AECB CarbonLite Programme

Delivering buildings with excellent energy and CO_2 performance

VOLUME ONE : AN INTRODUCTION TO THE CARBONLITE PROGRAMME

Version 1.0.0

AECB CarbonLite

CARBON LITERATE DESIGN AND CONSTRUCTION

Contents

Documents which make up the CarbonLite programme

- CLP VOLUME ONE:
  AN INTRODUCTION TO THE CARBONLITE PROGRAMME
- CLP VOLUME TWO:
  PRINCIPLES AND METHODOLOGIES
  Calculating and minimising heat loss and CO_2 emissions from buildings
- CLP VOLUME THREE:
  THE ENERGY STANDARDS
  Performance and prescriptive versions
- CLP VOLUME FOUR:
  STEP ONE DESIGN GUIDANCE
  Silver Standard
- CLP VOLUME FIVE:
  STEP TWO/THREE DESIGN GUIDANCE
  Passivhaus/Gold Standard
- CLP VOLUME SIX:
  INDUSTRY SOLUTIONS
- CLP VOLUME SEVEN:
  DELIVERING THE VISION
  Guidance for clients, developers and the project team
- CLP VOLUME EIGHT:
  THE DESIGN PROCESS
  Guidance for the design team
- CLP VOLUME NINE:
  THE CONSTRUCTION PROCESS
  Construction checklists for builders
- CLP VOLUME TEN:
  OWNING AND OPERATING LOW ENERGY AND CO_2 BUILDINGS
  A guide for building users

AECB
PO Box 32, Llandysul
Carmarthenshire, SA44 5ZA

T: 0845 456 9773

www.aecb.net

The CarbonLite Programme is funded by:

AECB the sustainable building association
CARBON TRUST Making business sense of climate change
Esmée Fairbairn FOUNDATION

Summary of the programme

SECTION 1

Delivering buildings with excellent energy and CO_2 performance requires a step change in our understanding of energy and carbon in buildings. We need to become carbon literate. That is the primary role of the CarbonLite Programme (CLP) – a crash course in carbon literacy.

The CarbonLite Programme is a step-by-step guide to creating and using buildings with low energy use and CO_2 emissions. It is aimed at clients, developers, design teams, builders and building users.

It is designed to fill the gap between the aspiration to deliver buildings with better energy and CO_2 performance and the often more disappointing reality. It explains the reasons for adopting robust, whole building energy standards, and provides straightforward and transparent guidance and advice on how to achieve them. Steps One, Two and Three of the CarbonLite Programme provide solutions to the CO_2 reduction requirements at Levels 4, 5 and 6 of the Code for Sustainable Homes, and are also expected to deliver the performance required by future revisions to the Building Regulations, and by the Code for Non-Domestic Buildings.

SECTION 1

The CLP advisory board consists of:

- Royal Institute of British Architects
- Chartered Institution of Building Services Engineers (CIBSE)
- Construction Products Association
- UCL Bartlett School of Architecture
- National Energy Services
- National Energy Foundation
- In attendance, Homebuilders' Federation

The programme is the brainchild of AECB, the sustainable building association, but benefits from an Advisory Board which represents a broad spectrum of the mainstream construction industry.

We aim:

- To give designers and builders meaningful feedback about design and construction decisions during the design process
- To give building owners and users a degree of confidence in the likely real-world performance of their buildings
- To allow the large-scale real-world energy and CO_2 impacts of widespread adoption of the AECB standards to be predicted with the degree of confidence needed to inform UK energy climate change policy.

The CarbonLite Programme is available to all AECB members who wish to become part of an active, learning network working to dramatically reduce the impact of the buildings sector on climate change. Some of the CLP documents will be available to non-members. Organisations or individuals wishing to participate in the Programme will be welcome to join the AECB and benefit from CLP design guidance and advice.

The CarbonLite Programme consists of:

1. Energy standards
2. Design guidance
3. Software
4. Web-based compendium of products and systems with linked specification clauses
5. Briefing documents
6. Training and education
7. Assessor network and accreditation system
8. Post-occupancy monitoring and reporting formats
9. Monitoring and feedback database
10. Case studies of monitored buildings with web-based Learning Zone

Introduction

SECTION 1

The urgent need to reduce climate change emissions requires the earliest possible action to minimise future cumulative CO_2 emissions. The AECB's CarbonLite Programme is designed to help all those involved in the commissioning, design, delivery and use of low energy and CO_2 buildings make those reductions as quickly and effectively as possible.

