

Active Building Glossary

Version 2.0, October 2020



Contents

	Page
Key Terminology	4
Abbreviations	7
Units of Measurement	10
Relevant Organisations	11
Relevant Legislation and Targets	12
Environmental Assessment Methods	13
Relevant Funding Bodies	15
Relevant Training Bodies	16
Relevant Teaching Resources	18
Further Resources	19

Key Terminology

Key Terms	Explanation
Active Building:	An environmentally responsive building that supports the energy network by intelligently integrating renewable energy technologies for electricity, heat and electric vehicles. Use of energy storage and smart controls allow controlled export and import of energy to and from the grid, significantly reducing grid stress.
Active Pod:	SPECIFIC's first building-scale prototype, constructed in 2014 as a research aid, to demonstrate the generation, storage and release of emerging technologies and how these could be installed into a working building. Further information can be found here .
Active Classroom:	SPECIFIC's first full-scale Active Building Demonstrator, constructed in 2016 on Swansea University's Bay Campus, to demonstrate emerging technologies developed by SPECIFIC and their industry partners. It was initially conceived as a showcase for the British Science Festival, which Swansea University hosted in 2016, and has been used extensively for teaching and hosting meetings, seminars and other events since it opened. It provides an ideal platform to test new technologies and how they integrate into a working building, also demonstrating possibilities of retrofitting technologies (e.g. a new PV window prototype; and a new battery storage system). Refer to Active Classroom Case Study for more information.
Active Office:	SPECIFIC's second full-scale building, constructed adjacent to the Active Classroom in 2018. The purpose of this building was to demonstrate scalability and replicability of the Active Building concept. Refer to the Active Office Case Study for more information.
Air-tightness Testing:	A recognised method of measuring the extent to which air is lost through leaks in the building fabric. Sometimes referred to as air leakage, air permeability, air infiltration or air pressure testing. The main method used is known as a door blower test.
CarbonBuzz:	A platform for benchmarking and tracking energy use in projects from design to operation developed and led by the RIBA and CIBSE. It was established with the intention of encouraging users to design for performance rather than just compliance. Users can upload energy data at each project stage, enabling comparison between designed and actual energy use, the aim being to close the design and operational energy performance gap in buildings.
Embodied Carbon:	The carbon footprint of a material. It considers how many greenhouse gases (GHGs) are released throughout the supply chain. The most complete measurement is from cradle to grave, although it is sometimes measured from cradle to (factory) gate or from cradle to site (pf use).
Energy:	The capability of an object, or system, to do work. Common units for energy in the built environment are kilowatt hours (kWh).
Energy Demand Profile:	An energy demand/consumption/load profile is essential to determine the energy strategy for a building; and to size energy generation and storage systems. The energy demand profile – hourly, daily and annually – can be used to develop a control strategy for the import and export of energy to and from a building, depending on energy costs or grid carbon intensity at different times of the day.

Key Terminology

Key Terms	Explanation
Energy Positive:	A building that produces more on-site energy from renewable sources than it consumes to achieve sufficient power to operate the building and deliver appropriate thermal comfort levels.
Energy Use Intensity (EUI):	The EUI expresses a building's energy use as a function of its total area and provides a way to evaluate the means of reducing overall energy consumption.
Form Factor:	The ratio of a building's external surface area to the internal floor area.
G-value:	A measure of how much solar heat (infrared radiation) is allowed in through glass. A low g-value indicates that a window lets through a low percentage of solar heat (i.e. will need less cooling, but will benefit less from passive solar heating)
Heat meters:	Devices to measure heat energy distributed within a heating or domestic hot water system
Maximum Charge Rate:	The limit at which an energy system can charge an energy storage system
Minimum State of Charge:	The relative state of charge below which the storage system is never drawn, specified as a percentage of the total capacity. Most batteries are not meant to be fully discharged (fully discharging could permanently damage them). The minimum state of charge is typically set to 30-50% in order to avoid damaging the storage system by excessive discharge
Microgrid:	A localised group of interconnected loads and distributed energy resources within clearly defined electrical boundaries acting as a single, controllable entity with respect to the grid. Microgrids can connect and disconnect to the grid to allow them to operate in both grid-connected or island-mode, depending on physical or economic conditions.
Net Zero Carbon:	When the amount of CO ₂ emissions released on an annual basis is zero or negative. The World Green Building Council define a net zero carbon building as a highly energy efficient building that is fully powered from on-site and/or off-site renewable energy sources and utilises carbon offsets.
Operational Carbon:	The amount of greenhouse gases (GHGs) associated with the in-use operation of a building. It usually includes carbon emissions associated with both regulated and unregulated energy uses.
Passive Design:	Utilising natural sources of heating and cooling, such as the sun and natural breezes. It is achieved by appropriately orientating a building on its site and carefully designing the building envelope to maximise benefits of the natural environment.
Power:	The rate at which energy is used or produced (energy/time) and is measured in Watts (W). Higher power levels require work to be done faster, consuming or generating energy more quickly.
Pyranometer:	A type of actinometer used for measuring solar irradiance on a planar surface. It is designed to measure the solar radiation flux density (W/m ²) from the hemisphere above within a wavelength range 0.3 µm to 3 µm.

