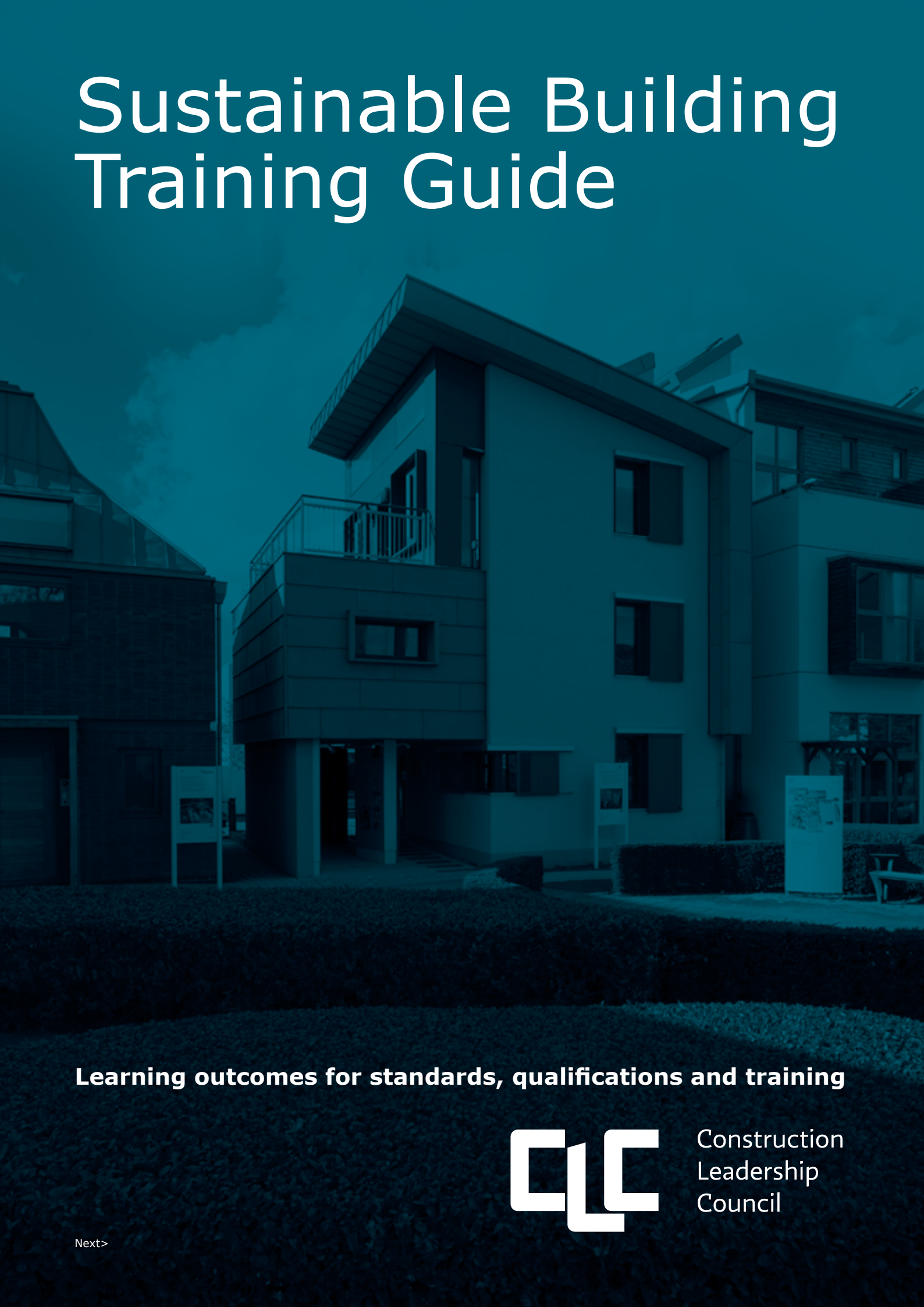
Sustainable Building Training Guide



Learning outcomes for standards, qualifications and training

Construction Leadership Council

Next>

Purpose of this guide

The Green Construction Board has produced this guide to explain the principles of sustainable building in terms that are useful for the development of content for standards, qualifications, apprenticeships and training courses.