The programme recognises that to achieve the aim of creating and successfully operating buildings that deliver real and significant CO_2 reductions is a major challenge in the UK where, until recently, the measured energy and CO_2 performance of buildings has not been high on the political agenda. Now that the government has set a target of 'zero carbon homes' by 2016, and is proposing a similar target for the non-domestic sector by around 2020, the need for expert and detailed guidance backed up by systematic monitoring and feedback is crucial.

The AECB is drawing on the experience and expertise of its members to create an education programme which is distilled in the ten elements of the CLP. At the core of the programme is a set of energy standards for buildings – not just homes, but a range of other building types such as offices, educational buildings and community centres. Around the core is a set of flexible tools to help derive solutions for low energy and carbon buildings.

All three standards - Step One/Silver, Step Two/Passivhaus and Step Three/Gold - lead to such large CO_2 savings that future atmospheric CO_2 concentrations would be markedly reduced if they were applied widely enough and quickly enough. Thus, in the period 2007-2015, three buildings which meet the Silver Standard in full would save more fossil fuel, and reduce CO_2 emissions faster, than one building of the same size which meets the Gold Standard in full.

The energy standards

SECTION 1

The standards aim to be clear, understandable and transparent. They also aim to be buildable and to deliver buildings that are comfortable, healthy and easy to operate. The AECB's standards regulate all the energy consumed in a building. Buildings are to be monitored post-occupancy to establish actual energy consumption. Fulfilling all of these aims is fundamental if we are to make real and significant CO_2 reductions.

The standards are expressed in terms of energy use and CO_2 emissions per square metre and year – measured in kWh and tonnes respectively. Buildings which meet the standards will be warm in winter, cool in summer, have excellent indoor air quality and be affordable to run.

There are two versions of the standards:

i) performance only: expressed in energy and CO_2 emissions, albeit with some limits on U values and air leakage, allowing design freedom or catering for unusual circumstances

ii) prescriptive standards, which spell out the means of delivering to the targets

The AECB has based the framework for supporting its standards on UK and international good and best practice. We believe in developing working methods that predict the actual energy performance of buildings and the resulting CO_2 emissions to a high level of precision.

The standards do not yet take account of the energy and CO_2 embodied in the construction materials and do not determine the choice of materials.

Of the total energy consumed by a building over a 100-year life, embodied energy typically accounts for 5-7% of the total for a building of current UK construction and 8-10% for a dwelling of Passivhaus construction (based on central European-type construction of externally-insulated masonry or concrete walls, heavyweight partitions, concrete intermediate floors and timber roofs). The rest is operational energy.

Some efforts to reduce embodied energy could increase a building's lifecycle energy use. In particular, increasing its thermal capacity may raise its embodied energy but will reduce its operational energy use for heating and for cooling. Proposals to regulate embodied energy could be counterproductive if they lead to buildings which use more energy to heat and cool over their whole lifespan. Equally, appropriate use of more sustainable materials may have a reduced CO_2 impact (including a carbon sequestration potential) and there is nothing to preclude designers from opting for these materials where they can.

Three steps towards near zero energy performance and CO_2 emissions

The energy standards provide three steps for AECB members and others to strive for. On a particular project, they may wish to be pioneers or they may wish to stick to more established technology and avoid perceived risks. The three standards achieved either via the prescriptive or performance route give them the choice of doing either.

Step One: **Silver**

SECTION 1

Silver Standard

A building which meets the AECB Silver Standard includes the following features:

1. Good levels of insulation
2. Minimal thermal bridges
3. Good level of airtightness
4. Effective orientation for winter solar gains and summer cooling
5. Mechanical exhaust-only ventilation or ventilation with heat recovery
6. Heating normally from low-powered gas, oil or LPG fired condensing boiler
7. Lighting by compact fluorescent lamps or similar
8. Electrical appliances normally A+ rated or better
9. A guidebook to explain to users how/why the building differs from many others and how to operate it

The Silver Standard is on a par with the Canadian R-2000 Standard, the German Low Energy Standard and the Swiss MINERGIE Standard. It would probably be met or exceeded by the UK's top 20-50 housing projects, if these were judged on the basis of measured energy performance.

Silver can be summed up as best widely-available technology. It does not push the technological boundaries radically forward but it represents a big advance on normal UK building practice. The very good energy and CO_2 performance is achieved without the addition of renewables or other 'bolted-on' equipment. It is achievable using products and materials which are readily available on the UK market and can be delivered at or very close to current building costs, given care at the design stage.

If it were applied in full to housing, the AECB estimates that it would lead to a 70% reduction in CO_2 emissions versus an average existing dwelling in the stock. The calculated saving applies to a typical house type; i.e., an 80 m2 semi-detached house, using SAP-2005/BREDEM, making realistic assumptions as far as possible.

