

Sustainable Energy Training of Trainers Workshop Report for National Certificates 1 – 4



06 – 12 June 2021
Emmas Conference Centre, Don Bosco Technical Institute
National Capital District, Papua New Guinea

1. Introduction & Background

Training of Trainers (ToT) Workshop is one of the support activities by the University of Papua New Guinea (UPNG) Centre of Renewable Energy (CoRE) to the TVET Division of the Papua New Guinea Department of Education under the SECTM component of the larger FREAGER project by UNDP to address capacity issues in Papua New Guinea (PNG) particularly in Sustainable Energy (SE).

Between 2014 and 2017, SPC/USP worked with the TVET Division of the PNG Department of Education to develop programmes in climate resilience and sustainable energy to address the issue of human capacity shortages in PNG under the EU-PACTVET. The frameworks of the following programmes were created: -

- National Certificate 1
- National Certificate 2
- National Certificate 3
- National Certificate 4
- Diploma
- Advance Diploma

However, these programmes were never progressed since 2017 due to a lack of capacity within the Department of Education. With the support and assistance from UNDP under the mentioned project, CoRE stepped in to assist in progressing this exercise. Hence, the Training of Trainers Workshop for Facilitators (NC1-4).

In December 2020, there was a 4-Day TVET Workshop on Developing Sustainable Energy NC1 & NC2: Review of Training Packages to adopt and adapt in closed doors to produce quality documents considering the new competencies where seen appropriate. This activity was conducted at Koitaki Country Club from 30th November – 04th December 2020.

In March 2021, TVET with the support of UPNG CoRE (SECTM Project) reviewed NC 3 and NC4 with the objective of reviewing training modules for NC3 and NC4 in Sustainable Energy (SE) and replacing old and outdated competencies with current competencies.

The Training of Trainer (ToT) programme is conducted to complement the delivery of the NC1-NC4 curriculum through capacity building of potential instructors in existing TVET institutions with a background in science and technology (mechanical, electrical, architecture, building, applied science, etc).

2. Aims and Objectives

The overall goal of the project is to upskill selected facilitators to be able to implement NC1-4 in their respective institutes.

The objectives of the training are to:

Potential TVET Facilitators to familiarise with the following;

- (a) generic qualifications NC1 and NC2 that delves into workplace responsibilities, on-grid and off-grid systems, RE and Non-RE energy sources and EE
- (b) NC3 that covers logistics and procurement of project activities; scheduled and preventative maintenance; EE assessments, practice, retrofitting, and evaluation; and RE applications of tools and equipment for complex tasks; Use of drawings, codes, standards and specifications; fault diagnosis and rectification; assistance in installation and O &M; and
- (c) NC4 that looks into WHS identification and risk assessment; Supervision and coordination of energy sector activities; Energy Management; and RE applications of tools, equipment, and materials for planning, design and installation; Installing, operation and coordination of maintenance efforts of RE systems.
- (d) Discuss the basic theory of systems introduced by a lecture, emphasise hands-on work (learning by doing) in preparing system design and carrying out installation, diagnosis and rectification, and O&M related activities of RE and EE systems.
- (e) Support energy audits (e.g.; buildings and industrial facilities) and include preparation of content for a course on building and industrial energy audits for partner tertiary education institutions.
- (f) Promote Renewable Energy and Energy Efficiency in rural and remote communities
- (g) Empower rural communities through RE&EE training and promote business start-ups and entrepreneurship

3. Targeted Participants

Current practising TVET instructors who are engaged in running programmes in the following fields: -

- Electrotechnology
- Mechanical
- Architecture
- Building
- Applied Science

4. Expected Outcomes

The expected outcomes of the ToT event are as follows;

- The ToT will prepare facilitators to deliver the NC1-4 qualifications through applicable institutions.
- The ToT will enable facilitators to discuss the basic theory of systems introduced by lecture and enhance hands-on work (learning by doing) skills in preparing the design of systems and conducting installations, diagnosis and rectification, and O&M activities of RE and EE systems.
- Enhance the capacity of facilitators to support energy audits (e.g. buildings and industrial facilities) and include preparation of content for a course on building and industrial energy audits for partner tertiary education institutions.
- A number of individuals including women in PNG that are newly involved in designing, installing, operating, maintaining and repairing off-grid rural RE power systems as one of their main sources of income.
- Increased understanding of renewable energy and energy efficient systems by future entrepreneurs
- Increased interest in the establishment of sustainable energy business and productive utilisation of renewable energy

5. SE Modules for the Workshop

The Sustainable Energy for National Certificate 1 – 4 consisted of:

- 8 Modules for SE1
- 7 Modules for SE2
- 29 Modules for SE 3
- 15 Modules for SE4

Due to the limited time in conducting the workshop and as much as possible meet the aims and objectives of the workshop, the following modules were selected based on:

- Introducing the concepts and fundamentals of sustainable energy
- Designing, construction, installation, maintenance and operation of sustainable energy technologies very applicable to PNG context – these were Energy Efficiency, Micro-Hydropower and Solar PV
- Introducing to workplace health and safety measures applicable for the sustainable energy technologies applicable to PNG
- Introducing to the social, environmental and economic impacts of sustainable energy technologies applicable to PNG
- Introducing the regulatory aspects of sustainable energy technologies applicable to PNG

Refer to section 7 where the Sustainable Energy for National Certificate 1 – 4 modules is captured.

6. Workshop Coordination and Facilitation

The Training of Trainers was overseen and coordinated by Mr Manu Rawali. Mr Rawali is the Director of the Centre of Renewable Energy and currently a PhD candidate at the University of New South Wales in Sydney, Australia.

The workshop was facilitated by Ms Darlen Lovi and Mr Damien Sonny. Ms Lovi is an electrical engineer with a Master of Engineering Science from the Curtin University in Australia and has extensive experience in designing and teaching sustainable energy programs. She is currently a lecturer with the Physics Division of the University of Papua New Guinea. Ms Lovi can be contacted on phone number +675 7183 3842 and/or on email: dplovi@upng.ac.pg

Mr Sonny registered engineer with a Masters of Energy from the University of Auckland in New Zealand. Mr Sonny has well over fifteen (15) years of experience in the electromechanical engineering field including project engineering and management particularly in the manufacturing and power industry in PNG. Mr Sonny can be contacted on phone number +675 7451 0736 and/or on email: damien.sonny@upng.ac.pg.

7. Workshop Delivery

The course was delivered over a period of five (5) days commencing June 07 to 11, 2021 with a total number of 25 participants who successfully completed the workshop.

7.1 Workshop Delivery Methodologies

All participants were provided with a Training Manual. A variety of learning delivery and assessment methodologies were employed, in an attempt to enable the course to be participatory and interactive and to allow participants to effectively assimilate the new ideas and learning. Importantly, emphasis was placed on adult learning methodologies and over the duration of the course there was a combination of:

- Lectures
- Group discussions and activities
- Oral and written presentations
- Practical sessions



Figure 1. Lectures on Multimedia Presentation



Figure 2. Lectures on White Boards



Figure 3. Group Activity



Figure 4. Group Activity Presentation



Figure 5. Practical Sessions



Figure 6. The support team from UPNG Physics Department

7.2 Workshop Sessions

The workshop commenced with the arrival of the participants outside of Port Moresby on June 06, 2021, and was ushered to the training venue by the facilitators' Ms Darlen Lovi and Mr Damien Sonny. The rest of the participants who were based in the Nation's Capital joined the rest on June 07, 2021, and were accommodated at the workshop venue till departure on June 12, 2021.

The actual workshop commenced on the 07th of June, 2021 and was ended on the 11th of June, 2021 with the Certificates of Participation awarded to the participants. The day sessions were facilitated by UPNG CoRE whilst TVET was responsible for the CBA workshop conducted in the evening.

The full workshop program is provided in Annex 11.1 – Training Workshop Programme.

