CHAPTER 13: Sustainability

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Functional Requirements

This part of the Technical Manual is provided to give guidance in relation to sustainability and is not intended as a prescriptive Chapter.

13.1 THE CODE FOR SUSTAINABLE HOMES

The Code for Sustainable Homes (CfSH) is the model within England and Wales that is used to improve the sustainability of new homes through reducing carbon emissions by developing sustainable methods of construction. It is part of the Government's continued commitment to address climate change.

The Code measures the sustainability of a home against nine different design categories. There are mandatory and tradable categories within these that allow the client to come up with the best possible solution to suit the property in question.

The CfSH has six different levels which can be met. The levels range from Level 1 which is the lowest through to Level 6 (zero carbon) which is the top level achievable. There are a minimum of points required for each level as shown in Table 1.

Often there is not a specific requirement to achieve a level and a 'nil-rating' certificate can be issued if a Code assessment is not carried out, although specific Code ratings are required for Social Housing schemes and also private housing in certain areas of the country.

Relationship between total percentage points score and Code level	
Total percentage points score (equal to or greater than)	**Code levels**
36 points	Level 1
48 points	Level 2
57 points	Level 3
68 points	Level 4
84 points	Level 5
90 points	Level 6

Table 1: Relationship between total points score and Code level

The CfSH will assess the property against nine different categories. Each category is allocated a number of credits and a weighting factor which then determines how many points are scored. The average weighting factors are shown in Table 2 below and the various sub-categories are analysed in Table 3.

Various sub-categories within each category are mandatory and have to be achieved as a minimum. The optional categories are then used in a trade-off basis to pick up the necessary points required for the Code level in question.

Category	**Credits available**	**Average weighting factor**	**Achievable points**
Energy	31	1.17	36.4
Water	6	1.50	9.0
Materials	24	0.30	7.2
Surface water run-off	4	0.55	2.2
Waste	8	0.80	6.4
Pollution	4	0.70	2.8
Health and wellbeing	12	1.17	14.0
Management	9	1.11	10.0
Ecology	9	1.33	12.0
Total:			**100**

Table 2: Category credit weightings

Summary of environmental categories and issues	
Categories	**Issue**
Energy and CO_2 emissions	**Dwelling emission rate (M)** **Fabric energy efficiency (M)** Energy display devices Drying space Energy labelled white goods External lighting Low or zero carbon (LZC) technologies Cycle storage Home office
Water	**Indoor water use (M)** External water use
Materials	**Environmental impact of materials (M)** Responsible sourcing of materials – basic building elements Responsible sourcing of materials – finishing elements
Surface water run-off	**Management of surface water run-off from developments (M)** Flood risk
Waste	**Storage of non-recyclable waste and recyclable household waste (M)** **Construction waste management (M)** Composting
Pollution	Global warming potential (GWP) of insulants NOx emissions
Health and well being	Daylighting Sound insulation Private space **Lifetime homes (M)**
Management	Home user guide Considerate constructors scheme Construction site impacts Security
Ecology	Ecological value of site Ecological enhancement Protection of ecological features Change in ecological value of site Building footprint

(M denotes mandatory element)

Table 3: Summary of environmental categories and issues

13.1.1 The Code for Sustainable Homes assessment process

- Pre-assessment (optional) is a basic report that can be used as evidence by the developer for planning consent.
- Site registration (required) is the version of the Code in use at the point of registration, and will remain the version that the site is assessed under.
- Design stage assessment (optional) is a process where the CfSH is based upon the design drawings, specification and commitments of the Developer. This will result in an 'interim' certificate. (Developers new to the CfSH may struggle to achieve the desired Code Level if they do not carry out this process).
- Post construction stage (required) is a process based on the confirmation through site records and/or visual inspection resulting in the 'Final' Code for Sustainable Homes certificate of compliance.

All Code for Sustainable Homes Assessors must be accredited to an approved accreditation scheme. These accreditation schemes undertake quality assurance on behalf of DCLG.

