REGISTERED NATIONAL STANDARD

UNIT OF COMPETENCY

Title:	Basic tools, equipment and materials used in *Renewable energy technology* (RET) and *Energy efficiency* (EE)				
TQF Level:	1	**Credits:**	6	**Version:**	1[1]
National standard code:	NS043-01				
Associated qualification (and code):	National Certificate in Sustainable Energy Level 1 (QR-01-NQ-018-01-0504-20-01)				
Approval date:	30 Nov 2020	**Review date:**	30 Nov 2025		
Purpose:	This unit standard is for a person who works, or may intend to work in the energy sector or energy related fields. Persons credited with this unit standard are able to: 1. Identify and use appropriate *tools*, equipment and resources for specific task in RET and EE. (Refer to range statement below) 2. Identify *problems* related to the use of tools and basic equipment and take appropriate action. (Refer to range statement below) 3. Repair and perform routine maintenance tasks to tools and equipment 4. Demonstrate care and safe work practices using tools and equipment and resources 5. Identify and apply the correct storage measures for tools, equipment and resources 6. Submit tool check records in accordance with procedures; and 7. Complete relevant job documentation				

[1] This Tonga unit standard was adapted from the regional unit standard SE1001 (version 1) with the same title which is a component of the *Regional Certificate 1 in Sustainable Energy (SE).*

	*[**Range statement:*** *i. Tools include but not limited to electrical multi-meters, mechanical fixtures, spanners, wrenches, circlip-pliers (inside and outside), vice grip, Tinman's snips, wrench set, socket screw, allen hex keys, twist bit/auger, wood chisel, tap & di, scissors, cross cut handsaw, hack saw & junior saw.* *ii. Problems related to the use of tools and equipment refers to elementary malfunctions or screws and bolts becoming loose in some apparatus and tools. The correct course of action may be to discontinue using the equipment or, if appropriate, to repair the hand tool or equipment* *iii. Work include but not limited to work report forms, job sheets, log books, observer verifications]*
Learning Outcome 1 (LO1)	Select basic tools, equipment and materials in RE and EE
Performance standards	1.1 Identify and access basic tools, equipment and materials according to specifications in wind power, micro hydro, solar and biomass and energy efficiency and conservation practices 1.2 Estimate quantities of materials required to complete tasks 1.3 Explain the purpose of different tools and equipment used for different fields of work 1.4 Demonstrate knowledge of keeping updated records on servicing and maintenance, including scheduled maintenance in accordance with organisational policies and procedures
Learning Outcome 2 (LO2)	Repair and perform routine maintenance tasks to tools and equipment
Performance Standards	2.1 Perform cleaning and routine maintenance of tools and equipment according to manufacturer's specifications or instructions 2.2 Identify problems associated with tools and equipment requiring additional repairs and report appropriately 2.3 Perform simple repair tasks on tools and equipment in accordance with manufacturer's specifications and instructions 2.4 Effectively tag defective and broken tools and equipment in accordance with establishment requirements 2.5 Maintain records concerning malfunctioning tools and equipment and report in accordance with work place procedures

Learning Outcome 3 (LO3)	Identify and apply the correct storage measures for tools, equipment and resources
Performance standards	3.1 Clean tools and equipment before storage in accordance with instructions 3.2 Store tools, equipment and resources according to prescribed methods and safety requirements 3.3 Demonstrate documentation of tools borrowed/loaned in a recommended format (log sheet) in accordance with instructions 3.4 Conduct routine inventory checks
Pre-requisites	N/A
Co-requisites	N/A
Underpinning skill and knowledge	The following knowledge and skills underpin this unit standard; • Skills in applying safety procedures when operating and maintaining hand tools, specialized tools and basic equipment used in various areas of Sustainable Energy / Renewable Energy Technologies • Knowledge on the basic functions of different types of tools, equipment (in order to recognize malfunctions and to perform simple repairs and maintenance) • Identification of wear and tear on tools and equipment. • Knowledge on purpose and suitability of different types of tools and equipment for different tasks; • Knowledge on regional and national Occupational Health and Safety legislation and regulations as it applies to the specific usage of tools, equipment and workplace practices; • Knowledge of workplace procedures to be followed regarding the reporting of problems related to tools and their status; • Use internet, email, and mobile phones to communicate messages
Suggested assessment methods	**Context of assessment:** To support student assessment and to ensure they are valid, reliable, flexible, and fair, provider institutions are encouraged to make the necessary arrangements to involve the relevant key industry organisations such as *Tonga Electricity Commission* (TEC), *Tonga Power Limited* (TPL) and other trusted licensed private energy and electricity entrepreneurs in the assessment of the required

standards and competencies. Such collaboration between provider institutions and the industry may include but not restricted to the following:

- Experts from the industry have input to the design and implementation of the curriculum and assessment activities;
- Experts from the industry are engaged as trainers, assessors, or assessment moderators;
- Students are placed in relevant industry organisations for workplace attachment;
- Industry experts act as supervisors of students on workplace attachment
- Etc.

To show that students have the required competence, they will need to:

1. Demonstrate knowledge in the workplace (or in an environment that closely resembles the workplace) in relation to:
   - Generic tools of equipment/materials used (components power systems for:
     - Wind
     - Solar
     - Biomass
     - Micro-hydro
   - RE
     - Basic understanding of RE, definition, concept and resources
     - Understand the type of RE technologies available: Solar, Wind etc
     - Understand the component for specific RET, e.g. Solar PV Home System
   - SE & EE
     - Define *Energy efficiency* and give example
     - Define *Energy conservation* and give example
     - Basic understanding of *Energy efficiency* (how efficient a system is) and *Energy conservation* (how to save energy)
     - Basic understanding the linkage of Energy efficiency in building, appliances, vehicles and power

- Explain in simple terms how Energy efficiency are used to improve Energy efficiency in building, appliances, vehicles and power houses.

