



# REGISTERED NATIONAL STANDARD

## UNIT OF COMPETENCY

<b>Title:</b>	<b>Maintain and repair solar PV system infrastructure and facilities associated with remote area essential service operations</b>  <u>Note:</u> 1. Due to safety issues inherent in working with combustible substances, all training and assessment activities must be in accordance with local industry and regulatory requirements; 2. This unit of competency has been adapted from the Pacific regional unit standard SE3305 (B) Maintain and repair facilities associated with remote area essential service operations (Biomass).		
<b>TQF Level:</b>	3	<b>Credits:</b>	4
<b>Version:</b>	1		
<b>National standard code:</b>	NS091-03		
<b>Associated qualification (and code):</b>	National Certificate in Sustainable Energy (solar) Level 3 (QR-03-NQ-018-05-0504-23-01)		
<b>Approval date:</b>	31 August 2023	<b>Review date:</b>	31 August 2028
<b>Purpose:</b>	<p>This unit covers basic maintenance of ‘remote area’ solar photovoltaic (PV) system infrastructure and facilities. It encompasses working safely to maintenance standards and following maintenance routines, identifying deterioration and damage to facilities using routine procedures, and completing the necessary maintenance reporting.</p> <p><i>[Range of infrastructure and facilities not restricted only to solar PV system and components but also include fences and gates, doors and locks, windows and louvers, gutter system and downpipes, paintwork, essential services facilities such as lighting, plumbing work. Only basic skills and knowledge for DIY jobs expected]</i></p> <p>This unit is intended primarily for people living or working in rural and remote communities such as those in the villages and outer islands of Tonga and the rest of the Pacific Islands.</p> <p>Persons credited with this unit standard are able to:</p> <ol style="list-style-type: none"> <li>1. Prepare to maintain and repair solar PV system facilities and infrastructure;</li> <li>2. Maintain and repair solar PV system facilities and infrastructure.</li> <li>3. Complete maintenance and repair work reports.</li> </ol>		

<b>Learning Outcome 1 (LO1)</b>	Prepare to maintain and repair solar PV systems facilities and infrastructure
<b>Performance standards</b>	<p>1.1. Identify and obtain the relevant <i>Occupational health and safety</i> (OHS) procedures;</p> <p>1.2. Identify and follow established OHS risk control measures and procedures in preparation for the remote area facilities and infrastructure repair work.</p> <p>1.3. Identify and report safety hazards in the remote area solar PV system facilities and Infrastructure, and seek advice on risk control measures from the work supervisor;</p> <p>1.4. Seek advice from the work supervisor to ensure the repair work is coordinated effectively with fellow workers and the local community.</p> <p>1.5. Establish the scope of repair work to be undertaken by seeking advice from the work supervisor to ensure the repair work is coordinated effectively;</p> <p>1.6. Identify materials, tools, and equipment (including testing devices) which would be required for the repair work.</p>
<b>Learning Outcome 2 (LO2)</b>	<p>Ascertain the kinds of remote area facility and infrastructure that need repair or maintenance</p> <p><i>[Range not restricted to solar PV system and components but also includes fences and gates, doors, windows and louvres, gutter system and downpipes, locks, paintwork, essential services facilities such as lighting, water source, basic plumbing work]</i></p>
<b>Performance Standards</b>	<p>2.1 Obtain the nature and location of remote area facilities and infrastructure either from documentation or relevant others such as community members or work supervisor to establish the scope of repair work to be undertaken;</p> <p>2.2 Identify sources of materials that may be required for the repair work and access materials in accordance with established routines and procedures;</p> <p>2.3 Identify correct types and specifications for materials required for repair work;</p> <p>2.4 Ascertain any prescribed limits, routines and procedures required for repair work;</p> <p>2.5 Obtain the tools, equipment and testing devices needed to carry out the repair work and check for correct operation and safety.</p>
<b>Learning Outcome 3 (LO3)</b>	Maintain and repair remote area facility and infrastructure
<b>Performance standards</b>	<p>3.1 Follow established OHS risk control measures and procedures for carrying out the repair work;</p> <p>3.2 Identify a range of safety, cleanliness issues in a work site that need the attention of workers and compliance officers.</p> <p><i>[Range include but not restricted to: over-grown bushes and branches of nearby trees encroaching too far into restricted areas or above electric facility, accumulation of dead leaves on or nearby facility and equipment, etc.)</i></p> <p>3.3 Identify solar PV system components which may require proper decommissioning in strict accordance with OHS requirements and procedures;</p>

