



Australian Government

Department of Education, Employment and Workplace Relations

UEENEEK151A Develop effective engineering strategies for energy reduction in buildings

Release: 1

UEENEEK151A Develop effective engineering strategies for energy reduction in buildings

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers evaluating energy used in buildings and developing and documenting strategies/methods to effectively reduce energy use without compromising occupancy standards. It encompasses working safely, setting up and conducting evaluation measurements and evaluating energy use from measured parameters.

Application of the Unit

Application of the Unit 2)

This unit is intended for competency development entry-level employment-based programs incorporated in approved contracts of training. It applies to any formal recognition for this standard at the aligned AQF 5 level or higher.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and contracts of training such as new apprenticeships.

Pre-Requisites

Prerequisite Unit(s) 4)

Competencies 4.1)

Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed:

UEENEEK1 32A Develop strategies to address environmental and sustainability issues in the energy sector

Literacy and numeracy skills 4.2)

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading 5 Writing 5 Numeracy 5

Employability Skills Information

Employability Skills 5)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to develop strategies for effective energy reduction in buildings.	1.1 OHS procedures for a given work area are identified, obtained and understood
	1.2 Established OHS risk control measures and procedures are followed in preparation for the work
	1.3 The extent of evaluation is determined from specifications of building(s) and services, plant and machinery and discussed with appropriate personnel
	1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others
	1.5 Tools, testing devices, and materials needed to carry out the work are obtained and checked for correct operation and safety
2 Develop strategies for effective energy reduction in buildings.	2.1 OHS risk control measures and procedures for carrying out the work are followed
	2.2 Tests and measurements are carried out in strict accordance with OHS requirements safety procedures
	2.3 In-depth knowledge of the energy use of building services, plant and machinery is applied to the evaluation process
	2.4 Energy evaluation tests are set up in accordance with established test methods and procedures for each particular parameter under scrutiny
	2.5 Strategies to reduce energy use with compromising occupancy standards are developed from knowledge of energy management and evaluation test results.
	2.6 Unexpected situations are dealt with safely and with the approval of an authorised person
	2.7 Evaluation is carried out without damage to systems, circuits, the surrounding environment or services and using sustainable energy

ELEMENT	PERFORMANCE CRITERIA
3 Document and report strategies for effective energy reduction in buildings	practices
	3.1 OHS work completion risk control measures and procedures are followed
	3.2 Work site is cleaned and made safe in accordance with established procedures
	3.3 Results of energy use evaluation and recommended strategies and their criterion for energy reduction are documented in accordance with established procedures
	3.4 Energy reduction report is forwarded to appropriate persons

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence must show that knowledge has been acquired of safe working practices and developing strategies for effective energy reduction in buildings.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EK151A **Energy efficient building design**

Evidence shall show an understanding of energy efficient building design to an extent indicated by the following aspects:

- T1 Climate and thermal comfort encompassing:
- characteristics of the different Australian climatic types.
 - use of climatic data in published and electronic forms to extract the quantities relevant to energy efficient design.
 - relationship between climate and comfort using bioclimatic or psychrometric charts.
 - calculation of heating or cooling degree days or degree hours for various locations.
 - calculation of thermal neutrality for a given location.