2. Apply their knowledge in the workplace (or in an environment that closely resembles the workplace), by:

i. Using of basic tools and measuring equipment such as electrical multi-meters, mechanical fixtures, spanners, wrenches for:
   - Making basic connections and setting up of wind turbine, micro-hydro, solar or biogas plant
   - Testing of installed set-ups and generations of test equipment

ii. Identifying and describing appropriate tools and equipment for the different types of technologies per RET type:
   - Type of Solar PV,
   - Type of Battery,
   - Type of Charge Controller,
   - Type of Wind Turbine, etc.

iii. Describing the main components of a Solar PV Home system:
   - Solar PV,
   - Battery,
   - Charge Controller, etc.

iv. Conducting simple calculation of the efficiency of simple electric circuit

Methods of assessment:

A range of assessment methods should be used to assess students' knowledge and application of skills, include but not restricted to the following:

i. Direct observation of students performing certain tasks (such as selection and using of basic tools and equipment and RE and EE materials, repair and conduct routine maintenance of tools & equipment, and applying measures of correct storage of tools and equipment)
ii. Written or oral questions to test relevant skills and knowledge during observation
iii. Inspection of storage of tools and equipment
iv. Checklist of repair and routine maintenance
v. Identifying basic tools, equipment and RE and EE materials
vi. Student Portfolio
vii. Review of workplace attachment reports (e.g. Supervisor/third party reports)

Resource requirements	i. Printed resources for Selecting Basic Tools, Equipment and Materials used in Renewable Energy Technology and Energy Efficiency at the discretion of the course/unit coordinator or trainer, ii. Computer, Printer, Internet Access, iii. Workshop for tools and equipment iv. Storage room v. Conventional classroom, classroom furniture and resources: White/blackboard, tables or benches, chairs, student notice boards, A3 coloured cards or wall charts. vi. *Personal Protective Equipment* (PPE) such as hard clothing/overall, grip it/gloves, safety spectacles, orange waist coat, valved dust-mask, first aid kit, safety boots, safety helmet and light weight ear defenders, vii. Basic tools such as spanners, mechanical fixtures, wrenches, circlip-pliers (inside and outside), vice grip, Tinman's snips, wrench set, socket screw, Allen hex keys, twist bit/auger, wood chisel, tap & di, scissors, cross cut handsaw, hack saw & junior saw viii. Appropriate tools and equipment for the following; • Solar PV: Stand-alone, grid-tied, and hybrid Solar PV Systems • Wind Systems: Small and Large Scale *Horizontal Axis Wind Turbine* (HAWT) systems and Hybrid Wind Systems • Energy Storage Systems: Lithium Ion Batteries, Lead Acid Batteries, etc. • Charge Controllers: *Pulse Width Modulation* (PWM) or *Maximum Power Point Tracking* (MPPT) • Measuring devices: Anemometer, Pyranometer, and Multimeter ix. Components of Solar PV System; • Solar PV panels, charge controller, inverter, batteries, cables, ac and dc loads (example of simple ac or dc loads are lighting fixtures or fans) x. Hydropower system Prototype Tube/conduit-like penstock connected to a hydro-power turbine which is coupled to a generator and conductors connecting the generator to a simple electrical load such as a single light

Moderation arrangements	Provider Institutions are responsible for moderation arrangements to ensure consistency in assessments. Moderation process must be approved by TNQAB.
Requirements to complete this unit	There are three (3) Learning Outcomes and thirteen (13) Performance Standards that measures competence. To demonstrate competence, the person studying this unit is: 1. Required to obtain an *Achieved* [2]grade (Competent) to fulfil the requirements of the Unit Standard. 2. Eligible to three (3) attempts to achieve the required competency within 5 days of the first attempt. Failure to achieve the required competency level after three (3) attempts of the exam or specific part of the assessment will require the person studying this Unit to re-enrol for the same Unit.
Important notes and definitions	**Notes:** 1. All training and assessment activities must be in accordance with health and safety legislation and related regulations of Tonga. **Definitions:** 1. **Industry practice** refers to those practices and procedures that competent practitioners within the industry recognise as current industry best practice. 2. **Maintenance activities** include scheduled maintenance and servicing and restoration of low voltage electrical components, motors, appliances and fittings and maintenance and servicing of tools and equipment used by electrical fitter mechanics, in particular power analysers, cathode ray oscilloscope (CROs), secondary injector set, relay tester, phase sequence testers 3. **Safety Procedure** refers to series of specific steps that guide a worker through a task for start to finish in a chronological order. Safe job procedures are designed to reduce the risk of injury by minimizing potential exposure.

[2] This unit is competency-based in which there are only two possible grades: *Achieved* and *Not Achieved*. An 'Achieved' grade is assigned to a candidate who has met the competency requirements of the unit.

	4. **Occupational Health and Safety** refers to protecting the safety, health and welfare of people engaged in work practices. 5. **Scheduled maintenance and servicing** include replacement of consumables; minor adjustments; replacement of faulty components; operational changeovers.
Public comments on unit	Please contact TNQAB National Qualifications Unit (email EnquireNQ@tnqab.to or Telephone 28136) if you like to discuss or suggest changes to the details of this unit.