7.2.1 Day 1 - June 07, 2021: Workshop Official Opening and SE1 Sessions

The Official Opening of the ToT workshop had distinguished guests attending as project stakeholders. This included Mr Markus Demi (Assistant Secretary TVET Curriculum), Mrs Rossa Apelis (Acting First Assistant Secretary TVET), Ms Gretel Orake (UNDP Programme Manager) and Mr Johnson Kilis (CCDA). Also joining online were Mr Manu Rawali (Director of Centre of Renewable Energy) and Mr Moyap Kilepak (Discipline Leader, UPNG Physics). The distinguished guests acknowledged the importance of the ToT Workshop to enable the participants to deliver the Sustainable energy curriculum developed by TVET. Mr Rawali also acknowledges UNDP, CCDA and PCREEE for the funding that enabled the ToT Workshop to be conducted. The ToT Workshop participants were encouraged to learn to impart the concepts of the Sustainable Energy Curriculum in their respective institutions.

The ToT participants were from different fields of expertise under TVET. It was vital that the concepts involved approaches mentioned in section 7.1 as a wholesome approach to achieve the objectives of the ToT workshop.



Figure7. Workshop Official Opening

The workshop content was centred on technologies available to PNG (Hydropower and Solar PV) and Energy Efficiency. The SE 1 Sessions were facilitated by Mr Sonny and Ms Lovi covering the following modules;

(i) SE10620 - Select Basic Tools, Equipment and Materials used in RET and EE. This module provided an overview on how to conduct the following tasks; Identify and use appropriate tools, equipment and resources for a specific task in RET and EE;

- Identify problems related to the use of tools and basic equipment and take appropriate action
- Repair and perform routine maintenance tasks to tools and equipment
- Demonstrate care and safe work practices using tools and equipment and resources
- Identify and apply the correct storage measures for tools, equipment and resources
- Submit tool check records in accordance with procedures, and complete relevant job documentation

(ii) SE10520- Describe and Explain Energy Sources. This module provided an overview on how to conduct the following tasks;

- Explain the concept of energy
- Identify and explain the origin of all the earth's energy
- Identify different forms and sources of energy on earth

- Explain energy transformation/conversion and transfer
- Explain the importance of energy in human societies

(iii) SE10720 - Promoting Sustainable Energy Practices in PNG Communities. This module provided an overview on how to conduct the following tasks;

Identify and explain safe, sustainable energy practices to others in the community

- Prepare to promote recognised, safe, reliable and affordable sustainable energy practice at regional, national and domestic levels
- Report on completed the promotion activities of sustainable energy

(iv) SE10820 - Perform Workplace Calculations for Energy Sector. This module provided an overview on how to conduct the following tasks;

- Perform calculations as an integral part of routine work in the energy sector
- Carry out required simple mathematical operations using manual and electronic processes
- Prepare basic statistics such as means, mediums, averages, standard deviations.
- Interpret basic graphical representations of mathematical information

The ToT Workshop participants were given activities to emphasize the learning outcomes and enhance their understanding of the module content. The exercises included the following tasks;

- Conduct load sizing of lighting and fans
- Identifying planned activities to promote safe, reliable and affordable practices within the organization/domestic setting and how to respond to unexpected factors to achieve safe, reliable and affordable safety practices also within the organization/domestic setting.
- Observe the principle of operation of the solar PV system, hydropower system, generator, and motor



Figure 8. Group Activity



Figure 9. Principle of operation of the solar PV

7.2.2 Day 2 - June 08, 2021: Sessions on Energy Efficiency and Energy Conservation

The second day of the ToT Workshop covered a combination of SE2, SE3 and SE4 modules. Ms Lovi and Mr Sonny facilitated the workshop with the following modules during the sessions;

- (i) SE20420-Describe and explain basic renewable energy technologies (RETs) and Energy Saving Practices. This module provided an overview on how to conduct the following tasks;
- Identify Renewable and Non-Renewable Energy Resources harnessed in a global, regional (Pacific-wide) and local (communities) context
 - Identify and describe different types of Renewable Energy Technologies used globally and those that are used in various Pacific Island communities.
 - Explain and distinguish energy efficiency and energy Conservation
 - Identify energy ratings on different electrical appliances used in households, offices and commercial buildings

- Identify the units of "power", "voltage", "electrical current" and "electrical energy" in accordance with the System of International Units (SI Units)

(ii) SE20520-Apply tools, equipment, materials relevant to tasks in RET and Energy Efficiency Practices. This module provided an overview on how to conduct the following tasks; Select and use tools and equipment relevant to each of the different RET and EE practices and measures;

- Identify and use relevant materials relevant for each of the differences in RETs and EE practices and measures;
- Identify basic faults in RETs and other power tools and perform repairs using correct too and procedures
- Demonstrate ability to write basic reports in regards to tool handling and storage, including wear and tear
- Demonstrate ability to work independently under limited supervision with RET

(iii) SE20620 – Provide basic sustainable energy solutions for energy reduction in residential, commercial and industrial premises. This module provided an overview on how to conduct the following tasks;

- Prepare to monitor energy usage to help in energy reduction in residential, commercial and industrial premises
- Identify basic sustainable energy options using renewable energy sources and renewable energy technologies to reduce energy consumptions in residential, commercial and industrial premises.
- Identify basic sustainable energy options using non-renewable energy sources to conserve and reduce energy consumptions for residential, commercial and industrial premises.
- Complete monitoring activities and provide reports on alternative sustainable energy options for residential, commercial and industrial premises

(iv) SE20720-Promote and contribute to energy efficiency. This module provided an overview on how to conduct the following tasks; Identify and describe the requirements to maintain energy efficiency

- Explain the benefits relating to energy efficiency using different sources of renewable energy
- Promote and apply energy efficient work practices
- Identify opportunities for efficiencies in energy consumption or use of raw materials
- Identify opportunities for innovation in energy efficiency

(v) SE3202 – Evaluate Energy Saving Measures in Energy Utilising Systems. This module provided an overview on how to conduct the following tasks:

- Identify and evaluate the efficiency of energy utilizing systems
- Identify and describe energy-saving measures
- Identify and describe energy utilizing systems in residential, commercial and industrial premises

(vi) SE 3201 - Evaluation, recommendation and selection of EE products. This module provided an overview on how to conduct the following tasks;

- Identify the drivers to promoting energy efficiency in residential, commercial and industrial premises.
- Identify the kind of equipment/apparatus and electrical appliance used in residential, commercial and industrial premises;
- Select high efficient appliances and equipment for residential uses
- Evaluate and select Electrical appliances including Refrigeration, Heating, Ventilation and air-conditioning (RHVAC), industrial and commercial equipment and apparatus and other energy systems such as all kinds of power generators, automobile and other utility 2-stroke engines that are energy efficient;
- Evaluate and select building design and construction methods and materials for energy efficient

(vii) SE3203 – Promote and Contribute to Energy Efficiency – This module provided an overview on how to conduct the following tasks;

- Identify means of contributing to systems improvement with regard to energy efficiency
- Identify ways to promote and improve energy efficient work practices
- Identify requirements to maintain and contribute to energy efficiency
- Develop an energy efficiency plan

(viii) SE3204– Assessment for Improving Energy Efficiency in Energy Consumption Systems. This module provided an overview on how to conduct the following tasks;

- Devise a plan for assessing the energy efficiency of energy systems
- Compile data and information on energy consumption from energy systems
- Analyse data on energy data systems consumption characteristics, costs and emissions
- Identify and recommend measures to improve energy efficiency in energy consumption systems

(ix) SE4302 – Assist Tradesperson to Determine Energy Efficiency and Energy Conservation Practices to Save Energy. This module provided an overview on how to conduct the following tasks;

- Prepare to evaluate energy efficiency and energy conservation practices to save energy
- Evaluate energy efficiency and energy conservation practices to save energy in energy utilizing systems
- Document the evaluation of energy efficiency and energy conservation practices to save energy in energy utilizing systems