The guide aims to support training providers in improving training courses and qualifications to encourage the construction industry to build sustainably, aiding the transition to an energy-efficient and low carbon built environment.

This guide has been produced by the Green Construction Board with the support of CITB. We would like to thank all the parties and individuals engaged in this project for their assistance, cooperation and support during the preparation of this publication.

We particularly recognise the contribution of the task group members:

Rob Lambe (chair), Melius Homes
Richard Bayliss, CITB
Ian Billyard, Leeds College of Building
Kevin Dowd, SummitSkills
Cat Hirst, UK-GBC
Liz Reason, Green Gauge Trust
Phil Stott, YKTO
Lynne Sullivan OBE, LSA Studios

For permission to use any images please contact CITB.

Construction Leadership Council

FOREWORD

If we are to create a built environment that meets the changing needs of society, and is fit for the future, it is critical that the workforce has the right knowledge and skills.

We must embrace the need to use resources more efficiently, reduce embodied carbon and create more energy efficient environmentally friendly built assets.

We must better understand the actual performance of our buildings and infrastructure and whilst there is an increasing understanding of the 'performance gap', much still needs to be done to address it.

It is also necessary to develop our knowledge of the inevitable effects of climate change and of solutions that future-proof buildings and infrastructure against them.

I believe this publication provides a helpful guide to all those involved in the development of standards, qualifications, apprenticeships and training courses and I would like to thank all those that have contributed.

Mike Putnam, Member of CLC and Chair of GCB, President and CEO Skanska UK.

It is essential that sustainability is not viewed as a specialist subject but is embedded within all mainstream learning, including the national curriculum, apprenticeships, degrees and professional qualifications.

All players must understand the impact their contribution makes to the performance of buildings and infrastructure and the inter-dependency of all those involved throughout the stages of design, construct, maintain. This guide is intentionally succinct, providing a common framework of outcomes applicable to a wide variety of roles.

The guide addresses environmental sustainability with an emphasis on energy and low carbon.

Following publication of the guide we will continue to work with training providers, professional institutes and those involved in developing apprenticeship frameworks to integrate sustainable building learning outcomes.

Rob Lambe, Chair of GCB Task Group, MD Melius Homes.

It is essential that our industry has both the knowledge and skills required to deliver sustainable buildings. We welcome this clear and concise guidance and support consistent training & qualifications across the industry that can be recognised by all employers.

Suzannah Nichol MBE, Chief Executive, Build UK

The Chartered Institute of Building is at the heart of a management career in construction and we embrace our role in ensuring that the individuals working in the sector have the knowledge and skills necessary to respond to the current and emerging needs of society. We welcome this guide and will map the content against our established learning framework to ensure that all aspects are embedded. We will also ask our Industry Partners to place this guidance at the core of their training offer so that our members are able to make a real contribution to sustainable building.

Chris Blyth, Chief Executive, Chartered Institute of Building (CIOB)

The RIBA supports energy reduction and sustainability in architectural education, Chartered Practice and continuing professional development. This guide is an important primer, that provides the basis for better cross-disciplinary understanding, between all those involved in building projects. It will enable integrated outcomes which deliver on quality and resilience.

Alan Vallance, Chief Executive, Royal Institute of British Architects (RIBA)

Endorsements:

> ***Construction employers know that sustainability is important and they want to ensure it is covered in mainstream training. This guide helps demystify sustainable construction by presenting the key principles in an accessible way, which can be included in new qualifications and in training delivery. It is a key reference for anyone involved in construction training.***
>
> Sarah Beale, Chief Executive, Construction Industry Training Board (CITB)

What is sustainable building?

