RIBA

# Climate Change Toolkit

# 05 Low Carbon Design Tools

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**Cover image** Neal's Yard Remedies Headquarters, Gillingham, Dorset, Feilden Clegg Bradley Architects. The building is intended to be sustainable and energy-efficient. Energy use has been reduced by predominantly natural ventilation, with high levels of insulation, tight construction, good solar control, recycling and composting facilities. **Photo** Simon Doling for Feilden Clegg Bradley Architects

## About this Document

This is the fifth of eight components of Climate Change Tools, a package of guidance developed by the RIBA to encourage architects to engage with the issue of climate change and to deliver low-carbon new buildings and low-carbon refurbishment of existing buildings.

*Low Carbon Design Tools* reviews design tools that are available for architects designing low-carbon buildings. The complete toolkit consists of:

**01** *Climate Change Briefing*

**02** *Carbon Literacy Briefing*

**03** *Principles of Low Carbon Design and Refurbishment*

**04** *Low Carbon Standards and Assessment Methods*

**05** *Low Carbon Design Tools*

**06** *Skills for Low Carbon Buildings*

**07** *Designing for Flood Risk*

**08** *Whole Life Assessment for Low Carbon Design*

Each guide summarises its subject and provides links to other sources of more detailed information.

You can explore all of the RIBA Climate Change Tools at www.architecture.com/climatechange

## Introduction

Climate change brought about by man-made emissions of greenhouse gases has been identified as the greatest challenge facing human society at the beginning of the twenty-first century. Carbon dioxide is one of the major greenhouse gases; low carbon buildings are designed to produce significantly lower carbon dioxide emissions than others, helping to mitigate climate change.

The construction industry is facing increasing pressure to address environmental performance earlier in the design process. Planning permissions are more and more likely to require technical substantiations of how carbon dioxide emissions targets will be met.

At the same time, developers are realising that early and ongoing consideration of environmental performance leads to buildings that meet the required standards by the most cost effective methods.

There are many tools that may be used by the design team at different stages during the development of a project. Some cover all building types; others are specific to domestic or non-domestic buildings.

This guide reviews design tools that are available for architects designing low-carbon buildings. The guide is not exhaustive – our focus is on proven tools that are in common use in the UK. We first identify the stages of design development at which tools may prove useful and then provide information and links to guidance, checklists, tools and other resources for the domestic and non-domestic sectors.

### Types of Design Tools

The major types of design tools are:

**Calculation tools** – for calculating, for example, thermal transmittances (U values) or linear thermal conductivities (Ψ values).

**Simulation tools** – for predicting the performance of buildings, for example, Standard Assessment Procedure (SAP) energy rating software.

**Dynamic simulation tools** – for modelling the effect on performance of the thermal capacity (thermal mass) of the building fabric.

**Sizing tools** – for building services, including renewable energy systems.

Some tools combine more than one function in the same software package.

It is important to distinguish between design tools of the above types and **compliance checking tools**, which use calculation procedures to check compliance with performance standards such as Building Regulations. The performance predictions made by such tools are necessarily approximate but can provide a comparison between different design options and thus inform the design and compliance process, particularly in the domestic sector.

### More Information about Low Carbon Design Tools

**A comprehensive, international review of design tools was carried out by the UK Green Building Council in 2008. See www.ukgbc.org**

## Using Design Tools

Before using any design tool, it is good practice to spend some time listing the design issues that need to be addressed, and then to select the appropriate design tool for each task.

All design tools, from simple calculation procedures to complex simulation models, are simply means of estimating the approximate performance of a given design. Tools will provide different degrees of confidence, depending on the quality and amount of the input data, the complexity of the calculations and the skill of the user. Beyond a certain level of design complexity, the accuracy of predictions can decline.

Thus, when using design tools to support the design of a low carbon building, you should adopt a staged approach, with the complexity of simulation increasing in proportion to the complexity of the design. The outputs from each modelling stage are bound to involve some approximation, so you will need to be careful about the level of confidence with which you interpret your predictions.