13.1.2 Further information and online Code calculator

For further information on The Code for Sustainable Homes and an online code calculator, we refer you to the following website: **http://www.premierguarantee.co.uk/csh-calculator**

13.2 LOW CARBON / LOW ENERGY HOMES

13.2.1 What is zero carbon?

There is currently much debate as to the true definition of zero carbon, but at present, a zero carbon home is defined as meeting a dwelling emission rate to Level 5 of The Code for Sustainable Homes. A Code Level 5 property will have a 100% improvement over a Building Regulations compliant property.

True zero carbon is a home that meets the emission rates to Level 6 of The Code for Sustainable Homes. Code Level 6 properties have 'Zero net CO_2 emissions' which means that all energy consumed in the dwellings including cooking, and appliances is provided or offset by a sustainable or renewable source.

To achieve Level 6 of the Code for Sustainable Homes, the house will need to contain a significant amount of the latest energy saving technologies such as PV, solar and hydro power. These technologies will need to be fitted alongside the other various energy features such as roof, floor and wall structures that have very low U-values to name just a few.

13.2.2 SAP Calculations and EPC

Standard Assessment Procedure, or SAP as it is usually called, is the Government approved method of assessing the energy performance of any new property. A SAP Calculation measures the CO_2 emissions and energy efficiency of a residential unit. The results are used to produce an Energy Performance Certificate. SAP 2009 calculates the typical annual energy costs for space and water heating, and the SAP 2005 model also takes into account lighting.

SAP Calculations and Energy Performance Certificates are mandatory requirements on a new residential development and must be included on any Building Regulation submissions to comply with Part L. EPCs are calculated from the SAP Calculations produced at as-built stage. The calculations also state how much carbon dioxide the dwelling emits and is called the dwelling emission rate. The dwelling emission rate (DER) must be below the target emission rate (TER) for the dwelling.

EPCs show how energy efficient a home is on a scale of A to G. The most efficient homes which will have the lowest fuel bills are in band A. The Certificate also shows on a scale of A to G, the impact the home has on the environment. Better-rated homes should have less impact through carbon dioxide (CO_2) emissions. The Certificate includes recommendations on ways to improve the home's energy efficiency to save you money and help the environment. All newly constructed dwellings must have an EPC to meet the requirements of the Energy Performance in Buildings Directive (EPBD).

13.2.3 Energy efficient dwellings

Energy saving within a house can be designed specifically to meet the type of house lived in (such as a two bed terrace or a five bed detached), so that the people living within that house can get the greatest benefits from the energy saved. Various types of systems can be applied to the dwelling in question to help reduce the energy CO_2 living costs.

13.2.3.1 Typical SAP standards to meet compliance

Table 4 shows the minimum allowable standards for U-values within the different elements of the building shown in the SAP Calculation. The air permeability testing can be given a default reading of $15m^3/h/m^2$ if the air permeability test is not carried out. Otherwise, the reading of $10m^3/h/m^2$ must be met at the as-built stage when the air permeability test is completed. (See Air Tightness and Robustness for definition of air permeability).

These are minimum standards as defined in Part L1a 2010 of the Building Regulations; however, for the dwelling to meet the required DER, improvements to the dwelling over and above these standards may be required. Typical examples of compliant dwellings can be found in Tables 5 to 9.

13.2.3.2 U-value

The U-value is the measurement of heat transmission through a material or assembly of materials. The U-value of a material is a gauge on how well heat passes through the material and the lower the U-value, the greater the resistance to heat, which has a better insulating value.

13.2.3.3 Thermal bridging

Thermal bridging and compliance with Building Regulations require that thermal bridging be taken into account in SAP and SBEM Calculations. The junctions that need to be accounted for include wall-floor junctions, wall-roof junctions, lintels, jambs, sills, intermediate floors, balconies, corners, party walls and other significant junctions. Their effects are expressed in terms of Ψ-values, or linear thermal transmittance values, and, unless they are recognised accredited details, they should be evaluated using thermal simulation software, following agreed conventions and standards.

A standard default value of Ψ-Value 0.15 can be entered into the SAP, although if accredited construction, although details are confirmed, the Ψ-value can be entered manually.

