Unit 2: Innovation in a Sustainable Construction Industry

Unit code:	H/504/4334
QCF level:	6
Credit value:	15

Aim

This unit gives learners an understanding of the importance of sustainable construction and the drive for innovation in all aspects of the industry. The unit gives learners an opportunity to demonstrate sustainable innovation in a construction application.

Unit abstract

The drive for innovation in a changing world makes this unit essential for commercial, social and environmental reasons. In this unit learners will apply their understanding of innovative materials, components and building systems to critically review a specific building design proposal in terms of its innovation and sustainability.

Learners will examine innovative, sustainable construction options, in the context of socially responsible strategies to create a sustainable solution to holistic infrastructure and building performance expectations. Finally, learners will have the opportunity to develop a proposal and evaluate the performance of this solution, based on parametric modelling. This should extend their understanding of the integration of materials and components into the construction systems needed for sustainable infrastructure and buildings.

Learning outcomes

On successful completion of this unit a learner will:

1 Be able to appraise the environmental drivers for innovation in sustainable construction

2 Understand the use of innovative materials, components and systems for sustainable construction

3 Be able to develop innovative proposals using appropriate modelling techniques.

Unit content

1 **Be able to appraise the environmental drivers for innovation in sustainable construction**

Environmental drivers on the construction sector: human induced climate change, e.g. extreme weather, rising sea levels, thermal comfort; resource depletion, e.g. fossil fuels, minerals, deforestation, water resources; energy demand; pollution, e.g. air quality, water quality, ozone layer damage; biodiversity; carbon reduction strategies; lifecycle considerations; regulatory control, e.g. Building Regulations

Innovation for sustainable construction: materials (e.g. synthetics, organics, polymers, composites, 'smart' materials); recycled components (e.g. photovoltaic, micro-processors, nanotechnology); building systems (e.g. structural, envelope, services, monitoring, energy management, micro-generation); infrastructure systems (e.g. highways, drainage, water, energy supply, data services)

Critical review of project proposal: review innovative and sustainable techniques adopted; communicate and present findings

Environmental ruler: land development, waste management (e.g. chemical, water, climate, air, noise); administrative procedures

2 **Understand the use of innovative materials, components and systems for sustainable construction**

Specification of materials that promote innovation: aesthetics; performance in use; energy efficiencies (e.g. production and processing of materials); environmental impact, health, safety and welfare

Specification of building services that promote innovation: requirements for temporary and permanent service installations; disposal of waste materials during construction; disposal of waste materials during the life of the project; impact of legislation on design of service installations; sustainable urban drainage systems (SUDS); renewable energy sources

Materials, components and systems: structural, e.g. renewable, composites (such as glulam), textiles, thermal mass, self-repairing, recyclable; envelope, e.g. aesthetics, thermal performance, self-cleaning, ceramics; services, e.g. photovoltaic polymers, photo-chromics, liquid crystal panels; structural, e.g. timber, glulam, structural insulated panels (SIPS), steel, lightweight steel, composite construction, concrete, fibre reinforced, pre-stressed, post-tensioned, hybrid, pneumatic structures, tension structures, structural textiles; envelope, e.g. cladding, rain screen, insulation, roofing, high performance polymer, photovoltaic membranes, glazing, solar gain control, self-cleansing, structural glazing; services, e.g. daylighting, light emitting diodes (LED), heating ventilation and air conditioning (HVAC), mechanical ventilation and heat recovery (MVHR), passive ventilation, grey water recycling, rainwater harvesting, building information systems); infrastructure, e.g. sustainable drainage systems (SUDS), porous paving, recycled bituminous materials; product testing; accelerated take up

3 **Be able to develop innovative proposals using appropriate modelling techniques**

Parametric model: model, e.g. structural model, energy (building simulation model), compliance model, standard assessment procedure (SAP), simplified building energy model (SBEM), drainage system model; experimental techniques; testing; materials and components; standards (national, international), model validation (such as timber roof truss); thermal imaging

Innovative proposal considerations using modelling techniques: materials and components (statutory standards, client specification); systems (statutory standards, client specification)

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	**Assessment criteria for pass** The learner can:
LO1 Be able to appraise the environmental drivers for innovation in sustainable construction	1.1 Critically analyse the impact of environmental drivers on the construction sector 1.2 Appraise how a specific environmental driver leads to innovation for sustainable construction 1.3 Critically review a project proposal in terms of innovation and sustainability
LO2 Understand the use of innovative materials, components and systems for sustainable construction	2.1 Examine the specification of innovative materials used in sustainable construction 2.2 Devise a specification for a project that promotes innovation and sustainability 2.2 Evaluate the long-term implications of using innovative materials, components and systems in a project
LO3 Be able to develop innovative proposals using appropriate modelling techniques	3.1 Evaluate the limitations of a parametric model for a specific design proposal 3.2 Develop an innovative proposal to a design brief using modelling techniques

