



REGISTERED NATIONAL STANDARD

UNIT OF COMPETENCY

Title:	Assist in the installation and operation of biogas systems		
	<u>Note:</u> 1. Due to safety issues inherent in working with electricity and 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 <i>SE3306 (B) Assist in the Installation, operation and maintenance of systems for RE & EE</i>		
TQF Level:	3	Credits:	6
		Version:	1
National standard code:	NS104-03		
Associated qualification (and code):	National Certificate in Sustainable Energy (Biomass) Level 3 (QR-03-NQ-018-03-0504-23-01)		
Approval date:	27 April 2023	Review date:	27 April 2023
Purpose:	This unit standard involves installation, and operation of biogas systems Persons credited with this unit standard are able to: <ol style="list-style-type: none"> 1. Prepare to install and operate a biogas system; 2. Demonstrate installation of biogas systems equipment. 3. Demonstrate the safe handling and operation of biogas systems equipment. 4. Write completion report on installation and operation of a biogas plant. 		
Learning Outcome 1 (LO1)	Prepare to install and operate biogas systems.		
Performance standards	1.1. Identify <i>occupation health and safety</i> (OHS) procedures for a given work area relevant to the installation and operation of a biogas system; 1.2. Determine the nature and location of the work from documentation (examples may include plans, feasibility study and/or a biomass resource assessment, survey or biomass resource assessment tool) or an appropriate person to establish the scope of work to be undertaken. 1.3. Identify and note safety <i>hazards</i> that have not previously been		

	<p>identified;</p> <p>1.4. Identify and implement established <i>risk control measures</i> and procedures in preparation to install and operate biogas systems;</p> <p>1.5. Identify others who are most likely to be affected by the installation and operation of a biogas system and consult with them to ensure relevant activities are sequenced properly to minimize disruptions;</p> <p>1.6. Plan the location of apparatus within the constraints of the building structure, land use issues, biomass resource availability and local regulations;</p> <p>1.7. Identify and obtain the materials needed for the installation work in accordance with established procedures and checked against job requirements;</p> <p>1.8. Identify and obtain tools, equipment and testing devices needed to for the installation work in accordance with established procedures and checked for correct operation and safety;</p> <p>1.9. Check preparatory work to ensure no damage has occurred to any materials, equipment, testing devices or any part of the biogas plant and ensure it and complies with requirements.</p>
<p>Learning Outcome 2 (LO2)</p>	<p>Demonstrate the safe handling and operations of biogas systems equipment.</p>
<p>Performance standards</p>	<p>2.1 Identify safe handling and operational procedures of a biogas system;</p> <p>2.2 Describe the safety procedures required for operational system checks on biogas systems;</p> <p>2.3 Describe safety procedures for handling and storage of biogas plant components and materials such as <i>digestate</i> and gases;</p> <p>2.4 Check the installation of apparatus and associated equipment to ensure compliance with technical standards and job specifications and requirements;</p> <p>2.5 Describe procedures for finding faults and defects in biogas systems components and materials;</p> <p>2.6 Explain safety monitoring techniques for biogas systems and equipment.</p> <p>2.7 Operate biogas system components and equipment safely and in accordance to OHS requirements and technical standards and job specifications and requirements.</p>
<p>Learning Outcome 3 (LO3)</p>	<p>Demonstrate installation of biogas systems equipment.</p>
<p>Performance Standards</p>	<p>1.1 Identify the various kinds of <i>biogas system configurations</i>.</p> <p>1.2 Identify the functions and limitations of each part and components of a biogas system or equipment;</p>

	<p>1.3 Select and obtain the right tools required for installing biogas system equipment according to established procedures;</p> <p>1.4 Demonstrate the assembly and disassembly of system components;</p> <p>1.5 Carry out installation efficiently without unnecessary waste of materials or damage to apparatus and/or the surrounding environment or services in compliance with sustainable energy principles;</p> <p>1.6 Carry out ongoing checks on the quality of the installed apparatus in accordance with established procedures;</p> <p>1.7 Identify and check apparatus and components as being isolated where necessary in accordance with OHS requirements and procedures;</p> <p>1.8 Demonstrate the testing and <i>commissioning</i> procedures involved in the installation of biogas systems and equipment.</p>
Learning Outcome 4 (LO4)	Write completion report on biogas installation and operation activities.
Performance standards	<p>4.1 Identify requirements for completion reporting in biogas systems;</p> <p>4.2 Perform final checks to the installed and functioning biogas systems so that they conform to requirements.</p> <p>4.3 Document 'As-installed' emergency systems apparatus and associated equipment;</p> <p>4.4 Notify appropriate person or persons in regards to biogas installation and in accordance with established procedures;</p> <p>4.5 Compile relevant data and information in accordance with completion report requirements;</p> <p>4.6 Complete installation completion report as required;</p>
Pre-requisites	N/A
Co-requisites	N/A
Underpinning skills and knowledge	<p>The following skills and knowledge are required:</p> <ol style="list-style-type: none"> 1. Knowledge of basic tools and equipment 2. Knowledge of basic functions and components of biogas systems 3. Knowledge of basic civil works involved in biogas set ups. 4. Installation and operation of a biogas system; 5. Safety of biogas systems 6. Knowledge of the environmental and social impacts of biogas system development.

