



Higher National Unit specification

General information for centres

Unit title: Energy Performance of Buildings

Unit code: F32B 35

Unit purpose: This Unit is designed to enable candidates to develop the knowledge and skills to plan for the effective management of energy within typical buildings. It develops an awareness of the factors that influence the energy demand of buildings through a study of building design features and common systems. Energy management techniques are studied and then applied to a real building and its systems with a view to creating a plan for improving its energy performance.

On completion of the Unit the candidate should be able to:

- 1 Evaluate the influence of building function and the building envelope on its energy performance.
- 2 Explain the influence of building services on the energy performance of a building.
- 3 Apply energy management techniques to a building.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. Whilst there is no requirement for any prior subject knowledge, the candidate would find it helpful to have mathematical skills at SCQF level 5 to understand graphical and tabulated data, manipulate arithmetical expressions and perform simple calculations.

Core Skills: There are opportunities to develop the Core Skills of *Numeracy* (all components) and the component 'written communication' of the Core Skill *Communication* both at level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: This Unit is assessed using two instruments of assessment. Outcomes 1 and 2 are jointly assessed by means of a report. Outcome 3 is assessed by means of an energy management report in which the candidate develops a strategy to enhance the management of energy of a specific building.

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Evaluate the influence of the use made of a building and the building envelope on its energy performance

Knowledge and/or Skills

- ◆ Building fabric factors
- ◆ Occupancy regimes, activity levels and comfort requirements
- ◆ Size, form, shape, location and orientation of buildings
- ◆ Thermal and related characteristics of buildings
- ◆ External climatic influences on buildings

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ identify three significant building fabric factors that influence building energy performance and justify their significance
- ◆ evaluate the merits of two options for the insulation of structural and glazed components of occupied buildings
- ◆ evaluate the comfort requirements for human occupation of two contrasting buildings in consideration of given anticipated activities
- ◆ determine the magnitude of the heat gains and losses from a given building structure relative to size, form, shape, location and orientation to external climatic factors

Assessment Guidelines

This Outcome could be assessed by means of a report addressing all components of the knowledge and skills and could be laid out in a conventional scientific format.

The candidate would be encouraged to complete sections as and when underpinning knowledge has been assimilated.

Higher National Unit specification: statement of standards (cont)

Unit title: Energy Performance of Buildings

Outcome 2

Evaluate the influence of building services on the energy performance of buildings

Knowledge and/or Skills

- ◆ Fuels, CHP, metering and environmental considerations
- ◆ Ventilation and air conditioning
- ◆ Heating and hot water systems
- ◆ Refrigeration options
- ◆ Lighting systems and energy demands
- ◆ Electrical motor systems
- ◆ Control of building systems

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ assess the relative merits of the provision of building energy through solid, liquid and gaseous fuels including the applicability to CHP systems
- ◆ explain the factors that influence the rates of natural and forced ventilation in buildings
- ◆ in qualitative terms, compare the energy performance of two contrasting heating and hot water systems
- ◆ evaluate the relative energy and environmental performance of two contrasting methods for providing cooling services
- ◆ appraise the impact of the choice of lamp and lighting strategy on energy conservation
- ◆ evaluate three measures that can be employed to maximise motor system energy efficiency
- ◆ explain two automatic control systems suitable for controlling building environments and explain the extent to which each is likely to satisfy the control objectives of a specified building or zone

Assessment Guidelines

This Outcome could be assessed by means of a report addressing all components of the knowledge and skills and could be laid out in a conventional scientific format.

The candidate would be encouraged to complete sections as and when underpinning knowledge has been assimilated.

Higher National Unit specification: statement of standards (cont)

Unit title: Energy Performance of Buildings

Outcome 3

Apply energy management techniques to a building

Knowledge and/or Skills

- ◆ Energy audits and surveys
- ◆ Benchmarking, Monitoring and Targeting
- ◆ Building management and maintenance
- ◆ Assessment of energy saving measures
- ◆ Technological and behavioural strategies
- ◆ Performance standards and legislation

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ prepare an accurate energy audit of a specified building area
- ◆ collate and analyse monitoring data to enable benchmark comparison to typical EM standards
- ◆ develop a valid evidence-based strategy for the future management of a building based on Monitoring and Targeting activity that consider both technological, behavioural and financial aspects
- ◆ correctly detail the information and actions required to conform to legislative or other given standards

Assessment Guidelines

This Outcome is assessed by means of a project report of about 2,500 words plus supporting diagrams/sketches. The report should be based on personal investigation of a building and follow the sequence from audit, through M&T activity to developing a strategy for the future management of the building with a view to improving its energy performance in an economically viable manner.

Administrative Information

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Unit title: Energy Performance of Buildings
Superclass category: TH
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History of changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Energy Performance of Buildings

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

It is more or less universally accepted that global climate change is a very real threat and that to reduce carbon emissions to the atmosphere is essential. This will require a multifactorial approach and it is in this context that effective energy management of buildings should be seen. This module explores in detail the options available to a building manager or specifier to enable them to strive for the best possible energy performance. European Directives increasingly include environmental considerations and foremost amongst these are directives concerning energy performance. Hence this module should not be approached from the viewpoint of the achievement of minimum standards, but rather seeking best performance.