	<p>3.4 Identify and adhere to procedures for referring non-routine events to immediate supervisor for directions;</p> <p>3.5 Repair faulty and damaged solar PV system components, and facility using routine procedures;</p> <p>3.6 Carry out maintenance and repairs efficiently within prescribed limits, routines, and procedures without waste of materials and energy and without damage to solar PV system and components and the surrounding environment or services;</p> <p>3.7 Carry routine quality checks in accordance with solar PV system repair instructions;</p>
<b>Learning Outcome 4 (LO4)</b>	Complete maintenance and repair work report.
<b>Performance standards</b>	<p>4.1 Identify and follow OHS work completion risk control measures and procedures;</p> <p>4.2 Identify and follow procedures for referring maintenance issues beyond the scope of prescribed work to persons of higher authority;</p> <p>4.3 Identify reporting line and other requirements for reporting maintenance and repair work;</p> <p>4.4 Complete relevant report forms as required and consult line supervisors when necessary;</p> <p>4.5 Submit reports for completed maintenance and repair work in accordance with established requirements.</p>
<b>Pre-requisites</b>	N/A
<b>Co-requisites</b>	N/A
<b>Underpinning skill and knowledge</b>	<p>The following knowledge and skill underpin this unit standard:</p> <p><u>KNOWLEDGE</u></p> <ul style="list-style-type: none"> <li>• Understanding the nature of use of a particular solar PV system in a particular location;</li> <li>• Knowledge of the environmental and social impacts of solar energy development;</li> <li>• Knowledge of the basic geography of Tonga and the Pacific region;</li> <li>• Knowledge of the Tongan culture, norms and values;</li> <li>• Knowledge of basic civil and engineering works involved in solar PV systems;</li> <li>• Electrical knowledge including but not restricted to: <ul style="list-style-type: none"> <li>○ Identification and basic function of electrical components used for generating and distributing.</li> <li>○ Electricity safety procedures when working with electricity.</li> <li>○ Identification of faulty electrical components</li> </ul> </li> <li>• Fire-fighting equipment knowledge including but not restricted to: <ul style="list-style-type: none"> <li>○ Fire extinguishers and signage</li> <li>○ Types of fire extinguishers</li> </ul> </li> </ul>

- Contents and colour
- Correct identification
- Use of fire extinguishers
- Use of water hose and reel
- Safety awareness
- Telephone knowledge including but not restricted to: ●
  - Answer calls promptly and clearly.
  - Using designated business protocol procedure
  - Making and receiving telephone calls in a workplace context
  - Obtain accurate telephone numbers from an appropriate source.
  - Establish contact using designated business protocol procedures.
  - Convey purpose all call clearly and concisely.
- Mathematical operations knowledge including but not restricted to:
  - Whole numbers.
  - Fractions
  - Decimals
  - Percentages
  - Ratios
  - Proportion

### SKILLS

#### 1. Essential services facilities lighting:

- Incandescent lamps - replacement
- Fluorescent tubes - replacement
- Fluorescent light starters - replacement
- Compact fluorescent lamps (energy-saving lights) - replacement
- Diffusion devices – replacement, maintenance
- Safety awareness
- Disposal of faulty lamps

#### 2. Essential services facilities safety and security and emergency checks:

- Broken windows
- Faulty lighting
- Damaged gates
- Logging the inspections
- Notification of the situation

#### 3. Repair and maintenance to fences and gates

- Emergency repairs
- Locks and catches
- Security fencing
- Fence maintenance
- Gates
- Safety awareness

