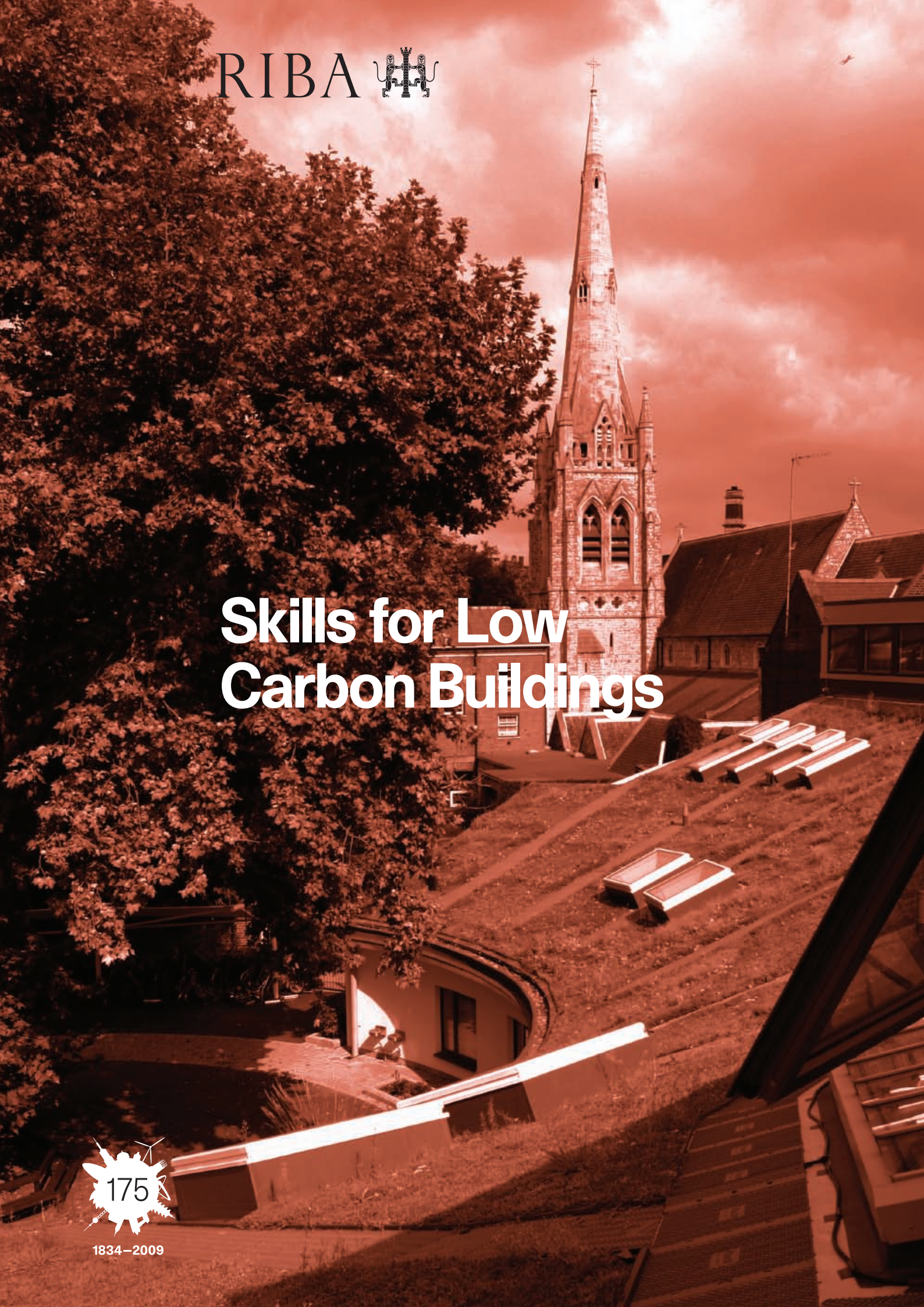
RIBA

Skills for Low Carbon Buildings



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Cover image Larmenier and Sacred Heart Primary School. The building, designed by Studio E Architects, features solar panels, generating ten per cent of the school's power, and a green roof. The design has also allowed for the preservation of two 120 year-old plane trees on the site. Other features include light-sensitive dimming controls on the light fittings, awnings outside the classroom windows, and independent temperature controls for each classroom.

