



Australian Government

UEERE0062 Design micro-hydro systems

Release: 1

UEERE0062 Design micro-hydro systems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

This unit replaces and is not equivalent to UEERE0029 Design micro-hydro systems rated to 6.4 kW. Modifications include:

- Unit title changed
- Unit application updated
- Prerequisites changed
- Significant amendments made to Elements and Performance Criteria
- Range of conditions updated
- Significant amendments to Performance and Knowledge Evidence
- Assessment conditions updated.

Application

This unit involves the skills and knowledge required to design micro-hydro systems and their installation.

It includes determining and developing micro-hydro system design, following design briefs, documenting design calculations and criteria, and obtaining design approval for micro-hydro system.

This unit is appropriate for Licenced Electricians or Electrical Engineers with responsibility for designing micro-hydro systems.

Licensing, legislative or certification requirements that apply to this unit may differ between jurisdictions and system types. They should be checked prior to commencing this unit.

Pre-requisite Unit

UEERE0055 Conduct site survey for off-grid photovoltaic/generating set systems
and

UEEEL0039 Design, install and verify compliance and functionality of general electrical installations

or

UEERE0051 Apply electrical principles to renewable energy design

Competency Field

Renewable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to design micro-hydro system

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1** Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied
- 1.2** Scope of the micro-hydro system electrical installation is determined from design brief
- 1.3** Safety and regulatory requirements to which the electrical installation must comply are identified, obtained and applied
- 1.4** Design development work is planned to meet scheduled timelines in consultation with other person/s involved in the micro-hydro system installation or associated work

2 Develop micro-hydro system design

- 2.1** Micro-hydro system performance standards and compliance methods are applied to the design
- 2.2** Safety, functionality and budgetary considerations are incorporated in the micro-hydro system design
- 2.3** Power and energy management requirements are incorporated in design
- 2.4** Design aspects are verified by qualified person/s
- 2.5** Micro-hydro system design is drafted and checked for compliance with the design brief and regulatory requirements
- 2.6** Micro-hydro system design is documented for submission to relevant person/s for acceptance and

approval

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Designing micro-hydro systems must include: • two different micro-hydro systems.

Unit Mapping Information

This unit replaces and is not equivalent to UEERE0029 Design micro-hydro systems rated to 6.4 kW.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEERE0062 Design micro-hydro systems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two occasions and include:

- applying relevant workplace procedures and practices, work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures
- developing micro-hydro systems design based on site survey data and within safety and functional requirements and budget limitations and meet design brief
- documenting and presenting final design.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- micro-hydro system components and configuration including:
 - structural differences between the various types of turbines and Pumps as Turbines (PATs)
 - system configuration for each turbine type identifying all major components
 - for impulse and cross- flow turbine types, the comparison of bucket and blade shapes, nozzle shapes and types, types of hydraulic and electrical controllers/governors, speed increasers and over speed clutches and their basic operation and appropriate application

- operational parameters and efficiency of different turbines
- circumstances under which battery storage would be used
- respective merits and suitability of various turbine types for various micro-hydroelectric applications
- advantages and disadvantages of water energy storage systems with other energy storage systems, such as battery banks
- relevant Australian micro-hydro systems standards and guidelines
- micro-hydro systems drawings including:
 - schematic and wiring diagrams for the micro-hydro system showing the general circuit layout and protection between the micro-hydro system, batteries, inverter and loads
- site survey including:
 - definition of the terms: potential and kinetic energy, micro-hydro system, gross head, net head and flow rate
 - available head at a site using common industry methods
 - the accuracy, advantages and disadvantages of different method for flow and head assessment
 - the flow rate of a given site using common industry methods
 - effects of seasonal variation using long-term weather data
 - effect of the energy demand profiles both daily and seasonally at the site on the system sizing
 - government regulatory requirements such as those covered under environmental or water resource legislation
 - environmental constraints at a site, including minimum stream flow rates, ecological impacts, visual and noise impacts
- system design including:
 - suitable micro-hydro system characteristics to suit site load, hydraulic head and stream flow rate characteristics and a suitable type of commercially available micro-hydro system to suit
 - frictional losses in delivery pipes using manufacturer's data
 - calculation of the energy output of the selected micro-hydro system at the site from water flow rate, head and manufacturer's data, allowing for seasonal variations in performance and environmental constraints
 - design of any required weirs or dams, open races or penstocks, strainer and intake systems
 - suitable balance of system components, including delivery pipe and fittings, transmission cable and voltage, voltage and frequency regulation, battery storage type and capacity, battery charger, inverter, back-up generator and load dump
 - likely environmental impacts of the micro-hydro system and appropriate measures to minimise these impacts
- system costing including:
 - major costs, including external costs, to be considered in the life cycle costing method
 - calculation of the capital and life cycle cost that includes the cost of various system configurations for a micro-hydro application

- micro-hydro systems installation and maintenance processes including:
 - appropriate installation, commissioning, fault diagnosis and rectification procedures and maintenance methods using appropriate safety procedures
 - maintenance schedule for the system
 - safety procedures for the installation, commissioning, fault diagnosis and maintenance of system components, seasonal variations in performance and environmental constraints
- WHS/OHS policy, workplace procedures and instructions
- relevant manufacturer specifications.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or simulations
- resources that reflect current industry practices in relation to designing micro-hydro systems
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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