See also (for instance) the following projects built between 1992 - 2000:

1. Lower Watts House (Oxon). Measured energy use gas 52 kWh, electricity 13 kWh/m^{2}yr in the 1990s with four occupants, now 10 kWh/m^{2}yr with two occupants; total = 62-65 kWh/m^{2}yr;
2. Embleton House (Berks.) Total gas plus elec. use about 75 kWh/m^{2}yr;
3. Garnham Houses (Essex). Total LPG (or oil) plus elec. use about 65 kWh/m^{2}yr;
4. Elizabeth Fry Building, UEA, Norwich. Measured gas use 25-30 kWh/m^{2}yr, initial electricity use 60 kWh/m^{2}yr. Elec. use rose later to 70, due to limited use of electricity-efficient equipment and lighting. In short its thermal efficiency appears to be in line with the Silver Standard but its electrical energy efficiency does not.

By and large, we take the view that individual self-builders constructing one-off houses might regard the Gold Standard as a challenge nowadays, but not the Silver Standard. Appreciable numbers of such buildings have met the Silver Standard for the last 20 years. Likewise, those commissioning small and medium-sized owner-occupied non-domestic buildings could well decide to aim for Gold. So would some Registered Social Landlords (RSLs). Larger-scale developers who are building blocks of flats, housing estates and offices for sale or lease might be more hesitant. At this time, they might prefer to adopt the Silver Standard. Step One is not intended merely as an easy option, for those who could reasonably aim for Step Two or Three. Rather, Step One is an option which is principally aimed at those who have not built to high energy efficiency standards before, and where the project budget, for example, precludes the use of renewable technologies.

Step Two or **Passivhaus**

SECTION 1

Passivhaus Standard

A building which meets the Passivhaus Standard includes the following features:

1. Excellent levels of insulation
2. Minimal thermal bridges
3. Advanced windows
4. Excellent levels of airtightness
5. Effective orientation for winter solar gains and summer cooling
6. Mechanical ventilation with heat recovery and efficient in its use of electricity
7. Space and water heating normally by a highly efficient gas, LPG or oil-fired boiler, supplemented by a solar water heating system
8. Lighting by high efficiency fluorescent lamps
9. Electrical appliances or office equipment normally A++ rated
10. A guidebook to explain to users how/why the building differs from many others and how to operate it

The German Passivhaus Standard (www.passiv.de) is probably the best known standard in Europe. It has not been widely-applied in the UK but a number of projects are underway, some involving RSLs.

Passivhaus maximises the use of energy efficiency technologies. It does not push the technological boundaries radically forward, but it still represents a big advance on normal UK building practice. If it were applied in full to housing, we estimate that it would lead to over an 80% reduction in CO_2 emissions, versus the average for the existing dwelling stock. If it were applied to non-domestic buildings, the reduction in CO_2 emissions, versus the average for the stock of that building type, can often be in the range 75 to 80%.

Overall, Passivhaus corresponds to best international practice in the design of building envelopes, their services and equipment. All the technology is in use somewhere in Europe or North America, albeit not widely. The present leader in meeting the thermal standards is the region comprising Germany, Austria and the German-speaking cantons of Switzerland, where roughly 10,000 buildings met the Passivhaus or MINERGIE P standards by late spring 2007.

Using Passivhaus in the UK should eventually encourage the manufacture of similar technologies in the UK. This should be strongly encouraged but we would need imported products in the early stages; e.g. windows, Mechanical Ventilation and Heat Recovery (MVHR) systems and perhaps highly-insulated hot water tanks.

This should not pose too many barriers. A limited number of certified Passivhaus windows already have UK agents. Several ventilation systems which can in principle be used to meet the standard have UK agents too, as do hot water tanks.

Step Three or **Gold**

SECTION 1

Gold Standard

A building which meets the AECB Gold Standard includes the following features:

1. Excellent levels of insulation
2. Minimal thermal bridges
3. Advanced windows
4. Excellent levels of airtightness
5. Effective orientation for winter solar gains and summer cooling
6. Mechanical ventilation with heat recovery and very efficient in its use of electricity
7. Space and water heating normally from a large solar heating system supplemented by a low-powered gas, oil or LPG fired condensing boiler
8. Lighting by high-efficiency fluorescent lamps
9. Electrical appliances normally A+ rated or better
10. Sufficient on-site electricity generation from renewables to offset the electricity used for lighting, appliances and ventilation
11. A guidebook to explain to users how/why the building differs from normal

Thermally the Gold Standard is almost identical to the Passivhaus Standard (www.passiv.de) or the Swiss MINERGIE P standard (www.minergie.ch). The lower primary energy use reflects savings in space and water heating, cooking, lights and appliances. The lower CO_2 emissions reflect the stronger requirements in particular for energy-efficient electrical appliances/ equipment and a requirement for more electricity-producing renewables.

