min	Monobloc with spray insert, available from www.greenbuildingstore.co.uk
Shower	14 litres/min	7 litres/min	Generally available (electric showers typically between 4 and 7 litres/minute). Mixer, gravity showers typically around 7 litres and 7 litres/minute low flow shower heads.
Bath	225 litres	140 litre capacity to overflow	Small bath, generally available. Source: Market Transformation Programme, BN DW BATHS: Bath design and efficiency
Kitchen sink taps	12 litres/min	2.5 litres/Min	Monobloc with spray insert, available from www.greenbuildingstore.co.uk
Standard washing machine	49 litres/use		See www.waterwise.org.uk
Standard dishwasher	13 litres/use		See www.waterwise.org.uk

There are other avenues for achieving water efficiency without resorting to water recycling. These include:

- installing water efficient washing machine and dishwasher;
- installing baths that are smaller than 140 litres; and
- not installing a bath - the extent to which this will improve the overall water efficiency will depend on how water efficient the shower is, as the shower will be used more often.

Experimentation with the water calculator will allow the most appropriate specification to be obtained for your consumers and residents. For instance a combination of the above solution options can allow a more powerful shower, which may be more acceptable to some consumers.

Issues to Note - Water Consumption

- The water calculator assumes a standard usage pattern for each person. The total result is determined by the water consumption levels of the specified appliances and fittings.
- It is very important to know the flow rate of the installation being used. Should this not be known, it will be assumed that standard fittings are being used. This will make it very difficult to meet Code level three requirements.
- The use of washing machines and dishwashers must always be assumed, even where neither space nor plumbing is provided.
- Wash hand basin and kitchen sink taps should be taken as two thirds of the maximum flow rate as quoted by the manufacturer, i.e. the flow rate should be multiplied by 0.67 before entry into the water calculator.

⁴ Source: BRE



Code Levels Five and Six

To achieve the consumption levels required of Code levels five and six it is necessary to reach below 80 litres per person per day. To achieve this it will be necessary to use greywater or rainwater harvesting systems. Greywater recycling systems normally collect shower, bath and tap water and recycle this for toilet flushing, and sometimes for use in washing machines. Rainwater recycling systems use collected rainwater typically for toilet flushing and washing machines. Both systems are likely to require some maintenance. Some will require resident training or education. It is important to consider how this will be provided. With rainwater harvesting, for instance, a usual maintenance obligation is a once-yearly service visit like that for a central heating boiler.

Issues to Note - Greywater

- If greywater is only used for flushing the WC, the amount of water deducted for reuse cannot exceed the amount of water required for flushing.
- Some residents may need educating about how the system works; other residents may need reassurance that the water will not infect other water systems in their house.

Issues to Note - Rainwater

- Inside the house, rainwater harvesting systems only require installation of a boiler-sized monitoring and filter system mounted on the wall.
- The tank and pump are installed below ground, eliminating much noise and disturbance.
- A large roof area is needed to collect rainwater and a large storage facility to store the water, usually underground.
- Collection of rainwater can also assist to gain credits in the surface water run-off category of the Code.

Cost of Recycling Systems

Table 11 shows the costs of rainwater and greywater recycling systems are significant for housing when assessed on the basis of a single dwelling. Greywater systems are cheaper than rainwater systems where an in-bathroom unit, such as the Ecoplay system, is used (see Example Products below). In apartments both rainwater and greywater systems are significantly less expensive than in houses (around 50-60% cheaper), reflecting the economies of scale achievable when using single tanks to serve multiple dwellings.

TABLE 11: Costs for water recycling systems⁵

Code level	Litres/person/day	Greywater or rainwater harvesting	Cost
Five - six	80	Houses	£2,520
		Apartments with communal systems	£680

Example Products

Ecoplay Greywater Recycling System

- A greywater recycling system for use in toilets.
- Around 100 units have been installed so far.
- The system has been used in the BRE Innovation Park; the Stoneguard C60 house; Aveda Spas; and 225 homes to be built in Charlton Triangle.
- It complies with all Government regulations and has full KIWA approval.
- It is designed to be maintenance free.
- It has a one-year system and five-year parts guarantee.
- It can be installed by any competent plumber.
- Indicative prices: a system for one WC is around £2000; a system to flush 2 WC's is around £2500.
- For more information see: www.ecoplay-system.com.

Brac Greywater Recycling System (BRAC w200)

- Capacity: 150; 200; 250; 350; 450 litres.
- It is used in BRE Innovation Park's ecoTech ORGANICS house.
- It works at normal household water pressure.
- It has a programmable electronic chlorination system.
- Maintenance includes cleaning the filter every two-three weeks by removing and rinsing, and by flushing the holding tank two-three times per year.
- An indicative price for the system is £925.00 (excluding delivery, VAT & installation)⁶.
- For more information see: <http://www.bracsystems.com/about-us.html>.

⁵ English Partnerships and the Housing Corporation, February 2007. A cost review of the Code for Sustainable Homes

⁶ <http://www.grey-water-recycling.co.uk>



CASE STUDIES OF PRODUCTS IN USE

Barn Park, Fremington, Devon:

What:	11 rain harvesting systems in 37 houses.
Who:	Built for Devon and Cornwall Housing Association.
Specs:	4,000 - 10,000 litre Glass Reinforced Plastic (GRP) tanks; Wisey WFF 100/150 filters, single pumps Multigo (40/08 or 80/12)
Usage:	Estimated 1,536 litres/day in WCs, washing machines and garden taps.
Rainfall:	94,000 litres is the expected annual rainfall collection.
Roof area:	240m ² .
Capital cost:	£3,349 per unit. This was shared across three to four homes.
Payback time:	Estimated as 4.6 years (based on South West Water 2006 tariff 370p/m ³).

A key point to note about the above example is that the capital cost of each system was £3,349. Each system served three to four homes at an average cost of £997 per house. Individual domestic systems cost around £1,800, therefore shared systems offer considerable savings.⁷

Broadclose, Bude Cornwall

What:	13 rainwater harvesting systems serving a mixture of 173 homes (two storey houses, two and three storey apartment blocks)
Specs:	A range of underground GRP Rainwater Holding Tanks from 12,000 - 27,000 litres A range of Underground Rainwater Volume Filters 25 Rainwater Harvesting Systems incorporating electronic control systems and Multigo 40/08 pumps
Average Rainfall:	921mm per annum
Total roof area:	4000 m ²
Rainfall Collection:	3300 m ³ (approximate annual)
Complete capital cost:	£60,000

Note: Small roof area in relation to population served has limited the use to toilet flushing only (35% of a domestic house water consumption)

Estimated payback period (based on water charge total of £4.14m³) - 4-5 years

Cost Analysis

A report by The Environment Agency in January 2007 found that the costs (including VAT) of complying with the Code's water targets were as shown in Table 12.

TABLE 12: Code water compliance costs

Target (l/p/d)	Estimated cost	Extra cost (% increase)
150 *	£508	+ £0 (0%)
130	£677	+ £169 (33.3%)
120	£697	+ £189 (37.2%)
100	£792	+ £284 (55.9%)
80	£3,737	+ £3229 (635.7%)
*Baseline cost		

The study also estimated that costs might reduce in time with a wider take-up of water efficiency measures over the next ten years. Future best case costs (including VAT) were predicted to be the same for the targets of 130, 120 and 100 litres per head per day, and reduced to £884 for compliance at 80 litres per head per day.

CATEGORY 3 - MATERIALS

Summary of Changes Compared to EcoHomes 2006

Table 13 summarises the key areas of the Code Materials section that have been amended since EcoHomes 2006.

TABLE 13: Main changes for Materials section

Major changes	EcoHomes	Code for Sustainable Homes
Category total	Weighting: 14%	Weighting: 7.2%
Mat 1 Environmental impact of materials	<p>Credits available: 16</p> <p>Credits are achieved by obtaining an A to C rating from the Green Guide for Housing Specification, for 80% by area of the element for each of the following elements:</p> <ul style="list-style-type: none"> - Roof - External walls - Internal walls - Upper and ground floors - Windows <p>No mandatory elements.</p>	<p>Credits available: 15</p> <p>Credit calculations are now based on BRE's 2007 interim Green Guide specifications based on an A+ to E rating system as opposed to the A to C system of EcoHomes. A new credit calculation method is also used, allowing a score of between 3 and 0.25 credits per building element depending on whether the proposed specification achieves a A+ to D standard. A total of 15 credits are available with each credit being valued at 0.3% of the overall score.</p> <p>Mandatory element Where at least 3 of the 5 key elements achieve a relevant Green Guide rating (2007) of A+ to D:</p> <ul style="list-style-type: none"> - Roof - External walls - Internal walls - Upper and ground floors - Windows <p>No credits are awarded for fulfilling the mandatory element.</p>
Mat 2 Responsible sourcing of materials - basic external water use building elements	<p>Credits available: 6</p> <p>80% of materials in the basic building elements must be responsibly sourced.</p>	<p>Credits available: 6 (No change).</p> <p>Change - 100% of any timber used in key elements must be legally sourced to attain Code credits.</p>
Mat 3 Responsible sourcing of materials - finishing elements	<p>Credits available: 3</p> <p>80% of materials in the finishing elements must be responsibly sourced.</p>	<p>Credits available: 3 (No change).</p> <p>100% of any timber used in finishing elements must be legally sourced to attain Code credits.</p>



Mat 1 - Environmental Impact of Materials

This section aims to encourage the use of materials with lower environmental impacts over their lifecycle. Mat 1 forms the mandatory element, with minimum standards set at Code level one. The Green Guide 2007 is currently available to licensed Code Assessors and will be available for general publication later in 2008. The calculation procedure at the design stage allows credits to be awarded based on the rating given in the 2007 version of the Green Guide as shown in Table 14.

TABLE 14: Green Guide rating credits

Rating	Credits available
A+	3
A	2
B	1
C	0.5
D	0.25

The following materials are assessed in the calculation of points:

- brick;
- composites;
- concrete;
- glass;
- plastics;
- metals;
- stone;
- timber; and
- plasterboard.

It should be noted that insulation materials, fixings, adhesives and other materials are excluded from the assessment.

Mat 2 - Responsible Sourcing of Materials (Basic Building Elements) and Mat 3 - Responsible Sourcing of Materials (Finishing elements)

These credit areas aim to recognise and encourage the specification of responsibly sourced materials in key building and finishing elements. Six and three credits are available respectively, and these form the flexible element of the materials section. Building elements comprise the building frame, ground floor, upper floors, roof, external walls, internal walls, foundations and substructure and staircase. Finishing elements comprise stairs (handrails, banisters etc), windows, external/internal doors, skirting, panelling, furniture (such as fitted kitchens) and fascias. Compliance is demonstrated through the use of timber certification schemes (such as Forest Stewardship Council) or environmental management schemes (EMS, such as ISO 14001)

Issues to Note

When complying with this section, it is important that evidence is collected for both the design stage and post construction assessments, such as certificates of origin (chain of custody) for timber, and purchase orders/receipts for recycled materials. The credits are not worth a great amount. Should you be seeking these credits try to make it as easy as possible. To make this process easier, this requirement should be stated up front with suppliers early on in the development process.