Key Terminology

Key Terms	Explanation
RIBA Plan of Work:	The Royal Institute of British Architects (RIBA) Plan of Work is used to organise the process of briefing, designing, constructing and operating building projects in eight stages. It explains the stage outcomes, core tasks and information exchanges required at each stage.
Roundtrip Efficiency:	The round-trip efficiency of electrical energy storage is the round trip DC-to-storage-to-DC energy efficiency of the storage system, or the fraction of energy input to a system which is available for use after system efficiency losses have been deducted. It is typically about 80%. Roundtrip efficiency = ((energy in - efficiency losses)/energy in) x 100
Seasonal Commissioning:	Seasonal commissioning takes place outside of the normal contract period, due to the recognition that some aspects of systems (such as heating) need to be commissioned when the external temperatures and indoor occupancy patterns are close to the peak conditions for which the system was designed. For the majority of the time, however, most systems are operating at part load and it is important to establish that they also operate correctly under those conditions.
Solar Energy:	Energy falling on the surface of the earth in the form of electromagnetic radiation generated by the sun.
Solar Irradiance:	The amount of light energy from the sun measured at the earth.
The SHED:	SPECIFIC's Industrial retrofit demonstrator, the Solar Heat Energy Demonstrator (SHED) is a 1990's built industrial unit, which has been retrofitted with a Transpired Solar Collector (TSC) on the southwest façade and on the roof – refer to Active Building Technology Showcase for more information; diurnal and inter-seasonal solar thermal storage prototypes; and a solar test rig on the southeast elevation. Further information can be found here .
Thermal Bridging	A situation in a building where there is a direct connection between the outside and inside through one or more elements that possess a higher thermal conductivity than the rest of the building envelope.
Thermography	A non-contact measurement technique that produces a false colour map of surface temperature – in other words, a visual method of illustrating invisible heat energy. Thermography or thermal imaging cameras are sensitive to invisible electromagnetic waves in the infrared range (0.78 - 1000µm) which are emitted by all surfaces above absolute zero (-273 °C).
U-value:	Measured in W/m ² K, this is the rate of heat transfer through a structure divided by the difference in temperature across that structure. The better insulated a structure is, the lower the U-value and hence the lower the heating requirements.
Vehicle to Grid:	Vehicle-to-Grid (V2G) is a system in which plug-in electric vehicles communicate with the grid to sell demand response services by either exporting electricity to the grid or controlling their charging rate