As a ballpark figure, the CO_2 emissions would be 5% of those of a normal UK building in the stock. This reflects the significance in buildings, which meet high thermal standards, of the CO_2 emissions due to the electricity consumed for lights and appliances. If a Step 3 / Gold Standard building, such as a dwelling or other residential-type building, has gas heating and uses electricity for lights and appliances, approximately one-third of its primary energy is used for space and water heating and two-thirds of it is used for electricity-specific tasks.

Overall, Step 3 / Gold corresponds to best international practice in the design of building envelopes, their services and equipment.

Using the Gold Standard in the UK should encourage the manufacture of similar technologies in the UK. This should be strongly encouraged, but we would need imported products in the early stages; e.g. Passivhaus windows and MVHR systems. This should not pose too many barriers. Several certified windows already have UK agents and some AECB individual members imported products directly from overseas manufacturer(s) before there was a UK agent, because it was a way to meet advanced energy efficiency standards without incurring excessive costs.

Applicability of the standards

The standards are applicable to new detached, semi-detached and row houses; blocks of flats; student residences; care homes; hotels; prisons and small non-residential premises such as village halls, other community buildings, visitor centres, small shops, churches and doctors' and dentists' surgeries. The principles are very similar for all these building types.

The standards may be applied with care to larger non-domestic buildings such as offices and schools. In Germany, some 20 offices, 10 schools and numerous sports halls meet the Passivhaus Standard and many more are at design stage or under construction.

We regard the performance standard as applicable to:

- All residential-type buildings
- Those other non-domestic building categories for which energy benchmarks have been produced by the Carbon Trust. www.carbontrust.co.uk

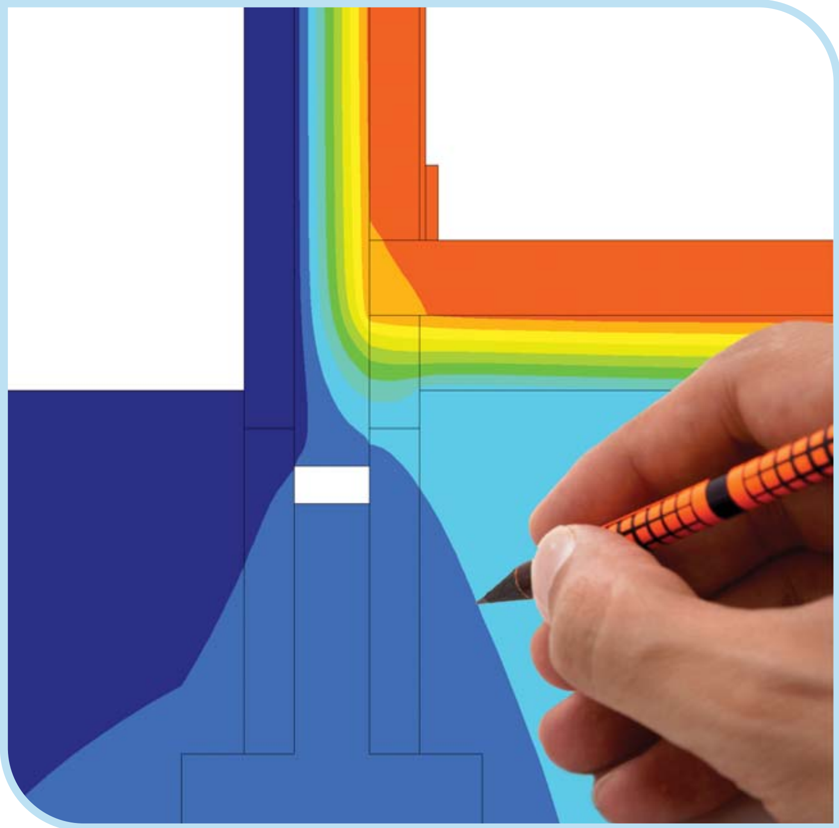
The standards are not yet intended to extend to the largest and most complex types of non-domestic building. In the government's Energy Consumption Guide 19, the standard could be used to cover office building types 1, 2, 3 or 4 - cellular offices, open plan offices, and corporate headquarters. However, it would not cover structures full of, for example, specialised computer equipment.