Many simulation tools are available, but most are less useful as design tools; they tend to aim for greater degrees of accuracy, requiring larger amounts of data and user time. By contrast, a really useful design tool does not need to be highly accurate. It supplements the designer's own knowledge by quickly confirming whether proposed changes to a design are likely to make performance better or worse and by indicating the relative effects on performance of different design features.

It is important that you continually question the validity of the results from your use of design tools. Models may be faulty or there may have been an error in the set up or input of data. Results should always be checked against benchmarks and evaluated in the light of experience.

## Early Guidance Tools for the Pre-Planning Stage

Good design decisions at an early stage can demonstrate a constructive approach to planning requirements and greatly reduce the risk of costly later revisions.

A growing number of tools is available to aid design teams in embedding low carbon design principles from the start of the design process, usually designed to help address Building Regulations or planning requirements.

Using these tools, even when only the site, the surrounding constraints and the development brief are known, the design team can start to make informed decisions on orientation, built form distribution, materials, types of servicing systems and fuels.

## Tools for Supporting Applications for Planning Permission

Some local planning authorities are starting to impose environmental standards on development projects, for example, requirements that a minimum percentage of the energy demand of a building must be met from renewable energy sources.

There are several tools that may be used to demonstrate compliance with such planning requirements and that are commonly accepted by planning authorities. These tools are used to make initial estimates of the carbon dioxide emissions from energy use in proposed developments and to demonstrate the reductions that may be achieved from using new/renewable energy systems.

**It is essential to consider energy efficiency first (i.e. reducing fuel demand), then shared energy supply (e.g. district heating or communal boilers), then finally renewable energy systems.**

## Building Regulations Compliance Tools

Building Regulations compliance tools simulate the performance of a building to demonstrate that predicted carbon dioxide emissions are within the targets set by the Regulations. They use data on the final design and specification of the building, including the building fabric and services. They generate reports and performance certificates that form part of the application for approval of the design under the Building Regulations.

Building Regulations compliance tools usually predict the annual carbon dioxide emissions associated with energy use in the proposed building and compare them with the emissions of a 'notional building' of similar size, shape and use, with a standard specification. The proposed building must perform better than the notional building by a set factor. Predictions are made using 'standard' occupancy conditions and use common databases of building fabric elements and building services.

These tools must be approved and, in many cases, the person carrying out the assessment must also be accredited.

The European Directive on the Energy Performance of Buildings (EPBD) has been implemented during the three years up to January 2009, through a series of measures to improve the energy efficiency of buildings. In the case of new buildings, there is a requirement to predict and certify the energy performance of the building at the design stage (when Building Regulations approval is sought) and on completion, using an approved software tool. To provide consistency, the same software tools used to demonstrate Building Regulations compliance can be used to predict performance under the EPBD.

## Low Carbon Design Tools for the Domestic Sector

### Domestic Energy Rating

The most useful low carbon design tool for housing projects, for both new and existing dwellings, is domestic energy rating software. The UK is a world leader in domestic energy rating and there is a wide range of simple and relatively accurate performance simulation software which both fulfils regulatory requirements and works well as design tools.

All of the UK's domestic energy ratings are based on estimated annual fuel costs. Fuel costs are used because consumers of housing understand costs better than energy use or carbon dioxide emissions, and because the fuel costs associated with a dwelling are a good proxy for its primary energy use.

### Building Research Establishment Domestic Energy Model

All domestic energy ratings use the Building Research Establishment Domestic Energy Model (BREDEM) to predict annual fuel use, fuel costs and carbon dioxide emissions under the same standard occupancy pattern (a typical, floorspace-dependent pattern incorporating a standard heating regime). Standard occupancy is used for the ratings because it refers to the dwelling, not the way it is used by a particular household.

Some energy rating software will also predict fuel use, fuel costs and carbon dioxide emissions under specified occupancy. Specified occupancy is useful for predicting households' actual costs and ensuring the availability of affordable warmth.