Photo Studio E Architects

About this Document

This is one of six 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.

This document reviews the skills and competencies required for low carbon design and refurbishment; the other elements of Climate Change Tools are:

- A *Climate Change Briefing*, setting the scene about climate change, its causes and its impacts
- A *Carbon Literacy Briefing*, about the carbon dioxide emissions associated with energy use in buildings
- *Principles of Low Carbon Design and Refurbishment*
- *Low Carbon Standards and Assessment Methods*
- *Low Carbon Design Tools*

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

In 2003, carbon dioxide emissions associated with energy use in the UK were approximately 560 million tonnes. Almost half of this came from energy use in buildings.

Energy use in housing accounts for slightly more than half of the emissions associated with energy use in all buildings, amounting to 27% of the UK total.

This document addresses the skills, knowledge and competencies required for low carbon design and refurbishment. It focuses particularly on the design phase, but architects should be aware that delivering low carbon buildings requires skills throughout the design and construction process.

'The professional work of the architect, like all human activities, has impacts upon the environment. It is the responsibility of all architects to understand these impacts and seek to minimise negative environmental effects at global, local and indoor levels.'
Tomorrow's Architect

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[1].

Action to address climate change falls into two categories: mitigation policies are designed to reduce greenhouse gas emissions to slow down or stop climate change; adaptation policies are designed to adjust society to cope with climate changes that are already happening or are likely consequences of current greenhouse gas emissions.

Tackling climate change requires concerted and focused action. This will include reducing carbon dioxide emissions by changing the ways in which buildings are designed, constructed, managed and used.

It's important to remember the wider context for action to address climate change. Buildings should be low carbon, but they should also be sustainably designed, that is, they should be created with consideration of the wider, long-term environmental, social and economic aspects of sustainability.

This briefing:

- Explores the importance of low carbon skills
- Identifies the skills and competencies required for low carbon design and refurbishment
- Helps you to identify the skills and competencies you already have and those you need to enhance
- Directs you to sources of further information about training and Continuing Professional Development (CPD)
- Explores the future of low carbon skills for the architectural profession.

The Importance of Low Carbon Skills

Over recent years, climate change has risen rapidly up the political and public agenda, with increasing amounts of legislation, regulation, media coverage and information in the public domain.

Architects are centrally involved in a sector of the national economy – buildings – which provides the setting for between 40% and 50% of UK national greenhouse gas emissions. Therefore the RIBA and its members have an important part to play and an opportunity to work with others to influence the future.

The President of the RIBA, Sunand Prasad, used his inaugural lecture in November 2007 to stress the importance of climate change as an issue to be addressed by architects and the construction industry, as well as society more widely[2].

More enlightened clients are adopting a bolder, socially responsibile agenda and are keen that their buildings reflect their corporate commitments. Increasing demand for low carbon buildings, coupled with the strengthening of regulation (for example, the Code for Sustainable Homes, placing us on a path to zero carbon new homes by 2016) mean that low carbon skills must become more integrated into mainstream architectural services.

By developing their low carbon skills rapidly, practising architects may gain competitive advantage from niche specialisation in low carbon design. Alternatively, simply having a stronger skills base and deeper knowledge of climate change and low carbon design issues will bring opportunities to build wider ranging relationships with clients and stakeholders who have an active interest in environmental issues.

Low carbon design offers great opportunities for creative thinking and innovation, and the journey towards a sustainable future should be taken with the spirit of adventure and as a source of inspiration. Low carbon skills should not be regarded as a 'chore', or a commoditised skill delivered more by the modelling software than by the architect's inspiration.

1 You can find out more about climate change in the RIBA *Climate Change Briefing*, see www.architecture.com/climatechange

2 See www.tinyurl.com/45xrkt

Low Carbon Skills and the Architect

In Training

The education of architects today will have a profound effect on our future. Many will practise architecture through most of this century and their legacy will continue well into the next. Many new graduates are already benefiting from the excellent work being undertaken by schools of architecture and universities in promoting sustainable design and low carbon skills.