At present, the standards only apply to new buildings. In future they will be extended to building refurbishments. This has happened in Germany, where it is now regarded as technically straightforward to improve existing non-listed buildings to Passivhaus Standard.

Design guidance

SECTION 2

The key elements of thermal design in all of the standards is the adoption of detailing which is effectively thermal bridge-free and defaults to low air permeability. The heat loss calculations are based on these assumptions and methodologies, which are spelt out in *CLP Volume Two: Principles and methodologies for calculating and minimising heat loss and CO_2 emissions from buildings*.



There are two volumes of design guidance.

The design guidance is there to assist those designers who are developing their own project-specific construction details. Alternatively, the AECB is developing product and company-specific solutions as a form of accredited details.

The AECB proposes to add further details to this guidance as time goes by (including, but not only, those described in the following section).

SECTION 3

Web-based compendium of products and linked specification clauses

Designers and builders are faced with an array of different products and systems which claim to deliver improved energy performance. Taken at face value, some of the claims made are impressive, but actual performance will often depend on how products and systems are incorporated in the design and construction.

The energy standards contain the criteria for establishing whether products and systems comply with the required performance for each element and at an integrated whole building level. Some manufacturers and suppliers have already shown an interest in demonstrating how their products will help to deliver the required energy performance. We aim to harness the potential to develop further design guidance using specific products and systems by offering the industry the opportunity to submit worked details to the CLP for approval.

These industry solutions to each of the standards will then be published in a series of documents:

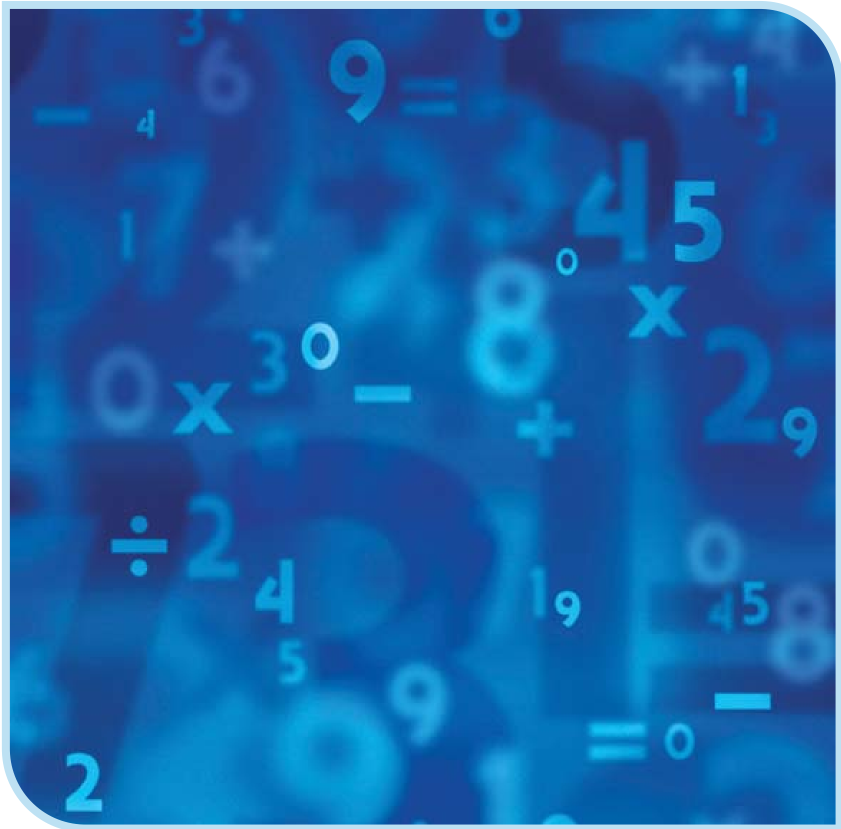
- building fabric solutions;
- ventilation, heating and cooling;
- lighting, domestic appliances and office equipment;
- monitoring and controls.

Identifying and procuring the appropriate products and systems for low energy buildings can be time-consuming and difficult, as can drafting appropriate specification clauses. We are therefore working with GreenSpec (www.greenspec.co.uk), a web-based specification tool, to incorporate the energy standards, products and systems which will deliver them into their site. It will also be possible to download specification clauses as required.

SECTION 4

Software for accurate energy/emissions projections at the design stage

The more energy-efficient the building fabric becomes, the more important it becomes to predict its heat loss accurately. Even a small increase in the amount of energy used to maintain temperature becomes significant as a proportion of the total. The non-space heating energy consumption also increases in relative importance so that, if the objective is to minimise energy use and CO_2 emissions, this needs to be done at the whole building level to include all fans and pumps, lighting, appliances and cooking.