Case Study - Medbourne 5, Midsummer Housing Association

Medbourne 5 is a £10.5 million development in west Milton Keynes, completed in September 2005. This EcoHomes Excellent scheme comprises 65 one and two bedroom apartments, and two and three bedroom houses for shared ownership (35 allocated for key workers), and 20 two-bedroom apartments and three bedroom houses for rent. The development was chosen as a demonstration project by English Partnerships, acting as an example of renewable and sustainable energy use. The scheme was designed by PRP Architects and constructed by members of Midsummer's strategic partnership, the Atlas project.

The scheme was developed using Midsummer's own design brief, which was carefully evolved from previous projects, harnessing shared learning and practical feedback from the Atlas Project partners and customers, including product suppliers. Where it could, Midsummer avoided the use of quarry products, opting for renewable and recycled products instead. Forest Stewardship Council (FSC) approved timber was used on the whole site and 'A' rated building materials from the Green Guide to Housing Specification were used where possible. Waste on the site was carefully monitored and was recycled wherever possible.

Cost Analysis

- Standard specifications for the roof, external walls, internal walls and floors achieve an A rating (not A+) in the draft Green Guide, an A+ rated specification can be achieved at no cost.
- Window units can be obtained for £140+. It is assumed that a softwood timber window would still achieve the highest (A+) rating.
- In Mat 2 (responsible sourcing of basic materials) five credits are achievable at no cost. The other four credits are achievable at costs of up to £900 per house/flat due to additional costs associated with achieving higher supply chain performance.⁸

CATEGORY 4 - SURFACE WATER RUN-OFF

Summary of Changes Compared to EcoHomes 2006

Table 15 summarises the key areas of the Code Surface Water Run-Off section that have been amended since EcoHomes 2006.

TABLE 15: Main changes for Surface Water Run-Off section

Major changes	EcoHomes	Code for Sustainable Homes
Category total	Weighting: 10% (as part of the Pollution section)	Weighting: 2.2%
Sur 1 Reduction of surface water run-off from the site	Credits available: 2 <i>Was Pol 3 - Reduction of Surface Run-off.</i> No mandatory elements.	Credits available: 2 (No change). Mandatory Elements Ensure that run-off rates and annual volumes of run-off post development will be no greater than the previous conditions for the site.
Sur 2 Flood risk	Credits available: 2 <i>Was Pol 5 - Flood Risk.</i>	Credits available: 2 (No change).

⁸ CLG, November 2007. Cost Analysis of The Code for Sustainable Homes Final Report, p.36



Surface water run-off aims to reduce and delay the run-off from the hard surfaces of a housing development to public sewers. It is a mandatory element carrying two credits. It ensures that peak run-off rates and annual volumes of run-off post development will be no greater than the previous conditions for the site. The attenuation of water run-off to either natural water courses or surface water drainage systems provides percentage peaks as follows:

- 50% in low flooding risk areas;
- 75% in medium flooding risk areas; and
- 100% in high flooding risk areas.

To meet the minimum standards for surface water run-off, housing developments must not have any detrimental effect on the site run-off compared to previous conditions. This includes both the peak rates and annual volumes of run-off. Other points are awarded for sustainable urban drainage systems, including peak-time attenuation and the placing of houses in an area of low flood risk.

Cost Analysis

Table 16 illustrates the costs for different dwelling types for a variety of measures.

TABLE 16: Costs of Surface Water Run Off measured by dwelling type⁹

CLG 2007 Cost-analysis	Cost per house	Cost per flat	Cost per home 2016	Comment
Hard surfaces	No cost	No cost	No change	Use of permeable surfacing.
Roofs	£450	£300	No change	Cost of one swale for every two dwellings.
Flood risk: low risk	No cost	No cost	No change	For development is in low flood risk area
Flood risk: medium/high risk	£16,635	£4,159	No change	Using flood resilient materials on the ground floor; costs for flat based on a four storey block.

CATEGORY 5 - WASTE

Summary of Changes Compared to EcoHomes 2006

Table 17 summarises the key areas of the Code Waste section that have been amended since EcoHomes 2006.

TABLE 17: Main changes to Waste

	EcoHomes 2006	Code for Sustainable Homes
Category total	Weighting: N/A	Weighting: 6.4% Whole new category for Waste with two completely new sub categories Was 2 and Was 3.
Was 1 Household waste storage and recycling	Credits available: 6 <i>Was Mat 4 - Recycling Facilities now in the Code as Was 1.</i>	Credits available: 4 Mandatory elements: Unlike the EcoHomes standard, mandatory elements must now be met. As waste storage provision is already a requirement of Building Regulations these mandatory elements should not be difficult to achieve.
Was 2 Construction site waste management	Credits available: 1 (waste management element). Was included in Man 3 - Construction Site impacts. Credits available: 2 (New Issue*)	Credits available: 2 Expanded to require Site Waste Management Plan (SWMP). Mandatory elements: Provision and implementation of a SWMP. For a development where the cost of construction is less than £200,000, SWMPs are not required and the element will be awarded by default.
Was 3 Composting	Credits available: N/A*.	Credits available: 1 (New Issue*) This issue has no mandatory elements.

Was 1 - Household Waste Storage and Recycling Facilities

What is important to note with this category is that there is a strong minimum requirement. This requires that external containers from a local authority collection service or the minimum capacity as calculated by the Code of Practice for storage and on site treatment of Solid Waste from Building (2005).

Up to four credits are available where enough internal and external storage facilities are provided. Where there is a local authority collection scheme, this negates the need for external storage. Where there is not, adequate external storage is required. This means either a number of large bins within 10 metres of the external door or, for a block of flats, a well managed private recycling scheme. For this issue, at least three of the following recyclable materials must be collected: paper; cardboard; glass; plastics; metals (tins and cans); or textiles (clothes and shoes).

Issues to Note

These credits are not extremely demanding to achieve and can make recycling significantly tidier and easier for residents.



Was 2 - Construction Site Waste Management

This issue recognises the importance of a Site Waste Management Plan on the efficient use of resources during construction and demolition, and to promote the reduction and effective management of site waste. The construction site must comply with the criteria in Table 18.

TABLE 18: Construction waste criteria

Criteria	Credits
<p>Mandatory element: Site waste management A Site Waste Management Plan must be produced and implemented. This will require the monitoring of waste generated on site and the setting of targets to promote resource efficiency in accordance with the specified guidance. Specific targets are not required.</p> <p>Default cases For a development where the cost of construction is less than £200,000, this element will be awarded by default.</p>	Mandatory at all levels
<p>Minimising construction waste The Site Waste Management Plan must include procedures and commitments for minimising waste generated on site in accordance with the specified guidance.</p> <p>AND The Site Waste Management Plan must include procedures and commitments to sort, re-use and recycle construction waste, either on site or through a licensed external contractor.</p> <p>Default Cases: None</p>	I

The Code is looking for constructors to reduce waste. There are varying degrees to which they can do this¹⁰.

1. Complete Checklist 1: Mandatory requirements in relation to monitoring of waste and the setting of targets. While targets have to be set they do not need to be met necessarily, although there is substantial cost advantage to doing so.
2. Complete Checklist 2: Procedures and commitments to confirm the obligation to minimise waste generated on site. This is required as evidence during the design stage to obtain the first issue credit. Some examples of what checklist two requires include:
 - confirmation that waste reduction targets are set, which can be facilitated using BRE's/DTI's Environmental KPI benchmarks figures, available at www.constructingexcellence.org.uk; and
 - procedures and targets for the efficient ordering, handling and storing of materials.
3. Complete Checklist 3a: Confirmation of the obligation to sort and recycle waste. This is required as evidence during the design stage to obtain the second issue credit.
4. Complete Checklist 3b: Procedures and commitments to identify the waste categories that will be sorted and recycled. This is a requirement of the mandatory elements.

¹⁰ CLG, October 2007. The Code for Sustainable Homes Technical Guidance, pp.127-129

CASE STUDIES

Wates - Setting Targets

In July 2006 Wates became the first construction company to commit to stop sending non-hazardous waste to landfill, promising to do so within five years. The Wates Group's stance is outlined in its 'Target:Zero' report, which provides recommendations to industry stakeholders on how to realise this goal at no extra cost:

1. Commit to an achievable but meaningful target and timeframe for waste reduction. Strategic targets have been set for reductions across Wates, leading to zero non-hazardous waste being sent to landfill by the end of 2010. (2006: 40%; 2007: 30%; 2008: 18%; 2009: 9%; 2010: Zero). This decision has quickly led to meaningful reductions, most notably within the Interiors business which has reduced landfill by 70% within three months at no extra cost.
2. Create a consistent approach using existing industry collaboration forums to measure, plan, execute and review how waste on site should deliver valuable transparency.
3. Target over-ordering by including contractors in the earliest stages of a project.
4. Reduce packaging, which can account for as much as 50% of the volume of waste sent to landfill from a site, using innovative approaches from manufacturers and a commitment to educate contractors and subcontractors.
5. Segregate and save via partnering with the waste management industry to enable contractors to change waste from a cost to an opportunity.¹¹

Waste exchange

There are a number of avenues for dealing with waste that allow the use of free facilities, including waste exchange. Free websites are available to assist in this, such as www.whywaste.org.uk (for Yorkshire and Humber region); www.waste-matchers.co.uk (for Staffordshire and the West Midlands); www.eastex.org.uk (for the East of England)

For example, 'Why Waste' provides a free service that offers:

- On-line waste listings allowing the opportunity to register your waste or resource requirements on line or browse through materials wanted and waste available.
- Staff assistance in making exchanges happen.
- On-site visits to assess waste and give advice on options.
- Information on suitable recyclers in conjunction with Recycling Action Yorkshire.¹²

90% of demolition material re-used:

The Liverpool Housing Action Trust's Childwall Housing Project involved the demolition and replacement of eight residential blocks and the creation of 157 new homes and a community facility. Sub-contractors were required to utilise good waste management, including the use of off-site manufactured timber frames, disposal route planning with demolition contractors, reclaiming demolition materials and providing residents with domestic waste segregation facilities. The project was also built to EcoHomes, Secure by Design and Lifetime Homes standards.¹³

¹¹ <http://www.wates.co.uk/uploads/pdfs/Corporate%20Responsibility/Target%20Zero%20Landfil%20Report.pdf>

¹² www.whywaste.org.uk

¹³ www.renew.co.uk; www.wrap.org.uk/docs/ResidentialNew%20Build.pdf



50% waste reduction:

Countryside Properties and Taylor Woodrow are providing over 1,400 new homes at the Greenwich Millennium Village. Specific initiatives were introduced for the first 300 homes to be built to promote waste reduction, including workshops, sustainable procurement policies, use of off-site manufacture, waste segregation and the use of recycled materials and monitoring of waste for landfill.¹⁴

81% overall recovery of materials achieved, including 100% of plasterboard and insulation:

Bovis Lend Lease's £20 million high density residential development of 142 apartments in Cheltenham required sub-contractors to ensure all waste was disposed of correctly. Plasterboard and insulation waste was collected by specialist recycling contractors, with remaining waste processed by a waste management contractor at a waste transfer station. BRE's SMARTStart¹⁵ benchmarking tool was used to record waste levels, with Plasterboard (35%), packaging (18%) and plastics (18%) accounting for the largest waste streams by volume from the weekly average of 53 m³ (17 tonnes) collected.¹⁵

Was 3 - Composting

Please see the Code for Sustainable Homes Technical Guidance for advice on composting.