	<p>4. Maintenance of paintwork:</p> <ul style="list-style-type: none"> <li>○ Preparation of surfaces</li> <li>○ Block work</li> <li>○ Concrete</li> <li>○ Timber</li> <li>○ Steel</li> <li>○ Paint selection</li> <li>○ Brush and roller selection</li> <li>○ Paint application</li> <li>○ Clean up process</li> <li>○ Paint and accessories storage</li> <li>○ Safety awareness</li> </ul> <p>5. Skills in technical report writing</p>
<p><b>Assessment requirements</b></p>	<p><b><u>Methods of assessment:</u></b></p> <p>A range of assessment methods should be used to assess students' knowledge and application of skills. These shall include but not restricted to the following:</p> <ol style="list-style-type: none"> <li>a) Direct observation of students performing certain tasks stated under context of assessment</li> <li>b) Oral questions to test relevant skills and knowledge during observation (e.g. Interviews)</li> <li>c) Written assessment such as:       <ol style="list-style-type: none"> <li>1) Maintenance and repair reports;</li> <li>2) Student Portfolios – containing other activities that demonstrate what a student can do – e.g. annotated photographs, video records, completed Activity logs, marked quizzes and assignments, etc., etc.</li> <li>3) Reviews of workplace attachment reports (e.g. Supervisor/third party reports; testimonials from Project manager or supervisor)</li> </ol> </li> </ol> <p><b><u>Context of assessment:</u></b></p> <p>To support student assessment and to ensure they are valid, reliable, flexible, and fair, a training provider is encouraged to make the necessary arrangements to involve the relevant key industry organisations such as <i>Tonga Electricity Commission (TEC)</i>, <i>Tonga Power Limited (TPL)</i> and other trusted licensed private energy and electricity entrepreneurs in the assessment of the required competencies. Such collaboration between provider institutions and the industry may include but not restricted to the following:</p> <ul style="list-style-type: none"> <li>• Experts from the industry contribute to the design and implementation of the curriculum and assessment activities;</li> <li>• Experts from the industry are engaged as trainers, assessors, or assessment moderators;</li> <li>• Students are placed in relevant industry organizations for workplace</li> </ul>

	<p>attachment;</p> <ul style="list-style-type: none"> <li>• Industry experts act as supervisors of students on workplace attachment</li> <li>• Etc.</li> </ul> <p>To show that learners have the required competence they will need to:</p> <ol style="list-style-type: none"> <li>1. <b>demonstrate</b> and <b>apply</b> their knowledge in the workplace (or in an environment that closely resembles the workplace) in relation to:       <ol style="list-style-type: none"> <li>a) LO1: Prepare to maintain and repair remote area solar PV systems facilities and infrastructure.</li> <li>b) LO2: Ascertain the kinds of remote area facility and infrastructure that need repair</li> <li>c) LO3: Maintain and repair remote area facility and infrastructure</li> <li>d) LO4: Complete maintenance and repair work report.</li> </ol> </li> <li>2. use <b>evidence</b> to demonstrate their performance to the standards described under each of the three LOs above. Every candidate of assessment is eligible to three (3) attempts on their assessment to achieve the required competency within 14 days of the first attempt.</li> </ol> <p><b><u>Re-assessment</u></b></p> <p>Candidates of assessment are eligible to three (3) attempts to achieve the required competency within 14 days of their first attempt:</p> <ol style="list-style-type: none"> <li>1. Feedback must be provided to the candidate and sufficient time provided to prepare for re-assessment.</li> <li>2. The trainer/ assessor has the discretion to vary the assessment tasks used in each assessment attempt as long as the:       <ol style="list-style-type: none"> <li>a) same competencies are being assessed;</li> <li>b) principles of assessment are adhered to.</li> </ol> </li> </ol> <p>Failure to achieve the required competency after three (3) attempts on the exam or specific part of the assessment will require the person studying this Unit to re-enrol for the same Unit.</p>
<p><b>Moderation arrangements</b></p>	<ol style="list-style-type: none"> <li>1. Training providers must have their own moderation system approved by TNQAB before accreditation is granted:       <ol style="list-style-type: none"> <li>a) Relevant internal moderation processes are documented;</li> <li>b) Assessment is planned for each unit, and moderation processes are integrated into such plan</li> </ol> </li> <li>2. External moderation is conducted by the National qualifications unit of TNQAB for all unit components of national qualifications;       <ol style="list-style-type: none"> <li>a) Samples of assessed activities are submitted for moderation;</li> <li>b) Moderation (external) forms are available on request from the National</li> </ol> </li> </ol>