Deriving energy and emissions projections requires a model of building use. In the UK, we use BRE's Domestic Energy Model (BREDEM), first created in the early 1980s and based on research in real homes. Since then, much has changed – people are generally more affluent, expect much higher comfort levels, own many more appliances and use their homes for a wider range of activities such as entertainment, computing, connecting to the internet, and so on.

For software to predict accurate figures for energy use and emissions, it needs to be validated against reality. Successive versions of Building Regulations have required improvements to the energy efficiency of the fabric, but to what extent do standards of design and construction comply with the new requirements? How much do we know about how people operate their homes and how people use their lights and appliances? The AECB intends to influence the development of BREDEM and the SAP-based calculation procedure to improve its accuracy as quickly as possible. We hope to be able to use BREDEM-based software within two years.

The calculation methodologies embedded within the models used can also have a significant impact on the accuracy of heat loss estimates, particularly as we adopt a highly thermally-efficient building fabric. Elements of potential impact of heat loss which were considered unimportant ten years ago become important.

It is for these reasons that we have decided to use the German Passivhaus Planning Package to calculate energy use and emissions from the energy standards for the first two years of the programme. PHPP has been validated by measurement in hundreds of buildings, and treats in a more sophisticated way a number of a building's characteristics which impact on its overall energy use compared to BREDEM. These include:

- Results of monthly and annual methods are given separately - they can differ by several kWh/m^2yr
- Location can be explicitly specified as and when more weather data becomes available
- Orientation, passive solar gain and influence of building thermal capacity are treated precisely - PHPP is calibrated by reference to the results of 1000s of dynamic thermal simulations
- Different treatment of solar
- Hot water systems explicitly include pipe length and insulation, and tank losses
- Evaporation of liquid water which is used in the building
- Heating up of liquid water in pipes en route through the building
- Electrical appliances
- In general, PHPP and the UK use the same EN standard methodologies but have different conventions associated with measuring heat loss from:
  - doors and windows
  - the fabric as a whole

The UK procedure for measuring the air permeability of attached dwellings allows the target to be met whilst in reality allowing an excessive rate of airflow, and hence heat loss through the external fabric. This is because, instead of dividing the air flow - as measured in the pressure test - by the area of the external surfaces alone, the UK takes the airflow and divides it by the SUM of the area of the external thermal envelope AND the separating walls and floors. This area is larger than the area of the external fabric alone. Measuring the air permeability the UK way allows a higher total airflow per square metre of external fabric, while still meeting the Building Regulations. Real heat losses are not being accounted for. The CLP adopts the convention used in Sweden and also used in UK non-domestic buildings.

In combination, these effects have a marked impact on a dwelling's space heating consumption. For example, in an 80m2 semi-detached house, the UK's different ways of measuring air permeability, the evaporation of water and the heating up of liquid water, would underestimate heat loss by the following order of magnitude:

UK method of measuring air permeability	+ 1.2 kWh/m²yr
Evaporation of water	up to + 3.0 kWh/m²yr
Heating up of liquid water	+ 0.6 kWh/m²yr
Total	+ 4.8 kWh/m²yr

Where the maximum space heat demand is set at 15 kWh/m2yr, these effects amount to one-third of the allowable total. If not modelled correctly at design stage, the energy demand of the building would exceed that target by one-third – equivalent to an additional 220kg/yr of CO_2 in a semi-detached house with gas heating.

Using PHPP provides the designer with more accurate information, encouraging better design decisions - such as specifying a more efficient MVHR system - to reduce heat loss to the level actually needed to achieve a space heating energy of 15 kWh/m²yr.

The methodologies to be adopted are fully described in *CLP Volume Two: Principles and Methodologies for Calculating Heat Loss and CO_2 Emissions*. It can be applied to domestic and a range of non-domestic buildings. Training courses will be available in its use.