Cost Analysis¹⁶

Was 1 - Household Waste Storage and Recycling Facilities

- Cost allowance for provision of internal bins: £160 per flat / house (weighting: 2 points / 2 credits).
- Assumed that local authority will provide kerbside collection service: £0 (weighting: 4 points / 2 credits).

Was 2 - Construction Site Waste Management

- Waste Construction Waste Monitor, sort and recycle construction waste: £100 per house / flat (weighting: 2 credits).

¹⁴ www.wrap.org.uk/docs/ResidentialNew%20Build.pdf

¹⁵ <http://www.wrap.org.uk/docs/WRQW%20High%20density%20housing%20development.pdf>

¹⁶ CLG, November 2007. Cost Analysis of The Code for Sustainable Homes Final Report, p.27

CATEGORY 6 - POLLUTION

Summary of Changes Compared to EcoHomes 2006

Table 19 summarises the key areas of the Code Pollution section that have been amended since EcoHomes 2006.

TABLE 19: Main changes to Pollution section

Major changes	EcoHomes	Code for Sustainable Homes
Category total	Weighting: 10%	Weighting: 2.8%
Pol 1 GWP for insulants	Credits available: 1	Credits available: 1 (No change)
Pol 2 NOx emissions	Credits available: 3 Applicable to 95% of the dwellings throughout the site	Credits available: 3 (No change). Applicable to each dwelling type.

There are no minimum standards for the pollution credit area. As shown in table 17 there has only been a minor change to the pollution credits criteria, in line with the Code becoming an individual dwelling assessment. Points are gained for the use of insulating materials that use substances that have a global warming potential (GWP) of less than five. Points are also awarded for low emissions of nitrous oxide from space heating and hot water systems.

Cost Analysis¹⁷

- GWP Insulant: no cost - mineral wool, air blown and several types of rigid insulation comply.
- NOx Emissions <40 mg kWh: £0 No cost; high efficiency boilers meet highest performance standards.

¹⁷ CLG, November 2007. Cost Analysis of The Code for Sustainable Homes Final Report, p.28



CATEGORY 7 - HEALTH AND WELL BEING

Summary of Changes Compared to EcoHomes 2006

Table 20 summarises the key areas of the Code Health and Well-being section that have been amended since EcoHomes 2006.

TABLE 20: Main changes to Health and Well Being section

Major changes	EcoHomes	Code for Sustainable Homes
Weighting	14%	14%
Hea 1 Daylighting	Credits available: 3	Credits available: 3 (No change)
Hea 2 Sound insulation	<p>Credits available: 4</p> <p>Credit targets (Improvement on Approved Document E base):</p> <p>Airborne sound: 1 = 0 2 = 0 3 = +3 4 = +5</p> <p>Impact sound: 1 = 0 2 = 0 3 = -3 4 = -5</p>	<p>Credits available: 4 (No change)</p> <p>Credit targets (Improvement on Approved Document E base):</p> <p>Airborne sound: 1 = +3 3 = +5 4 = +8</p> <p>Impact sound: 1 = -3 3 = -5 4 = -8</p> <p>Please note that unlike EcoHomes standards, there are no points awarded for meeting the Building Regulation sound requirements.</p> <p>Robust Details: Credit criteria can now be met through the use of constructions for all relevant building elements that have been assessed and approved by Robust Details Limited and found to achieve the specified performance standards.</p> <p>For further information see: http://www.robustdetails.com/fileadmin/documents/RDL/pdfs/The_Code_for_Sustainable_Homes_-_Additional_Info_-_WM.pdf</p>
Hea 3 Private space	Credits available: 1	Credits available: 1 (No change)
Hea 4* Lifetime Homes (New credit criteria*)	Credits available: 0 (N/A)	Credits available: 4

There has been no significant change to Hea 1, and Hea 3. This guide will not address those credit areas but will focus instead on the Hea 2 and Hea 4 sub-categories. Neither of these is mandatory but each provides four credits, and is medium weighted.

Hea 2 - Sound Insulation

Hea 2 aims to ensure the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours. Credits are awarded for achieving higher standards of sound insulation than performance standards given in Approved Document E of the Building Regulations as shown in Table 21.

TABLE 21: Sound insulation criteria

Criteria	Credits
Where results are as follows relative to those set out in the Building Regulations Approved Document E (2003/4):	
<ul style="list-style-type: none"> • Airborne sound attenuation values are at least 3dB higher • Impact sound attenuation values are at least 3dB lower 	1
<ul style="list-style-type: none"> • Airborne sound attenuation values are at least 5dB higher • Impact sound attenuation values are at least 5dB lower 	3
<ul style="list-style-type: none"> • Airborne sound attenuation values are at least 8dB higher • Impact sound attenuation values are at least 8dB lower 	4
Default cases:	
Detached dwellings	4
Attached dwellings where separating walls or floors only occur between non habitable rooms.	3

The key point to note is that it is now possible to meet this standard using Robust Standard Details. The precise requirements are “a commitment to use constructions for all relevant building elements that have been assessed and approved by 'Robust Details Limited', and found to achieve the performance standards stated above”.

What this means is that Robust Standard Details need to have tested those specifications and the tests need to show that the credit requirements are met for the 90th percentile of results from the last 100 site tests. In order to determine this, assessors need to visit the Robust Standard Details website which has a list of the specifications and states the number of credits each specification would relate to: <http://www.robustdetails.com/Code-for-Sustainable-Homes-fa62cdf>.

Alternatively this standard can still be met using pre-completion testing based on the normal programme of testing described in Approved Document E for every group or sub-group of houses or flats

It is not the case that both sound-testing and use of Robust Details is required. Provided the materials used meet the Robust Details and the specification is listed on the site, this will be acceptable.

Currently it is difficult to achieve the maximum credits available for sound insulation. Manufacturers of construction systems are currently trying to produce and test products that will consistently meet these standards.



References for Best Practice

- Robust Details Limited - www.robustdetails.com.
- The United Kingdom Accreditation Service (UKAS) - www.ukas.com.
- Association of Noise Consultants (ANC) - www.association-of-noise-consultants.co.uk.

Hea 4 - Lifetime Homes

This is a new credit area. Credits are now available for compliance with all the principles of Lifetime Homes. This offers the opportunity to gain four medium weighted credits. Lifetime Homes standards may require larger plot areas in some developments; however this is required under part M (accessibility) of the Building Regulations.

Some sources of grant funding also require adherence to the principles. For example, the uptake of Lifetime Homes standards is required by English Partnerships, and affordable housing providers are encouraged to utilise the available four additional Code points for Lifetime Homes provision by the Housing Corporation's Design and Quality Standards (D&QS).

D&QS set out the Corporation's requirements and recommendations for all new homes which receive Social Housing Grant (SHG). The performance measure stipulated for the sustainability core performance standard consists of fully meeting a prescribed minimum standard as set out in the Code for Sustainable Homes.¹⁸

Checklist

The Lifetime Homes checklist should be used (by the developer/designer) to check whether the Assessment Criteria have been met. Table 22 gives an overview of the Checklist Points, full details can be found in the Code for Sustainable Homes Technical Guide, and at www.lifetimehhomes.org.uk.

TABLE 22: Lifetime Homes checklist

Hea 4 - Lifetime Homes
Access to dwelling:
1. Car parking: Where this is adjacent to the home, it should be capable of enlargement to attain 3.3m width.
2. Access from car parking: The distance from the car parking space to the home should be kept to a minimum and be level or gently sloping.
3. Approach: The approach to all entrances should be level or gently sloping
4. External entrances: All entrances should be illuminated and have level access over the threshold, and the main entrance should be covered.
5. Communal stairs: These should provide easy access and any lifts should be fully accessible in accordance with specified dimensions.
Inside the home:
6. Doorways and hallways: All should be sufficiently wide to provide easy access to all rooms and accord with specified dimensions.
7. Wheelchair accessibility: There should be space for turning a wheelchair in dining areas and living rooms and adequate circulation for wheelchairs elsewhere in accordance with specified dimensions.
8. Entrance level living room: The living room should be at entrance level.
9. Entrance level bedspace: In houses of two or more storeys, there should be space on the entrance level that could be used as a convenient bed space.
10. WC: There should be a downstairs toilet which should be wheelchair accessible, with drainage and service provision enabling a shower to be fitted at any time.
11. Bathroom and WC walls: Walls in the bathroom and WC should be capable of taking adaptations such as handrails.
12. Lift capability: The design should incorporate provision for a future stair lift and a suitably identified space for a through the floor lift from the ground floor to the first floor.
13. Main bedroom: The design and specification should provide a reasonable route for a potential hoist from a main bedroom to the bathroom.
14. Bathroom layout: The bathroom should be designed for ease of access to the bath, WC & wash basin and meet specified dimensions to provide sufficient space for wheelchair users.
Fixtures and fittings:
15. Window specification: Living room window glazing should begin no higher than 800mm from the floor level and windows should be easy to open/operate.
16. Fixtures and fittings: Switches, sockets, ventilation and service controls should be between 450 and 1200mm above the floor level.



Many of the standards can be absorbed into schemes at little or no cost. Lifetime Homes incorporates 16 design standards which, when incorporated within refurbishment proposals, fall into three cost categories:

1. No-cost improvements

These include changes to the positioning of electrical sockets, switches and radiator controls if they are being replaced as part of the renovations.

2. Low-cost improvements

Improvements that cost only a little extra (£25 - £100) and can include additional hand rails, widening doorways, external lighting, widened and levelled paths. These access items can be incorporated with only a little extra consideration.

3. Higher-cost improvements

Fewer items come into this category of relatively high cost (over £100) but this could include rearrangement of internal walls and services to form a new ground floor WC and/or shower and enlargement of the upstairs bathroom with widened doors if not already considered.