Assessment requirements

Methods of assessment:

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:

1. Direct observation of students performing a:
 - a) seminar or
 - b) certain tasks stated under *context of assessment*
2. Oral questions to test relevant skills and knowledge during observation (e.g. Interviews)
3. Written assessment such as:
 - a) Reports on biogas installation or operation activities;
 - b) 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.
 - c) Reviews of workplace attachment reports (e.g. Supervisor/third party reports; testimonials from Project manager or supervisor)

Context of assessment:

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 *Tonga Electricity Commission (TEC)*, *Tonga Power Limited (TPL)* 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:

- Experts from the industry contribute 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 organizations for workplace attachment;
- Industry experts act as supervisors of students on workplace attachment
- Etc.

To show that learners have the required competence they will need to **demonstrate** and **apply** their knowledge in the workplace (or in an environment that closely resembles the workplace) in relation to:

- a) LO1: Prepare to install and operate biogas systems.
- b) LO2: Demonstrate the safe handling and operations of biogas systems equipment
- c) LO3: Demonstrate installation of biogas systems equipment.
- d) LO4: Write completion report on biogas installation and operation activities.

	<p><u>Re-assessment</u></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"> 1. Feedback must be provided to the candidate and sufficient time provided to prepare for re-assessment. 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"> a) same competencies are being assessed; b) principles of assessment are adhered to. <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>Moderation arrangements</p>	<ol style="list-style-type: none"> 1. Training providers must have their own moderation system approved by TNQAB before accreditation is granted: <ol style="list-style-type: none"> a) Relevant internal moderation processes are documented; b) Assessment is planned for each unit, and moderation processes are integrated into such plan 2. External moderation is conducted by the National qualifications unit of TNQAB for all unit components of a national qualification; <ol style="list-style-type: none"> a) Samples of assessed activities are submitted for moderation; b) Moderation (external) forms are available on request
<p>Resource requirements</p>	<ol style="list-style-type: none"> 1. Biogas plant: At least one of the following types: <ul style="list-style-type: none"> • Balloon plant • Fixed dome plant • Floating drum plant • Horizontal' plant • Earth-pit plant • Ferro-cement plant 2. Electrician's Tool Kit includes a sturdy tool-case containing the following: <ol style="list-style-type: none"> (i) Electric drill and bit sets (ii) Ratchet handle, universal joint, (iii) Sockets (iv) Coupler (v) Extension bar (vi) Insulated screwdrivers (approved for electrical safety) (vii) Combination spanner (approved for electrical safety) (viii) Pliers (approved for electrical safety) (ix) Electric tester

	<ul style="list-style-type: none"> (x) Hammer (xi) Measuring <p>3. Personal protective equipment (PPE):</p> <ul style="list-style-type: none"> (i) Hand gloves for electrical and mechanical lab work (ii) Safety helmets (iii) Safety glasses (iv) Ear mask for use in workshop environment (v) Dust masks (vi) Body harness (vii) Safety tags – e.g., Lock and tag out tags such as out of service, do not operate, live wire)
<p>Requirements to complete this unit</p>	<p>There are four (4) Learning outcomes and thirty-four (34) Performance standards to measure competence.</p> <p>To satisfy the requirements for competency, the person studying this unit is:</p> <ul style="list-style-type: none"> a. Required to demonstrate all LOs to the expected standards of performance; b. Required to attain an <i>Achieved Grade (Competent)</i> to fulfil the requirements of the Unit Standard; c. Eligible to three (3) attempts to achieve the required competency within 14 days of the first attempt. <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>Important notes and definitions</p>	<p>Notes</p> <ul style="list-style-type: none"> 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. 2. If relevant legislations are not available locally, legislations or policies from New Zealand or Australian are to be used for training. <p>Definition.</p> <ul style="list-style-type: none"> 1. <i>Biogas</i> is a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials (feedstock) such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source and, in many cases, exerts a very small carbon footprint. 2. <i>Biogas plant</i> is an anaerobic digester that produces biogas from feedstock.

3. *Biogas system* refers to the complete unit required for biogas production at a household level (apparatus and materials from feedstock collection through biogas production to storage/end use - including digestate collection/end use and may also include the use of a compressor for transfer and storage of gas).
4. *Biogas system configuration* – refers to key design parameters of the biogas system which include the **mixing temperatures** and **combination of digestion phases** (*hydrolysis, acidification, acetogenesis, methanogenesis*) in an anaerobic digester. These phases can happen in a single reactor or in separate reactors.
5. *Civil works* refers to work that involves civil engineering and construction of concrete base and digester including ducting for the biogas system, construction of digestate collection tanks and livestock pens.
6. *Commissioning (of equipment)* - is the process of ensuring that all systems and components of a system are designed, installed, tested, operated, and maintained according to the operational requirements (of the owner or manufacturer, etc.)
7. *De-commissioning (of equipment)* – the process of taking an equipment out of use.
8. *Digestate* refers to the material that is left after anaerobic digestion has taken place.
9. *Feedstock* refers to the raw materials that is used in a digester to produce biogas;
10. *Hazard* is a potential source of harm or adverse health effect on a person or persons.
11. *Occupational health and safety (OHS)* refers to the practice of dealing with all aspects of health and safety in the workplace, with a strong focus on preventing workplace hazards.
12. *OHS control measures (or risk control measures)* are actions that can be taken to reduce the potential of exposure to workplace hazards. It could be as simple as removing the hazard (so as to reduce the likelihood of the risk of exposure to that hazard).
13. *Sustainable energy development* refers to an energy system that contributes to sustainable development via the provision of energy services which meet the needs of the present without compromising the ability of future generations to meet their needs – biogas systems fit within the definition of sustainable energy

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.