Abbreviations

Abbreviation	Explanation
AC	Alternating Current - an electric current that reverses polarity at a given rate (50 times a second, or 50 Hz in the UK), typically used in power supplies.
AHU	Air Handling Unit - used to condition and distribute air within a building
ASHP	Air Source Heat Pump - Uses the refrigeration cycle to absorb heat from outside air to provide space heating and hot water for use in a building.
BIPV	Building Integrated Photovoltaics – solar technology integrated into façade or roof elements.
BMS	Building Management System – used to monitor and control a buildings mechanical and electrical services.
BPE	Building Performance Evaluation – uses testing and physical monitoring techniques combined with POE methods to evaluate how a building performs and to detect any issues in design, commissioning, handover and operation.
CHP	Combined Heat and Power – a highly efficient process that captures and utilises the heat by-product of the electricity generation process
CI	Carbon Intensity of electricity is a measure of how much CO ₂ emissions are produced per kilowatt hour of electricity consumed.
COP	The efficiency of refrigeration systems and heat pumps is denoted by its Coefficient of Performance (COP), which is the ratio between electrical energy input to the compressor and useful thermal output for cooling at the evaporator (in a refrigeration system) or heat extracted from the condenser (of a heat pump). A high COP value represents a high efficiency
DALI	Digital Addressable Lighting Interface – a network-based protocol that controls lighting in building automation.
DC	Direct Current: an electric current that flows in one direction only. Photovoltaic renewable energy sources produce DC electricity and this is usually converted to AC for use in buildings.
DEC	Display Energy Certificate – a record of actual energy use of a building, mandatory for all public buildings over 250m ² .
DSM	Dynamic Simulation Model – an accurate tool for assessing the environmental performance of a building.
DSR	Demand Side Response: the modification of consumer demand for energy through various methods such as financial incentives and behavioural change through education.
EPC	Energy Performance Certificate – predicts energy use of a building, energy costs and carbon emissions; mandatory for all buildings eligible to buy or let in the UK.
EUI	Energy Use Intensity – a calculation of the total energy consumed by a building in one year divided by the total gross floor area of the building – kWh/m ² /yr.

Abbreviations

Abbreviation	Explanation
EV	Electric Vehicle – a vehicle that uses an electric motor instead of an internal combustion engine, hence emitting no exhaust from a tailpipe. An EV uses a large traction battery pack to power the electric motor and must be plugged in to a charging station to charge. Typically refers to electric cars, vans, buses, motorbikes, bicycles, or scooters
FMT	Facilities Management team – team responsible for ensuring effective building operation
GAHE	Ground to Air Heat Exchanger – also known as earth tubes, for pre-tempering ventilation air by drawing air through underground pipes at a depth of 1.5m – pre-cools air in summer and pre-heats air in winter, using the near constant temperature of the ground.
GHG	Greenhouse gases absorb and emit radiant energy within the thermal infrared range. The primary greenhouse gases in Earth’s atmosphere are water vapour, carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), and ozone
GSHP	Ground Source Heat Pump – uses the refrigeration cycle to harness heat from the ground by pumping water through pipes within the ground to provide space heating and hot water.
HVAC	Heating, Ventilation and Air-Conditioning – ducted air technology, widely used in buildings and vehicles, to provide thermal comfort and acceptable indoor air quality.
IAQ	Indoor Air Quality – refers to the air quality within and around buildings. It is related to the health and comfort of building occupants.
IoT	Internet of Things: the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data
LCA	Life Cycle Assessment – a methodology for assessing the environmental impact of a building from inception to completion, operation and demolition.
LCCA	Life Cycle Cost Analysis – a method for assessing the total cost of a building over its life (often calculated over a 60-year period).
LTHW	Low Temperature Hot Water circuit
MEP	Mechanical, Electrical and Plumbing elements of a building design.
MVHR	Mechanical Ventilation with Heat Recovery – a continuous source of controlled ventilation that extracts stale, moist air from a building and resupplies fresh, filtered air back in - the extracted air is passed through a heat exchanger that transfers up to 90% of the thermal energy to the incoming fresh air (to work efficiently, requires an air tightness level of < 3m ³ /hr per m ³).
MMC	Modern Methods of Construction is a broad term describing a range of offsite manufacturing and onsite techniques that provide alternatives to traditional construction methods. MMC ranges from volumetric modules, to panelised construction, to the use of innovative techniques for laying concrete blockwork onsite.