BREDEM is a well tested model that predicts total annual fuel use (for heating, hot water, cooking, lighting and appliances) under standard occupancy to an accuracy of ±5% in 95% of cases.

### National Home Energy Rating

The National Home Energy Rating (NHER) is the leading domestic energy rating scheme, see www.nher.co.uk. This UK-wide scheme is used extensively by consultants, designers and specifiers and social housing organisations. The NHER of a dwelling is based on the estimated total annual fuel use (for space heating, water heating, cooking, lighting and the use of appliances), per square metre of floorspace, under standard occupancy. It is expressed on a scale of 0 (very inefficient) to 20 (very low carbon), to an accuracy of one decimal place. NHER assessments are location-dependent so, for example, three identical dwellings in Cornwall, Cheshire and Caithness will all have different NHERs, depending on the regional climate and the exposure of the site.

NHER software includes:

- NHER Plan Assessor for assessing designs for new dwellings using data from plans and specifications
- Stock Assessor multi-functional software for assessing energy efficiency in housing stocks, including individual dwelling energy ratings, stock profiles and stock performance indicators such as average ratings and emissions
- Auto Assessor works in association with Stock Assessor and third-party housing stock databases to provide batch-processing of dwellings data to support housing stock energy management.

All NHER software also delivers the SAP energy rating (see below). NHER Plan Assessor, incorporating SAP 2005, is particularly useful as a design tool for new housing, as well as for assessing Building Regulations (Part L1A and the devolved nations' equivalents) compliance, Code for Sustainable Homes compliance, and performance certification.

### Standard Assessment Procedure (SAP)

The Standard Assessment Procedure (SAP) energy rating is the Government's preferred domestic energy rating, incorporated into Part L1A of the Building Regulations (England and Wales), the Northern Ireland Building Regulations Part F, the Energy Saving Trust's Housing Energy Best Practice Standards and the Code for Sustainable Homes.

The SAP of a dwelling is based on the annual fuel use for space heating, water heating and fixed internal lighting only, per square metre of floorspace, under standard occupancy. It is expressed on a scale of 1 (very inefficient) to 100+ (very efficient) to an accuracy of one integer. Dwellings with SAP energy ratings greater than 100 are net energy exporters (due to local microgeneration).

SAP energy ratings are independent of location: all dwellings are assumed to be located in the East Midlands. This means that three identical dwellings built in Cornwall, Cheshire and Caithness all have the same SAP. Thus the SAP does not provide reliable predictions of occupants' fuel costs or of the availability of affordable warmth.

Existing dwellings may be assessed with a version of SAP known as Reduced Data SAP (RDSAP). This procedure uses 'least unlikely' default data for inputs such as external wall and ground floor insulation, window areas and ventilation, in order to reduce the cost and complexity of energy surveys. It is therefore slightly less accurate than the 'full SAP' procedure that is used for assessments of new dwellings. RDSAP is the basis of assessments for the production of Energy Performance Certificates (EPCs) for existing dwellings.

There are many suppliers of SAP software – for a full list of approved SAP software, see www.projects.bre.co.uk/sap2005

It is recommended that architects obtain their SAP energy ratings via an accredited assessor.

SAP energy ratings of new dwellings should be obtained from accredited On Construction Domestic Energy Assessors (OCDEAs). SAP assessments that are used to demonstrate compliance with Part L of the Building Regulations or the Code for Sustainable Homes, or to produce EPCs for new dwellings, must be obtained from accredited OCDEAs.

SAP energy ratings of existing dwellings, for which drawings and specifications are not available, should be obtained from accredited Domestic Energy Assessors (DEAs). RDSAP assessments that are used to produce EPCs for existing dwellings must be obtained from accredited DEAs.

Accredited OCDEAs and DEAs can be identified via the Government's 'Landmark' registry at www.hcrregister.com.

