Title	**Demonstrate knowledge of micro-hydro systems**		
Level	**4**	**Credits**	**15**

Purpose	This unit standard is for people who work with renewable energy systems and covers knowledge of the design and operation of micro-hydro systems. People credited with this unit standard are able to demonstrate knowledge of: – the principles and attributes of micro hydro systems; – methods of evaluating the suitability of a site for locating a micro-hydro energy system; and – methods used to determine the suitability of a micro-hydro energy system for a particular application in terms of its characteristics and the application.

Classification	Renewable Energy Systems > Renewable Energy Systems - Design

Available grade	Achieved

Guidance information

1 This unit standard has been developed for learning and assessment off-job.

2 References
All Australian/New Zealand Standards (AS/NZS) may be found at http://www.standards.org.nz/;
AS/NZS 3000:2007, *Electrical Installations (known as the Australian/New Zealand Wiring Rules)*;
AS/NZS 4509.1:2009, *Stand-alone power systems - Part 1: Safety and installation*;
AS/NZS 4509.2:2010, *Stand-alone power systems - Part 2: System design*;
Electricity (Safety) Regulations 2010;
Electricity Act 1992;
Health and Safety at Work Act 2015, and associated regulations;
and all subsequent amendments and replacements.

3 Definitions
a.c. – alternating current.
Current regulations and standards – in this unit standard this term is used to refer to the requirements of the above references.
d.c. – direct current.
Enterprise policies and procedures – those practices and procedures that have been promulgated by the company or enterprise for use by their employees.
Industry practice – those practices that competent practitioners within the industry

recognise as current industry best practice.
MHS – micro-hydro system.
PAT – Pumps As Turbine.

4 Range
a All measurements are to be expressed in Système Internationale (SI) units, and where required, converted from Imperial units into SI units.
b Candidates shall be supplied by the assessor with formulae involving more than three quantities.
c Use of a calculator during assessment is permitted.
d All activities must comply with any policies, procedures, and requirements of the organisations involved.
e All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with legislation, enterprise policies and procedures, ethical code, current regulations and standards, industry practice; and where appropriate, manufacturer's instructions, specifications, and data sheets.

5 It is recommended that candidates have been assessed against Unit 27426, *Demonstrate knowledge of d.c. and a.c. machines used for small scale renewable energy systems* and Unit 27439, *Demonstrate knowledge of photovoltaic technology* prior to assessment to this unit standard.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the principles and attributes of micro-hydro systems.

Performance criteria

1.1 Define terms associated with hydro power generation.

Range flow rate, gross or static head, potential energy, net or dynamic head, hydraulic efficiency, MHS efficiency, equivalent pipe length, reaction turbine, impulse turbine.

1.2 Identify units of measurement and schematic symbols associated with hydro generation.

Range flow rate, head, gravitational constant.

1.3 Distinguish different MHSs in terms of their physical and operating characteristics.

Range may include but not limited to flow rate, gross or static head, potential energy, net or dynamic head, hydraulic efficiency, MHS efficiency, equivalent pipe length, reaction turbine, impulse turbine; at least four characteristics are distinguished for three different MHSs.

1.4 List the major specification criteria for an MHS for electricity generation.

Range flow rate, gross or static head, potential energy, net or dynamic head, hydraulic efficiency, MHS efficiency, equivalent pipe length, reaction turbine, impulse turbine.

Outcome 2

Demonstrate knowledge of methods of evaluating the suitability of a site for locating a micro-hydro energy system.

Performance criteria

2.1 Describe methods of measuring the available head and flow rate at a site.

Range head – dumpy level or theodolite, altimeter, pressure gauge, contour maps;
flow – catchment area calculations, water diversion to fill a container, stream velocity/area measurement, weir construction.

2.2 Describe and compare the advantages and disadvantages of each method for head and flow assessment in terms of their accuracy.

2.3 Estimate the long term usable flow rate from long term stream flow data and with reference to environmental considerations.

2.4 Identify effects of seasonal variation on usable flow rate using long term weather data.

2.5 Identify environmental constraints at a site.

Range minimum stream flow rates, ecological impacts, visual and noise impacts.

2.6 Describe a method of calculating typical daily and seasonal energy consumption profiles at a given site.

2.7 Describe the effect on system sizing of daily and seasonal energy demand profiles at the site.

2.8 Identify regulatory requirements for environmental or water resource management.

Range government regulations, environmental considerations.

Outcome 3

Demonstrate knowledge of methods used to determine the suitability of a micro-hydro energy system for a particular application in terms of its characteristics and the application.

Performance criteria

3.1 Describe structural differences between primary movers.

Range Pelton, turbo impulse, Francis propeller type, Michell-Banki cross flow turbines, PATs.

3.2 Describe system configuration for each turbine type with reference to the positioning and type of major components.

3.3 Compare operation and features of impulse and cross flow turbines and describe advantages and disadvantages of each turbine type for various micro-hydro-electric applications.

Range bucket and blade shapes, nozzle shapes and types, types of hydraulic and electrical controllers/governors, speed increasers and overspeed clutches, basic operation, applications, operational parameters, efficiency.

3.4 Describe circumstances where battery storage is used.

3.5 Describe the use of tables or a nomogram to determine the size of a MHS to meet given parameters.

Range load, efficiency, available flow rate, net head.

3.6 Explain the operation of hydraulic rams or similar water pumps and describe their efficiencies.

3.7 Describe hydraulic ram system applications.

3.8 Compare advantages and disadvantages of water energy storage systems with other energy storage systems.

Range three advantages and three disadvantages.

Planned review date	31 December 2024

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2011	31 December 2020
Review	2	24 October 2019	N/A

Consent and Moderation Requirements (CMR) reference	0003

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Comments on this unit standard

Please contact The Skills Organisation at reviewcomments@skills.org.nz if you wish to suggest changes to the content of this unit standard.