Abbreviations

Abbreviation	Explanation
PCM	Phase Change Materials = substances which absorb or release ‘latent’ heat when they experience a change in their physical state, e.g. from solid to liquid and vice versa. They can be used to store heat within building systems for a period of up to a few weeks.
PDT	Project Delivery Team. This refers to a group of people responsible for delivering a building project, including (but not necessarily limited to) the Architect, Building Services Consultant, Structural Engineer, Main Contractor, Project Manager and Subcontractors/installers.
PIR	Passive Infra-Red – electronic sensor that measures infra-red (IR) light radiating off objects in its field of view – technology used in occupancy sensors
POE	Post Occupancy Evaluation – the process of obtaining feedback on a building’s performance in use, part of the BPE process.
PV	Photovoltaics – sometimes referred to as solar panels, a technology that converts solar energy into electricity using semiconducting materials.
PVT	Hybrid Solar Thermal and Photovoltaic technology – generating both heat and electrical energy. Refer to Active Building Technology Showcase for examples.
QA	Quality Assurance - a method of assessing whether the required quality standards for a building and its services are fulfilled
SIPS	Structurally Insulated Panel System is a high performance form of construction using sandwich panels. A SIP is a sandwich structured composite panel, consisting of an insulating rigid core sandwiched between two layers of structural board. SIPS can be used to construct floors, walls and roofs of buildings
TSC	Transpired Solar Collector – solar air heating system that draws ambient air warmed by the sun through perforations in a metal cladding skin to supply a space heating and/or a hot water system. Refer to Active Building Technology Showcase for further details.
WLC	Whole Life Cost - the total cost of ownership over the life of an asset.

Units of Measurement

Units	Description
1 sun	The light intensity on a solar cell is called the number of suns. 1 sun = 1,000 watts of solar energy per square metre (1kW/m ²)
ach	Air changes per hour = the volume of air added to or removed from a space divided by the volume of the space (sometimes called air change rate). Used in the specification of a ventilation system. Also, sometimes used to measure air tightness – the amount of air changes per hour through the external envelope
kgCO₂/m²/yr	CO ₂ emission rate = the amount of CO ₂ emitted from a known area of a building over an annual period
kW	Kilowatt = 1,000 watts of power (the rate of energy transfer)
kWh	Kilowatt hour = unit of measurement that describes the amount of energy used if 1,000 watts of power was used for one hour
kWh/m²/yr	(Sometimes denoted as kWh/(m ² /a) Used to measure energy consumption over an annual period. Divide the total annual energy consumption by the building area to calculate annual energy usage
kWp or Wp	Kilowatt peak or Watt peak = maximum peak power
l/h	Litres per hour – measure of volumetric water flow in a heating or domestic hot water system
m³/m²h @ a specific atmospheric pressure (Pa)	A measurement of air permeability = the rate of air flow passing perpendicularly through a known area under a prescribed air pressure differential between the two surfaces of a material. To comply with Part L of the Building Regulations in the UK, the air permeability of a building should be <10m ³ /m ² h @50pa. For effective use of MVHR in a building, an air permeability <3m ³ /m ² h @50pa is required
W/(m²K)	Watts per metre squared Kelvin is the unit of measurement given to thermal transmittance or U-value = the rate of transfer of heat through a structure (single or composite material), divided by the difference in temperature across that structure. The better insulated a structure is, the lower the U-value will be