(xi) SE4104 – Conduct a Sustainable Energy Audit. This module provided an overview on how to conduct the following tasks;

- Coordinate, manage and apply safe working practices
- Define appropriate boundaries for the sustainable energy audit
- Conduct energy balance analyses for a site or process
- Identify high energy use/wastage
- Conduct cost/benefit analyses
- Ensure improvement strategies proposed to reflect stakeholder needs and regulatory environment

(xii) SE4304 – Coordinate Maintenance of RE Apparatus and System. This module provided an overview on how to conduct the following tasks;

- Apply safe working practices
- Follow maintenance schedules
- Determine the extent of repairs required
- Determine the personnel needed to repair the breakdown
- Provide technical support to maintenance

(xiii) SE4305 - Supervise and coordinate energy sector work activities. This module provided an overview on how to conduct the following tasks;

- Coordinate, manage and apply safe working practices.
- Implement safety procedures and processes
- Sequence work activities
- Provide guidance and work instructions to others
- Ensure job requirements are met
- Maintain necessary work documentation

(xiv) SE4102– Supervise and Coordinate Energy Sector Work Activities. This module provided an overview on how to conduct the following tasks;

- Prepare to supervise and coordinate work activities in various work locations
- Supervise and coordinate work activities in various work locations
- Document supervision and coordination activities

The ToT Workshop participants were given activities to emphasize the learning outcomes and enhance their understanding of the module content. The exercises included the following tasks;

- Identify the specifications of the EE lights
- Compare the EE lights and the compact fluorescent lamps specifications to appreciate the advantage of the lighting retrofit approach
- Conduct a walk thorough an energy audit

- Determine the cost and energy-saving from three (3) cases whereby normal AC lights were used and the cost and energy savings with the applications of energy efficiency and energy conservation measures
- Observe the use of energy data loggers and identify data that can be collected to determine energy consumption. Conduct planned activities to promote safe, reliable and affordable SE practices at a domestic level State planned approaches to respond to unexpected factors to achieve safe, reliable and affordable SE practices at domestic levels in communities identify the four (4) risk management process

7.2.3 Day 3 - June 09, 2021: Session on Micro hydropower

The third day of the ToT Workshop was focused on SE3 modules. The content covered micro hydropower. Mr Sonny facilitated the workshop with the following modules throughout the day;

- (i) SE30117 MHP – Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Operations and Maintenance (Micro-Hydropower). This module provided an overview on how to conduct the following tasks;
- Identify the different types and uses of Power tools, equipment’s and Materials used for operating testing and maintenance of micro-hydro power
 - Demonstrate the safe handling of power tools, equipment’s and materials for operating, testing and maintenance of micro-hydro power
 - Demonstrate the maintenance practices of power tools, equipment’s and materials used for micro-hydro power

- (ii) SE30217 MHP– Apply Basic Concepts in RE for Energy Generation and Consumption (Micro-Hydropower).

This module provided an overview on how to conduct the following tasks;

- Identify and describe the importance of social inclusion in energy and electrification
- Identify and describe the function of all parts/ components that constitute a micro-hydropower system
- Estimate the power available from hydropower plants through the seasons
- Estimate the electrical power demand for a community through the day
- Perform a simple economic and environmental assessment of the micro-hydropower technology in the Pacific island countries’ context.

- (iii)SE30317 MHP– Use Drawings, Diagrams, Schedules, Standards, Codes and Specifications (Micro-Hydropower). This module provided an overview on how to conduct the following tasks;

- Prepare to use drawings, diagrams, schedules and manuals for MHP design and installation
- Use drawings, diagrams, schedules and manuals to obtain MHP job information.
- Use MHP drawings, diagrams, schedules and manuals to convey information and ideas.
- Prepare to use compliance standards, codes and specifications.

- (iv) SE30417 MHP – Diagnose and Rectify Faults in Renewable Energy Control Systems (Micro-Hydropower). This module provided an overview on how to conduct the following tasks;

- Identify and rectify/repair any technical faults within micro-hydropower control systems
- Complete completed micro-hydro power systems fault finding and repair activities

- (v) SE30517MHP – Maintain and repair facilities associated with remote area essential service operations (Micro-Hydropower). This module provided an overview on how to conduct the following tasks;

- Prepare to maintain and repair micro-hydropower facilities.
- Maintain and repair micro-hydropower facilities.
- Complete maintenance and repair work reports

(vi) SE30617 MHP – Assist in installation, operation and maintenance of systems for RETs and EE (Micro-Hydropower).

This module provided an overview on how to conduct the following tasks;

- Prepare to install operate and maintain micro-hydro power systems
 - Demonstrate installation of renewable energy systems equipment.
 - Demonstrate the safe handling and operations of renewable energy systems equipment.
 - Demonstrate the maintenance practices of renewable energy systems and equipment.
- Write completion reports on installation and maintenance activities.

The ToT Workshop participants were given activities to emphasize the learning outcomes and enhance their understanding of the module content. The activity for the day included the following tasks;

- Calculations on the power output of micro-hydropower systems
- Identifying micro hydropower system components and state the functions
- Determine power output of the Microhydro prototypes by measuring the flow rate and elevation applicable to each technology

7.2.4 Day 4 - June 10, 2021: Session on Solar Photovoltaics

(i) SE30117 S – Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Operations and Maintenance (Solar Photovoltaics). This module provided an overview on how to conduct the following tasks;

- Identify the different types and uses of power tools, equipment and materials used for operating testing and maintenance of solar photovoltaic
- Demonstrate the safe handling of power tools, equipment's and materials for operating, testing and maintenance of solar photovoltaic.
- Demonstrate the maintenance practices of power tools, equipment's and materials used for solar photovoltaic

(ii) SE30217 S – Apply Basic Concepts in RE for Energy Generation and Consumption (Solar Photovoltaic). This module provided an overview on how to conduct the following tasks;

- Identify and describe the importance of social inclusion in energy and electrification
- Identify and describe the function of all parts/ components that constitute a Solar photovoltaic system
- Estimate the power available from the solar photovoltaic system through the seasons
- Estimate the electrical power demand by a community or a household through the day
- Perform a simple economic and environmental assessment of the solar photovoltaic technology in the Pacific island countries' context.

(iii) SE30317S – Use Drawings, Diagrams, Schedules, Standards, Codes and Specifications (Solar Photovoltaics). This module provided an overview on how to conduct the following tasks;

- Prepare to use drawings, diagrams, schedules and manuals.
- Use drawings, diagrams, schedules and manuals to obtain job information, convey information and ideas.
- Prepare to use compliance standards, codes and specifications.

(iv) SE30417S – Diagnose and Rectify Faults in Renewable Energy Control Systems (Solar Photovoltaics). This module covers:

- Identify and prepare to diagnose technical faults in the solar photovoltaic control system.
- Identify and rectify/repair any technical faults within solar photovoltaic control systems
- Compile completed RE systems fault finding and repair activities

(v) SE30517S – Maintain and repair facilities associated with remote area essential service operations (Solar Photovoltaics). This module provided an overview on how to conduct the following tasks;

- Prepare to maintain and repair solar PV facilities.
- Maintain and repair solar PV facilities.

- Complete maintenance and repair work reports

(vi) SE30617S – Assist in installation, operation and maintenance of systems for RETs and EE (Solar Photovoltaics).

This module provided an overview on how to conduct the following tasks;

- Prepare to install operate and maintain solar PV systems
- Demonstrate installation of renewable energy systems equipment.
- Demonstrate the safe handling and operations of renewable energy systems equipment.
- Demonstrate the maintenance practices of renewable energy systems and equipment.
- Write completion reports on installation and maintenance activities.