Outcome 1 is concerned with exploring the building structure. Given that most energy is used in occupied buildings for space heating, this Outcome concentrates on the desired environmental conditions for occupancy and the thermal performance of the building structure. In particular the thermal transmittance values (U-values) of the principal structural components, the walls, floor, roof and glazed areas need to be considered. Exploring the factors such as exposure, orientation, solar radiation and their influence on the performance is essential. The other principal factor is unplanned ventilation ie draughts, their cause, typical sources and cures should also be considered.

Outcome 2 is perhaps the most substantial of the three Outcomes. It develops Outcome 1 and considers in detail the systems and services in buildings, their performance characteristics and the options that are available to manage (and reduce) the energy requirements. Hence for example, absorption chillers are normally discounted due to their poor COP, but if there is a ready heat source that would otherwise not be fully utilised the candidate should be able to identify this cooling option as an opportunity. All the principal services should be considered but particular focus should be given to those services with the highest energy consumption. This will inevitably include detailed study of heating systems. It is recommended that the characteristics of sophisticated control systems are considered in their application to heating systems.

The final Outcome, 3 concerns the analysis of a real building. The first two Outcomes will have alerted the candidate to the possibilities for the application of energy reduction technologies and in this Outcome the candidate is encouraged to see how these might be applied in practice. It is vital however that this is done on the basis of evidence of need. Hence developing auditing skills and establishing effective metering and recording systems is an essential prerequisite to gather the evidence on which to base action proposals. As all technology developments to enhance energy management are financially limited, the candidate should be trained in simple investment appraisal techniques. The management of a building also demands that the occupiers have appropriate attitudes and behaviour. Thus the programme should incorporate consideration of these areas so that an effective whole building strategy can be produced that considers both technological and behavioural elements. It is too easy to assign a whole building for the candidate to work on however, the scale and complexity of the data may well be too much for the candidate to assimilate. It would be preferable to identify a limited area and data set for the candidate to enable the development of clarity of thinking.

Higher National Unit specification: support notes (cont)

Unit title: Energy Performance of Buildings

Guidance on the delivery and assessment of this Unit

The Unit is specifically designed for use as part of a Group Award in the environmental sciences and it is best delivered in this context. During the course of the Unit the candidate will need to visit buildings to observe first hand the plant and structures under discussion. This will obviously mean gaining access to parts of buildings that are not ordinarily accessed by the general public. There are obvious safety implications in this activity and hence the candidates should be encouraged to undertake risk assessments as part of the Unit and draw up appropriate codes of conduct. It is preferable for as much of the delivery to be related to live examples as possible. Hence it is preferable for the Unit to be taught in the spring or autumn of the year when both heating and air conditioning may be active and can be studied.

The assessment of Outcomes 1 and 2 of the module is through the completion of a common logbook or record of work. The logbook which may be of a pro forma nature should ideally have sections relating to each of the Knowledge and/or Skills areas that the candidate completes through a combination of programmed class work compulsory exercises, site visits and their own research. The candidate should be encouraged to complete discrete sections on a regular basis. This will build to a comprehensive and assessable record and report of their work at the conclusion of the Unit. The final Outcome is assessed through the medium of a report. This should be in the style of a professional report as furnished by energy management professionals. So it will be necessary to guide candidates on the structure and format of such report, preferably through the use of exemplar material. The expectation should be of high quality submissions with a proposed strategy for the future management of a building well supported by evidence, which should include written, tabular and graphical material.

Opportunities for developing Core Skills

The analysis of performance data, and building specifications means there is ample opportunity to develop the *Numeracy* Core Skill. The completion of the logbook and the project report also provide good opportunities to develop written communication skills. Successful completion of this Unit would suggest the attainment of these Core Skills at SCQF level 6, however this is not certificated.

Open learning

It is possible for this module to be completed by distance learning. The candidate will need to be supervised when visiting locations like boiler rooms, refrigeration plant etc and this need should be borne in mind. The assessments can be completed on-line, with the exception of the assessment or Outcome 3 which will require a suitable scenario to be prepared.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Energy Performance of Buildings

Tackling global climate change is an urgent issue and reducing carbon emissions to the atmosphere is essential. To achieve this will require a wide range of approaches and one of the most important of the approaches will be the effective energy management of buildings. This Unit explores in detail the options available to a building or energy manager to improve energy performance and reduce emissions and operating costs.

The Unit is designed to develop your awareness of the factors that determine the energy efficiency of buildings and their systems. So you will learn about such varied subjects as systems for heating, lighting, ventilation, refrigeration, electrical power, insulation and glazing as well as many others. You will gain new skills in energy management and learn how to spot opportunities for improvement. This is done in an applied way. So you will survey a particular building and make recommendations to improve its energy performance.

Energy managers require many skills; from understanding the application of sophisticated technologies in buildings, through knowing how to cost projects, to understanding peoples' behaviour. All these aspects are covered in this Unit which will equip you with some of the key skills for the environmental industries.