The RIBA's manifesto for architectural education is laid out in *Tomorrow's Architect*. The core of the document sets out the benchmarks for passing the Parts 1, 2 and 3 examinations in architecture as administered by the RIBA.

Low Carbon Skills at Part 1

Part 1 helps students to develop insight into the benefits of an integrated approach to architectural design. Central to this is a demonstration of the student's ability to produce designs showing an understanding of the integrated relationship between climate, building design, materials, building services systems, energy use and greenhouse gas emissions. This incorporates environmental design techniques, building methods and active and passive building technologies that are employed to ensure the comfort of occupants and the conservation of energy.

Low Carbon Skills at Part 2

At Part 2, students are expected explicitly to address issues around social, environmental, technical and professional responsibilities. From the perspective of low carbon skills, this includes:

- The principles and theories associated with thermal environments
- Climatic design and the relationship between climate, built form, construction, lifestyle, energy consumption and human well-being
- Building technologies, environmental design and construction methods related to issues including the development of a sustainable environment
- The physical properties and characteristics of building materials and components and the environmental impact of specification choices.

Low Carbon Skills at Part 3

Part 3 is designed to test graduates' understanding of their professional obligations and responsibilities and is largely focused on architecture and management in practice. Low carbon issues are not explicitly addressed in Part 3 at present; however, in the future it is likely that sustainability criteria will become integrated into building contracts, so there is already scope for their consideration both in terms of the architect's professional duty to his/her client and to society more widely, and in terms of the design standards and managerial approaches adopted towards projects.

Continuing Professional Development

All chartered members of the RIBA are obliged to undertake 35 hours of CPD each year.

At least 19.5 hours of this CPD should cover aspects of the RIBA CPD Core Curriculum, which includes a module on sustainable architecture.

CPD: Sustainable Architecture

The RIBA's Core Curriculum for CPD includes sustainable architecture, which is defined as the inter-relation between the social, environmental and economic aspects of the built environment. Members are encouraged to consider:

- **Climatic design and the relationship between climate, built form, construction, lifestyle, energy consumption and human well-being**
- **Building technologies**
- **Environmental design and construction methods in relation to human well-being, the welfare of future generations, the natural world and the consideration of a sustainable environment**
- **Pertinent legislation, statutory requirements and building regulations.**

Members should also undertake at least 15.5 hours of CPD on other subjects; there are many low carbon and sustainable design options available (see page 10 for further information).

Types of Low Carbon Skills

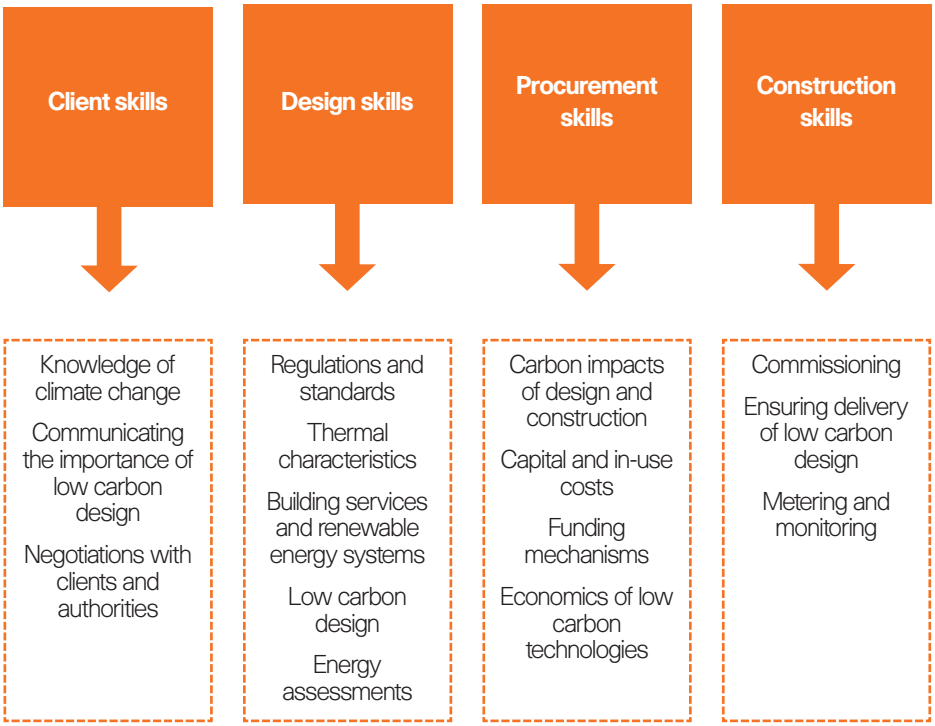
This section identifies the range of low carbon skills and competencies that architects should consider and encompasses both technical and commercial skills. It is a fairly comprehensive list and you will need to consider which are priorities for you in delivering low carbon designs for your clients.