It is recommended that architects with substantial housing workloads should train at least one in-house OCDEA and/or DEA, and acquire approved SAP software for use as a design tool and for demonstrating and certifying compliance with Part L of the Building Regulations and other standards. Architects who only intermittently undertake housing design or refurbishment may prefer to obtain their SAP assessments via a consultant accredited in OCDEAs and DEAs.

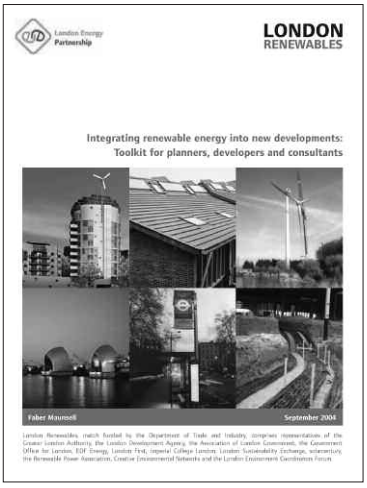
### Domestic Tools for the Pre-Planning Stage

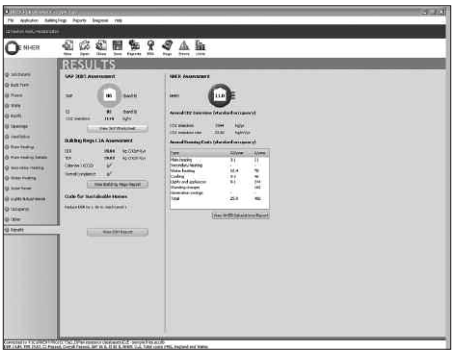
At the pre-planning and early design stages, the design team must address low carbon principles. As design information is often limited at this stage, checklists and good practice guides are commonly used to identify design considerations that will influence the eventual performance of the development. Checklists can also help you to identify conflicts between a specific development brief and low carbon good practice.

The Housing Energy Best Practice Programme is managed by the Energy Saving Trust and has published a large number of guides and case studies available free from www.energysavingtrust.org.uk tinyurl.com/yafogak

Key guides are:

- *Best Practice in New Housing – A Practical Guide* (CE95, 2005), intended to help designers and builders achieve best practice standards of energy efficiency.
- *Meeting the 10% Target for Renewable Energy in Housing – A Guide for Developers and Planners* (CE190, 2006), which provides developers, planners and specifiers with guidance on meeting a 10% target for the use of renewable energy sources on new housing developments.
- *Building your own Energy Efficient House* (CE123, 2005), which demonstrates how homes that exceed the requirements of Building Regulations, in terms of their energy efficiency, can be built cost-effectively.
- *Building Energy Efficient Buildings using Modern Methods of Construction* (CE139, 2005), which demonstrates that homes that exceed the requirements of Building Regulations in terms of their energy efficiency, and use modern methods, can be built cost-effectively.
- *Energy Efficient Refurbishment of Existing Housing* (CE83, 2004), provides practical advice to help housing managers, landlords, builders and installers to refurbish existing housing in an energy efficient way. An invaluable tool for refurbishing in full or for specific measures including heating, insulation, lighting and appliances.
- *Refurbishing Dwellings – A Summary of Best Practice* (CE189, 2006), which offers advice to those specifying refurbishment work in homes and provides information on best practice standards for typical dwellings in the UK. The main construction elements and building services are summarised in this document.




- *New and Renewable Energy Technologies for Existing Housing* (CE102, 2005), deals with the integration of new and renewable energy technologies into housing refurbishment schemes. It describes the technologies that are available, as well as how and where they can be used.
- *Renewable Energy Sources for Homes in Urban Environments* (CE69, 2004), a non-technical guide giving clear and concise information on the integration of renewables into new and existing dwellings within the overall context of designing energy efficient homes.
- *Renewable Energy Sources for Homes in Rural Environments* (CE70, 2004), provides advice on the options and opportunities for specifying renewable energy technologies for new and refurbished rural homes.

There are many other technical guides that deal with the building fabric and windows, and with heating, hot water, ventilation and lighting systems.