Relevant Organisations

Organisation	Description
AECB	Association for Environment Conscious Building - a network for sustainable building professionals in the United Kingdom. Membership of the AECB includes local authorities, housing associations, builders, architects, designers, consultants and manufacturers.
ARB	Architects Registration Board – statutory body for the registration of architects in the UK.
BESA	Building Engineering Services Association – a trade organisation for building engineering services contractors – representing the interests of firms active in the design, installation, commissioning, maintenance, control and management of engineering systems and services in buildings.
BRE	Building Research Establishment – a centre for building science in the UK
CABE	Chartered Association of Building Engineers – a professional body for building engineers across the UK and overseas.
CIAT	Chartered Institute of Architectural Technologists – the qualifying body for architectural technology, primarily in the UK but also internationally
CIBSE	Chartered Institute of Building Services Engineers – an international professional engineering association representing building services engineers
LETI	London Energy Transformation Initiative – a network of built environment professionals working together to put London on the path to a net zero carbon future.
RIBA	Royal Institute of British Architects – professional body for architects primarily in the UK.
RICS	Royal Institute of Chartered Surveyors – professional body promoting and enforcing the highest international standards in the valuation, management and development of land, real estate, construction and infrastructure
RSAW	Royal Society of Architects in Wales (Welsh branch of RIBA)
SPECIFIC IKC	SPECIFIC Innovation and Knowledge Centre – an academic and industry collaboration established to accelerate new products to commercialisation. The centre is led by Swansea University and evolved from the Materials Science Department in the College of Engineering to develop functional coatings for buildings that generate, store, or release energy, with a primary focus on solar energy. It is the founder of the Active Building concept.
SUNRISE	An international project to address global energy poverty through the development of next-generation solar technologies. Led by Swansea University, the SUNRISE network unites several leading universities from the Global South in a transdisciplinary research collaboration, and will build five solar-powered building demonstrators in rural India.
UK GBC	The United Kingdom Green Building Council is a membership organisation which aims to ‘radically transform’ the way that the built environment in the UK is planned, designed, constructed, maintained and operated.

Relevant Legislation and Targets

Legislation	Description
Climate Change Act	To cut greenhouse gas (GHG) emissions by 100% below 1990 levels by 2050
Climate Change Strategy for Wales	3% per annum target reduction in GHG emissions, leading to 40% reduction below 1990 levels by 2020
Construction 2025	33% lower costs, 50% faster delivery, 50% lower emissions and 50% improvement in exports, from construction and built environment by 2025
EPBD	Energy Performance of Buildings Directive – to reduce greenhouse gas (GHG) emissions by 20% below 1990 levels by 2020
EU 20-20-20 targets	20% reduction in GHG emissions from 1990 levels, 20% of EU energy from renewables, 20% improvement in energy efficiency by 2020
EU Energy Efficiency Directive	To reduce final energy consumption by 18% compared to 2007 baseline by 2020
Net Zero: The UK's contribution to stopping global warming	The Committee on Climate Change recommends a new emissions target for the UK: net-zero greenhouse gases by 2050
Paris Agreement	To limit rising global temperatures to 'well below' 2°C using the temperature in pre-industrial times as a baseline. Long-term goal for near net-zero emissions by 2050
Road to Zero Strategy	At least 50%, and as many as 70%, of new car sales and up to 40% of new van sales to be ultra low emission by 2030. End the sale of new conventional petrol and diesel cars and vans by 2040.
UK Housing: Fit for the Future	No gas connections to new housing developments by 2025
UK Industrial Strategy	Grand Challenge Mission for Clean Growth as part of the UK Industrial Strategy: to at least halve the energy use of new buildings by 2030
UK Renewable Energy Strategy	30% of electricity, 12% of heat and 10% of transport energy to come from renewable sources (to meet EU 20-20-20 targets) by 2020
UN SDGs	United Nations Sustainable Development Goals – the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice.
Wellbeing of Future Generations Act	To make provision for public bodies to do things in pursuit of the economic, social, environmental and cultural well-being of Wales in accordance with sustainable development principles. There are seven wellbeing goals: A prosperous Wales; A resilient Wales; A healthier Wales; A more equal Wales; A Wales of cohesive communities; A Wales of vibrant culture and thriving Welsh language; A globally responsive Wales