The activities for the day included the following tasks;

- Estimate solar PV output based on resource potential
- Identify functions of Solar PV system components
- Determine load size and energy requirements
- Identify DC system voltage for small scale solar PV system based on load requirements
- Choose components based on load requirements and system voltage for small scale systems
- Identify specifications of components to maintain system voltage and meet system requirements
- Identify factors contributing to power losses
- State occupational health and safety measures to consider before doing work on the solar PV system
- Identify hazards at a solar PV worksite
- Identify tools that may be required in the diagnosis and rectification work
- Scheduling of maintenance tasks



Figure 10. Identify functions of solar PV system



Figure 11. Occupational Health and Safety Measures



Figure 12. Scheduling of maintenance tasks

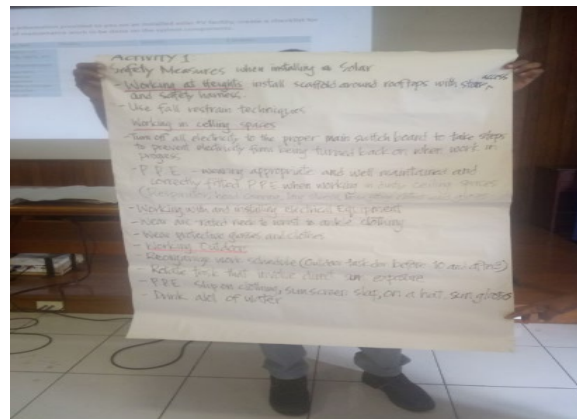


Figure 13. Identifying installation safety measures

7.2.5 Day 5 - June 11, 2021: Session on SE 4 modules and Workshop Closing

The fifth day was the final day of the program of the ToT Workshop. Since the modules of day four (4) were not completed on the previous day, the day began with SE40317 S before proceeding with the modules for day five (5). The modules were covered in the sequence below;

- (i) SE40317 S - Design, Install, Operate and Maintain RET Systems (Solar Photovoltaic System). This module provided an overview on how to conduct the following tasks:
 - Prepare to install, operate and maintain solar PV systems
 - Demonstrate Installation of solar PV system equipment.
 - Demonstrate the safe handling, operations and maintenance of solar PV system
 - Write completion report on installation and maintenance activities.

- (ii) SE4103– Describe and Use Logical Framework Analysis and Cost-Benefit Analysis to Appraise. This module provided an overview on how to conduct the following tasks:
 - Determine the objective of the cost-benefit analysis and LFA
 - Identify the costs and benefits for a given energy activity measure or project
 - Identify and explain steps involved in LFA for energy project design
 - Value the costs and benefits as much as possible in quantifiable terms
 - Sum the costs and benefits over time
 - Assess the importance of major uncertainties and limitations associated with both analytical tools and activity
 - Consider who will incur the costs and benefits and what impact this might have on the activity

- (iii) SE4105– Planning and Managing the Energy Sector. This module provided an overview on how to conduct the following tasks:
 - Demonstrate the use of energy planning and energy management tools
 - Develop and use a basic Energy Data Base using Microsoft window-based software,
 - Develop energy balance (tables and flow diagram) using Microsoft window-based software
 - Understand how energy is priced
 - Demonstrate use of Project Planning and management tools in planning, implementing and monitoring energy projects

- (iv) SE4106 – Regulating the Energy Sector and Energy Policy Development. This module provided an overview on how to conduct the following tasks;
 - Explain why to regulate, who regulate and what can be regulated in the energy sector,
 - Describe various types of energy regulations and the principles of regulation
 - Explain how energy commodity account is essential in energy policies development
 - Describe how Energy policy encourage renewable energy and energy efficiency

- (v) SE403017 MHP - Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Designing, Installing and Commissioning (Micro-Hydropower System). This module provided an overview on how to conduct the following tasks;
 - Identify the different types and uses of power tools, equipment and materials used for designing, installing and commissioning micro-hydro power systems
 - Demonstrate the safe handling of power tools, equipment and materials for designing, installing and commissioning micro-hydropower
 - Demonstrate the knowledge and skills in designing, installing and commissioning micro-hydropower power systems

- (vi) SE40317 MHP - Design, Install, Operate and Maintain RET Systems (Micro-Hydropower System). This module provided an overview on how to conduct the following tasks:
 - Prepare to install operate and maintain micro-hydropower (MHP) systems
 - Demonstrate Installation of micro-hydropower (MHP) systems equipment.
 - Demonstrate the safe handling and operations of micro-hydropower (MHP) systems equipment.
 - Demonstrate the maintenance practices of micro-hydropower (MHP) systems and equipment.
 - Write completion report on installation and maintenance activities.

The session for the day ended late in the afternoon and the participants had time to freshen up to prepare for the workshop closing at 7 pm.

7.3 Workshop Participants

A total of 25 personnel has benefited from the workshop. The participants were from various Technical and Vocation institutions in PNG as well as from the TVET division of the Department of Education.

	Total Male	Total Female
Workshop	17	8

Both males and females were given equal opportunity to attend the workshop and institutions were able to nominate either male or female participants to attend the training. The selection of participants by institutions would have been based on the target participants for the training as indicated in the workshop programme and letters of invitation sent out. The venue for the delivery of the workshop was the Emmaus Conference Centre at Don Bosco Technical Institute in Port Moresby.

The participants and institutions they represented are presented in the table below:

No.	Names of Participant	Gender	Institution	Province	Comments
1	Joseph Kisokau	M	Port Moresby Technical College	NCD	ToT
2	Daniel Bernard	M	Port Moresby Technical College	NCD	ToT
3	Job Kum	M	Port Moresby Technical College	NCD	ToT
4	Maria Tetu	F	Limana Vocational Centre	NCD	ToT
5	Sr. Maria Gorethy Leison	F	Limana Vocational Centre	NCD	ToT
6	Sam Onom	M	Ogelberg Vocational Centre	WHP	ToT
7	Steven Yambundimi	M	TVET Inspector	WHP	ToT
8	Tasman Dau	M	Regional Vocation Coordinator	MBPS	ToT
9	Joseph Batia	M	Woolnough Vocational Centre	ENBP	ToT
10	Maria Taudiri	F	Bolubolu Vocational Centre	Milne Bay	ToT
11	Cyprian Dademo	M	Kwato Vocational Centre	Milne Bay	ToT
12	Lina Tarubi	F	Umi Vocational Centre	Morobe	ToT
13	Richmond Kababa	M	Umi Vocational Centre	Morobe	ToT
14	Rachel Pena	F	Lae Polytechnical Institute	Morobe	ToT
15	Jinky Baltazar	F	Lae Polytechnical Institute	Morobe	ToT
16	Urex Masina	M	Mt. Hagen Technical College	WHP	ToT
17	Paul Mangau	M	Madang Technical College	Madang	ToT
18	Dominic Kora	M	Madang Technical College	Madang	ToT
19	Pelega Leka	M	Keakalo VTC	Central	ToT
20	Matan Dindi	M	Goroka Technical College	EHP	ToT
21	Janet Gaima	F	TVET Head Office – FOL	NCD	ToT
22	Raymond Grangin	M	TVET Head Office – Automotive	NCD	CBT Facilitator
23	Thomas Aiye	M	TVET Head Office – Mechanical	NCD	CBT Facilitator
24	Johnson Kilis	M	CCDA Adaptation Rep	NCD	SE Content Facilitator
25	Violet Gerega	F	TVET Head Office – Programme Coordinator	NCD	TVET Programme Coordinator/Facilitator

8. Workshop Evaluation

The workshop evaluation survey provided great feedback from 20 participants from TVET institutions who were present at the end of the workshop. Refer to Annex 1.2. Participants viewed the workshop as an eye-opener and were keen on evaluating the energy usage to identify the electrical load profile and consequently EE & C opportunities and also utilizing the solar PV and micro-hydro power technology in their various schools. The main feedback from participants was that the five (5) days of the ToT workshop was limited to cover each module thoroughly for preparation for the delivery of the SE curriculum. It was expressed that the workshop program was not followed as there was a large number of modules to cover. Also, that questions raised to encourage learning delayed the learning progress. However, the activities and practical sessions played an important role in enhancing learning over the duration of the ToT workshop. It was new knowledge that needed to be disseminated and it required ample time to understand fully the SE curriculum content. Overall the feedback generally showed that the participants would agree that the ToT Workshop was a success despite the limitations due to time.

