Title	**Demonstrate and apply knowledge of stand-alone renewable energy system components and operation**		
Level	**4**	**Credits**	**15**

Purpose	People credited with this unit standard are able to demonstrate knowledge of the components and operation of standalone power systems. People credited with this unit standard are able to demonstrate knowledge of: – standalone renewable energy power systems schematic diagrams; – the operation and performance of batteries for renewable power system applications; and – system components and common loads for standalone RES.

Classification	Renewable Energy Systems > Renewable Energy Systems - Installation and Maintenance

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.govt.nz;
AS/NZS 4777.1:2024, Grid connection of energy systems via inverters, Part 1: Installation requirements;
AS/NZS 4777.2:2020, Grid connection of energy systems via inverters, Part 2: Inverter requirements (Includes Part 3 Grid Protection Requirements);
AS/NZS 3000:2018 Amd3: 2023, *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*;
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.
ELV – extra low voltage.

Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
MPPT – maximum power point trackers.
PAT – pumps as turbine.
PV – photovoltaic.
RES – renewable energy systems.

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, manufacturers' instructions, specifications, and data sheets.

5 It is recommended that candidates have been assessed against Unit 27427, *Demonstrate and apply knowledge of extra-low voltage requirements and testing for small scale renewable energy systems*; Unit 27433, *Demonstrate knowledge of renewable energy concepts and technologies*; and Unit 27439, *Demonstrate knowledge of photovoltaic technology* prior to assessment to this unit standard.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of standalone renewable energy power systems schematic diagrams.

Range may include but is not limited to – functional block diagram, circuit schematic, a.c., d.c., control board wiring diagram, site diagram.

Performance criteria

1.1 Represent typical stand-alone renewable power system configurations on functional block diagrams.

1.2 Draw and label circuit schematics of all major components of typical renewable power systems supplying d.c. and a.c. loads.

1.3 Draw and label a wiring diagram for a typical renewable stand-alone power system d.c. control switch board.

1.4 Mark up architectural and site diagrams to show the locations of equipment, fittings and cabling.

1.5 Connect an electronic device to a computer using cable and cable connectors.

Outcome 2

Demonstrate knowledge of the operation and performance of batteries for renewable power system applications.

Range may include but is not limited to battery types, battery life, capacity limiters, charging, precautions, disposal, battery banks.

Performance criteria

2.1 Define terms related to batteries.

Range nominal voltage, cell, primary and secondary cells, battery, charge and discharge rate, amp hour capacity, watt hour capacity, state of charge (SOC), depth of discharge (DOD), specific gravity (SG), watt hour and amp hour efficiency, cycle life, peuket effect.

2.2 Outline major features for each of the major types of commercially available batteries for stand-alone power system applications.

Range basic chemistry, physical structure, sealed, vented, advantages and disadvantages.

2.3 Outline factors affecting the life of a battery.

2.4 Describe the causes, effects, methods of prevention or reduction of sulphation and stratification in lead acid batteries.

2.5 Describe the effect that discharge depth and temperature have on the capacity and life of lead-acid batteries.

2.6 Describe major specification requirements for a lead-acid battery used in a stand-alone power system application.

Range three specification requirements.

2.7 Describe methods of determining the state of charge of a lead-acid battery or battery system of specific gravity and battery voltage.

2.8 Describe the main features of charging regimes suitable for the major types of stand-alone power system batteries using real examples.

2.9 Estimate the life of a standalone power system battery in years based on manufacturer’s cycle life data and given capacity, configuration and operating conditions.

2.10 Outline the precautions required when handling, installing and maintaining lead-acid batteries.

2.11 Outline the procedures required for safe disposal of batteries.

Outcome 3

Demonstrate knowledge of system components and common loads for standalone RES.

Range may include but is not limited to inverters, waveforms, power factor, regulators, MPPTs, PV array tracking, data transfer, inverter charger, charge controller.

Performance criteria

3.1 Compare features, applications, and differences of commercially available inverters suitable for use in stand-alone RES.

Range at least three inverters.

3.2 Measure major operating parameters of an inverter over a range of loads up to five minute ratings.

Range d.c. voltage operating window; efficiency, output voltage waveform, output voltage regulation.

3.3 Describe effects of non-sine wave power supply on typical loads and the solutions used to overcome them.

3.4 Describe the significance of low power factor loads for inverter systems and the principle of power factor correction.

3.5 Describe operation of the major types of regulators for use in stand-alone renewable power systems using commercially available equipment as examples.

3.6 Measure current versus voltage characteristics, efficiency, and charging voltage waveform of battery chargers suitable for use in stand-alone RES.

Range transformer and / or rectifier battery charger, switchmode battery charger, engine alternator.

3.7 Outline operation of MPPTs and their applications.

3.8 Outline basic operation, advantages, and disadvantages of mechanical tracking devices for PV arrays.

3.9 Read and set control parameters or data using digital displays on inverters, regulators, or controllers.

Planned review date	31 December 2026

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2011	31 December 2019
Review	2	24 October 2019	N/A
Rollover and Revision	3	27 March 2025	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 Waihanga Ara Rau Construction and Infrastructure Workforce Development Council qualifications@waihangaararau.nz if you wish to suggest changes to the content of this unit standard.