### Tools to Support Domestic Planning Submissions

It is becoming more common for local planning authorities to require a commitment to achieving carbon reduction targets or other environmental standards such as the Code for Sustainable Homes. Developers and design teams need to demonstrate how these targets and standards will be delivered as part of their application for planning permission.

The following tools may be used to demonstrate carbon performance at the planning application stage:

*Integrating Renewable Energy into New Developments: Toolkit for Planners, Developers and Consultants* (2004) – a paper-based tool to assess the feasibility of renewable energy systems and to assist developers and design teams in achieving Mayor of London and related borough planning policies. Where developments require proof of feasibility of achieving renewable energy targets (e.g. 20% carbon dioxide emissions reduction as a result of using renewables), this tool may be used to identify appropriate routes to that target.
www.london.gov.uk/mayor/environment/energy/docs/renewables_toolkit.pdf

Low Carbon Designer – a software tool following on from the Toolkit above. This tool offers a sequential, prescribed procedure for showing planning authorities the low carbon features that have been considered as part of a design, and the output report is suitable for inclusion with an application for planning permission. This tool also facilitates detailed studies to substantiate environmental performance claims at the planning stage.

Good quality SAP energy rating software such as NHER Plan Assessor (see page 5) can often be used to support planning submissions and demonstrate compliance with minimum renewable energy contribution requirements. The software can be used to estimate annual fuel use, fuel costs and carbon dioxide emissions of conventional building services, and then to identify the most cost effective renewable energy technologies and assess their potential contributions to the overall energy demand. SAP energy rating assessments can include biofuel boilers (including communal boilers) and room heaters, solar water heating, photovoltaics, heat pumps and micro-CHP, and micro wind-power.

Some of the tools listed below may also be used with early design information, supplemented by reasonable assumptions about as-yet undetermined aspects of the design, in order to gain insight into likely energy demands and any potential problems of compliance with the requirements of Building Regulations or the Code for Sustainable Homes.

## Domestic Compliance Tools

**SAP energy rating software** is the principal design tool for demonstrating compliance with the Building Regulations Parts L1A and L1B (and devolved equivalents) and with the energy credits of the Code for Sustainable Homes. All BRE-approved SAP software calculates the **TER** (Target Emissions Rate) and **DER** (Dwelling Emissions Rate) required to demonstrate compliance with the Building Regulations and the energy credits of the Code, and the software also checks compliance with design limits (for building fabric and building services) and summer overheating risk.

Good quality SAP software such as **NHER Plan Assessor** allows the designer to evaluate and compare specification options embracing the building fabric and building services, in order to identify the most appropriate and cost effective specification for meeting a given standard.

Design assessment reports may be exported in machine-readable formats for exchange with other members of the design team.

Once a compliant specification has been identified the software will print a detailed compliance report and/or Energy Performance Certificate for submission to the building control body or Code for Sustainable Homes assessor, or for issue in accordance with the requirements of the EPBD.

The Passive House Planning Package **(PHPP)**[1] is workbook-based performance simulation software that is applicable to domestic buildings. It was developed by the PassivHaus Institute in Hannover as a method of certifying performance against the Passive House Standard that is emerging as the pan-European standard for low carbon houses. It has been adopted by the Association for Environment Conscious Building (AECB) as the means of demonstrating compliance with the Carbon Lite standards (Silver, PassiveHouse and Gold) that are being promoted with support from the Carbon Trust.

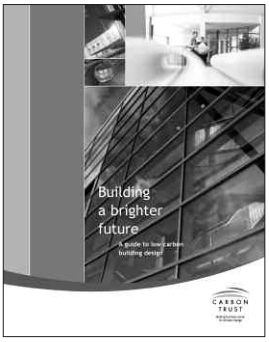
PHPP makes a very detailed, location-specific simulation of dwelling performance, embracing all energy uses including space heating, water heating, cooking, lighting and appliances. The package can be used to evaluate and compare specification options and to certify the compliance of a completed dwelling with the Passive House or Carbon Lite standards; it is not, however, an accepted method of demonstrating compliance with Building Regulations.