9. Workshop Closing

The ToT Workshop Closing began at 7 pm and the Assistant Secretary TVET Curriculum, Mr Markus Demi, once again acknowledged the stakeholders for making the event a success. He encouraged the ToT participants to disseminate the knowledge and skill acquired over the duration of the ToT Workshop facilitated by UPNG CoRE. The participants expressed gratitude towards the stakeholder through a speech from workshop participant representative, Mr Tasman Dau.



Figure 14. Speech from Mr Tasman Dau

The event ended with the presentation of the Certificate of Participation by the Assistant Secretary TVET Curriculum, Mr Markus Demi and gifts presented to the workshop facilitators from the Milne Bay participants.

10. Annexures

10.1 Training Programme

Sunday, 06th June 2021

- The arrival of Participants from Outside Port Moresby
- Transport for pick up will be available at Jacksons Airport.
- Contact Darlen Lovi on mobile number 7183 3842 and/or Damien Sonny on mobile number 7451 0736.
- Accommodation will be at Emmaus Conference Centre at Don Bosco Technical Institute (DBTI)

Monday, 07th June 2021: Day 1 – National Certificate I (NCI)

Time	Topic	Activities	Facilitator
8:00 – 8:45	Registration		Damien Sonny
8:45 – 9:45	Introduction and housekeeping including Covid-19 Protocols		Damien Sonny
	Opening Ceremony (Damien Sonny-Master of Ceremony)		
9:45 – 9:50	Opening Prayer		Pastor Onamusi
9:50 – 10:00	National Anthem and Pledge		MC
10:00 – 10:10	Welcome and Purpose of Workshop		Darlen Lovi
10:10-10:15	Opening Remarks from UNDP/CCDA Remarks		Gretel/Danny
10:15 – 10:30	Opening Remarks from DoE Secretary or Representative		Secretary of Education
10:30-10:45	Closing of Ceremony Photo Session (Group Photo)-Taken at the courtyard with Photographer on the second floor Morning Tea and Coffee		MC
10:45 – 11:45	SE10520- Describe and Explain Energy Sources	<ul style="list-style-type: none"> • Explain the concept of energy • Identify and explain the origin of all the earth's energy • Identify different forms and sources of energy on earth • Explain energy transformation/conversion and transfer • Explain the importance of energy in human societies 	Darlen Lovi
11:45 – 12:45	SE10620 – Select Basic Tools, Equipment and Materials used in RET and EE	<ul style="list-style-type: none"> • Identify and use appropriate tools, equipment and resources for a specific task in RET and EE; • identify problems related to the use of tools and basic equipment and take appropriate action • repair and perform routine maintenance tasks to tools and equipment • demonstrate care and safe work practices using tools and equipment and resources • identify and apply the correct storage measures for tools, equipment and resources • submit tool check records in accordance with procedures, and complete relevant job documentation 	Damien Sonny
12:45 – 13:30		Lunch	

13:30– 14:30	SE10720 – Promoting Sustainable Energy Practices in PNG Communities	<ul style="list-style-type: none"> Identify and explain safe, sustainable energy practices to others in the community Prepare to promote recognised, safe, reliable and affordable sustainable energy practice at regional, national and domestic levels Report on completed the promotion activities of sustainable energy 	Darlen Lovi
14:30 – 15:30	SE10820 – Perform Workplace Calculations for Energy Sector	<ul style="list-style-type: none"> Perform calculations as an integral part of routine work in the energy sector Carry out required simple mathematical operations using manual and electronic processes Prepare basic statistics such as means, mediums, averages, standard deviations. Interpret basic graphical representations of mathematical information 	Damien Sonny
15:30 – 15:45	Afternoon Tea Break		
15:45 – 16:45	SE20420-Describe and explain basic renewable energy technologies (RETs) and Energy Saving Practices	<ul style="list-style-type: none"> Identify Renewable and Non-Renewable Energy Resources harnessed in a global, regional (Pacific-wide) and local (communities) context, Identify and describe different types of Renewable Energy Technologies used globally and those that are used in various Pacific Island communities. Explain and distinguish energy efficiency and energy Conservation Identify energy ratings on different electrical appliances used in households, offices and commercial buildings <p>Identify the units of “power”, “voltage”, “electrical current” and “electrical energy” in accordance with the System of International Units (SI Units)</p>	Darlen Lovi
16:45 – 17:45	Practical Session/Group Activity		Darlen Lovi
17:30 – 18:00	Back to Emmaus Centre		
18:00 – 19:00	Dinner		
19:00 – 20:00	M1	TVET, CBT&A Principles & Concepts; Paradigm shift; NQF	Grangin/Aiye/Gerega
20:00 – 21:00	M2	Design & Develop Learning Program	Grangin/Aiye/Gerega
21:00 – 22:00	Activity Task 1	Develop a unit of competence	Grangin/Aiye/Gerega

Tuesday, 08th June 2021: Day 2 – National Certificate 2 (NC2 & National Certificate 3 (NC3))

Time	Topic	Activities	Facilitator
8:00 – 8:15		Registration	Damien Sonny
8:15 – 9:15	SE20520-Apply tools, equipment, materials relevant	<ul style="list-style-type: none"> Select and use tools and equipment relevant to each of the different RET and EE practices and measures; 	Damien Sonny/

	to tasks in RET and Energy Efficiency Practices	<ul style="list-style-type: none"> Identify and use relevant materials relevant for each of the differences in RETs and EE practices and measures; Identify basic faults in RETs and other power tools and perform repairs using correct too and procedures Demonstrate ability to write basic reports in regards to tool handling and storage, including wear and tear Demonstrate ability to work independently under limited supervision with RET 	
9:15 – 10:15	SE20620 – Provide basic sustainable energy solutions for energy reduction in residential, commercial and industrial premises	<ul style="list-style-type: none"> Prepare to monitor energy usage to help in energy reduction in residential, commercial and industrial premises Identify basic sustainable energy options using renewable energy sources and renewable energy technologies to reduce energy consumptions in residential, commercial and industrial premises. Identify basic sustainable energy options using non-renewable energy sources to conserve and reduce energy consumptions for residential, commercial and industrial premises. Complete monitoring activities and provide reports on alternative sustainable energy options for residential, commercial and industrial premises 	Damien Sonny
10:15-10:30	Morning Tea Break		
10:30 – 11:30	SE20720-Promote and contribute to energy efficiency	<ul style="list-style-type: none"> Identify and describe the requirements to maintain energy efficiency Explain the benefits relating to energy efficiency using different sources of renewable energy Promote and apply energy efficient work practices <ul style="list-style-type: none"> Identify opportunities for efficiencies in energy consumption or use of raw materials Identify opportunities for innovation in energy efficiency 	Damien Sonny
11:30 – 12:30	SE3202 – Evaluate Energy Saving Measures in Energy Utilising Systems	<ul style="list-style-type: none"> Identify and evaluate the efficiency of energy utilizing systems Identify and describe energy-saving measures Identify and describe energy utilizing systems in residential, commercial and industrial premises 	Damien Sonny
12:30 – 13:30	Lunch		
13:30– 14:30	SE 3201 - Evaluation, recommendation and selection of EE products	<ul style="list-style-type: none"> Identify the drivers to promoting energy efficiency in residential, commercial and industrial premises. Identify the kind of equipment/apparatus and electrical appliance used in residential, commercial and industrial premises; Select high efficient appliances and equipment for residential uses 	Damien Sonny/Darlen Lovi