Environmental Assessment Methods

Environmental Assessment Method	Explanation
Active House	A worldwide quality stamp for comfortable and sustainable buildings, advising on elements that are important to humans life and living in homes. Buildings that receive the Active House label have been designed and evaluated with a combined focus on comfort, smart use of energy and minimum impact on the environment. The label is a sign to homeowners that this building is designed with focus on human needs and a home fit for the future.
BREEAM	Building Research Establishment Environmental Assessment Method – a world leading sustainability assessment method for master planning projects, infrastructure and buildings of all types. It deals with new construction, buildings in-use and refurbishment of buildings. Buildings are scored against 10 categories: Energy; Health and Wellbeing; Innovation; Land Use; Materials; Management; Pollution; Transport; Waste; Water.
Energiesprong	A whole house refurbishment and new build standard and funding approach, based on reducing heating and cooling demand.
Estidama	The Arabic word for sustainability, Estidama is a building design methodology for constructing and operating buildings and communities sustainably. It forms a key aspect of the “Abu Dhabi Vision 2030” drive to build the Abu Dhabi emirate according to innovative green standards.
Green Globes	Green Globes provides in-depth bespoke support for improvements to individual projects, for improved building operation, occupant comfort and the environment. Applicable for new construction, existing buildings and refurbishments.
Green Star	A voluntary sustainability rating system for buildings in Australia, that assesses the sustainability of buildings at all life cycle stages. Projects are assessed against 9 categories: Management; Indoor Environmental Quality; Energy; Transportation; Water; Design Innovation; Material; Land Use & Ecology; Emissions.
LEED	Leadership in Energy and Environmental Design – most widely used green building rating system worldwide, for all building types. Projects are assessed across 6 categories: Sustainable Sites; Water Efficiency; Energy and Atmosphere; Materials and Resources; Indoor Environmental Quality; Innovation in Operations and Regional Priority.
Living Building Challenge	A rigorous, proven performance standard for buildings. A regenerative design framework used to create spaces that give more than they take, with 7 assessment criteria ‘petals’: Energy; Equity; Health; Beauty; Materials; Site; Water.
NABERS	National Australian Built Environmental Rating System - Compares the performance of a building or tenancy to benchmarks representative of other similar buildings in the same location, 12 months of real, measurable data, such as energy and water bills, and waste consumption are used to assess a building or tenancy.

Environmental Assessment Methods

Environmental Assessment Method	Explanation
Passivhaus	Passivhaus focuses on a high level of occupant comfort while using very little energy for heating and cooling. They are built to high levels of air-tightness and thermal efficiency, with rigorous attention to detail at design and construction stages. A retrofit version of Passivhaus is known as Enerphit.
SKA	A tool developed by RICS for fit-outs of non-domestic buildings. It comprises over a hundred 'good practice' measures for energy, carbon emissions, waste, water, materials, pollution, wellbeing and transport.
WELL Building Standard	Global tool for advancing health and wellbeing in buildings. Projects are assessed through 7 concepts: Air; Water; Nourishment; Light; Fitness; Comfort; Mind.

Relevant Funding Bodies

Funding Body	Description
ERDF	The European Regional Development Fund (ERDF) is a fund allocated by the European Union. Its purpose is to transfer money from richer regions and invest it in the infrastructure and services of underdeveloped regions, to allow those regions to start attracting private sector investments, and create jobs of their own. The fund is administered through the Welsh European Funding Office (WEFO).
JRCT	The Joseph Rowntree Charitable Trust supports people who address the root causes of conflict and injustice, primarily through funding applied for by applicants. Funding applications can be made under five priority areas: Peace and Security; Power and Accountability; Rights and Justice; Sustainable Future; Northern Ireland.
The Royal Society	The independent scientific academy of the UK, dedicated to promoting excellence in science for the benefit of humanity. The society provides grants and fellowships for outstanding researchers in the UK and internationally.
UKRI	<p>UK Research and Innovation (UKRI) is the national funding agency investing in science and research in the UK. Operating across the whole of the UK with a combined budget of more than £6 billion, UKRI brings together the 7 Research Councils (including the EPSRC), Innovate UK and Research England.</p> <p>EPSRC - The Engineering and Physical Sciences Research Council is the main funding body for engineering and physical sciences research in the UK. By investing in research and postgraduate training, they build the knowledge and skills base needed to address the scientific and technological challenges facing the UK.</p> <p>Innovate UK is part of UKRI, set up to drive productivity and economic growth by supporting businesses to develop and realise the potential of new ideas, including those from the UK's world-class research base. Innovate UK has a strong business focus, driving growth by working with companies to de-risk, enable and support innovation. The organisation funds business and research collaborations to accelerate innovation and drive business investment into research and development, supporting businesses across all economic sectors, value chains and UK regions.</p>

