REGISTERED
NATIONAL STANDARD

UNIT OF COMPETENCY

Title:	**Diagnose and rectify faults in biogas energy control systems.** Note: 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 *SE3304 (B) Diagnose and rectify faults in renewable energy control systems (Biomass).*				
TQF Level:	3	**Credits:**	4	**Version:**	1
National standard code:	NS102-03				
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 2028		
Purpose:	This unit standard is for people who work, or intend to work in the *Bioenergy* sector. Persons credited with this unit standard are able to: 1. Identify and prepare to diagnose technical faults in biogas systems. 2. Identify and rectify technical faults within a biogas control system. 3. Compile reports on fault-finding and repair activities in biogas systems.				
Learning Outcome 1 (LO1)	Prepare to diagnose and rectify technical faults (or breakdown) in biogas control system.				
Performance standards	1.1 Identify and understand relevant *Occupational health and safety* (OHS) procedures for a given work area; 1.2 Identify and obtain fault reports (or breakdown reports) from specific work area(s); 1.3 Assess the likely extent of work to be undertaken from fault reports (or breakdown reports) and/or discussions with appropriate person(s);				

	1.4 Use specific examples to describe the importance of strict adherence to OHS control measures; 1.5 Organise with others involved directly or indirectly to ensure the work is coordinated effectively; 1.6 Identify sources of materials that may be required for the work and make them available in accordance with established procedures; 1.7 Select and obtain tools, equipment and testing devices needed to locate faults or breakdown in accordance with established procedures; 1.8 Check tools, equipment and testing devices (above in PS 1.7) for correct operation and safety.
Learning Outcome 2 (LO2)	Identify and understand technical faults within a biogas control system.
Performance Standards	2.1 Ascertain the need for rectification of technical faults within a biogas control system; 2.2 Identify relevant OHS risk control measures and procedures for rectifying faults on biogas systems; 2.3 Identify fault methodically, drawing on knowledge of biogas systems and interconnecting pipes/tubes and vessels using measured and calculated values of components/apparatus parameters; 2.4 Identify the likely impact of specific technical faults on the whole biogas system; 2.5 Emphasize the importance of strict adherence to OHS control measures using specific examples from rectification work at hand; 2.6 Identify and document *hazards* resulting from fault or breakdown and devise *risk control measures*; 2.7 Determine the need to test or measure live in strict accordance with OHS requirements; 2.8 Isolate and check biogas system where necessary in strict accordance with OHS requirements and procedures; 2.9 Arrange for procurement of materials and replacement parts required to rectify faults in accordance with established procedures.
Learning Outcome 3 (LO3)	Rectify technical faults within a biogas control system.
Performance standards	3.1 Identify and obtain relevant fault reports; 3.2 Identify and strictly adhere to OHS risk control measures and procedures for carrying out the work on rectifying faults on biogas systems;

	3.3 Isolate and check biogas system where necessary in strict accordance OHS requirements and procedures; 3.4 Conduct live tests or measures within established safety procedures; 3.5 Repair fault without damage to apparatus, components, the surrounding environment, or services and using sustainable energy practices; 3.6 Reassemble apparatus and conduct final test in preparation for return to service; 3.7 Assess and handle unexpected situations safely and with the approval of an authorised person; 3.8 Clean and make safe work area in accordance with established procedures. 3.9 Appraise the effectiveness of the repair in accordance with established procedures.
Learning Outcome 4 (LO4)	Compile report on fault-finding and repair activities.
Performance standards	4.1 Employ OHS work completion risk control measures and procedures. 4.2 Identify requirements for fault reporting and obtain reporting template; 4.3 Complete relevant forms as required and consult line supervisors where necessary; 4.4 Justify through written statement the rationale for repairs done on components; 4.5 Compile a written report on work completed and appropriate person(s) notified in accordance with established procedures.
Pre-requisites	N/A
Co-requisites	N/A
Underpinning skill and knowledge	The following skills and knowledge are required: 1. Knowledge of the basic geography of the Pacific region and local, including culture, norms and values; 2. Knowledge of basic operation of a biogas system 3. Occupational hazards and risks in biogas systems 4. Industrial safety 5. Tools and equipment health and safety 6. OHS control measures 7. Skills in technical report writing. 8. Understanding the nature of use of a particular biogas system in a particular location. 9. 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 seminar or performing 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) Maintenance and rectification/repair reports; 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) or 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 diagnose and rectify technical faults (or breakdown) in a biogas control system. b) LO2: Identify and understand technical faults within a biogas control system. c) LO3: Rectify technical faults within a biogas control system.