		<ul style="list-style-type: none"> Evaluate and select Electrical appliances including Refrigeration, Heating, Ventilation and air-conditioning (RHVAC), industrial and commercial equipment and apparatus and other energy systems such as all kinds of power generators, automobile and other utility 2-stroke engines that are energy efficient; Evaluate and select building design and construction methods and materials for energy efficient 	
14:30 – 15:30	SE3203 – Promote and Contribute to Energy Efficiency	<ul style="list-style-type: none"> Identify means of contributing to systems improvement with regard to energy efficiency Identify ways to promote and improve energy efficient work practices Identify requirements to maintain and contribute to energy efficiency Develop an energy efficiency plan 	Damien Sonny
15:30 – 15:45	Afternoon Tea Break		
15:45 – 16:45	SE3204– Assessment for Improving Energy Efficiency in Energy Consumption Systems	<ul style="list-style-type: none"> Devise a plan for assessing the energy efficiency of energy systems Compile data and information on energy consumption from energy systems Analyse data on energy data systems consumption characteristics, costs and emissions Identify and recommend measures to improve energy efficiency in energy consumption systems 	Damien Sonny
16:45 – 17:45	Practical Session/Group Activity		Darlen Lovi
17:45 – 18:00	Break		
18:00 – 19:00	Dinner		
19:00 – 20:00	M3 – Section A	Plan, organise and deliver group-based learning	Grangin/Aiye/Gerega
20:00 – 21:00	M3 – Section B	Facilitate group-based learning	Grangin/Aiye/Gerega
21:00 – 22:00	Activity Task 2	Produce a module from the unit	Grangin/Aiye/Gerega

Wednesday, 09th June 2021: Day 3 – National Certificate 3 (NC3) & National Certificate 4(4)

Time	Topic	Activities	Facilitator
8:00 – 8:15		Registration	Damien Sonny
8:15 – 9:15	SE3301 MHP – Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Operations and Maintenance (Micro-Hydropower) SE3017	<ul style="list-style-type: none"> Identify the different types and uses of Power tools, equipment's and Materials used for operating testing and maintenance of micro-hydro power Demonstrate the safe handling of power tools, equipment's and materials for operating, testing and maintenance of micro-hydro power 	Damien Sonny

		<ul style="list-style-type: none"> • Demonstrate the maintenance practises of power tools, equipment's and materials used for micro-hydro power 	
	SE3302 MHP– Apply Basic Concepts in RE for Energy Generation and Consumption (Micro-Hydropower) SE30217	<ul style="list-style-type: none"> • Identify and describe the importance of social inclusion in energy and electrification • Identify and describe the function of all parts/ components that constitute a micro-hydropower system • Estimate the power available from hydropower plants through the seasons • Estimate the electrical power demand for a community through the day • Perform a simple economic and environmental assessment of the micro-hydropower technology in the Pacific island countries' context. 	Damien Sonny
9:15 – 10:15	SE3303 MHP– Use Drawings, Diagrams, Schedules, Standards, Codes and Specifications (Micro-Hydropower) SE30317	<ul style="list-style-type: none"> • Prepare to use drawings, diagrams, schedules and manuals for MHP design and installation • Use drawings, diagrams, schedules and manuals to obtain MHP job information. • Use MHP drawings, diagrams, schedules and manuals to convey information and ideas. • Prepare to use compliance standards, codes and specifications. 	Damien Sonny
10:15-10:30	Morning Tea Break		
10:30 – 11:30	SE3304 MHP – Diagnose and Rectify Faults in Renewable Energy Control Systems (Micro-Hydropower) SE30417	<ul style="list-style-type: none"> • Identify and rectify/repair any technical faults within micro-hydropower control systems • Compile completed micro-hydro power systems fault finding and repair activities 	Damien Sonny
11:30 – 12:30	SE3305 MHP – Maintain and repair facilities associated with remote area essential service operations (Micro-Hydropower) SE30517	<ul style="list-style-type: none"> • Prepare to maintain and repair micro-hydropower facilities. • Maintain and repair micro-hydropower facilities. • Complete maintenance and repair work reports 	Damien Sonny
12:30 – 13:30	Lunch		
13:30– 14:30	SE3306 MHP – Assist in installation, operation and maintenance of systems for RETs and EE (Micro-Hydropower) SE30617	<ul style="list-style-type: none"> • Prepare to install operate and maintain micro-hydro power systems • Demonstrate installation of renewable energy systems equipment. • Demonstrate the safe handling and operations of renewable energy systems equipment. • Demonstrate the maintenance practices of renewable energy systems and equipment. • Write completion reports on installation and maintenance activities. 	Damien Sonny
14:30 – 15:30	SE3301S – Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Operations and Maintenance	<ul style="list-style-type: none"> • Identify the different types and uses of Power tools, equipment's and Materials used for operating testing and maintenance of solar photovoltaic 	Damien Sonny

	(Solar Photovoltaics)	<ul style="list-style-type: none"> • Demonstrate the safe handling of power tools, equipment's and materials for operating, testing and maintenance of solar photovoltaic • Demonstrate the maintenance practises of power tools, equipment's and materials used for solar photovoltaic 	
15:30 – 15:45	Afternoon Tea Break		
15:45 – 16:45	SE3302S– Apply Basic Concepts in RE for Energy Generation and Consumption (Solar Photovoltaics)	<ul style="list-style-type: none"> • Identify and describe the importance of social inclusion in energy and electrification • Identify and describe the function of all parts/ components that constitute a Solar photovoltaic system • Estimate the power available from the solar photovoltaic system through the seasons • Estimate the electrical power demand by a community or a household through the day • Perform a simple economic and environmental assessment of the solar photovoltaic technology in the Pacific island countries' context. 	Darlen Lovi
16:45 – 17:30	Trainees' trip for Essentials		
17:30 – 18:00	Back to Emmaus Centre		
18:00 – 19:00	Dinner		
19:00 – 20:00	Activity Task 3	Produce a session plan	
20:00 – 21:00	Group Presentation	<ul style="list-style-type: none"> • Unit of competence • The module of the Unit • Session Plan 	Grangin/Aiye/Gerega
21:00 – 22:00	Group Presentation	<ul style="list-style-type: none"> • Unit of competence • The module of the Unit Session Plan	Grangin/Aiye/Gerega

Thursday, 10th June 2021: Day 4 – National Certificate 4 (NC4)

Time	Topic	Activities	Facilitator
8:00 – 8:15		Registration	Damien Sonny
8:15 – 9:15	SE3303S– Use Drawings, Diagrams, Schedules, Standards, Codes and Specifications (Solar Photovoltaics)	<ul style="list-style-type: none"> • Prepare to use drawings, diagrams, schedules and manuals. • Use drawings, diagrams, schedules and manuals to obtain job information, convey information and ideas. • Prepare to use compliance standards, codes and specifications. 	Darlen Lovi
9:15 – 10:15	SE3304S – Diagnose and Rectify Faults in Renewable Energy Control Systems (Solar Photovoltaics)	<ul style="list-style-type: none"> • Identify and prepare to diagnose technical faults in a solar photovoltaic control system. • Identify and rectify/repair any technical faults within solar photovoltaic control systems • Compile completed RE systems fault finding and repair activities 	Darlen Lovi
10:15-10:30	Morning Tea Break		
10:30 – 11:30	SE3305S – Maintain and repair facilities associated with remote area essential service operations (Solar Photovoltaics)	<ul style="list-style-type: none"> • Prepare to maintain and repair solar PV facilities. • Maintain and repair solar PV facilities. • Complete maintenance and repair work reports 	Darlen Lovi