Relevant Training Bodies

Training Body	Description
AECB	<p><u>Association for Environment Conscious Building:</u> A member organisation which aims to help educate and effect deep lasting change within the construction industry, offering a Carbonlite Retrofit Course; a Passivhaus Training Courses for Designers and Contractors; Webinars, through a free webinar programme; Conferences; and online resources.</p>
BRE Academy	<p>The Building Research Establishment (BRE) Academy offer online and classroom-based training courses on topics such as BIM, Fire Safety, BREEAM and sustainability (including training for BREEAM Assessors).</p>
CAT	<p>The Centre for Alternative Technology (CAT), based in Machynlleth, North Wales, offers graduate and post-graduate courses, short courses, webinars and online events, all focused on the sustainable built environment.</p>
CITB	<p>Construction Industry Training Board: The CITB supports the skills needs of the British construction sector, set up to help the construction industry attract talent and to support skills development. It does this by providing training courses and apprenticeships.</p>
Metal (Swansea University)	<p><u>Materials and Manufacturing Education Training and Learning:</u> An industry demand-led project originally established to upskill people in the field of Advanced Materials and Manufacturing through the provision of short, 10 credit courses at level 4 and above. It is a work-based learning scheme that focuses on technical training modules to address skills shortage and provide industry skills required to thrive in a knowledge-led sector. In 2020, Metal teamed up with SPECIFIC to offer a selection of Active Building courses to construction industry stakeholders:</p> <ul style="list-style-type: none">• Active Building Taster Sessions• E-learning modules• CPD seminars• Short training courses (1 – 3 days)• Toolbox talks for site inductions
RIBA Core CPD	<p>The <u>RIBA CPD Core Curriculum</u> sets out 10 areas for CPD for all RIBA Members. A CPD Programme of seminars is developed every year to provide Architects with all the CPD they need. Other methods of achieving the 35 hours of CPD required each year, include seminars, articles, podcasts, online learning, factory tours, site visits and trade show visits.</p>
SCSS	<p><u>Supply Chain Sustainability School:</u> A free industry wide collaboration, with a vision to be “A world class collaboration to enable a sustainable built environment”. It is applicable for everybody working in the Construction, FM, Homes and Infrastructure sectors in England, Scotland and Wales. Once registered, members complete a self assessment, which provides them with an action plan for their own individual training needs. Services include:</p> <ul style="list-style-type: none">• Training and networking events• E-learning modules• Online training resources

Relevant Training Bodies

Training Body	Description
The Green Register	Established in 2000, the Green Register trains construction professionals from all disciplines of the construction industry to build better, more sustainable buildings. Their courses are delivered across the UK and cover all aspects of sustainable building practices from healthy buildings, passivhaus and retrofitting older buildings through to highly technical training sessions on the holistic management of heat, moisture and air tightness.

Other relevant CPD Providers

https://www.tatasteelconstruction.com/en_GB/services-and-downloads/Continuing-professional-development-courses

<https://www.rehau.com/gb-en/pvcu-windows-doors--composite-curtain-walling/passivhaus-products-and-services/rehau-forum-london/continuous-professional-development>

<https://www.greenbuildingstore.co.uk/services/training-cpds/free-cpds/>

<https://www.ecologicalbuildingsystems.com/cpds>

Useful Websites

Better Buildings Partnership: <http://www.betterbuildingspartnership.co.uk/>

Building Research Establishment (BRE) Group: <https://www.bregroup.com/>

British Photovoltaic Association: <http://www.bpva.org.uk/>

Building Regulations: <https://www.gov.uk/government/collections/approved-documents>

CIBSE technical resources: <https://www.cibse.org/knowledge>

Global Building Performance Network: <http://www.gbpn.org/>

Green Building Store: <https://www.greenbuildingstore.co.uk/>

Green Guide to Specification: <https://bregroup.com/greenguide/podpage.jsp?id=2126>

RIBA Research: <https://www.architecture.com/knowledge-and-resources/>

SPECIFIC IKC: www.specific.eu.com

Supply Chain Sustainability School: <https://www.supplychainschool.co.uk/wal/sustainability/construction/default.aspx>