References

There are a number of references for best practice including:

- Lifetime Home Standards - www.lifetimehomes.org.uk.
- Meeting Part M and designing Lifetime Homes 1.0 Edited by Caitriona Carroll, Julie Cowans and David Darton: www.jrf.org.uk/bookshop/details.asp?pubID=181.
- One of the most useful references is the question and answer section provided by the Joseph Rowntree Foundation. This can be accessed at the following link: <http://www.jrf.org.uk/housingandcare/lifetimehomes/questions/questions.asp>. Here there are answers to a number of questions that are sometimes put to Sustainable Homes, including:

Is it difficult to get a different sized door?

No. Most door manufacturers use CAD-CAM to meet any client specification.

Why build Lifetime homes when we now have Part M?

Part M of the Building Regulations relates to accessibility, whereas Lifetime Homes addresses the overall usability of the housing stock. Lifetime Homes will be suitable for older people and for the vast majority of disabled people as well as the non-disabled person, allowing them to have a wider potential market.

Cost Analysis¹⁹

The following are the updated costs from Cyril Sweett report 2008:

Hea 1 - Daylighting

Kitchen: £140

Living room: £150

Comment: Cost allowance for additional glazing (based on needs of typical house); costs for specific houses will vary according to design and size of glazed area.

View of sky: No additional cost, although achieving a view of the sky from all homes requires careful layout.

Hea 2 - Sound insulation

- 3dB: £330 per flat; no cost for detached properties, costs for terraced properties and flats based on costs of testing activities.
- 5dB: £330 per flat; no cost for detached properties; £160 for terraced properties.
- 8dB: No cost for detached properties or flats, at present it is not clear how this performance standard will be achieved (and if it can be achieved with current construction methods).

It is expected that by 2016 a broader range of robust standard details would be in use to avoid the need for sound insulation testing in most circumstances

Hea 3 - Private Space

No cost. Provision already exists in housing and can be designed into apartment blocks.

Hea 4 - Lifetime Homes

Lifetime Homes: £550 per house; £75 per flat.

Comment: Allowance for additional supports/fixing points within partitions and drainage point in first floor toilets.

CATEGORY 8 - MANAGEMENT

Summary of Changes Compared to EcoHomes 2006

Table 23 summarises the key areas of the Code Management section that have been amended since EcoHomes 2006.

TABLE 23: Main changes to Management section

Major changes	EcoHomes	Code for Sustainable Homes
Weighting	10%	10% - There are no mandatory elements in this category
Man 1 Home user guide	Credits available: 3	Credits available: 3 (No change)
Man 2 Considerate Constructors Scheme	Credits available: 2	Credits available: 2 (No change)
Man 3 Construction site impacts	Credits available: 3	Credits available: 2 (but note reinforced commitment on site waste in WAS 2)
Man 4 Security	Credits available: 2	Credits available: 2 (No change) (but note the revision to the Secure by Design assessment)



Man 1 - Home User Guide

There has been no significant change to Man 1 (Home User Guide) and Man 2 (Considerate Constructors Scheme) under the Code. As well as the number of credits available, the assessment criteria have remained the same under the Code as EcoHomes. As before, the Home User Guide offers an effective cost per credit option relying on common data and information across dwelling types, neighbourhood amenities and local services. Once gathered, the information is readily repeated across sites/projects and often across programmes/partnering agreements in terms of model dwelling types.

Presentation formats can also be varied (e.g. DVD and other electronic formats) to maximise interest in the Guide, maximise the Guide's impact on environmental awareness and behaviour change and, combined with e.g. pre-tenancy consultations and resident handbooks, these can have an important role in building relationships, managing expectations and setting standards. Landlords are increasingly working with developers in ensuring that the presentation of the information is accessible and in plain English (with appropriate translation advice), as well as interesting, in being able to make a difference in how the homes are profiled and eventually used.

As with homes for sale, the environmental credentials of a home to let are becoming increasingly important in terms of choice in matters such as fuel costs, affordable water consumption, affordable waste and the ease with which residents can exercise environmental responsibility through recycling, choice of transport etc. The information can also be framed around other initiatives such as healthy living, the support of local economies and community development in the form of consulting on new standards in the way the landlord will manage sites and the properties.

Man 2 - Considerate Constructors Scheme

This remains the same as the EcoHomes criteria. The aim of this credit area is to recognise and encourage construction sites that are managed in an environmentally and socially considerate and accountable manner. The credit requirements are that all dwellings in the development must meet the following criteria:

- Where evidence can be provided to demonstrate that there is a commitment to comply with best practice site management principles, e.g. Considerate Constructors - 1 credit.
- Where evidence provided demonstrates that there is a commitment to go significantly beyond best practice site management principles - 2 credits.

Man 3 - Construction Site Impacts

The main change here is the reduction in the number of credits available, down from three under EcoHomes to two under the Code, although this is result of a re-ordering of categories rather than a dilution of credits. Site Waste Management has been removed from this category and included in the mandatory section Was 2. The reinforcement of responsible waste management in homes and on sites with a higher number of credits available is illustrated in Was 2 above.

Once again the encouragement here is to establish best practice through the application of readily available management tools such as the DTI KPI models and to apply continuous improvement through their applications, and the associated learning and influence on the developer.

As with the Home User Guide and residents exercising choice, there is a by-product for developers in the commercial benefits of being seen to have, and being able to promote, the organisation's environmental credentials. Corporate social and environmental responsibility will enable organisations to prepare for and respond to regulatory shifts, meet stakeholder expectations, maintain and enhance their reputation and grow business in these new markets.

Man 4 - Security

The most significant difference here is the revision of the assessment criteria. EcoHomes required a Secure by Design Certificate for a credit to be awarded and specified security standards on doors and windows for the second credit to be awarded. The Code does not require certification; it awards two credits where the recommendations of the Police Architectural Liaison Officer or Crime Prevention Design Advisor are both sought and incorporated into the design (and verified at the post construction stage). The security standards for doors and windows are no longer specified as a separate award criteria. Developments accessing Housing Corporation funding are required to achieve this credit area through the Corporation's Design and Quality Standards (D&QS) - http://www.housingcorp.gov.uk/upload/pdf/Design_quality_standards.pdf

This is an important response to the concerns within the sector that the blanket requirement for Secure by Design was impractical, and often mitigated against other design aspects and site constraints. Compliance with the standards of 'Section Two - Physical Security' from 'Secured by Design New Homes' allows more flexibility for Police Advisors and developers/landlords alike.

The other important principle here is to ensure that, as with all design influences, the relevant advice is sought at an early stage in the design process.

CATEGORY 9 - ECOLOGY

Summary of Changes Compared to EcoHomes 2006

Table 24 summarises the key areas of the Code Ecology section that have been amended since EcoHomes 2006.

TABLE 24: Main changes to Ecology section

Major changes	EcoHomes	Code for Sustainable Homes
Weighting	15.01%	14%
Eco 1 Ecological value of site	Credits available: 1	Credits available: 1 (No change)
Eco 2 Ecological enhancement	Credits available: 1	Credits available: 1 (No change) Guidance for the Code now makes it explicitly clear that a site visit must be carried out prior to site clearance for this credit to be awarded. The guidance also notes that the report of the Suitably Qualified Ecologist should be prepared using BRE's 'Code for Sustainable Homes Ecology Report Template'.
Eco 3 Protection of ecological features	Credits available: 1	Credits available: 1 (No change)
Eco 4 Change in ecological value	Credits available: 4	Credits available: 4 (No change) Can now be assessed on an individual dwelling basis.
Eco 5 Building footprint	Credits available: 2	Credits available: 2 (No change) Credit requirements for houses, flats or combined sites with houses and flats, are now set out separately. Thresholds have been lowered for the first credit and raised for the second.



The ecology category has the third highest weighting of all the categories in the Code. This means that the nine credits available in ecology count for more in the overall assessment when the Code level is determined. This greater weighting reflects the high importance placed upon ecology by BRE, and the impact that this section can have on the overall environmental performance of a building. Another key aspect of the ecology credits is that four of the five criteria are assessed at a whole site level. This gives scope for undeveloped land within the site boundary to be used for improving the ecological value of a site; therefore gaining a greater number of credits.

The ecology category provides a very cost-effective way to gain credits. The most effective way to gain maximum credits from an ecology assessment is to appoint a 'Suitably Qualified Ecologist' (SQE) to make the ecology assessment. An SQE is defined in the Code guidance, and accredited professionals can be found via organisations such as the Association of Wildlife Trust Consultancies (AWTC) or the Institute of Ecology and Environmental Management (IEEM).

An ecology assessment can usually be synchronised into the timescale of most projects, and the assessment will follow a simple, step-by-step process. When appointing an SQE to undertake an assessment you should be ready to supply plans showing the current site layout, such as a topographical survey, and the landscape proposal, if this is available. If the design has not reached this stage then it can be a good opportunity to discuss the scheme with an ecologist so that ideas can be incorporated at an early stage. With this information, the assessment can begin.

The completed assessment form will clearly show which credits have been awarded, as well as listing the evidence that will need to be submitted to BRE as part of the assessment.

The first step is for an SQE to visit the site prior to clearance works. Whilst there, the SQE will make an assessment of the current ecological value of the site and record all of the information necessary to carry out the rest of the assessment. A site visit also allows the SQE to assess the site context and the quality of the surrounding environment, so that this is adequately considered in the rest of the assessment. If an appropriate ecological survey has already been completed as part of the planning process, then this visit may not be necessary.

Eco 1 - Ecological Value of Site

This credit area rewards developments that make use of previously developed land, but it can still be awarded for vegetated sites on the advice of an SQE, if they can confirm that the land is of low ecological value.

Even if there are features of ecological value, so long as these are retained and adequately protected, the credit can still be awarded. An SQE can help to make the decision on which features have ecological value and give advice on how best to protect them.

Eco 2 - Ecological Enhancement

This credit area requires an SQE to make recommendations for enhancing the ecological value of the site. They will provide a list of key recommendations and a (usually longer) list of additional recommendations. Only a proportion of the additional recommendations need to be adopted. Recommendations will often include simple measures, such as bird boxes and insect hibernacula, which are cost-effective but provide significant environmental gains. For example, on many ground-level projects in London it is appropriate to include features to encourage the Stag Beetle. This species needs dead wood, which can be provided in the form of a 'logger' in an area only as big as 3m², but provides a credit.

Eco 3 - Protection of Ecological Features

If the land has already been defined as having low ecological value, the credit may be awarded by default. The most common ecologically valuable features on development sites are mature trees. It should be noted though, that not all trees are of significant ecological value, and this can be verified by an SQE. Where trees are deemed to be of ecological value, it may be worth retaining them in order to gain this credit.

Eco 4 - Change of Ecological Value of Site

This is where the most credits are available, but in order to achieve maximum credits it is necessary to give careful consideration to how ecology can be included in the scheme. Up to four credits are available for an increase in ecological value, which is calculated by comparing the number of species per area before and after development.