11:30 – 12:30	SE3306S – Assist in installation, operation and maintenance of systems for RETs and EE (Solar Photovoltaics)	<ul style="list-style-type: none"> • Prepare to install operate and maintain solar PV systems • Demonstrate installation of renewable energy systems equipment. • Demonstrate the safe handling and operations of renewable energy systems equipment. • Demonstrate the maintenance practices of renewable energy systems and equipment. • Write completion reports on installation and maintenance activities. 	Darlen Lovi
12:30 – 13:30	Lunch		
13:30– 14:30	SE4102– Supervise and Coordinate Energy Sector Work Activities	<ul style="list-style-type: none"> • Prepare to supervise and coordinate work activities in various work locations • Supervise and coordinate work activities in various work locations • Document supervision and coordination activities 	Damien Sonny
14:30 – 15:30	SE4103– Describe and Use Logical Framework Analysis and Cost-Benefit Analysis to Appraise	<ul style="list-style-type: none"> • Determine the objective of the cost-benefit analysis and LFA • Identify the costs and benefits for a given energy activity measure or project • Identify and explain steps involved in LFA for energy project design • Value the costs and benefits as much as possible in quantifiable terms • Sum the costs and benefits over time • Assess the importance of major uncertainties and limitations associated with both analytical tools and activity • Consider who will incur the costs and benefits and what impact this might have on the activity 	Damien Sonny
15:30 – 15:45	Afternoon Tea Break		
15:45 – 16:45	SE4104 – Conduct a Sustainable Energy Audit	<ul style="list-style-type: none"> • Coordinate, manage and apply safe working practices • Define appropriate boundaries for the sustainable energy audit • Conduct energy balance analyses for a site or process • Identify high energy use/wastage • Conduct cost/benefit analyses • Ensure improvement strategies proposed to reflect stakeholder needs and regulatory environment 	Darlen Lovi
16:45 – 17:45	Group Activity Session/Practical:	•	Darlen Lovi
17:45 – 18:00	Break		
18:00 – 19:00	Dinner		
19:00 – 20:00	Activity Task 3	Produce a session plan	
20:00 – 21:00	Group Presentation	<ul style="list-style-type: none"> • Unit of competence • A module of the Unit • Session Plan 	Grangin/Aiye/Gerega

21:00 – 22:00	Group Presentation	<ul style="list-style-type: none"> • Unit of competence • A module of the Unit • Session Plan 	Grangin/Aiye/Gerega
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Friday, 11th June 2021: Day 5 – National Certificate 4 (NC4)

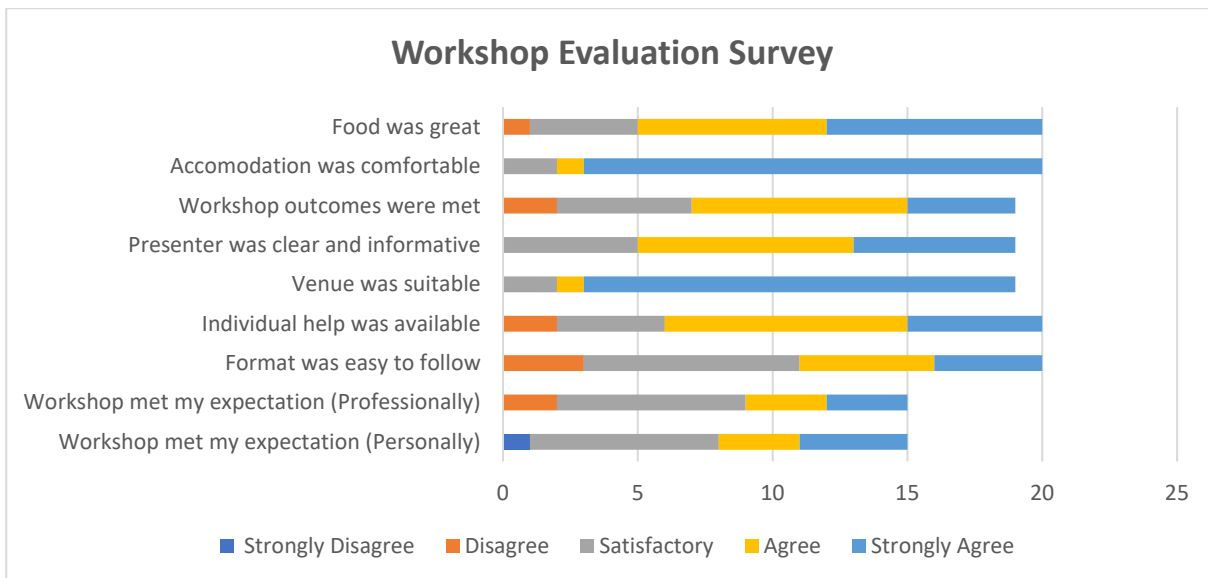
Time	Topic	Activities	Facilitator
8:00 – 8:15		Registration	Damien Sonny
8:15 – 9:15	SE4105– Planning and Managing the Energy Sector	<ul style="list-style-type: none"> • Demonstrate the use of energy planning and energy management tools • Develop and use a basic Energy Data Base using Microsoft window-based software, • Develop energy balance (tables and flow diagram) using Microsoft window-based software • Understand how energy is priced • Demonstrate use of Project Planning and management tools in planning, implementing and monitoring energy projects 	Damien Sonny
9:15 – 10:15	SE4106 – Regulating the Energy Sector and Energy Policy Development	<ul style="list-style-type: none"> • Explain why to regulate, who regulate and what can be regulated in the energy sector, • Describe various types of energy regulations and the principles of regulation • Explain how energy commodity account is essential in energy policies development <p>Describe how Energy policy encourage renewable energy and energy efficiency</p> <ul style="list-style-type: none"> • 	Damien Sonny
10:15-10:30		Morning Tea Break	
10:30 – 11:30	SE4301 MHP - Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Designing, Installing and Commissioning (Micro-Hydropower System)	<ul style="list-style-type: none"> • Identify the different types and uses of power tools, equipment and materials used for designing, installing and commissioning micro-hydro power systems • Demonstrate the safe handling of power tools, equipment and materials for designing, installing and commissioning micro-hydropower 	Damien Sonny

		<ul style="list-style-type: none"> • Demonstrate the knowledge and skills in designing, installing and commissioning micro-hydropower power systems 	
11:30 – 12:30	SE4303 MHP - Design, Install, Operate and Maintain RET Systems (Micro-Hydropower System)	<ul style="list-style-type: none"> • Prepare to install operate and maintain micro-hydropower (MHP) systems • Demonstrate Installation of micro-hydropower (MHP) systems equipment. • Demonstrate the safe handling and operations of micro-hydropower (MHP) systems equipment. • Demonstrate the maintenance practices of micro-hydropower (MHP) systems and equipment. • Write completion report on installation and maintenance activities. 	Damien Sonny
12:30 – 13:30	Lunch		
13:30– 14:30	SE4301 S - Apply Tools, Equipment & Materials in Complex Tasks in RE & EE for Designing, Installing and Commissioning (Solar Photovoltaic System)	<ul style="list-style-type: none"> • Prepare to install, operate and maintain solar PV systems • Demonstrate the use of different types of power tools, equipment and materials used for designing, installing and commissioning solar PV systems • Demonstrate the safe handling of power tools, equipment and materials for designing, installing and commissioning of solar PV system • Demonstrate technical knowledge and skills in designing, installing and commissioning solar PV system • Demonstrate the maintenance practises of solar PV systems, equipment, materials and power tools used for designing, installing and commissioning RE systems 	Damien Sonny
14:30 – 15:30	SE4303 S - Design, Install, Operate and Maintain RET Systems (Solar Photovoltaic System)	<ul style="list-style-type: none"> • Prepare to install, operate and maintain solar PV systems • Demonstrate Installation of solar PV system equipment. • Demonstrate the safe handling, operations and maintenance of solar PV system • Write completion report on installation and maintenance activities. 	Darlen Lovi
15:30 – 15:45	Afternoon Tea Break		
15:45 – 16:45	SE4302 – Assist Tradesperson to Determine Energy Efficiency and Energy Conservation Practices to Save Energy	<ul style="list-style-type: none"> • Prepare to evaluate energy efficiency and energy conservation practices to save energy • Evaluate energy efficiency and energy conservation practices to save energy in energy utilizing systems • Document the evaluation of energy efficiency and energy conservation practices to save energy in energy utilizing systems 	Darlen Lovi
16:45 – 17:45	SE4304 – Coordinate Maintenance of RE Apparatus and Systems	<ul style="list-style-type: none"> • Apply safe working practices • Follow maintenance schedules • Determine the extent of repairs required 	Damien Sonny