13.2.3.4 Limiting standards

Element	Limiting U-Value
Walls	0.30W/m²k
Floors	0.25W/m²k
Roof	0.20W/m²k
Party walls	Solid / Unfilled no edging / Unfilled edging / Fully filled
Windows, doors and roof lights	2.00W/m²k
Air permeability	10m³/h/m²

Table 4: Limiting standards

The following tables show a typical SAP compliance pass for standard typical dwellings. The typical U-values and limiting factors have been lowered than in table 4, in order that the dwelling meets the required carbon emission standards.

Improved U-Value specification		
Mid floor flat	**U-Value**	**Area**
External wall	0.18W/m²K	60m²
Sheltered wall to corridor	0.17W/m²K	17m²
Party wall	Fully Filled	12m²
Thermal bridging	y Value = 0.08	
External door	1.40W/m²K	2m²
Windows	1.20W/m²K	8m²
Air permeability	7m³/h/m²	
Heating	90% efficient gas combi, with delayed start thermostat and weather compensator	
Low energy lighting	100%	
Result	**Pass**	

Table 5: Mid-floor flat - example of compliance Part L England and Wales 2010

Improved U-Value Specification		
Semi - detached house	**U-Value**	**Area**
Ground floor	0.15W/m²K	48m²
External wall	0.18W/m²K	102.5m²
Ceiling level insulation	0.10W/m²K	48m²
Party wall	Fully filled	53.5m²
Thermal bridging	y value = 0.08	
External door	1.80W/m²K	1.89m²
Windows	1.40W/m²K	10.5m²
Air permeability	8m³/h/m²	
Heating	90% efficient gas combi	
Low energy lighting	100%	
Result	**Pass**	

Table 6: Semi-detached - example of compliance Part L England and Wales 2010

Improved U-Value Specification		
Detached house	**U-Value**	**Area**
Ground floor	0.15W/m²K	48m²
External wall	0.18W/m²K	102.5m²
Ceiling level insulation	0.10W/m²K	48m²
Party wall	Fully filled	53.5m²
Thermal bridging	y value = 0.08	
External door	1.80W/m²K	1.89m²
Windows	1.40W/m²K	10.5m²
Air permeability	8m³/h/m²	
Heating	90% efficient gas combi	
Low energy lighting	100%	
Result	**Pass**	

Table 7: Detached - example of compliance Part L England and Wales 2010

Improved U-Value Specification		
End-terrace house	**U-Value**	**Area**
Ground floor	0.15W/m²K	75m²
External wall	0.20W/m²K	220m²
Ceiling level insulation	0.10W/m²K	75m²
Thermal bridging	y value = 0.08	
External door	1.80W/m²K	1.89m²
Windows	1.40W/m²K	30m²
Air permeability	6m³/h/m²	
Heating	90% efficient gas combi, with time and temperature zone control	
Low energy lighting	100%	
Result	**Pass**	

Table 8: End-terrace - example of compliance Part L England and Wales 2010

Improved U-Value Specification		
Mid-terrace house	**U-Value**	**Area**
Ground floor	0.15W/m²K	48m²
External wall	0.20W/m²K	51m²
Ceiling level insulation	0.10W/m²K	48m²
Party wall	Fully filled	90m²
Thermal bridging	y value = 0.08	
External door	1.80W/m²K	1.89m²
Windows	1.40W/m²K	14.5m²
Air permeability	7m³/h/m²	
Heating	90% efficient gas combi, with a delayed start thermostat	
Low energy lighting	100%	
Result	**Pass**	

Table 9: Mid-terrace - example of compliance Part L England and Wales 2010

13.2.4 Renewable energy reports

Local Planning Authorities may require developments to obtain a percentage of energy from renewable sources which can be shown via a renewable energy report. In preparing energy statements, the following steps are involved:

- Determining the target energy performance of the building compared to Building Regulations.
- Identify the energy saving measures that will be employed to achieve the target.
- Estimate the likely carbon emissions from the building.
- Consider the implementation of low or zero carbon technologies.

13.3 AIR TIGHTNESS AND ROBUSTNESS

The requirements of Part L within the Building Regulations means that new build houses within England have to be tested for air tightness.