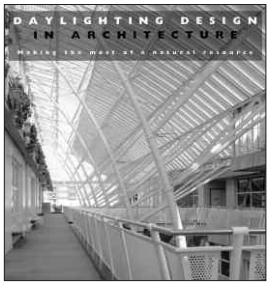
All domestic energy performance assessments are sensitive to the thermal transmittances (U values) of the building fabric elements, so it is important that accurate U values are calculated, by means of appropriate software. Designers should use only U value calculation software that embodies the Combined Method, with corrections, in accordance with the relevant European Standards[2]. Such software includes:

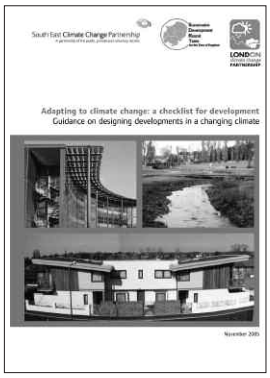
- **NHER U value calculator**, supplied by National Energy Services (and bundled with NHER Plan Assessor), see www.nher.co.uk
- **BRE U value calculator**, downloadable from www.bre.co.uk
- **Uvaluate**, available from the insulation company Xtratherm UK Ltd, see www.xtratherm.co.uk
- **BuildDesk U**, available from BuildDesk, see www.builddesk.co.uk

**1** PHPP is available in the UK from PassivHaus UK, managed by BRE Ltd www.passivhaus.org.uk

**2** See Anderson, B *Conventions for U Value Calculations*, BRE www.bre.co.uk








## Low Carbon Tools for the Non-Domestic Sector

The following sections describe available and up-and-coming tools that are commonly used during the pre-planning, planning and detailed design stages and to demonstrate Building Regulations compliance for non-domestic buildings.

### Non-Domestic Tools for the Pre-Planning Stage

At the pre-planning and early design stages the design team must address low carbon principles and work these into the scheme alongside all of the other development requirements and constraints.

As design information is often limited at this stage, checklists and good practice guides are commonly used to identify design considerations that will influence the eventual performance of the development. They are also useful where a design team is responding to a specific development brief as they can highlight conflict between the brief and low carbon good practice.

The Carbon Trust administers the Government's non-domestic Energy Efficiency Best Practice Programme, providing guidance on energy saving in the non-domestic sector. Free guidance can be downloaded from www.carbontrust.co.uk, by using the search facility and typing in the appropriate publication codes. It is necessary to register (which is free) in order to download the documents.

Key guidance includes:

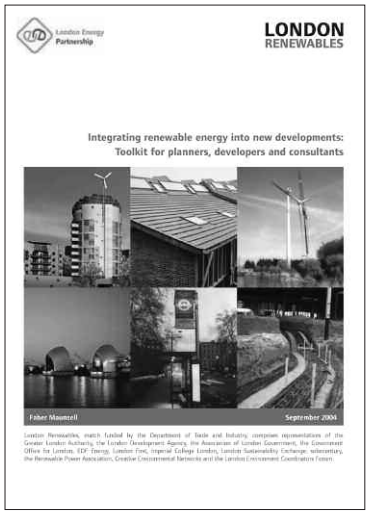
*Design Advice Pack* (PAC031, 2006) – which provides information on how best to attain a feasible, low carbon building from first design sketches to final occupation and operation.

*Daylighting Design in Architecture* (ADH011, 1998) – a guide to making best use of the sun's natural resource to provide daylighting within buildings offering diverse solutions to a range of building types.