At its simplest, this credit rewards developments that result in an overall increase in green space. If there is no loss in the overall area of green space, then credits can often be achieved by including a certain number of plant species within the existing soft landscaping, and the assessor can advise on how many, and which species to include. For sites where green space will be lost, there are a number of functional and ecologically valuable options to consider. Cellular concrete paving with grass-covered voids (also known as grasscrete or grassblock) can be used in areas subject to heavy loading such as car parks or emergency access. This system can increase the number of plant species on a site and help to reduce storm water run-off.

If you do not have space on the ground, then planted roofs can increase the proportional area of plant species on a development. Various tried and tested options exist, from 'intensive' green roof gardens with shrubs and trees, to 'extensive' green roofs consisting of a pre-seeded layer of low-growing plants. This option is most suitable where weight is an issue. Whichever option is chosen, these are high-impact solutions that bring big environmental and aesthetic gains. There is also an opportunity for cross-compliance, as green roofs can contribute to reducing surface water run-off, potentially gaining credits under the surface water run-off category.

Eco 5 - Building Footprint

This credit area rewards buildings for making the best use of vertical space, which reduces the building footprint area. Up to two credits are available under this assessment, which is the only one of the ecology credits to be awarded at dwelling level. This means that a mix of two and three storey buildings can be used to balance design criteria with credit rewards.

Case study

Every development is unique, so must be analysed for possibilities. By working closely with the landscape architect on a project in Maidstone, Kent, RSK ecologists were able to award full credits for ecology. Through a site visit, RSK were able to confirm that while the site did have mature trees, they were of low ecological value. RSK were able to suggest a range of ecological improvements which the developer was able to adopt, including bat boxes fixed to buildings. By working with the landscape architect, RSK were able to develop a planting scheme that included native species in new boundary hedges and resulted in all four credits being awarded for change in ecological value.

Cost Analysis

Undertaking a Code Assessment is now a more straightforward process using BRE's template reporting form, which helps to keep costs to a minimum. Typical costs for an assessment may range between £700 and £900, where an appropriate ecological survey has already been carried out. The cost of completing an appropriate ecological survey may be around £1,500 for small sites, with costs being adjusted depending on the size or complexity of a site.

The cost of implementing the requirements of ecology credits is usually small when compared with that for other credits. Small items such as bird boxes and insect hibernacula retail for around £30 (the number required will depend on the site layout and the presence of surfaces to which they can be attached). Creating extra green space can be more expensive, with green roofs typically adding £100 per square metre to normal roofing costs (it would be unusual for all units to need a green roof), although creating an area of wildflower meadow on the ground can be much less expensive. These costs usually compare favourably with the cost of achieving credits in other categories.



Residents

It is not enough just to provide sustainably designed and built housing. There is a role for housing associations to educate their residents on how to use, and get the full benefit of, the environmental features which have been incorporated into their homes. This is an issue echoed by the UK Sustainable Development strategy 'Securing the Future', published by the Government in March 2005. In addition to setting out the priorities and objectives for the next 20 years, the strategy has a much greater focus on action and changing people's behaviours, than in previous strategies.

The Code for Sustainable Homes starts to address influencing resident behaviours on how they use their home, through the retention from EcoHomes 2006 of the requirement to provide a Home User Guide in Man 1 of the Management section. However there is scope for housing associations to have more influence in this area. Compliance with the Code, particularly for the higher levels, may start to be a source of conflict for associations, particularly where resident behaviours are being significantly curtailed, for example, in meeting the maximum 80 litres per person per day minimum levels for water use, compared to the 150 litres per person per day current average use.

Behaviour is a crucial element in the achievement of a more sustainable society, with strategies and action plans being no more than words on paper if people cannot be influenced to move to more sustainable ways of life. Research for the 2004 Sustainable Homes publication, 'Green Voices and Choices', showed that residents want to live in environmentally efficient homes, however housing associations may need to invest more time in communicating and educating efficiency measures to residents so that their homes achieve their full potential. Similarly, the Association for the Conservation of Energy (ACE) undertook research on resident behaviour in 2004, with a specific focus on energy efficiency. This resulted in the report 'User Behaviour in Energy Efficient Homes'.

Green Voices and Choices can be downloaded from the Library in 'What We Do' on the Sustainable Homes website (www.sustainablehomes.co.uk) - go to 'Publications'. The User Behaviour report is available to download from www.ukace.org/pubs/reports.htm.

Capital Costs

There have been two substantive costing reports carried out on the Code for Sustainable Homes. Both were undertaken by Cyril Sweett Sustainability Consultants. The first was published in January 2007 and found that the average increase in cost to shift a home specification from EcoHomes Very Good to Code level three was two to six percent, depending on house type and solution. Cyril Sweett have recently been commissioned by Communities and Local Government to revisit this work, focusing on the increase between Building Regulations 2006 and Code rated homes.

In the report, Cyril Sweett, with all the caveats about ensuring technology suits the site, record that the more cost effective technologies to be used are likely to be solar thermal to reach Code level three, apart from flats which may need photovoltaics. Following this, at higher code levels, is the use of photovoltaics and biomass heating or biomass combined heat and power to gain Code levels five and six. Of course each site has its own demands. It is important to consider what is right for your mix of properties, your site, your customers and your access to renewable energy.

Table 25 summarises the expected costs on sites that achieve some ecology and some low flood risk credits (from page 31, 32 and 33 of the Cost Analysis of the Code for Sustainable Homes report). None of these costs include the use of small scale wind.

Further research is being commissioned by organizations such as English Partnerships and others. Research and the findings of English Partnerships on carbon challenge sites and tenders are showing costs are significantly lower when zero carbon is delivered at scale. English Partnerships will be sharing their experiences and costs as research and works complete.

TABLE 25: Costs to achieve Code levels, variety of dwellings (wind excluded)

Market town:	Detached home	End terrace	Flat
Code level three	£4,991 (5%)	£5,027 (7%)	£2,922 (4%)
Code level four	£11,733 (13%)	£9,490 (13%)	£6,059 (8%)
Code level five	£22,197 (24%)	£18,738 (25%)	£12,267 (15%)
Code level six	£38,817 (43%)	£31,747 (42%)	£21,251 (27%)

Where it is possible to use medium or large scale wind on or just off site, the CLG report demonstrates that this can provide some cost effective solutions. For instance the achievement of a Code level three end terrace house in a market town scenario is markedly lower.

TABLE 26: Costs to achieve Code levels, variety of dwellings (wind included)

Market town:	Detached home	End terrace	Flat
Code level three	£1,566	£1,137	£1,000
Code level four	£2,600	£2,001	£1,593
Code level five	£3,053	£2,600	£2,600
Code level six	£13,065	£8,771	£8,685

The Future

The requirement for Code level three for new-build homes is just the start. In the new-build sector we will move up the Code levels in future years. There are also increasing calls for development of a Code for existing homes and for a Code for non-domestic homes.

Demand for further efficiency is coming from the way we measure homes. The Code is already making demands on SAP to incorporate more information about energy use. The possibilities of encouraging lower energy consumption in existing buildings will also be investigated.

As the Code is more widely taken up and adopted, the knowledge of how to achieve different Code levels will be tested and learnings will be disseminated amongst house builders. This will lead to pressure on house builders and supply chains to procure the materials needed to reach ever higher levels of the Code, culminating in lower prices through economies of scale.



Some general recommendations for successful Code for Sustainable Homes compliance are:

- Above all, ensure that you are familiar with the Code process. There are areas of the Code where it may be necessary to get expert help from external consultants or suppliers. However a good in-house knowledge of the Code is vital for managing the process and specifying what you require.
- As with EcoHomes, a key factor in the Code process is early planning. The Code should be incorporated at the start of the design and specification process. Considering the implications at the outset can reduce costs and provide solutions to achieving the maximum number of credits.
- The team established to deliver the development is also a critical factor. Ensure that the team is established early and includes all the skills and understanding necessary to deliver the scheme. The appointment of the Code Assessor is essential and, again, should be done at the earliest opportunity. Also ensure that high levels of communication are maintained throughout the development.
- The scheme should be underpinned by a strong design brief, which states explicitly the requirement to achieve Code for Sustainable Homes level three (or above), and even specify the credit areas that you wish to obtain.
- The achievement of the Code is largely reliant on the quality of your supply chain, in sourcing and supplying the correct materials and services (with the relevant evidence base and documentation). Invest some time early on in sourcing the right suppliers and products, and requesting the correct documentation to provide evidence for the assessment.
- The cost for achieving the Code is an important factor; however a definitive cost for compliance cannot be established due to the varying factors affecting each and every organisation in delivering the Code. Indicative costs have been established for use as a benchmark, which will be revised as the Code is used more widely.
- Costs will come down and availability of products will become easier as the Code is more widely used.



Sustainable Homes

Sustainable Homes is a leading consultancy providing training and support to all organisations involved in the design, construction and maintenance of sustainable housing and communities. In particular we can provide training on the Code for Sustainable Homes. The main types of training are:

Code for Sustainable Homes Awareness Training

This one day CPD accredited course, delivered as either an open course or on an in-house basis, enables delegates to increase their understanding of the Code for Sustainable Homes. For housing associations this training helps to identify an outline action plan for preparing for the minimum Housing Corporation requirements. For developers, designers and architects it provides a useful overview of the requirements of the Code. The key areas covered include:

- a detailed insight into the minimum requirement for affordable housing;
- workshops on water and ecology credit areas;
- the Code assessment process;
- the main differences to the EcoHomes standard;
- key issues of compliance; and
- indicative costs.



Code for Sustainable Homes Assessor Training

Sustainable Homes is one of the first organisations outside the BRE to be licensed to run assessor training. The course comprises three days of training followed by a one day examination which, on passing, will result in accredited assessor status.

For more information about both training courses, including available dates, venues and prices, please see page 62 of this guide, or the 'Upcoming Events' section of 'What's New' on www.sustainablehomes.co.uk. Or alternatively photocopy, complete and return the booking form on page 63 of this guide.



Full details of all the services that Sustainable Homes can provide are available on www.sustainablehomes.co.uk.

BRE

The BRE Group is a world leading research, consultancy, training, testing and certification organisation delivering sustainability and innovation across the built environment and beyond. It has developed the Code for Sustainable Homes on behalf of CLG, and the BREEAM family of environmental assessments, including EcoHomes and EcoHomes XB. For further information see: www.breeam.org. For enquires on the Code please contact the BREEAM office via: csh@bre.co.uk.

Energy Saving Trust (EST)

The EST is a non-profit organisation, funded by both Government and the private sector. They are one of the UK's leading organisations set up to address the damaging effects of climate change. Their aim is to cut CO₂ emissions by promoting the sustainable and efficient use of energy. Their Best Practice Programme energy standards for new-build have been adopted into the Code for Sustainable Homes energy category. EST can provide a number of useful case studies and best practice guides on a variety of energy technologies. For more information see: www.est.org.uk.



English Partnerships – Carbon Challenge Hanham Hall, South Gloucestershire.