The Construction Leadership Council wants to support and encourage the construction industry to build sustainably. This will aid the transition to an energy-efficient and low carbon built environment.

The principles of sustainable development are:

- environmental protection
- economic development
- social development.

Sustainable (or 'green') building aims to embody these principles in the siting, design, building, maintenance, occupation and use of buildings.

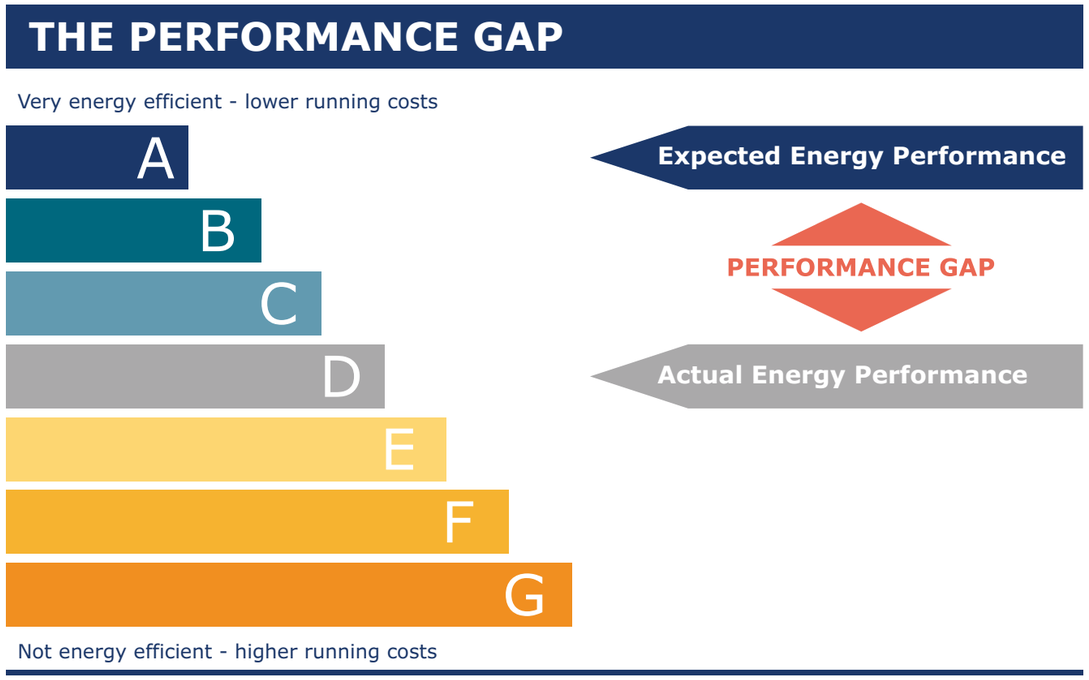
Sustainable buildings are designed and constructed to high environmental standards to minimise energy requirements, reduce water consumption, use materials which are resource efficient and of low environmental impact (e.g. low embodied energy or carbon), reduce wastage, conserve and enhance the natural environment, and safeguard human health and wellbeing.

The construction industry has a vital role to play in consistently designing, constructing and maintaining buildings that deliver these outcomes, providing healthy places for people to live and work.

Achieving energy efficiency

Buildings should work as an energy system, in which heat gains and losses are always in balance. The higher the loss from the building fabric, the more energy is needed to heat or cool it. Buildings lose heat through the external envelope in two ways: firstly, by a complex mix of conduction, convection and radiation through the materials and air spaces in the construction, and secondly via direct air leakage from inside to outside. This means that the design of the building envelope is critical.

Insulation layers and the associated detailing at junctions need to be designed and constructed with considerable care, based on a good understanding of the heat loss mechanisms involved. In addition, plant and equipment needs to be correctly sized, energy-efficient, and the whole services system designed, installed, commissioned and operated to achieve maximum overall efficiency.