REQUIRED SKILLS AND KNOWLEDGE

- T2 Solar geometry and radiation encompassing:
- definition of the terms: declination, hour angle, zenith angle, azimuth and altitude angles, the equation of time.
 - conversion of solar time to local time and vice versa.
 - position of the sun and the length of shadows with the aid of algorithms, tables, sun charts or computer software.
 - daily irradiation incident on a wall, window or roof of a given tilt and orientation.
 - relative summer and winter irradiation of windows facing the cardinal orientations.
- T3 Heat transfer encompassing:
- thermal processes of conduction, convection and radiation apply to the transfer of heat in buildings.
 - calculation of the summer and winter U-values of building elements using tables and software.
 - calculation of the infiltration heat transfer in a building.
- T4 Glazing Systems encompassing:
- different types of glazing systems and their characteristics.
 - different types of shading devices and the window orientations for which they are most appropriate.
 - solar heat gain for different glazing types and angles of incidence
 - calculation of the average daily irradiation of a window partly shaded by eaves, using computer software.
 - calculation of the average daily heat gain through a window partly shaded by eaves.
- T5 Insulation encompassing:
- different types of insulation and where they are used.
 - how different types of insulation are installed in roofs, walls and floors.
 - determination of the minimum R-values of roof insulation for different locations using Australian Standard AS2627 or similar standards.
- T6 Thermal mass encompassing:
- advantages and disadvantages of using substantial thermal mass in different climate types and for different heating and cooling regimes.
 - where thermal mass can be located in a building.

REQUIRED SKILLS AND KNOWLEDGE

- explain what is meant by the following terms: time lag, decrement factor, admittance, response factor.
- T7 Comfort control strategies encompassing:
- interpretation of the usefulness of a design strategy with the aid of a psychrometric chart showing control potential zones for a particular location.
 - selection of the most useful comfort control strategies for Australian climatic regions.
- T8 Energy efficiency in buildings encompassing:
- determination of the direction of the following: both true and magnetic, north winter and summer sunrise, winter and summer sunset.
 - solar access in summer and winter to various possible house locations on a site and room locations within the house.
 - how vegetation can be used to both funnel and deflect wind.
 - using cross ventilation as a cooling strategy.
- T9 Thermal performance of a building encompassing:
- heating requirements of a building using the heating degree day or hour method.
 - dynamic performance predicted by a computer simulation program such as NatHERS or BERS.
- T10 Integration of active solar systems encompassing:
- active solar system types available which can provide hot water, space heating and cooling.
 - the best location on the roof, and the optimum tilt and orientation of the collector panels.
 - function of the main components of an air or water-based solar space heating system.
 - schematic of the fluid circuit of an air or water-based space heating system.
 - main solar cooling system types.
- T11 Energy rating schemes encompassing:
- differences in approach used by house energy rating schemes in Australia.
 - energy performance of a number of houses using a computer simulation program such as NatHERS or BERS.
 - other methods to reduce energy consumption within and outside a building including appliance efficiency, human

REQUIRED SKILLS AND KNOWLEDGE

- behaviour changes, building management strategies and transportation minimisation.
 - additional cost of energy efficiency measures and cost savings using life cycle cost or simple pay back methods according to Aust. Standard AS3595 and AS4536.
- T12 Sustainable and safe building materials encompassing:
- common building materials and their embodied energy content.
 - environmental impact of the production of various building materials.
 - problems associated with the use or disposal of building materials.

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit and must be read in conjunction with the performance criteria and the range statement of the unit and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment **9.1)**

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. In some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the

most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety issues inherent in working with electricity, electrical equipment, gas or any other hazardous substance/material present a challenge for those determining competence. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit 9.2)

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit must be considered holistically. Each element and associated performance criteria must be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence must also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this must incorporate evidence that shows a candidate is able to:
 - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
 - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
 - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a

percentile graded result for the purpose of regulatory or licensing requirements.

- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Develop strategies for effective energy reduction in buildings as described in 8) and including:

A Determining the extent of the evaluation.

B Setting up and conducting appropriate examinations and tests.

C Reporting evaluation including recommendation for improving energy efficiency

D Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items

Context of and specific resources for assessment 9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to developing strategies for effective energy

reduction in buildings.

**Method of
assessment**

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires assessment in a structured environment which is intended primarily for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

**Concurrent
assessment and
relationship with
other units**

9.5)

There are no concurrent assessment recommendations for this unit.

Range Statement

RANGE STATEMENT

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit must be demonstrated in relation to developing strategies for effective energy reduction in at least two buildings each used for a different purpose.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field 11)

Renewable and Sustainable Energy