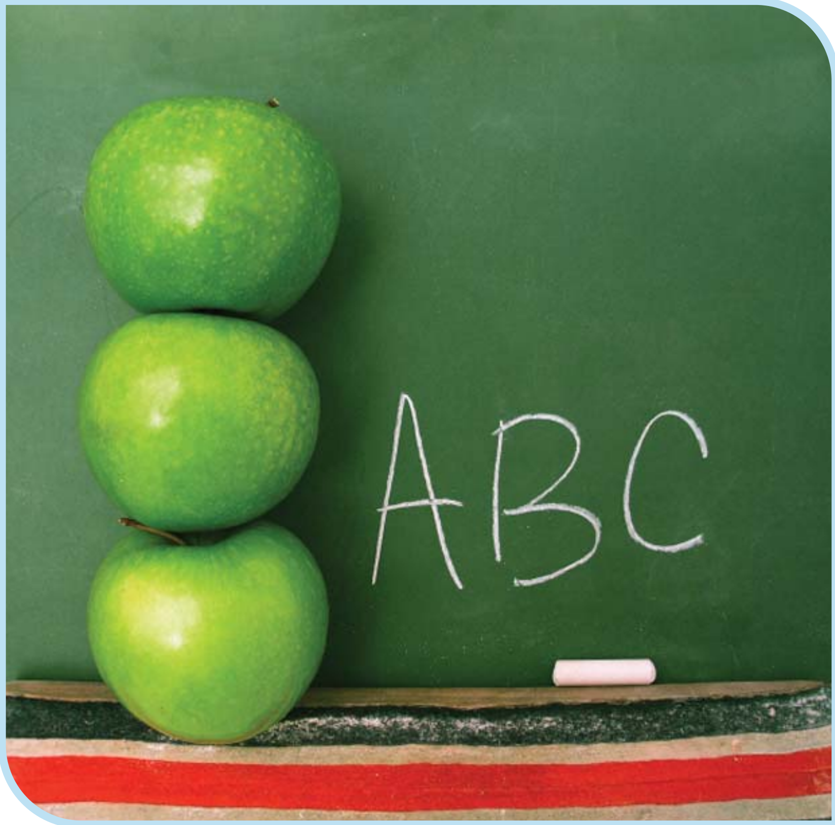
The AECB recognises that any modelling tool and accreditation route adopted will require members also to produce a SAP rating as the basis of claiming Code for Sustainable Homes points, a DER rating as basis for compliance with ADL1 -2006, an Energy Performance Certificate and similar documentation for non-domestic buildings.

AECB is working closely with others, including the DCLG/CPA Technical Working Group on SAP Modification, to help develop BREDEM and SAP to improve their accuracy for low energy buildings as quickly as possible.

Briefing documents on how to achieve low energy and carbon buildings

SECTION 5

Low energy buildings require a different kind of attention from that required by 'normal' buildings. This is because clients and design teams quite properly focus on the aesthetics and functionality of a 'normal' building, taking energy and CO_2 into account only for the purposes of compliance with Building Regulations. Builders are generally required to concentrate on cost and delivery times and rely on drawings and specifications from the designers to tell them what to do. Users take over a new building and want a comfortable environment, but few will regard their building as a system which needs careful and systematic operation to work efficiently.



Achieving low energy and carbon buildings needs the integration of all those involved in commissioning, designing, constructing and using buildings. That means integration over the process, so that those commissioning the building are thinking about how it will be used and, where possible, should involve the users from the outset. The design team too needs to understand how a building will be used if it is to predict energy use and CO_2 emissions with any kind of accuracy.

It also means proper integration within design teams. Decisions made very early in the design process - building orientation, shape and glazing ratio - have fundamental implications for energy use. They can even double it. These decisions are usually impossible to reverse at a later stage. The M&E team cannot devise a heating, ventilation and cooling strategy that meets the standards without taking proper account of all the energy end uses of the building, or from understanding the savings to be made from good orientation and an appropriate thermal capacity. Also, the builder needs to understand how decisions made on site can inadvertently have a dramatic impact on overall energy use, especially for space heating.

Overall, the message is that energy cannot be taken for granted, and that thinking about energy and CO_2 must be integral to the process of creating and operating a new building. For this to be successful, an overall champion is needed, with the authority to call into question any decisions that are made which have a negative impact on energy use and CO_2 emissions. And the overall champion needs champions within each of the teams involved so that influence can be brought to bear on decisions at all stages.

The aim of the briefing documents is to encapsulate this requirement for integration and help people at all stages of the process to understand what is required of them and how best to achieve it.
The documents will include:

- **Creating Low Energy and CO_2 Buildings:**
  CLP briefing document for clients and developers
- **The Design Process for Low Energy and CO_2 Buildings:**
  CLP briefing document for designers
- **Delivering Low Energy and CO_2 Buildings:**
  CLP construction checklists for builders
- **Owning and Operating Low Energy and CO_2 Buildings:**
  A guide for building users

Education & training

SECTION 6

The plan is to encapsulate the rationale for the standards, the content of the briefing documents, and the technical guidance into a coherent set of training courses and workshops for those proposing to work to the new standards.