13.3.1 What is air leakage?

Air leakage is the uncontrolled flow of air through gaps and cracks in the fabric of a building. Too much air leakage will lead to preventable heat loss and discomfort to the occupants from cold draughts. With the increasing need for energy efficient buildings and also the requirements of Building Regulations, air tightness within a building has become much more of an issue.

13.3.2 Air testing requirements

Air pressure testing is a requirement of Part L of the Building Regulations. Testing is carried out when the properties are finished but unfurnished. The windows must be fitted along with the skirting boards, kitchen and bathroom.

The design air permeability for each dwelling type within a development will be determined by designers as part of the overall DER (Dwelling CO_2 Emissions Rate) calculation produced by the SAP Calculations. The maximum design air permeability allowable is $10m^3/(m^2.hr)$ at 50Pa. If the test result does not meet the requirement, then further testing and remedial works will be required.

An assumed air leakage rate of $15m^3/(m^2.hr)$ at 50Pa can be used if the development consists of two units or less.

The Developer can build to Accredited Construction Details which reduces the number of air pressure tests that will be required.

If Accredited Construction Details are not used, then the number of tests required on a new build development is as per below:

- Four or less dwelling types – one of each to be tested
- Between five and 40 types – test two of each
- Above 40 types – test 5% of each

Houses with low air pressure testing results $<5m^3/(m^2.hr)$ at 50Pa will benefit the homeowner with:

- Lower fuel bills
- Better living conditions
- Environmentally friendly homes

13.3.3 Accredited Construction Details

Accredited Construction Details have been developed to assist the construction industry in achieving the performance standard requirements to comply with Part L of the Building Regulations.

They focus on issues such as insulation and air tightness and help to encourage a common approach to design, construction and testing for new homes.

The details contain checklists which should be used by the Designer, Constructor and Building Control Body to demonstrate compliance with Part L.

13.4 RENEWABLE ENERGY SOURCES

13.4.1 Solar

Solar water heating systems use heat from the sun to warm domestic hot water. A conventional boiler or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.

Advantages

- It is a cheap source of water heating in comparison to other renewables.

Disadvantages

- Reliant on a south un-shaded orientation for optimum results.
- Large cylinder capacities are required.

13.4.2 Solar photovoltaic (PV)

Solar panel electricity systems, also known as solar photovoltaic (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work as they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting.

Advantages

- It has a good pay-back period and reduced installation costs

Disadvantages

- The pay-back is reliant on renewable heat incentives from Local Authorities etc. which may be reduced or withdrawn.
- Installation outlay is still expensive.

13.4.3 Wind turbines

Wind turbines harness the power of the wind and use it to generate electricity. 40% of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines (known as 'micro-wind' or 'small-wind' turbines). A typical system on a site within an exposed area could easily generate power for your lights and electrical appliances.

Advantages

- Ideal for exposed areas of land.

Disadvantages

- Not suitable for urban locations.

13.4.4 Hydro

Use running water to generate electricity, whether it's a small stream or a larger river. Small or micro hydroelectricity systems, also called hydropower systems or just hydro systems, can produce enough electricity for lighting and electrical appliances in an average home.

Advantages

- The source is a constant flow of energy.

Disadvantages

- Reliant on nearby flowing water and is therefore rarely used.

13.4.5 Heat pumps

Ground source heat pumps use the natural energy stored in the earth to heat your home.

Air to water heat pumps are intended to be the sole source of heating and hot water production for the home. Air to water heat pumps use the constant energy available in the air with a refrigerant circuit which allows the temperature to be improved to a suitable level for heating or hot water for the home.

Air to air heat pumps provide heating and cooling for the home. The heat pump includes an outdoor and an indoor unit, which convert latent energy in the air into heat for your home. The outdoor unit extracts the energy in air outside the property. This heat, absorbed by refrigerant solution within the unit, is turned into hot air by the indoor unit and circulated within the property.

Advantages

- Claimed high levels of energy efficiency.
- Can be used to heat and cool a building.

Disadvantages

- Does not generate the same heat output as traditional boilers.
- Building fabric requires high levels of insulation and air tightness for optimum results.