Guidance

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 4	Level 5	Level 6
Unit 1: Design Principles and Application for Construction and the Built Environment (D/601/1245) Unit 2: Science and Materials for Construction and the Built Environment (H/601/1246) Unit 13: Environmental Impact of Construction (A/601/1270)	Unit 14: Economics for Construction and the Built Environment (J/601/1272) Unit 26: Properties and Performance of Construction Materials (L/601/1287) Unit 47: Energy Utilisation and Efficiency for Building Services Engineering (F/601/1366)	Unit 1: Major Project (Y/503/7221) Unit 3: Managing in the Natural and Built Environment (T/504/4337) Unit 4: Construction Design (T/504/4340) Unit 5: Building Services Design (F/504/4342) Unit 6: Civil Engineering Design (D/504/4347) Unit 9: Construction Regulations for a Sustainable Society (M/504/4353) Unit 12: Planning for Sustainable Communities (F/504/4356)

This unit has been informed by the following National Occupational Standards:

COSBED4C03	Develop and agree detailed designs P4, P6, P8, P11–P13, P16, P21, P22, K11–K13, K23 and K24
COSBED4O11	Specify, manage and analyse testing P1–P3, P7, P13–P16, K1–K3, K10–K12, K20, K22 and K23
COSCCOL4O07	Identify, assess and evaluate project requirements P1, P2, K1, K2, K3 and K12
COSCCOL4O08	Develop and agree detailed project designs P3–P8, P10–P15, K1, K5–K9, K12–K14, K18–K23, K27
BEDCL4/O 04	1.5, 2.5
BEDCL4/O 05	1.1–1.4, 2.1, 2.3, 2.4, 3.3–3.5, 4.3–4.5
CCOL/4O 07	1.1–1.5, 2.1, 2.2
CCOL4/O 08	1.3, 1.4, 2.1–2.4, 3.1–3.6, 4.1–4.4, 4.6, 5.1–5.5, 6.1–6.5.

Essential requirements

For this unit learners unit require access to IT facilities with building simulation modelling software.

Delivery

Learning outcome 1 sets the unit context and enables learners to explore, critically analyse and appraise the environmental drivers for innovation in sustainable construction. This learning outcome can be delivered using articles, from textbooks and reliable websites.

Learners could critically review a centre-devised project proposal.

The tutor could lead an introduction to learning outcome 2 in which learners explore and describe the use of innovative materials, components and systems used for sustainable construction. The tasks that learners have to carry out could relate to the centre-devised project proposal used for assessment criterion 1.3.

For learning outcome 3, there should be an introduction to the solutions and modelling techniques that could be used to develop innovative proposals. Learners could then complete a report evaluating the limitations of a parametric model and apply techniques to develop an innovative proposal to a specified design brief.

Assessment

Assessment for this unit could be in the form of one large assignment covering all the assessment criteria or could be split into two, or perhaps three assignments. For assessment criteria 1.1 and 1.2 learners could produce a written report which critically analyses the impact of environmental drivers on the construction sector followed by a task which asks learners to appraise one specific driver leading to innovation for sustainable construction.

Assessment criteria 1.3, 2.1, 2.2 and 2.3 should focus on a written report which critically reviews a project proposal, devises a specification for a project that promotes innovation, and evaluates the long-term implications of using materials, components and systems in a project. These could all focus on a centre devised project proposal.

Assessment criteria 3.1 and 3.2 could be covered by a written report linked to the centre-devised project, or be assessed separately to separate modelling techniques from the other two learning outcomes.

Evidence for most assessment criteria is likely to be in the form of written reports as identified above. However, learners could present their work though presentations supported by plans or drawing details.

Resources

Books

Berry C and McCarthy S – *Guide to Sustainable Procurement in Construction* (CIRIA Report) ISBN 978-0860176954

Graedel T E and Allenby B R – *Industrial Ecology and Sustainable Engineering* (Pearson, 2010) ISBN 978-0138140342

Griffiths W – *SAP for Beginners: An Introductory Guide for Building Professionals* – IP 10/10, (IHS BRE, 2010) ISBN 978-1848061323

Hitchin R – *A Guide to the Simplified Building Energy Model (SBEM): What it does and how it works* (IHS BRE, 2010) ISBN 978-1848061293

Terry A and Smith S – *Build Lean. Transforming Construction Using Lean Thinking*, CIRIA C696, (CIRIA, 2011) ISBN 978-0860176961

Other publication

BS ISO 15686-5:2008, *Buildings and Constructed Asset – Service Life Planning Part 5: Life Cycle Costing* (British Standards Institution, 2008)

Websites

www.carbontrust.com	Carbon Trust
www.cic.org.uk	Construction Industry Council
ec.europa.eu	European Commission
www.sci-network.eu	Sustainable Construction and Innovation Through Procurement
www.wrap.org.uk	Waste and Resources Action Programme