You may also find this section useful in helping to describe the design services that you seek from engineers and other specialists to support an integrated approach to low carbon design.

We define low carbon skills as:

'knowledge, skills and competencies that support the design and delivery of low carbon new buildings and low carbon refurbishment projects'.

Whilst our core focus in this document is on design skills, it's important to remember that low carbon skills extend beyond design; they should be embedded within communications, procurement and project management activities to ensure that the quality of the low carbon design is reflected in the building that results.



For each of the knowledge and competency areas listed overleaf, you can rate yourself from 1–3 according to the following system:

1 I keep up to date with changes in professional practice and changes in the industry. I know where to go for further advice and information, but I still need to enhance my level of knowledge. Low carbon design is sometimes embedded in my design projects.

2 I have a detailed knowledge of this subject area, gained through learning and through experience. I am able to advise colleagues and clients about this area. Low carbon design is usually embedded in my design projects.

3 I am an expert or specialist in this area and it is embedded and made prominent in my design work. My skills in this area are used to market to clients and I am asked to provide training, write manuals or run technical workshops.

Try to be honest with your ratings as this will help you to pinpoint the areas where you need either generic training or more specific, targeted support.

Low Carbon Skills Knowledge or Competency Area

Knowledge of current and forthcoming planning and building regulations about low carbon design and refurbishment	1	2	3
'Merton Rule' standards for renewable energy contributions, as set by planning authorities and other agencies (eg English Partnerships)	○	○	○
Building Regulations Part L1 and the devolved nations' equivalents and the associated methods of demonstrating compliance for new dwellings, extensions, changes of use and refurbishment	○	○	○
Building Regulations Part L2 and the devolved nations' equivalents, and the associated methods of demonstrating compliance for new non-domestic buildings, extensions, changes of use and refurbishment (including consequential improvements)	○	○	○
The EU Energy Performance of Buildings Directive	○	○	○

Knowledge of non-statutory energy and environmental standards, and the ability to identify, evaluate and select appropriate low carbon standards and strategies related to low carbon design and refurbishment	1	2	3
The Energy Saving Trust Best Practice standards	○	○	○
The Code for Sustainable Homes	○	○	○
The Passive House Standard	○	○	○
The AECB CarbonLite standards	○	○	○
The Building Research Establishment Environmental Assessment Method (BREEAM)	○	○	○
Other recognized environmental standards such as LEED	○	○	○
Ability to identify, evaluate and select low carbon strategies for design schemes	○	○	○
Ability to identify, evaluate and select low carbon strategies for refurbishment schemes	○	○	○

Knowledge of the thermal implications of building form, and of how thermal performance can be improved	1	2	3
The effects of location, shelter and shading on thermal performance	○	○	○
The effects of building form on heat loss and solar aperture	○	○	○
The use of solar and internal heat gains	○	○	○
The use of building form to promote natural ventilation and cooling	○	○	○

Knowledge of the thermal characteristics of building fabric, and of how performance can be improved	1	2	3
The importance of insulation and air-tightness	○	○	○
The importance of minimizing thermal bridging and air leakage	○	○	○
The ability to deploy constructions of high and low thermal mass appropriately, including the role of ventilation in maximising the benefit of thermal mass	○	○	○
The ability to calculate thermal transmittances (U values)	○	○	○
The ability to calculate linear thermal conductivities (Ψ values)	○	○	○
The ability to design construction details to minimise thermal bridging and air leakage, whilst avoiding the risk of interstitial condensation	○	○	○