Closing the performance gap

Recent research has revealed a huge gap between how much energy a building is designed or predicted to use, and its actual energy use, which is often much higher – in some cases as much as five times the designed or predicted energy consumption. Although some of this can be attributable to variations in use, which is difficult to predict, a large element is related to the technical underperformance of fabric and services due to design and construction failings. This is referred to as the 'performance gap', and one of the important contributors to the gap is a lack of understanding of energy efficiency within the built environment workforce. It is now common for building performance to be either measured during construction (e.g. airtightness tests) or after the building is complete, to identify how it performs while in use rather than just relying on a statement of the design intent.

Recommended Learning Outcomes for Sustainable Building

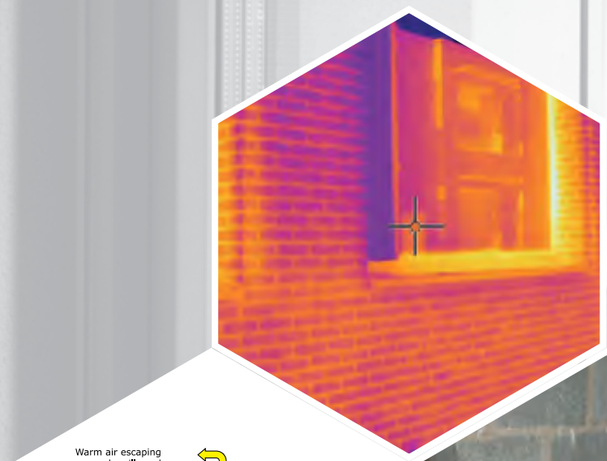
These tables comprise specific learning outcomes that can be used to embed the principles of sustainable building in standards, qualifications, apprenticeships, and training courses. They set out the key criteria for the sustainability knowledge and skills required in four different occupational areas:

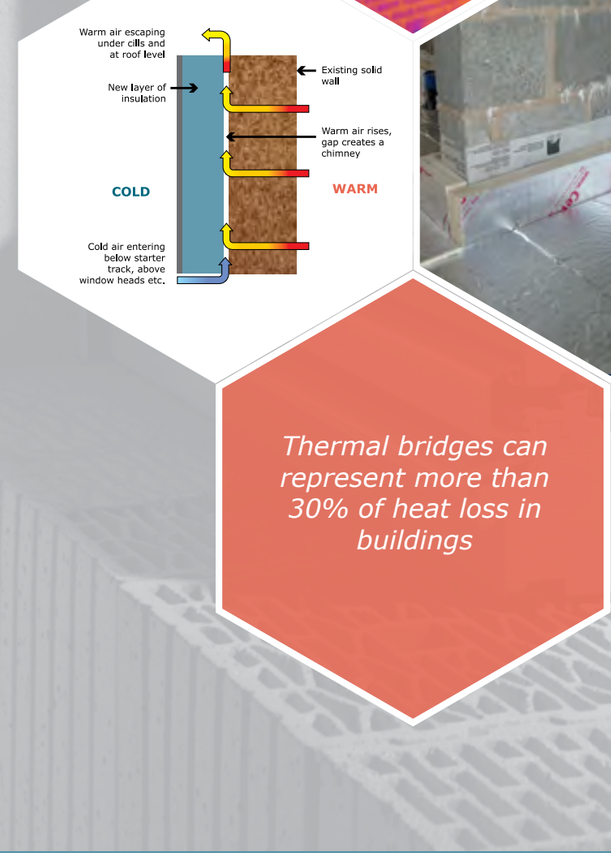
- construction trades
- building services engineering trades
- managers and supervisors
- designers.