The English Partnerships Carbon Challenge Initiative was to become an early test bed for the highest level of the Code, delivering a number of cutting edge exemplar environmental developments on strategic sites in their ownership, and to support delivery of these same standards on other sites owned by public sector land owners. Whilst meeting level 6 of the Code, the Carbon Challenge also had to meet aspirations for affordability by striving for an overall target of 50% affordable homes and then still deliver schemes which meet the usual English Partnerships quality standards ensuring that all other crucial aspects of successful place making are not forgotten. The lessons learned from these developments are then to encourage and influence the wider building industry to embrace new standards in their core business, and so gear up to the ten year environmental goals set by Government, becoming in effect trailers for the proposed EcoTowns.

The first Carbon Challenge site is being delivered by Barratt Homes, providing 180 new homes; the first volume solution for reaching level 6 of the Code for Sustainable Homes and as such will revolutionise the way house builders work in the build up to the zero carbon target in 2016. They have utilised a top-flight design team along side their inhouse expertise. HTA and Arups have provided the technical, urban design and sustainability knowledge to enabled the submission of a very thorough proposal that won the project. Barratts have built upon their experiences with the Design for Manufacture, constructing the Green House at the BRE Innovation Park and the EcoSmart Village at Buckshaw, Chorley. They intend to use the techniques gained from these developments alongside Hanham Hall to drive down the cost of achieving Code 6 and be at the forefront of these changes to the industry.

Construction

Providing a very flexible home with great potential for multi functional use and home working, the Barratt houses will be built using Kingspan TEK panels. Seeking to ensure that the building fabric performs at the maximum insulation level and will therefore minimise energy requirements — the external walls will have u-values of 0.11W/m²K and an air tightness performance of approximately 1m³/hr/m²

Energy

Barratt plan to construct an energy centre on site with a biomass boiler to deliver site wide heat and power for all the housing on the development. Excess heat will be delivered to on site glasshouses which will support a local food production enterprise.

Other significant features

The development proposes a site wide urban drainage system which incorporates formal ponds, streams and open swales. This complements the rain water harvesting system that will supply the homes with flushing for toilets and washing machines.

Further Information

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PRE-APRIL 2007 SCHEMES

Due to the Code introducing completely new standards for some categories, particularly energy and water, there are no pre-2007 schemes that meet the Code requirements exactly. However there are a few schemes that meet certain elements of the Code, particularly energy.

RATING:
Code level five
equivalent on energy



BowZED, BOW ROAD, EAST LONDON - PRIVATE DEVELOPMENT

Scheme Summary

BowZED is a development of four flats by Yorklake Ltd with contractor Tower Region, completed August 2004. Designed by Bill Dunster Architects, the designer of BedZED in South London, the scheme demonstrates how a Zero (fossil) Energy Development (ZED) can be delivered on a tight urban site.

Energy

The key priority was creating optimum energy performance and a building that generates as much energy from renewables as it consumes annually. Each flat includes a south-facing terrace and conservatory, which have enough photovoltaic (PV) cells incorporated into the glass to meet at least half of the occupants' annual electricity demand. Large windows provide high levels of daylight, while a 1.5 kWp SwiftTM silent wind turbine mounted on the communal stair tower supplies the other half of the occupants' annual electricity demand. Both the turbine and PV cells export surplus energy generated back to the grid.

The scheme is finished to 'ZEDstandards', which means levels of insulation and thermal mass are such that space heating is redundant. Fitting 'A' grade appliances and induction cooking hobs reduces electrical power demand

further, while such appliances also form an additional heating source. This enables a single 15kW wood pellet boiler to supply the whole block with hot water and back-up heating in winter. Wood-pellet is a zero fossil carbon fuel as it comes from a renewable source and only releases as much carbon as the trees absorbed while growing. A wind-powered ventilation system also uses heat-exchange to re-use heat from outgoing air to warm air coming in.

Resident Benefits

Residents typically do not have a gas bill, with annual electricity bills as low as £60, which may be cancelled out by their share of the energy generated from the solar panels.

Cost

The cost to build BowZED was £250/sqm compared to around £150/sqm for a more conventional house, however the additional costs were more to do with the requirements of the site rather than increased environmental performance. The sale prices for the flats achieved by the developer were better than expected and well above local comparable property, showing there is a healthy appetite for eco-housing in the market place.

Further Information

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GLAZIER'S LANE, GUILDFORD AND DARTMOUTH AVENUE, WOKING - GREENOAK HOUSING ASSOCIATION



Scheme Summary

Greenoak has undertaken two EcoHomes developments. Glazier's Lane consists of 12 semi-detached dwellings and Dartmouth Avenue consists of 14 dwellings in two-storey terraces.

These two developments are the first of a programme that aims to create innovative and desirable homes which:

- Test the limits of sustainability in construction and use;
- Are designed to EcoHomes Excellent and full Lifetime Homes²⁰ standards;
- Are comfortable and convenient for all, plus adaptable to changing needs;
- Are 'future-proof' in allowing for new energy sources and global warming;
- Will be economic to run and maintain;
- Are cost effective to build and achieve measured build quality;
- Provide a high quality environment and sense of place for residents; and
- Create a 'model' for further evaluation, development and replication.

Achieving Excellence

The design and specification of the development was based on best practice for sustainable construction and extends beyond the scope of EcoHomes. The approach taken will maximise lifetime building performance whilst minimising the environmental impacts of construction both on and off-site. Notable features include:

- Closed panel timber-frame with high levels of insulation to walls, floors and roofs, airtight breathing wall construction and generous triple-glazed timber windows.
- Masonry construction has generally been avoided and pile foundations without ground beams employed. These reduce time and cost as well as the amount of spoil.

²⁰ Lifetime Homes, Habinteg Housing Association. Helen Hamlyn Foundation & The Joseph Rowntree Foundation, 1992. www.lifetimehomes.org.uk

RATING:

EcoHomes Excellent

(Energy equivalent to Code level four)

- PVC-free specification throughout using galvanized steel gutters and down pipes, linoleum floor finishes in kitchens and bathrooms, low smoke zero halogen cable insulation, clay drainage below ground, and polyethylene above ground.
- Surface water is all disposed of on site to reduce the load on the sewer system and avoid the risk of flooding - roof drainage is to soakaways and the roads have porous block paving.
- Cross-wall construction with clear-span I-beams and web joists provides complete flexibility for internal arrangement and openings.
- Services are entirely accommodated in ducts and voids to permit easy access for upgrading and renewal and help achieve an airtight construction by avoiding the penetrations in the vapour control layers.
- Mezzanine platforms make use of extra space below the warm roof panels, which form bedroom ceilings.
- Tested airtight shell delivered by timber frame sub-contractor and tested again after the installation of services to ensure effective sealing.
- The homes achieve around 1.5m³/m²/hr, which compares with the future Building Regulations standard of 10m³/m² hr.
- Post-completion sound testing also demonstrated performance up to 10dB better than standard.
- Improved air quality is provided by whole house/heat recovery ventilation systems that provide fresh air continuously day and night.
- Potentially hazardous products are avoided by using formaldehyde-free board products and natural paints, stains and floor finishes.
- Waste minimisation through rationalised design, on-site waste management and recycled demolition materials on brownfield sites.

It has not proved viable to use on-site renewable energy sources. However allowance has been made for these to be incorporated as circumstances change, for example service routes for solar collectors, space for thermal store, etc. Although gas fired heating has been included, this was principally driven by the need for affordable domestic hot water. It is expected that little use will be made of this for space heating. It is not expected that condensing gas boilers will be replaced in these homes in 10-15 years time. Experience of tenants in use will inform the approach, which may include for example, CHP and solar hot water. In future developments the association would like to make greater use of recycled materials, and to improve their supply chain with less reliance on imported products.

Both schemes are in sustainable locations and have been built on local authority owned sites to meet their specific local needs. Cycle stores are provided to the front of houses to encourage their easy use. Both sites benefit from recycling schemes to complement segregated domestic waste storage. Although the Guildford development is in a rural location, it is served by mains gas and public transport.

Cost

Dartmouth Avenue build cost - £1,309/m².

Glazier's Lane build cost - £1,590/m²

Lessons Learned

- The energy consultant was employed from the outset to guide the energy strategy.
- Key supply chain members were identified early and considerable emphasis was placed on quality testing.
- Care was taken to employ a general contractor who identified with the aim of producing a project with minimum environmental impacts.
- The crucial importance for success was the early integration of sustainability in the design.
- All sub-contractors need to identify with the aims of sustainable construction in order that the necessary care is taken over construction and specification.
- There is a need for training on site to achieve an airtight construction.
- Particular difficulties were identified as:
 - The weak market in timber frame contractors interested in or able to producing high-performance quality-tested units.
 - Sourcing sustainable and slightly unusual materials.
 - Sourcing high performance elements locally, such as joinery, ventilation, and sanitary goods.

The next development of 12 terraced and semi-detached houses is due on site in Horsham, Sussex in February 2008. This development builds on the experience of the previous schemes and seeks to rationalize the specification, reduce costs whilst achieving Level 4 of the Code for Sustainable Homes. Improved windows to PassivHaus standard and solar hot water panels are provided. Two homes are equipped with an air to water heat pump which provides heating, hot water and heat recovery ventilation all in one cost effective package.

Further Information

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POST-APRIL 2007

THE OSBORNE DEMONSTRATION HOUSE

When the Code was first introduced in April 2007 it was an untried standard on site. To remedy this and to provide exemplars for the housing sector, a range of properties were built on the BRE Innovation Park to varying Code levels. These properties were the first to be assessed against the Code rating system. The case studies of these properties are provided in this section.

BRE Innovation Park

The BRE Innovation Park is a valuable new facility for the construction industry, to showcase the latest innovations in construction in full scale. The Park, at the BRE's Watford site, features a number of demonstration properties showcasing Modern Methods of Construction (MMC), near zero-carbon homes, and over 200 different innovative and emerging technologies.

The Innovation Park is sponsored by Communities and Local Government and BERR, (formerly the DTI) and is partnered by eco-TECH, Dupont, Hanson, Kingspan Offsite, Osborne, Open Hub, Stewart Milne Group and Re-Thinking by Willmott Dixon.

To arrange a visit to the Innovation Park, please see www.bre.co.uk/events or contact the Innovation Park team at BRE Watford by calling 0845 22 32 966 or by email innovationpark@bre.co.uk



RATING: Code level four



Scheme Summary

Developed by Osborne for the BRE Innovation Park, the Osborne Demonstration House pushes the boundaries of sustainable affordable housing and supply chain integration. The house was created to demonstrate how homes can be built to extremely high environmental and design standards at reduced costs. The three storey house was constructed by Osborne using structurally insulated panels by Innovare Systems, and was completed in September 2006 after a 12 week build programme involving over 60 supply chain partners. The build exceeds current Part L requirements for carbon emissions by 40% and needs two thirds less energy for heating and cooling than a house constructed to 2006 Building Regulations. The energy bills for the house are estimated to be just £150 a year.