These training courses and workshops include:

- **How to achieve low energy and CO_2 buildings**

  This course will focus on the need for an integrated design process including the client and the user, with an appointed energy and carbon champion – and demonstrates what can happen when these principles are not adhered to!

- **The principles of low energy design - a guide to adding up and basic building physics**

  Now that energy is becoming an increasing priority in the design of buildings, understanding how energy in buildings works is essential. How many clients and designers are surprised by actual energy use because they failed to account adequately for all energy end uses during the design process? What are the many ways that buildings lose heat and how can such apparently trivial design features and on-site changes lead to higher energy bills than predicted?

- **Early adopters' workshops – an introduction to the standards and the issues raised by working to them**

  A detailed introduction to the standards by fabric, heating, ventilation and cooling, lighting and appliances, and subsequent monitoring of energy consumption. Designers and advisors working to the standards on different building types share their experiences.

- **Building to Step One (Silver)**

  A more detailed look at the calculation methodologies to use and detailed design elements for those building to Silver. Transforming an existing design into Silver Standard.

- **Building to Steps Two and Three (Passivhaus and Gold)**

  A more detailed look at the calculation methodologies to use and detailed design elements for those building to Gold.

- **Understanding and using PHPP (Passivhaus Planning Package)**

  Working with an experienced trainer to help you find your way around PHPP.

All courses will be CPD accredited.

Course/audience	Client	Design team	Builder	User	Energy consultant
How to achieve low energy and CO_2 buildings	✓	✓	✓	✓	✓
Principles of low energy design		✓	✓		✓
Early adopters		✓			✓
Building to Step One (Silver)		✓	✓		✓
Building to Steps Two and Three (Passivhaus/ Gold)		✓	✓		✓
Understanding and using PHPP					✓

Assessor network and accreditation system

The primary aim of the CLP is to provide the tools needed to create buildings with better energy performance. An assessor network and accreditation system is aimed to support those working to the standards by providing additional assistance with estimating the energy use and CO_2 emissions, and advising on better solutions where appropriate.

For those who want their buildings to be accredited to the standards to use as a marketing tool, the AECB will set up a system of accreditation which will include submission of:

- design drawings and specification that form the contract package with completed PHPP spreadsheet to demonstrate that targets will be met
- photographic evidence of on-site construction using an AECB checklist
- two years' worth of post-occupancy energy data

The intention is not to remove accreditation from those buildings which do not perform to the standard. A willingness to provide data and share information about what works and what does not is more important at this stage than denying accreditation to those who have not delivered.

The AECB will be working with National Energy Services to train a small cohort of its current network of building assessors to the specific standards of assessment required by the CLP.

Post-occupancy energy and CO_2 measurement and reporting formats

SECTION 8

These is no history in the UK of systematic measurement of the energy and CO_2 performance of buildings, nor of reporting post-occupancy energy use and CO_2 emissions. With the new emphasis on sustainable building, this needs to change rapidly. Setting ambitious targets for improvement is meaningless unless we have ways of monitoring our progress.

For monitoring and reporting to be useful, we need standard formats to be used so that buildings can be compared on a like-for-like basis. While all participants in a reporting system may not be able to answer every question, it should be possible to establish some basic benchmarks, as well as additional information for those aiming to improve their designs or a building's performance.

The standard reporting format will be allied to similar schemes in other countries in the EU to widen the base of experience and learning.

Monitoring and feedback database

SECTION 9

The AECB is setting up a database of existing and new low energy buildings with monitored energy data. The aim is to develop a resource for those wishing to understand more about the design and operation of low energy buildings, to monitor progress against the standards, and to contribute to learning about what works and what does not.

A summary of the information by building type will be publicly available.

Buildings with particularly good performance and/or interesting lessons to teach will be the focus of discussions on the Learning Zone. It is intended that some will subsequently become the subject of more detailed case studies to be made available as downloads on the AECB website.

Web-based Learning Zone for internet discussion to support those adopting the standards

SECTION 10

The Learning Zone will be open to all those AECB members who have decided to work to the standards and are looking for additional support and advice. Joining the CLP Learning Zone will provide somewhere to share experiences and air problems with a network of like-minded companies and individuals in a secure environment.

Structured topic areas will be moderated by AECB experts to aid development of an in-depth understanding of the standards and how to commission, design, construct and use low energy buildings.

The AECB aims to draw on the best of existing publications and other guidance on how to produce low energy and CO_2 buildings. The Zone will also provide access to a suite of additional high quality resources – which will be added to over time.