	<p>qualifications unit of TNQAB.</p>
<p><b>Resource requirements</b></p>	<ol style="list-style-type: none"> <li>1. A textbook (or compilation of printed resources) on Solar PV control system fault analysis, at the discretion of the course/unit coordinator or trainer;</li> <li>2. Student computers, Printer, Internet access</li> <li>3. Conventional classroom furniture and resources: White/blackboard, tables or benches, chairs, student notice boards;</li> <li>4. Safety Tools and equipment:       <ol style="list-style-type: none"> <li>a) Hand gloves for electrical and mechanical lab work</li> <li>b) Safety helmet;</li> <li>c) Safety glasses</li> <li>d) Ear-mask/muff for use in noisy workshop environment</li> <li>e) Dust mask</li> <li>f) Electrician safety harness</li> <li>g) Safety tags (e.g. out of service, do not operate, live wire)</li> </ol> </li> <li>5. Tools and Equipment:       <ol style="list-style-type: none"> <li>a) Drill set for electricians (with bits)</li> <li>b) Electrician’s Tool Kit includes insulated screwdrivers, pliers, electrical tester, ratchet handle, universal joint, extension bar, measuring tape, coupler etc.</li> </ol> </li> <li>6. Cables and cable termination tools:       <ol style="list-style-type: none"> <li>a) Crimping tool</li> <li>b) Air blower</li> <li>c) Heat gun for cable sleeving</li> <li>d) Soldering iron workstation</li> <li>e) Solder wire</li> <li>f) Crimp lugs</li> <li>g) Cables and accessories</li> </ol> </li> <li>7. Testing Equipment for electrical:       <ol style="list-style-type: none"> <li>a) AC Variable Power Supply</li> <li>b) DC variable Power Supply</li> <li>c) Oscilloscope</li> <li>d) Frequency counter</li> <li>e) Power factor tester</li> <li>f) Three-phase power analyzer</li> <li>g) Fused Low-voltage test lamp</li> </ol> </li> </ol>
<p><b>Requirements to complete this unit</b></p>	<p>There are four (4) Learning Outcomes and twenty-three (23) Performance Standards to measure competence.</p> <p>To demonstrate competence, the person studying this unit is:</p> <ol style="list-style-type: none"> <li>1. Required to demonstrate ALL Learning outcomes to the expected standards of performance;</li> <li>2. Required to attain an <i>Achieved</i> Grade (Competent) to fulfil the requirements of the Unit Standard.</li> <li>3. Eligible to three (3) attempts to achieve the required competency within 14</li> </ol>

	<p>days of the first attempt.</p> <p>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.</p>
<p><b>Important notes and definitions</b></p>	<p><b><u>Notes:</u></b></p> <ol style="list-style-type: none"> <li>1. All activities associated with this unit standard must comply with the requirements of national codes of practice, regulations and legislation for workplace health, safety, and environmental protection and any subsequent amendments.</li> <li>2. Assessors must comply with Tonga national assessment and moderation requirements.</li> <li>3. If relevant local legislations are not available, those of New Zealand or Australia are to be used for training.</li> </ol> <p><b><u>Definitions:</u></b></p> <ol style="list-style-type: none"> <li>1. <i>Essential services</i> refer to services which are necessary to the lives of people living in a particular area at a particular time (e.g., health services, food and water, electricity, gas, security, etc.). The lives of people could be endangered by interruption of these services.</li> <li>2. <i>Hazard</i> is a potential source of harm or adverse health effect on a person or persons;</li> <li>3. <i>Occupational Health and Safety (OHS)</i> refers to a multi-disciplinary field concerned with protecting the safety, health and welfare of people working at an organization</li> <li>4. <i>Photovoltaics (PV)</i> - is the conversion of light into electricity using semiconducting materials that exhibit the <i>photovoltaic effect</i></li> <li>5. <i>Photovoltaic effect</i> is the generation of voltage and electric current in a material when it is exposed to light.</li> <li>6. <i>Remote area</i> in this unit refers to a community (e.g., village or island community with no regular scheduled flights, no or limited access roads, minimal telephone or radio services.</li> <li>7. <i>Risk</i> refers to the likelihood that a person may be harmed or suffers adverse health effects if exposed to a hazard.</li> <li>8. <i>Silicon</i> is a chemical element with the symbol Si and atomic number 14. It is the semiconducting material from which most solar panels are made.</li> <li>9. <i>Solar panel (or solar photovoltaic panel)</i> is a piece of flat semiconducting material (usually <i>Silicon</i>) that transforms the sun's rays into electricity.</li> <li>10. <i>Solar photovoltaic (PV) system or solar power system</i>, is an electric power system designed to supply solar power by means of photovoltaics. It is composed of one or more <i>solar panels</i> combined with an inverter and other electrical and mechanical components that</li> </ol>

	use energy from the Sun to generate electricity.
<b>Public comments on unit</b>	Please contact TNQAB National Qualifications Unit (email <a href="mailto:EnquireNQ@tnqab.to">EnquireNQ@tnqab.to</a> or Telephone 28136) if you like to discuss or suggest changes to the details of this unit.