Knowledge of building services systems and of their key characteristics that contribute to low carbon performance	1	2	3
The importance of reducing cooling loads to avoid the need for cooling and/or air conditioning	○	○	○
Ventilation options including natural cross-ventilation, passive stack ventilation, and mechanical supply and/or extract ventilation, including the importance of minimising ventilation fan-power and maximising heat recovery efficiency	○	○	○
The efficiency and responsiveness of heating and cooling plant such as boilers, calorifiers and chillers	○	○	○
The responsiveness of heat emitters (e.g. radiators, under-floor systems)	○	○	○
The use of responsive controls to improve efficiency and permit the use of solar and internal gains	○	○	○
Efficient internal and external lighting systems and controls	○	○	○

Knowledge of post-construction testing and commissioning of buildings and the ability to educate building users and managers	1	2	3
Knowledge of commissioning procedures	○	○	○
Understanding of energy and carbon performance benchmarks	○	○	○
Ability to communicate energy performance standards and benchmarks to others (e.g. building occupants)	○	○	○
Ability to communicate verbally and in writing to provide occupants and managers of the building with a sound understanding of how it is intended to work	○	○	○

Design of metering and monitoring regimes and reporting systems to enable informative and diagnostic monitoring of energy performance ○ ○ ○

Ability to communicate metering and monitoring systems to ensure effective application by building users ○ ○ ○

Knowledge of new and renewable energy systems for use in buildings, and the ability to compare and evaluate systems 1 2 3

Knowledge of heat pumps (ground- and air-source) ○ ○ ○

Knowledge of combined heat and power (CHP) including micro CHP ○ ○ ○

Knowledge of solar water heating ○ ○ ○

Knowledge of biofuel heating systems ○ ○ ○

Knowledge of photovoltaic arrays for electricity generation ○ ○ ○

Knowledge of wind turbines for electricity generation ○ ○ ○

Ability to compare and evaluate new and renewable energy systems for use in buildings ○ ○ ○

The application of integrated low carbon design principles (embracing building form and fabric, building services, and new and renewable energy systems) to new buildings and refurbishment projects 1 2 3

Application of low carbon design principles (see the guide to *The Principles of Low Carbon Design and Refurbishment* in this suite of Climate Change Tools) ○ ○ ○

Knowledge of energy performance simulation techniques, and the ability to apply them to designs for new buildings and refurbishment of existing buildings 1 2 3

Knowledge of energy performance simulation techniques (see the guide to *Low Carbon Design Tools* in this suite of Climate Change Tools) ○ ○ ○

Ability to apply simulation techniques for new buildings and refurbishments ○ ○ ○

Knowledge and application of energy and environmental assessment procedures for new buildings 1 2 3

Knowledge of domestic energy rating (SAP and NHER), including performance certification (for Building Regulations and Energy Performance Certificates (EPCs) ○ ○ ○

Ability to apply domestic energy ratings to designs for new buildings ○ ○ ○

Knowledge of non-domestic energy rating (SBEM, etc), including performance certification (for Building Regulations and EPCs) ○ ○ ○

Ability to apply non-domestic energy ratings to designs for new buildings ○ ○ ○

Knowledge of environmental assessment methodologies such as BREEAM and the Code for Sustainable Homes ○ ○ ○

Ability to carry out environmental assessments using the Code for Sustainable Homes, BREEAM or other appropriate methodologies including EPCs 1 2 3

Ability to undertake surveys and assessments of existing buildings and produce energy ratings and environmental assessments ○ ○ ○

Knowledge of domestic energy surveys and assessments, including Energy Performance Certificates (EPCs) ○ ○ ○

Ability to undertake domestic energy surveys ○ ○ ○

Housing stock assessment and profiling (including domestic energy ratings and EcoHomes XB) ○ ○ ○

Knowledge of non-domestic energy surveys and assessments of existing buildings, including performance certification (for EPCs) ○ ○ ○

Ability to undertake non-domestic energy surveys ○ ○ ○

Commercial and management skills, knowledge and competencies 1 2 3

Broad knowledge of the issues surrounding climate change ○ ○ ○

Communications skills for making the environmental, economic and social case for low carbon design to clients, authorities and others ○ ○ ○

Knowledge of funding mechanisms and fiscal measures which support the use of low carbon technologies by overcoming capital barriers ○ ○ ○

Knowledge of capital and in-use costs of low carbon technologies ○ ○ ○

Ability to calculate and assess the economics of low carbon technologies, namely the comparative lifetime costs of different design options ○ ○ ○

Identifying Training Needs

Personal Training Needs

Using the competency table on pages 8–9, you can now highlight areas for further training or improvement.