Other useful guidance includes:

*CIBSE Guide to Energy Efficiency, Guide F* (2008) – using CIBSE performance benchmarks, this guide highlights the opportunities to save energy in buildings in both design and operation and includes a useful design checklist, 'How to carry out an energy survey'. It has been written with architects, as well as building services engineers, as part of the target audience.
www.cibse.org
tinyurl.com/yo6k4a

*Adapting to Climate Change: A checklist for Development* (2005) – a useful checklist to highlight the need for developments to be 'climate proofed', i.e. well adapted to our changing climate. Although commissioned by the Three Regions Climate Change Group in the South-East of England, many principles outlined here can be applied nationwide and the guide is endorsed by national bodies.
www.climatesoutheast.org.uk
tinyurl.com/yzrlqay




## Non-Domestic Tools to Support Planning Submissions

It is becoming more common for local planning authorities to require a commitment to achieving carbon reduction targets or other environmental standards. Developers and design teams need to demonstrate how these targets and standards will be delivered as part of their application for planning permission.

The following tools may be used to demonstrate carbon performance at the planning application stage:

*Integrating Renewable Energy into New Developments: Toolkit for Planners, Developers and Consultants* (2004) – a paper-based tool to assess the feasibility of renewable energy systems and to assist developers and design teams in achieving Mayor of London and related borough planning policies. Where developments require proof of feasibility of achieving renewable energy targets (e.g. 20% carbon dioxide emissions reduction as a result of using renewables), this tool may be used to identify appropriate routes to that target.
www.london.gov.uk
tinyurl.com/y3atkh

Low Carbon Designer – a software tool following on from the Toolkit above. This tool offers a sequential, prescribed procedure for showing planning authorities the low carbon features that have been considered as part of a design, and the output report is suitable for inclusion with an application for planning permission. This tool also facilitates detailed studies to substantiate environmental performance claims at the planning stage.

## Non-Domestic Building Regulations Compliance Tools

Some of the tools listed below may also be used with early design information, supplemented by reasonable assumptions about as-yet undetermined aspects of the design, in order to gain early insight into likely energy demands and any potential problems of compliance with the requirements of Building Regulations.

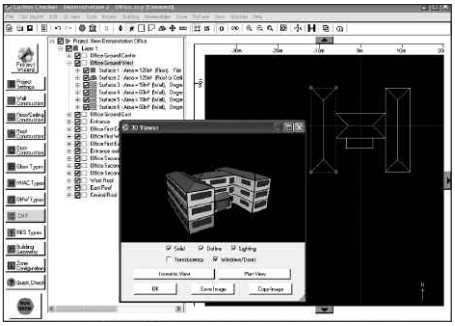
The Simplified Building Energy Method (SBEM) has been developed by the Government to support the implementation of the Energy Performance in Buildings Directive[3]. SBEM is the only tool that may be used to demonstrate compliance with the requirements of Part L2A of the Building Regulations.

Using data about built form, activities accommodated, building fabric, HVAC and lighting systems, SBEM predicts the annual energy use and the associated carbon dioxide emissions of the proposed building and compares them with those of a notional building from which a maximum emissions target is established.

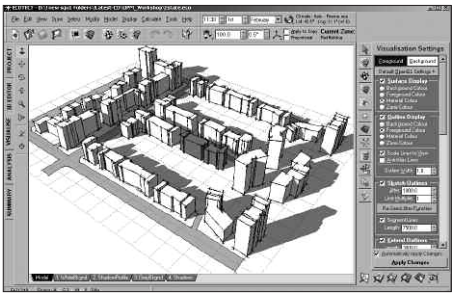
iSBEM is the user interface to SBEM, where the user enters the relevant building data and generates standardised performance reports which demonstrate compliance and which should form part of the application for approval under the Building Regulations. The interface itself is a series of data entry and drop down menus (from pre-existing datasets), with multiple tabs to take the user through the process sequentially.

iSBEM currently has no graphic interface. Other commercially developed interfaces are now available; these have been developed to simplify and speed up the process of demonstrating compliance using SBEM.