The Carbon Trust: <https://www.carbontrust.com/home/>

The Zero Carbon Hub: <http://www.zerocarbonhub.org/>

UK Green Building Council: <https://www.ukgbc.org/>

Usable Buildings Trust: <http://www.usablebuildings.co.uk/>

Relevant Teaching Resources

Training Body	Description
Class of Your Own	Established in 2009, <u>Class of Your Own</u> was established to develop innovative, contextualised approaches to teaching and learning, enabling young people from all backgrounds to explore aspirational career pathways, and to establish sustainable relationships between education and industry to provide opportunities for young people. Their aim is to encourage students, teachers and parents to recognise careers in Architecture, Engineering and Construction as highly skilled opportunities. They deliver workshops and other student engagement programmes to schools and colleges; and have developed the Design Engineer Construct (DEC) Curriculum.
MOBIE	<u>Ministry of Building, Innovation and Education</u> (MOBIE) was founded in 2017 by Architect and TV presenter, George Clarke. It is an educational charity to train and inspire young people to innovate in the design and construction of homes in the UK and abroad. The charity's purpose is to attract and inspire future creators of the Built Environment through exciting new technical and vocational courses and schools outreach. The main aim of MOBIE is to inspire future generations into the building profession.

Further Resources

- Brundtland, G.H. 1983. *Our Common Future*. Oxford University Press, USA.
- Caplan, B. 2016. *Buildings are for People: Human Ecological Design*. Libri Publishing, Faringdon, UK.
- Chase, J. 2019. *Solar Power Finance without the Jargon*. World Scientific Publishing Europe Ltd, London, UK.
- Cheshire, D. 2012. *Energy Efficiency in Buildings: CIBSE Guide F*. The Lavenham Press, Lavenham, UK.
- Cheshire, D. 2016. *Building Revolutions: Applying the Circular Economy to the Built Environment*. RIBA Publishing, Newcastle upon Tyne, UK.
- Clarke, J. Littlewood, J. Wilgeroth, P. Jones, P. 2018^p. *Rethinking the Building Envelope: Building Integrated Energy Positive Solutions*. Eco Architecture: 7th International Conference on Harmonisation between Architecture and Nature, New Forest, UK, 2018.
- Clarke, J. Jones, D. P. Littlewood, J.R. Worsley, D. 2019. *Active Buildings in Practice. Chapter 47. In: Smart Innovation, Systems and Technologies*, Vol 163, pp. 555-564.
- Corner, D.B. Fillinger, J.C. & Kwok, A.G. 2018. *Passive House Details: Solutions for High Performance Design*. Routledge, Oxon. UK.
- Dollard, T. 2018. *Designed to Perform*. RIBA Publishing, London, UK.
- Evans, H.M.A. 2016. *How Buildings Work*. RIBA Publishing, RIBA Enterprises Ltd, Newcastle-upon-Tyne, UK.
- Clegg, P. Bradley, K. Feilden, R. & Gething, B. 2007. *Feilden Clegg Bradley - The Environmental Handbook*. Right Angle Publishing, London, UK. (online version: <https://www.theenvironmentalhandbook.com/>)
- Lelyveld, T. & Livingstone, M. 2018. *Good Practice in the design of homes, CIBSE TM:2018*. The Chartered Institute of Building Services Engineers, London, UK.
- Mackay, D.J.C. 2009. *Sustainable Energy – Without the Hot Air*. UIT Cambridge Ltd, Cambridge, UK. (free download: <http://www.withouthotair.com/cft.pdf>)
- Morgan, J. Littlewood, J. Jones, P. Wilgeroth, P. 2017. *Testing and validation of 'building as power station technologies' in practice, to maximise energy efficiency and user comfort and minimise carbon emissions*. International Conference on Sustainability in Energy and Buildings, Chania, Crete, 2017.
- Olgay, V. 2015. *Design with Climate*. Princeton University Press, Oxford, UK.
- Pelsmakers, S. 2015. *The Environmental Design Pocketbook, 2nd Edition*. RIBA Publishing, London, UK.
- Rawlings, R. 2009. *Capturing solar energy, CIBSE Knowledge Series: KS15*. The Chartered Institute of Building Services Engineers, London, UK.
- Stevenson, F. 2019. *Housing Fit For Purpose*. RIBA Publishing, London, UK.