Construction

The house uses the latest technology in modern methods of construction with:

- a zinc and slate clad cassette roof that requires no trusses or rafters;
- off-site manufactured bathroom pod and door sets;
- a plug-together wiring system; and
- timber I-beam floor joists.

Energy

The energy strategy for the house was to reduce demand, maximise renewable energy and use any fossil fuel as efficiently as possible. The house design was considered on an holistic approach: thermal insulation, ventilation, cold bridging and heating systems, whilst demonstrating family

living with a typically conventional layout. The building's design consultants, Baily Garner, WSP and Tully De'Ath, have incorporated a range of energy saving measures, including:

- high levels of insulation (walls with U-values of 0.15 W/m²K or better);
- under floor heating;
- solar hot water heating; and
- a heat recovery ventilation system.

The house requires around only one third the energy for space heating and cooling compared to a regular house built to 2006 Building Regulation Standards, and all of these factors contributed strongly towards achieving the Energy credits within the Code.

Other Significant Features

The house has been designed to be flexible and capable of simple adaptation to accommodate changes in occupants' mobility over the years, including an inter-floor wheelchair lift. The bedroom includes a study area to promote home-working, and the house sits within landscaping which has been designed to promote wildlife.

Further Information

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ORGANICS BY ecoTECH SWEDISH HOUSE



Scheme Summary

Swedish house manufacturer, eco-TECH, has developed a two bedroom modular house with a self-contained one bedroom apartment on the ground floor, in the Innovation Park, called 'ORGANICS by ecoTECH'. The house is fully inclusive of IT infrastructure provided by CISCO Systems, and offers an affordable, low maintenance, low energy, sustainable way of living. The houses are supplied in kit form which includes turnkey solutions; ready equipped with all white goods, wireless solutions for home entertainment including remote monitoring and security. The prefabricated central pod was craned into place containing all building services units and appliances, which drastically reduced costs and on-site construction time.

Water

The house meets the water requirements for Code levels five and six at 80 litres per person per day, achieved by the use of flow restrictors and greywater recycling. Flow restrictors on sink and wash basins taps limit flow rates to two litres per minute, with showers restricted to six litres per minute. A 46 litre low-capacity Bette bath is also provided. Toilets are flushed using a BRAC w200 greywater recycling system, which enables the house to achieve Code water requirements by recycling waste water from taps, showers, washing machine and dishwasher. The greywater unit has been placed in the cycle storage area under the external staircase. This minimises the risk of leaks or smells affecting the property, and would also ease maintenance issues for social landlords. For more information see: <http://bracsystems.com/home.html>; http://www.eco-techgroup.com/pdfs/ecoTECH_Technical_Manual.doc.

RATING:

Code level four

(Code level five/six for Water)

Design Flexibility And Robust Standards

The structure of the house is designed so that the load is carried by the external walls, which allows maximum flexibility with the layout and enables easy refurbishment of the dwellings.

Non-load-bearing pods are used to provide pre-finished kitchens, bathrooms, cloakrooms and stairs within the house. The non-load-bearing nature of these pods means that they can sit on a standard floor construction and under the ceiling, which enables the use of Robust Standard Details in apartment construction.

Energy: 50 per cent improvement on Part L1 A 2006

An air-water heat pump provides space heating using energy from the air and supplies constant fresh air to the building. A heat recovery unit recovers a large portion of the energy in the exhaust air. Energy efficient lighting is also used, which can reduce household electricity costs by up to £7 a year for each energy-saving bulb used. Energy-efficient appliances similarly offer additional financial and energy savings.

Renewables

Solar hot water (3.17m² area): this is one of the most cost effective renewable options available, and can provide over half of the domestic hot water requirements over the year.

Reduced Demand

The ecoTECH house which is available to buy today, incorporates the following improvements which substantially reduce space heating requirements:

- fabric U-values of 0.06 to 0.13W/m²K;
- window average U-value 1.3W/m²K;
- thermal bridge-free construction;
- reduce unwanted air leakage to Energy Saving Trust Best Practice levels; and
- whole house mechanical ventilation with heat recovery.

Lessons Learned

- Energy use must be considered from conception to completion: the design must be signed-off before construction starts, and any subsequent changes must be accounted for.
- Avoid complicated house designs and floor layouts; compact designs work best. Try to make the most of the plot, provide ample daylight and choose a good orientation for the house.
- Make sure that the site manager and contractors understand what 'air tightness' is and also carry out checks to ensure that insulation is correctly installed.
- The insulation should be continuous and thermal bridges should be avoided.
- The main heating system should be as efficient as possible, such as an EST recommended condensing boiler, and ideally also run on the cheapest and least polluting fuel.
- For properties off the gas network heat pumps can be an attractive solution. Decorative fires should be avoided as they are inefficient.

The EST provides free technical guidance and solutions to help UK housing professionals design, build and refurbish to high levels of energy efficiency. These solutions cover all aspects of energy efficiency in domestic new-build and renovation. They are made available through the provision of training seminars, downloadable guides, online tools and a dedicated helpline.

Further Information

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EST publications can be obtained free of charge by telephoning the helpline on 0845 120 7799 or by visiting the website at www.est.org.uk/housingbuildings.



THE SIGMA HOME BY STEWART MILNE GROUP



Scheme Summary

Timber frame manufacturers Stewart Milne Group, have developed two four-storey homes on the BRE Innovation Park. The houses are known as Sigma I and II, with the layout of Sigma II being easily converted to a one bedroom flat or work unit on the ground floor level and a three bedroom house above, known as Sigma III. Each house is a 4-5 person, open-plan, split-level town house. One property is fitted out like a show house, whilst the other demonstrates some of the structural features and technology used. The properties are the first to achieve a Code level five rating, and aim to provide a design that is commercially viable for volume produced housing.

Construction

The wall build up is based on a 140 mm closed panel timber frame system. This focuses on the thermal benefits of timber frame construction, in delivering improved levels of fabric performance. The fabric design targeted 0.15 u-value and air tightness of 1. within some areas of the home, a phase material has been used to reduce the risk of overheating. This is a relatively new product and is being tested and researched for the first time in the UK. Of note is the absence of the traditional outer skin of concrete block work within the wall build up, with the use instead of a combination of sustainable timber cladding and a Sto thermal render system. This approach speeds up the build process on site. The build process adopted a higher usage of off-site technologies including pre-made foundations, bathroom pods, floor cassettes and pre-insulated roof cassettes. The pair of homes took just 10 weeks to build from grass to keys.

LEVEL FIVE COMPLIANCE:

Carbon Neutral

The house is designed to be carbon neutral in terms of its space heating, hot water, lighting and ventilation requirements. High performance insulation and triple glazed thermally broken windows make it a highly energy efficient design. The house also includes low energy

RATING:

Code level five

appliances, a secondary high efficiency condensing gas boiler backup, a home office and cycle storage to reduce car travel. The design also maximises the amount of solar gain, although the home can be orientated in any direction.

Low Water Use

Water saving devices, such as low usage shower valves, flow restrictors fitted to the taps and low flush WCs, are used to minimize unnecessary water consumption. The Ecoplay greywater recycling unit takes greywater from taps and showers and cleans and filters it for re-use in flushing WCs. The system is self-monitoring and stores greywater for a maximum of 24 hours before purging the system to ensure that hygiene standards are never compromised. Water (and energy) efficient dishwashers (10 litres of water per cycle) and washing machines (40 litres) are specified. Water butts are provided to collect rainwater from the roof for watering the garden.

Flexible Design

The house is designed with an open-plan layout to suit modern lifestyles. Floor plates are connected onto a core allowing flexibility of sizes and uses of space, allowing the home to change over time along the principles of Lifetime Homes.

Energy

The homes include the following energy efficiency measures:

- increased levels of insulation are used, with a U value of $<0.15 \text{ W/m}^2\text{K}$ achieved for the walls, roofs and ground floor;
- all windows are triple glazed and argon filled achieving a U value of $0.7 \text{ W/m}^2\text{K}$. The windows also allow a generous level of daylight;
- airtight construction techniques used throughout the home is designed to achieve an impressive air tightness value of $1.0 \text{ m}^3/(\text{h.m}^2)$ and reduce heat loss through the building fabric;
- high efficiency mechanical ventilation and heat recovery system is used, where fresh incoming air recoups heat from the extracted air;
- careful use of solar gain;
- solar collectors on the roof of the 'solar chimney' preheat the hot water cylinder;
- the north facing windows allow daylight into the stair and passive ventilation of hot air out in the summer;

- by using the stack effect in the stair, core air can be drawn through the house for cooling;
- wind turbines are attached to each house, exporting electricity to the national grid;
- photovoltaic panels offset the remaining CO_2 associated with space heating, hot water, lighting and other small demand;
- a high efficiency gas boiler is located in the kitchen as a secondary heat source, when required; and
- highly energy efficient appliances have been specified (A and A+ rated).

Energy Usage Monitor Panel (EWGECO)

A prototype version of a user awareness system for energy usage is provided to monitor and display the energy usage for electricity (E), water (W) and Gas (G), and advises the building user accordingly. This is expected to lead to a reduction of the energy load through behaviour change.

Other Features

- Careful selection of materials;
- airborne sound insulation values that are at least 8dB higher than the Building Regulations;
- ecological enhancement of the site;
- internal and external recycling facilities;
- compost bin;
- best practice construction management in reducing waste, low energy usage and recycling;
- designed to Secure by Design standards;
- extensive outdoor spaces have been built into the design at upper levels;
- minimal requirements for wet trades on site, speeding up the build process; and
- the walls are finished with Nutshell Super Eco emulsion which is micro-porous, biodegradable and virtually odour free.

Further Information

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THE LIGHTHOUSE NET-ZERO CARBON HOME



Scheme Summary

This 93.3m², two and a half storey, two-bedroom house is the first house to be awarded the Code level six standard. It has been designed in line with Lifetime Homes and Scheme Development Standards (SDS), and every building material and component used has been specified for its ability to optimise the house design's overall sustainability credentials. The materials used include highly insulated, airtight building fabric which has been designed to provide generous daylight levels and includes effective solar control, together with integrated building services based around a platform of renewable and sustainable technologies. These include water efficiency techniques, renewable energy technologies, passive cooling and ventilation, as well as mechanical ventilation with heat recovery (MVHR).

Construction

The structure of the Lighthouse is a simple barn-like form, derived from a 40° roof accommodating a PV array. The living space uses a timber portal structure so floors can be slotted between the frames or left open as required.

It is constructed using Kingspan Off-Site's TEK[®] Building System, high performance SIPS (structurally insulated panel based system) which provide a high level of thermal insulation and performance: U-values of 0.11W/m²K and air tightness of less than 1m³/hr/m² at 50 Pascals - reducing the heat loss by potentially two thirds of a standard house.