CONSTRUCTION TRADES	
Theme	Learning outcomes
Low energy / Low carbon building	Understand the role of your trade in achieving the required energy and carbon performance to minimise energy demand and associated costs over the life of the building. Understand the principles of airtightness and the requirements for effectively installing the air barrier (sealing at junctions and penetrations etc.) Understand the principles of effective insulation, including: • insulation fitting and placement for different insulation types • thermal bridging and condensation risks • thermal bypassing. Understand the impacts of your trade on the design and installation of efficient energy and ventilation services. Understand the basic principles of air quality and ventilation. Understand the main causes of overheating and how to reduce it.
Sustainable products	Know and identify responsibly sourced products (FSC/PEFC and responsibly sourced materials, e.g. BES6001).
Waste, reuse and recycling	Understand the principles of materials storage, recycling and reuse opportunities, in order to minimise waste.
Water	Have a working knowledge of water efficiency on a construction site.
Whole build process	Know the sequence of works and the role of dependent trades in the build process.

This guide is essential in ensuring that future construction education & training reflect the drive towards sustainability.

Martyn Price MBE, Chairman, Cross-Industry Construction Apprenticeship Task Force (CCATF)





Thermal bridges can represent more than 30% of heat loss in buildings

BUILDING SERVICES ENGINEERING TRADES

Theme	Learning outcomes
Low energy / Low carbon building	Understand the effect upon the building fabric of remedial or new installation work (e.g. installers should know the effects of walls and windows on heat loss; heating designers should be able to accurately calculate U-values). Understand ventilation and its effects on health, condensation, dampness etc. Understand the principles of renewable energy technologies systems installation, commissioning, handover and maintenance including heat pumps, solar thermal and PV, water harvesting/reuse and biomass systems. Understand how heating technologies, such as radiators and underfloor heating, and combustion and heat pumps can be integrated. Understand the effect that control systems (including weather compensation, thermostats, individual room control and internet-based controls) have on heating. Understand the difference between insulation types and how they are incorporated into the building fabric. Understand the main causes of overheating and how to reduce it. Understand basic life cycle costing (e.g. capital cost, energy consumption, energy costs, business case) for lighting and heating systems. Understand the principles of flexible HVAC and lighting systems in creating adaptable spaces.
Sustainable products	Know and identify responsibly sourced materials (FSC/PEFC and responsibly sourced products, e.g. BES6001).
Waste, reuse and recycling	Understand the principles of materials storage, recycling and reuse opportunities in order to minimise waste.
Water	Have a working knowledge of water efficiency on a construction site. Communicate to customers appropriate resource-efficient water systems.
Whole build process	Understand the role of dependent trades in the build process. Understand the main requirements and objectives of the commissioning process, as well as the various standards and how to meet them.

Benefits of improving heating systems and insulation are lost if warm air can leak out of a building and cold air can leak in

One of the key requirements of BESA membership is the demonstration of technical competence. This guide is a real contribution to ensuring that this competence extends to understanding the role of our members in delivering sustainable buildings.

Paul McLaughlin, Chief Executive, Building Engineering Services Association (BESA)