	d) LO4: Compile report on completed biogas systems' fault finding and repair activities. **Re-assessment** Candidates of assessment are eligible to three (3) attempts to achieve the required competency within 14 days of their first attempt: 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: a) same competencies are being assessed; b) principles of assessment are adhered to. 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.
Moderation arrangements	1. Training providers must have their own moderation system approved by TNQAB before accreditation is granted: a. Relevant internal moderation processes are documented; b. Assessment is planned for each unit, and moderation (both internal and external) processes are integrated into such plan; 2. External moderation is conducted by the National qualifications unit of TNQAB for all unit components of national qualifications; a. Samples of assessed activities are submitted for moderation; b. Moderation (external) forms are available on request from the National qualifications unit of TNQAB. c. Requests for staff professional development on moderation are welcomed by TNQAB.
Resource requirements	1) Biogas plant - at least one of the following types: • Balloon plant • Fixed dome plant • Floating drum plant • Horizontal plant • Earth-pit plant • Ferro-cement plant 2) Flash drive (or external hard drive) for supervisory control and data acquisition (SCADA) 3) *Personal protective equipment* (PPE) a) Hand gloves for electrical and mechanical lab work b) Safety helmets

	c) Safety glasses d) Ear mask for use in workshop environment e) Dust masks f) Body harness g) Safety tags – e.g., Lock and tag out tags such as *out of service*, *do not operate*, *live wire*) h) Electric drill and bits 4) **Electrician's Tool Kit** includes a sturdy tool-case containing the following: a) Electric drill and bit sets b) Ratchet handle, universal joint, c) Sockets d) Coupler e) Extension bar f) Insulated screwdrivers (approved for electrical safety) g) Combination spanner (approved for electrical safety) h) Pliers (approved for electrical safety) i) Electric tester j) Hammer k) Measuring tape
Requirements to complete this unit	There are four (4) Learning outcomes and thirty-one (31) Performance standards to measure competence. To satisfy the expected competence, the person studying this unit is: a. Required to demonstrate all LOs to the expected standards of performance; b. Required to attain an *Achieved* Grade (Competent) 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. 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.
Important notes and definitions	**Legislation.** 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 local legislations are not available, relevant legislations or policies from New Zealand or Australian are to be used for training. 3. Assessors must comply with Tonga national assessment and moderation requirements.

Definition.

1. *Aerobic* means 'with oxygen' or 'requiring oxygen';
2. *Anaerobic* means 'without oxygen' or 'does not require oxygen';
3. *Bioenergy* refers to renewable energy produced from natural sources capable of replacing fossil energy (e.g. Biomass energy).
4. *Biogas* 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.
5. A *biogas plant* is an anaerobic digester that produces biogas from feedstock.
6. The term *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).
7. *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.
8. *Hazard* is a potential source of harm or adverse health effect on a person or persons.
9. *Job safety analysis* or *Job hazard analysis (JHA)* is a procedure that helps integrate accepted safety and health practices into a particular task or job operation. It involves the breaking down of a job to its main steps, identifying the potential hazards for each main step, and recommending the safest way to do complete each step;
10. *Methanogens* are microorganisms that produce methane gas during anaerobic digestion;
11. *Occupational Health and Safety* includes the laws, standards and programs that aim to making the workplace and work activities safer. OHS aims at protecting the health, safety, and well-being of employees, employers, clients and the public using that workplace.
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. *Risk* - is the likelihood that a person may be harmed or suffers adverse health effects if exposed to a hazard.

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.