The foundations consist of off-site timber floor cassettes on a ring beam of timber beams supported off the ground level by screw fast pile heads. The piles provide minimal disturbance to the ground and provide suitable supports for domestic scale dwellings.

RATING: Code level six

On-site Renewable Energy:

- 4.7kW, 46m² photovoltaics;
- 10 kW automatic wood pellet boiler - only 2kW needed;
- wood pellet store, filled 2/3 times a year; and
- 4m² solar hot water to reduce wood pellet resource used in summer

Energy

The energy use has been calculated using an adapted SAP method as follows:

- 100% low energy lighting rather than 30%
- 0% secondary heating rather than 10% electrical;
- 88% heat recovery efficiency rather than 66% ;
- specific fan power (SFP) of 0.92 W//s rather than 2 W//s;
- 2940 kWh/yr solar thermal (calculated by manufacturer) rather than 1475 kWh/yr; and
- water heating based on reduced shower water flow rate.

The energy cost of running the Kingspan Lighthouse would be about £31 per year for the wood pellets, assuming wood pellets cost 1.8 p/kWh. The electricity is free, from the sun. In comparison a house of the same size and shape but built to 2006 Building Regulations standards would cost about £500 a year in energy bills.

Further Information

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TABLE 27: The Lighthouse: energy use, CO₂ emissions and fuel costs per year

	Energy use		Carbon Dioxide emissions		Fuel cost	
	kWh/yr	kWh/m ² /yr	kgCO ₂ /yr	kgCO ₂ /m ² /yr	£/yr	£/m ² /yr
Lighting	500	4	0	0	0	0
Other fans and pumps	200	2	0	0	0	0
MVHR fans	400	4	0	0	0	0
Domestic hot water	3000	29	2	0	1	0
Space heating	1700	19	43	0.4	30	0.3
Catering	900	9	0	0	0	0
Occupant electricity use	2100	20	0	0	0	0
Total	8800	83	45*	0.4	31	0.3

* Offset by PV energy exported into grid, in this way, the house is Net-Zero Carbon on an annual basis.

BERR	The Department for Business, Enterprise and Regulatory Reform (Previously DTI)
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method - The BRE's assessment methods and tools designed to help construction professionals understand and mitigate the environmental impacts of developments.
CAD-CAM	Computer-aided design and computer-aided manufacturing
CHP	Combined Heat and Power - The simultaneous generation of usable heat and power (usually electricity) in a single process.
CLG	The Department of Communities and Local Government. (Also known as DCLG)
CO₂	Carbon dioxide
CPD	Continuing Professional Development - The CPD Foundation is a non-profit organisation committed to raising professional standards in property related industries.
CSH	The Code for Sustainable Homes
D&QS	The Housing Corporation's Design and Quality Standards
dB	A unit used to measure the relative intensity of sound, i.e.: Breathing 5 dB, office activity 50 dB, Jet Aircraft during takeoff at a distance of 300 feet 130 dB. ²¹
DER	Dwelling Emission Rate - an estimated value for the actual dwelling based on kilograms of CO ₂ emitted by each square metre of internal area per annum (kg/m ² /yr) arising from energy use for heating, hot water and lighting.
DTI	The Department of Trade and Industry (Now BERR)
EMS	Environmental Management Schemes
EST	Energy Saving Trust
GRP	Glass reinforced plastic
GSHP	Ground Source Heat Pump
GWP	Global Warming Potential - a relative measure of how much a given mass of greenhouse gas prevents the passage of infra-red radiation (i.e. the Earth's heat), thus contributing to global warming.
HLP	Heat Loss Parameter - the total fabric and ventilation heat losses from the dwelling divided by the total floor area (W/m ² K).
kgCO₂/m²/yr	Kilograms of carbon dioxide emitted per square metre per year.
kgCO₂/yr	Kilograms of carbon dioxide emitted per year.
KIWA	An independent organisation specialising in certification and testing.
KPI	Key Performance Indicator
kW	Kilowatt
kWe	Kilowatt-electric - one thousand watts of electric capacity.

kWh	Kilowatt-hour - the basic measure of electric energy generation or use based on a unit of energy equal to 1,000 watt-hours.
kWh/m²/yr	Kilowatt-hours per square metre per year - the measure of energy generation or use per square metre of area per annum.
kWh/yr	Kilowatt-hours per year - the measure of electric energy generation or use per annum.
kWp	Kilowatts (peak) - the maximum possible output of a generator operating under standard conditions measured in kilowatts
KWth	Kilowatt-thermal - a unit based on one thousand watts of heat-supply capacity used to measure the potential output from a heating plant.
l/p/d	Litres per person per day - the water consumption measure used in Code assessments.
m³/(h.m²)	Measurement of air permeability - the volume of air leaking from a building per hour per square metre of building envelope under a specified pressure.
MVHR	Mechanical ventilation with heat recovery
NOx	Nitrogen oxide
PCR	Post Construction Review - a new assessment feature of the Code.
PV	Solar photovoltaic cells
SAP	The Government's Standard Assessment Procedure for Energy Rating of Dwellings; used to demonstrate compliance with Building Regulations for dwellings Part L (England and Wales)
SDS	Scheme Development Standards - SDS set out the Housing Corporation's requirements and recommendations for all housing projects which receive Social Housing Grant (SHG). It is a guide for housing associations and their partners.
SQE	Suitably Qualified Ecologist
SWMP	Site Waste Management Plan
TER	Target Emission Rate - the maximum emission rate permitted by Building Regulations based on kilograms of CO ₂ emitted by each square metre internal area per annum (kg/m ² /yr).
True Zero Carbon Dwellings	Where net CO ₂ emissions resulting from all energy used in the dwelling are zero or better. True Zero Carbon homes are required to have a Heat Loss Parameter of 0.8W/m ² K or less and net zero CO ₂ emissions from use of appliances (i.e. on average over a year). The calculation can take account of contributions from on-site renewable/low carbon installations and off-site renewables where these are directly supplied to the dwellings by private wire arrangement. ²²
W/l/s	Watts per litre per second - a measure of power consumption.
W/m²K	Measure for U-values - heat transfer coefficient expressed in watts per square metre kelvin.
WRAS	The Water Regulations Advisory Scheme - the UK Water Industry's approval scheme.
£/m²/yr	Cost in pounds per square metre per year.
£/yr	Cost in pounds per year

²¹ http://www.illbruck-sonex.com/faq_glossary.php

²² CLG, October 2007. The Code for Sustainable Homes Technical Guidance, p.31

TRAINING DATES

Month	Date	Event	Location	Fee Ex VAT
June	3 & 4	Code Assessor Training (4)	London	£750
	11	Code Awareness	Sheffield	£250
	24, 25 & 26	Code Assessor Training (6)	Leeds	£900
July	1, 2 & 3	Code Assessor Training (5)	London	£900
	3	Code Assessor Exam (4)	London	£450*
	23	Code Assessor Exam (6)	Leeds	£450*
	29	Code Assessor Exam (5)	London	£450*

*(or £350 if booked at same time as Assessor training)

To book, or for information on further dates, contact Sustainable Homes.

Code for Sustainable Homes

In the courses you will obtain:

- A detailed insight into Code level 3 - the requirement for affordable homes from 2008
- Hands on experience with how code weightings work
- Understanding the Code assessment process and costs and case studies
- The main differences from the EcoHomes standard and key issues for compliance
- A CPD Certificate of attendance (if required)



Code Assessor Training

This course provides:

- in-depth training on the code technical manual
- interactive workshops practicing applying the Code for Sustainable Homes
- summary of the assessment process



Code Assessor Examination

An additional day will be required for those wishing to become assessors. This day will include workshops/tutoring on the expanded scope of the Code and an examination. Please note that once qualified your organisation must hold a BREEAM licence agreement in order to carry out Code for Sustainable Homes assessments. A copy of the BREEAM Licence Agreement is available from the BREEAM Office.

In-house courses

Sustainable Homes also offer a range of in house training and consultancy services. In-house day courses are priced from £100 per person with a minimum fee of £700 and a maximum fee of £2000 for up to 25 people.

Bespoke courses

For bespoke courses and events our consultants will speak with you in more detail to determine your objectives, design an outline and forward a fee proposal.

We offer discounts for multiple bookings. Get in touch today!

www.sustainablehomes.co.uk

Please select event type, and write in the date and location details:			
Full day EcoHomes for eXisting Buildings (£250)*		Full day Code for Sustainable Homes training (£250)*	* All prices subject to VAT @ 17.5%
Three day Code Assessor training (£900)*		Code Assessor Exam (£350)* if booked at same time as training	Code Assessor Exam (£450)* if booked separately
Date:			
Location:			
Where did you hear about this training?	(Name of publication / website etc)		

Delegate name(s) & job titles
Contact name
Company
Address
Post code
Phone
email
Signature

TERMS & CONDITIONS

Booking Confirmation - A confirmation of your booking will be sent on receipt of FULL PAYMENT, which can be made by cheque (payable to Sustainable Homes Limited) or BACS (Account No: 2378963 Sort code: 30-98-79) **please ensure you quote ref: SH/training/(event date) plus your company name on all BACS payments.** Please ensure your payment is made **before** the event date, otherwise your booking will not be confirmed.

Cancellation & transfer policy: Code Assessor training - There is a cancellation charge of 50% of the booking fee if cancelled within three weeks of the course start date. This rises to 100% if cancellation is within one week of the course start date.

Course Transfer Fee There is a course transfer fee of £100 per person if transfer is within three weeks of the course start date. This rises to £200 per person if transfer is within one week of the course start date.

Examination Day Cancellation There is a cancellation charge of 50% of the examination fee if cancelled within three weeks of the examination day. This rises to 100% if cancellation is within one week of the examination day.

Cancellation & transfer policy: all other courses - In the event that you need to cancel your booking, please confirm your cancellation in writing (letter or fax). Cancellations made within 10 working days of the event date will be charged the full fee. Transfer of dates may be made, subject to availability, however an admin fee of £30.00 per person will be charged.

Code training / EcoHomes XB training			
No. of delegates	<input type="text"/>	@ £250.00	£
Plus VAT		@ 17.5%	£
Total			£

Please send to Heather Russell by:

Email: hrussell@hastoe.com

Fax: 020 8943 2163

Or post with full payment to:

**Sustainable Homes
Marina House, 17 Marina Place, Hampton Wick
Kingston-upon-Thames, Surrey KT1 4BH**

Tel: 020 8973 0405

Code Assessor training / exam			
No. of delegates	<input type="text"/>	@ £900.00	£
No. of delegates	<input type="text"/>	@ £350.00	£
No. of delegates	<input type="text"/>	@ £450.00	£
Plus VAT		@ 17.5%	£
Total			£

Method of payment (please tick)

- Cheque (enclosed)
- BACS (see note above)
- Please invoice



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