MANAGERS AND SUPERVISORS

Theme	Learning outcomes
Low energy / Low carbon building	Be aware of policies, legislation, and regulation. Understand the key principles of energy performance measurement, and measurement protocols, methodologies and tools. Understand the key principles of passive and low energy design. Understand the key principles of carbon and energy reduction in buildings and the application of life cycle costing to make better informed design decisions. Understand the principles of building physics in relation to energy and carbon performance. Understand the principal requirements of a range of common energy performance standards, and have a working knowledge of how to achieve them. Understand the principal causes of the performance gap. Understand the key elements in the design and construction of an effective thermal fabric, including: • insulation design and construction • minimisation of thermal bridging and condensation risks • minimisation of thermal bypassing • air permeability and air barrier design and construction. Understand the key principles of the design and construction of efficient energy services, including the impact of the whole system (e.g. pipework, flues and other components) on energy performance. Understand the impact of services commissioning on performance, and be able to ensure they are effectively specified. Understand the key requirements for ventilation. Understand the key determinants of overheating and how it can be minimised.
Sustainable products	Know how to procure and identify responsibly sourced materials (FSC/PEFC and responsibly sourced products e.g. BES6001) and healthy materials (e.g. low VOC products). Understand the principles of embodied carbon and other issues such as resource depletion, reuse and recycling potential waste. Understand the principles of the circular economy.
Waste, reuse and recycling	Be aware of policies, legislation, and regulation. Understand the principles of good waste management. Understand the value of resource efficiency and how to promote it. Understand the key principles of designing for waste minimisation, deconstruction, reuse, recycling and the circular economy.
Water	Understand best practice in water conservation and planning on-site water use.
Whole build process	Know the sequence of works, the role of dependent trades in the build process and their impact on the energy performance of buildings. Understand the principles of build process design to ensure effective building performance. Engage with end users and stakeholders where possible to promote the benefits of resource-efficient products and services. Work to outcomes rather than inputs – not ‘how many’ or ‘how much’ has gone into the building, but whether it will work well when it is operational.

Clients are seeing the tangible benefits of a sustainable fit out. This guide provides a valuable reference to ensure our members have the right skills to meet this demand.

David Frise, Chief Executive, Finishes and Interiors Sector (FIS)

The equivalent to one building in every twenty is thrown away in construction waste

DESIGNERS

Theme	Learning outcomes
Low energy / Low carbon building	Be aware of policies, legislation, and regulation. Understand the key principles of energy performance measurement and measurement protocols, methodologies and tools. Understand the key principles of passive and low energy design. Understand the key principles of carbon and energy reduction in buildings and the application of Life Cycle Costing to make better informed design decisions. Understand the principles of building physics in relation to energy and carbon performance. Understand the principal requirements of a range of common energy performance standards and a working knowledge of how to achieve them. Understand the principal causes of the performance gap. Understand the key elements in the design and construction of an effective thermal fabric, including: • insulation design and construction • minimisation of thermal bridging and condensation risks • minimisation of thermal bypassing • air permeability and air barrier design and construction. Understand the key principles of the design and construction of efficient energy services, including the impact of the whole system (e.g. pipework, flues and other components) on energy performance. Understand the impact of services commissioning on performance and be able to ensure they are effectively specified. Understand the key requirements for ventilation. Understand the key determinants of overheating and how it can be minimised. Understand the key future maintenance requirements of the buildings assets and how these affect energy efficiency and the impact on the life-cycle costs of the building.
Sustainable products	Know how to specify responsibly sourced materials (FSC/PEFC and responsibly sourced products e.g. BES6001) and healthy materials (e.g. low VOC products). Understand the principles of embodied carbon and other issues such as resource depletion, reuse and recycling potential waste. Understand the principles of the circular economy.
Waste, reuse and recycling	Be aware of policies, legislation, and regulation. Understand the principles of good waste management. Understand the value of resource efficiency and how to promote it. Understand the key principles of designing for waste minimisation, deconstruction, reuse, recycling and the circular economy.
Water	Understand best practice in water conservation and planning water use on site.
Whole build process	Know the sequence of works, the role of dependent trades in the build process and their impact on the energy performance of buildings. Understand the principles of build process design in order to ensure effective building performance.

One of our key strategic priorities is to encourage collaboration and knowledge sharing amongst our members. This guidance neatly contributes to this agenda and we will ensure that it is widely circulated and acted upon.

Graham Watts, Chief Executive, Construction Industry Council (CIC)

Additional resources

www.constructionleadershipcouncil.co.uk

CIBSE Guide L: Sustainability

CIOB Education Framework

CITB Standards for 14 to 19 Education

SummitSkills' guides to sustainable energy

www.supplychainschool.co.uk

Zero Carbon Hub Builders' Book

Zero Carbon Hub Thermal Bridging Guide

Construction
Leadership
Council

<Previous

Feb 2017 (17-046)