If you scored a 1 – you can maintain or enhance your level of knowledge through general reading. You should also consider undertaking CPD modules to bolster your skills in this area.

If you scored a 2 – you can maintain or enhance your skills by attending courses or conferences, whether face to face or online. Your projects should also help to increase your experience. You may want to consider attending a RIBA Skill module specifically aimed at Low Carbon Skills (see below).

If you scored a 3 – you may wish to develop your specialism further through courses leading to certificates, diplomas or degrees. You could also consider projects which expose you to specialist research or academia, or sharing your knowledge by becoming a trainer.

Organisational Training Needs

You should also think about your skills and competencies in the context of your team or practice. Using the competency table, you can map your organisational skills profile and identify any corporate strengths and weaknesses. Your strengths can be used to gain competitive advantage by promoting your low carbon skills to prospective clients; your weaknesses can be addressed through training, recruitment or partnering strategies.

Training and CPD Providers

RIBA CPD Providers Network

The 500 members of the RIBA CPD Providers Network offer architects and other construction professionals RIBA-assessed, high-quality CPD material.

Network members include universities and colleges, training companies, solicitors, advisory organisations, IT companies, trade associations and construction and design product manufacturers and suppliers.

Network members offer seminars, conferences, degrees, courses, books, design guides, CD-ROMs, e-learning and factory tours. Many Network members will offer you their CPD free of charge in your practice at lunchtime.

This is the only CPD assessed by the RIBA.

In 2008 RIBA and RIBA Enterprises launched a dedicated RIBA CPD Providers Network website – a one stop shop for all RIBA accredited material from the RIBA CPD Providers Network for architects, surveyors, engineers, facilities managers, building service managers and other construction professionals.

You can access a list of approved CPD providers on the RIBA website at: www.tinyurl.com/5mg8vz

RIBA Skill

RIBA Skill is a new service from the RIBA CPD Providers Network, offering intensive training to Advanced Learning level, enabling you to gain competitive advantage by developing specialist skills. RIBA Skill addresses low carbon skills in a number of modules:

Advanced Environmental and Energy Studies

From the University of East London in conjunction with the Centre for Alternative Technology (see www.cat.org.uk), this course covers energy provision and consumption, climate change, resource provision, waste disposal, local environmental considerations, environmental design, energy efficiency and renewable energy technologies.

BREEAM and EcoHomes

From BRE (see www.bre.co.uk), courses cover all aspects of BREEAM and Ecohomes assessment for new buildings, Building Regulations Part L, and the Code for Sustainable Homes.

Building the Future – Sustainable Development

From the Prince's Foundation for the Built Environment, part of a suite of short courses on current issues in the built environment.

Further Information

Tomorrow's Architect

Tomorrow's Architect is the RIBA's manifesto for architectural education. Copies can be purchased from the RIBA Bookshop for £15. Information about *Tomorrow's Architect*, and a list of current RIBA validated courses, visit:
www.tinyurl.com/4gc4zv

Undergraduate and postgraduate studies

You can search for undergraduate and postgraduate courses in the UK at www.ucas.co.uk. This will provide you with full course details, information about the institutions, entry requirements and fees.

CPD

The RIBA's CPD Providers Network provides you with access to over 500 organisations providing ongoing training opportunities. The full list of providers is available at:
www.tinyurl.com/5mg8vz

RIBA Skill

Advanced learning opportunities through RIBA Skill can be researched at:
www.tinyurl.com/6rzovq

RIBA Climate Change Tools

The full suite of climate change tools produced by the RIBA is available for download at:
www.architecture.com/climatechange

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