Australian Government

UEENEEK131A Design wind energy conversion systems (WECS) rated to 10 kW

Release 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEK131A Design wind energy conversion systems (WECS) rated to 10 kW

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers the design of wind energy conversion systems and their installation. It encompasses following design briefs, incorporating schemes for protection of persons and property from dangers of system malfunction, ensuring other safety and performance standards and functional requirements are meet and documenting design calculations and criteria.

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

UEENEEK130A	Solve problems in wind energy conversion systems rated to 10 kW
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEE104A	Solve problems in d.c. circuits
UEENEEE101A	Apply occupational health and safety regulations, codes and practices in the workplace

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

Employability Skills **5)**

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 design wind energy conversion systems	1.1	OHS processes and procedures for a given work area are identified, obtained and understood
	1.2	The extent and nature of the system is determined from design brief
	1.3	Safety and other regulatory requirements to which the electrical installation must comply are identified, obtained and understood
	1.4	Design development work is planned to meet scheduled timelines in consultation with others persons involved in the installation or associated work
2 Develop wind energy conversion systems design.	2.1	Knowledge of wind energy conversion systems performance standards, compliance methods is applied to the design
	2.2	Alternative arrangements for the wind energy systems design are considered based on the requirements outlined in the design brief
	2.3	Safety, functional and budgetary considerations are incorporated in the design
	2.4	Wind energy system design draft is checked for compliance with the design brief and regulatory requirements

ELEMENT	PERFORMANCE CRITERIA	
	2.5	Wind energy system design is documented for submission to appropriate persons for acceptance and approval
	2.6	Solutions to unplanned situation are provided consistent with organisation policy
3 Obtain approval for wind energy conversion systems design.	3.1	Wind energy system design is presented and explained to client representative and/or other relevant persons
	3.2	Requests for alterations to the design are negotiated with relevant persons within the constraints of organisation policy
	3.3	Final design is documented and approval obtained from appropriate persons
	3.4	Quality of work is monitored against personal performance agreement and/or established organisational or professional standards

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 designing wind energy conversion systems rated to 10 kW.

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

KS01-EK131A Design of small wind energy conversion systems (WECS)

Evidence shall show an understanding of the design of small wind energy conversion systems (WECS) to the extent indicated by the following aspects:

T1 Wind characteristics encompassing:

- definition of the terms: weather charts, isobars, fronts and troughs, cyclone and anti-cyclone, atmospheric boundary

REQUIRED SKILLS AND KNOWLEDGE

layer, geotropic wind, gradient wind, wind shear, wind rose

- major global wind circulations and the formation of major wind flows over your continent.
- major features of the atmospheric boundary layer including: variation of wind speed with height according to logarithmic and power Laws, effects of surface roughness
- atmospheric stability and temperature inversions turbulence.
- major local winds including: trade winds, sea and land breezes, katabatic and anabatic winds.
- likely effects on the major local winds from local topography, surface roughness, isolated barriers and temperature inversions.
- typical diurnal, monthly and seasonal patterns of winds over the local area.
- the formation and likely effects of extreme winds and wind shear.

T2 Wind speed data measurement and analysis encompassing:

- definition of the terms: porosity, internal boundary layer, speed-up factor, temperature inversion factor, wind speed frequency distribution, lull period, calms.
- interpretation of local and regional wind speed and direction data such as local records (E.g. Meteorological Bureau data), ecological indicators and wind speed/energy maps.
- wind speed and direction using data logging anemometers.
- manufacturer's calibration curves for anemometers to correct recorded data.
- calculation at a site, monthly and yearly average wind speed , and wind power density from existing, nearby data or on-site measurements, using appropriate software
- estimation of the wind speed at a WECS tower of suitable height and location given: wind speed data recorded at two or more elevations at the site, and wind speed data recorded at one elevation and appropriate surface roughness, temperature inversion and speed-up factors at the site.

T3 Site selection encompassing:

- the likely effects of local topography, surface roughness, isolated barriers and temperature inversions on a WECS at a given site.
- assessment of available local or regional wind speed, wind energy and direction data.
- selection of the most appropriate site-monitoring location

REQUIRED SKILLS AND KNOWLEDGE

taking into consideration factors such as: topography, accessibility, surface roughness, shielding from isolated barriers (obstacles), turbulence, temperature inversions, power transmission distance , environmental and heritage impacts e.g. noise, visual, bird life, national parks or aboriginal sites.

- measurement of wind speed and direction data at an appropriate site and height(s) using a data logging anemometer over a sufficient period of time.
- analysis of the recorded wind speed and direction data to determine if the site is suitable for wind energy utilisation.

T4 Selection of WECS encompassing:

- selection of suitable WECS specifications to suit site load and wind speed data according to AS4509 including: cut-in, rated and furling wind speeds, blade diameter, rated power at an appropriate rated wind speed, materials of construction.
- select a suitable commercially available WECS that most closely fits the specifications above.
- suitable tower requirements at the site including site access, soil type and foundations, structural certification and planning approvals.
- calculation of the monthly and annual energy output of the selected WECS at the site from wind speed data and load data using appropriate computer software and in accordance with AS4509.
- height of the tower and the size of the WECS for optimum use.
- suitable system configurations.
- balance of system components including: battery storage, inverter, regulator, transmission cable, back-up battery charger and generator.
- equipment reliability and manufacturer/suppliers back-up service including availability of spare parts and service personnel
- installed capital and life cycle costs of various system configurations according to AS3595 and AS4536.
- environmental, cultural and social factors that impact on the implementation of a WECS such as: external costs, WECS manufacturing processes and embodied energy and energy payback time, noise levels, visual amenity, RFI

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, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Design wind energy conversion systems rated to 10 kW as described in 8) and including:

A Developing outlines of alternative designs

B Developing the design within the safety and functional requirements and budget limitations

C	Documenting and presenting design effectively
D	Successfully negotiating design alteration requests
E	Obtaining approval for final design
F	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 designing wind energy conversion systems rated to 10 kW.

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)**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UEENEED10 Use computer applications relevant to a workplace 1A

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 designing at least two different wind energy conversion systems and their installation.

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