3 www.communities.gov.uk/index.asp?id=1504720

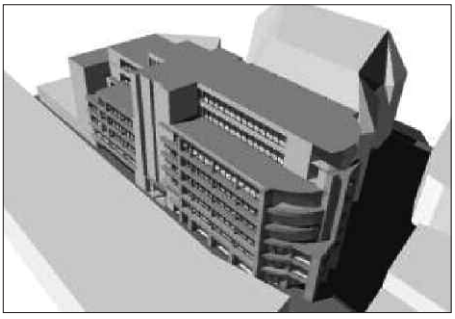


Carbon Checker



Ecotect

DesignBuilder



Tas

**Carbon Checker** – a bespoke, accredited piece of software using the SBEM calculation engine at its core but with a number of refinements compared with iSBEM. Carbon Checker is based around a 2D/3D graphic interface, where the building can be drawn and checked visually (in iSBEM, the geometry has to be entered numerically and there is no way to visualise the resulting building form). It also allows the user to import CAD files and physically trace over them. A number of 'runs' may be compared, so the user can look at the effects of different design scenarios. Carbon Checker is regularly updated in line with the latest versions of SBEM. The output reports are the same as from iSBEM and may be used for the Building Regulations Part L2 compliance part of an application for approval under the Building Regulations.
www.builddesk.co.uk

**Ecotect** – this tool provides facilities to help designers understand environmental issues for a particular site and then assess combined energy use, thermal and lighting performance. Visualisation facilities are provided along with dynamic thermal modelling. This product has been designed and developed with architects in mind and provides integration with CAD packages. It has particular strength in daylight analysis and as an interface to the Radiance analytical package.
www.usa.autodesk.com
tinyurl.com/yermk48

**DesignBuilder** – this tool has been developed to help designers understand the performance associated with different design and building services options. Various facilities are provided that help evaluate façade options, potential for overheating, energy use and visualisation. Dynamic thermal modelling is provided via Energy Plus.
www.designbuilder.co.uk

**Hevacomp** – a set of building services design software tools bundled together as a number of packages to suit a variety of users. One of the modules is an accredited Building Regulations Part L2 compliance checker (incorporating SBEM). Predicted building performance can be checked using the latest SBEM calculation engine. The output reports may be used to show Building Regulations Part L2 compliance as part of an application for approval under the Building Regulations.
www.hevacomp.com

**Tas** – an established set of tools, developed at Cranfield University, which feature graphical data entry and provide dynamic thermal simulation of a building and its services. It is a fairly complex package with a wealth of features. Tas uses its own Communities and Local Government accredited calculation engine (not SBEM), and may be used to demonstrate Building Regulations Part L2 compliance via output reports that may be included in applications for approval under the Building Regulations.
www.edsl.net

**IES Virtual Environment** – a range of software packages to provide complex building performance simulation. The IES Virtual Environment suite of thermal simulation packages enables the user to predict carbon dioxide emissions.

This software has been accredited by Communities and Local Government, so the results may be used to show compliance as part of an application for approval under the Building Regulations. IES also allows the user to check results against the SBEM calculation engine.
www.iesve.com

The **Passive House Planning Package** (PHPP)[4] is workbook-based performance simulation software that is applicable to small and medium-sized non-domestic buildings. It was developed by the PassivHaus Institute in Hannover to provide a method of certifying performance against the Passive House Standard. It has been adopted by the Association for Environment Conscious Building (AECB) as the means of demonstrating compliance with the Carbon Lite standards (Silver, PassiveHouse and Gold) that are being promoted with support from the Carbon Trust.

All energy performance assessments are sensitive to the thermal transmittances (U values) of the building fabric elements, so it is important that accurate U values are calculated, by means of appropriate software. Designers should use only U value calculation software that embodies the Combined Method, with corrections, in accordance with the relevant European Standards[5]. Such software includes:

**BRE U value calculator**
www.bre.co.uk

**Uvaluate**
www.xtratherm.co.uk

**BuildDesk U**
www.builddesk.co.uk

**4** PHPP is available in the UK from PassivHaus UK, managed by BRE Ltd.
www.passivhaus.org.uk

**5** See Anderson, B *Conventions for U Value Calculations*, BRE
www.bre.co.uk

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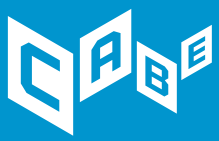

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