		<ul style="list-style-type: none"> • Determine the personnel needed to repair the breakdown • Provide technical support to maintenance 	
	SE4305 - Supervise and coordinate energy sector work activities	<ul style="list-style-type: none"> • Coordinate, manage and apply safe working practices • Implement safety procedures and processes • Sequence work activities • Provide guidance and work instructions to others • Ensure job requirements are met • Maintain necessary work documentation 	
17:45 – 18:00	Prepare for the closing ceremony		
18:00 – 18:10	Rep from UPNG		
18:10 – 18:20	Rep from Industry		
18:20 – 18:30	Rep from Education Department		
18:30 – 18:40	Teacher rep		
18:40 – 18:50	Manager rep		
18:50 – 19:00	TVET Coordinator Rep		
19:00 – 19:20	Closing Remarks – Rep from Education Board		
19:20 – 19:30	Closing Prayer – Fr. Simal		
19:30 – 20:30	Dinner		

10.2 Evaluation Results

A workshop evaluation was conducted to receive feedback from the ToT participants as stated in Section 8. Only 20 participants participated in the survey and the results are reflected through the graph below.



Generally, the participants expressed what they most liked about the ToT workshop as stated;

- Powerpoint presentations and visuals
- Demonstrations and practical activities because of hands-on work
- Group work and presentations to complement the theory
- Interesting sessions on solar PV, MHP and EE and also component specifications and simple calculations
- Learning with participants from different fields of expertise
- New knowledge. Great work.
- Learning of alternative energy sources ideal for the location where the generator is the main school electricity supplier

- Involvement of technicians to explain how the solar PV system, micro-hydropower system, and generator and motor operate through the use of prototypes.

The participants disliked the workshop.

- Time limitation
- The font size of power points presentation is small
- Technical terms used interchangeably
- Hardcopy of presentations should be provided in advance
- Punctuality of participants
- Evening sessions disrupted
- Calculations were difficult as they are not used in the daily work routine
- Experiment with MHP, Magnetism and current and solar installation
- Powerpoint presentations
- Food
- Presenter giving his back while presenting
- Program not followed
- Content too broad for limited ToT workshop duration
- No chance of setting up a PV system

Further comment;

- The selection of participants was poor. SE curriculum requires participants with an Electrical and Science background for the implementation of SE to be effective and sustained.
- Good presentation and informative
- Recommend similar workshop in future
- An outstanding presentation by facilitators and technicians. Very informative. Learnt a lot in five days. Thanks, Facilitators.
- Five days insufficient. Conduct for three to four weeks.
- Field trips to hydropower and solar PV sites
- NC 1&2 should be facilitated separately from NC 3&4
- Training will not match the learning capacity of the least educated/illiterate
- Hardcopies of the presentations must be provided for exercises and self-learning
- References of SE curriculum should be provided to obtain more information on sustainable energy in order to access content knowledge to impart to trainees
- Use PowerPoint applications, provide terminologies with graphs prior to presentation, give activities and speak less

Appendix: Attendance

Day 1



University of Papua New Guinea
Centre of Renewable Energy

TVET Training of Trainers (ToT) on Sustainable Energy

Emmaus Conference Centre, Don Bosco Technical Institute (DBTI), National Capital District

PARTICIPANTS REGISTRATION LIST

DATE : Monday 07th June 2021

NO	NAME	ADDRESS	TIME IN	SIGNATURE	TIME OUT
1	Pelega Leka	KRAKHO VTC	10.25	[Signature]	4:30
2	Matan Dindi	GOROKA TECH COLL	8:00	[Signature]	4:30
3	Tasman Dau	NGI TVET	11:00	[Signature]	4:30
4	Joseph Batia	WOODNOUGH VTC	11:00 am	[Signature]	02:00
5	Dominic Korah	MADANG TECH. COLLEGE	8:41	[Signature]	5:30
6	Paul Mangau	MADANG TECH. COLL	8:55	[Signature]	5:30 pm
7	Maria Taudiri (MOKOWALEMA)	BOLUBOLU VOC CENTRE	8:40 am	[Signature]	4:30 pm
8	Cyprian Dademo	KIATO VOCATIONAL	8:40 am	[Signature]	16:30
9	Lina Tarubi	UMI VOCATIONAL-LAE	8:30	[Signature]	4:30
10	Richond Kababa	UMI VOCATIONAL-LAE	8:30	[Signature]	19:00 74568859
11	Rachel Pena	NPIPNG	8:30	[Signature]	16:30
12	Jinky Baltazar	NPIPNG	8:30	[Signature]	16:00
13	Sammy Onom	OGELBENG TVET	8:30	[Signature]	16:30
14	Steven Yambundimi	TVET INSPECTOR - WHP	8:22	[Signature]	16:00 pm
15	Urex Masina	Hagen Tech	8:41	[Signature]	5:30 pm
16	Joseph Kisokau	POMTECH	8:41	[Signature]	5:30 pm
17	Daniel Bernard	POM Tech College	8:15	[Signature]	16:30 73069 720
18	Job Kum	POM TECH COLLEGE	8:15	[Signature]	16:30
19	Maria Tetu	LIMANA VOC CENTRE	8:00	[Signature]	16:30
20	Sr Maria Gorethy Leison	LIMANA VOC CENTRE	8:00	[Signature]	16:30
21	Janet Gaima	TVET HQ	8:00	[Signature]	5:30 pm
22	Raymond Grangin	TVET HQ	8:00	[Signature]	16:30
23	Thomas Aiye	TVET HQ	8:30	[Signature]	16:30
24	Johnson Kilis	CCDA	8:00	[Signature]	16:30
25	Darlen Lovi	UPNG	8:30	[Signature]	16:30
26	Gary Hamou	UPNG CORE	10:00am	[Signature]	19:00
27	Aiden Arakua	UPNG CORE	10:00am	[Signature]	16:30
28	Damien Sonny	UPNG CORE	8:00	[Signature]	16:30
29	Violet Gerega	UPNG TVET	8:00	[Signature]	16:30

30. JESSE TABALI
31. VERNON UWEFA

UPNG CORE 10:00 [Signature] 19:00
UPNG CORE 10:00 [Signature] 09:00



University of Papua New Guinea
Centre of Renewable Energy

TVET Training of Trainers (ToT) on Sustainable Energy

Emmas Conference Centre, Don Bosco Technical Institute (DBTI), National Capital District

PARTICIPANTS REGISTRATION LIST

DATE : Tuesday 08th June 2021

NO	NAME	ADDRESS	TIME IN	SIGNATURE	TIME OUT
1	Pelega Leka	TVET	8:30	[Signature]	4:30 10:00
2	Matan Dindi	TVET GOTEKO	8:30	[Signature]	4:30 10:00
3	Tasman Dau	TVET NDOETS	8:30	[Signature]	4:30 10:00
4	Joseph Batia (BONIFAKO)	Woolwough VTC	8:30	[Signature]	4:30 PM -10:00 PM
5	Dominic Kora H	MADANG TECH COLLEGE	8:30	[Signature]	4:30 PM
6	Paul Mangaui	Madang Tech Coll	8:30	[Signature]	4:30 PM 10:00
7	Maria Taudiri (MOKAWALEHA)	BOLYBOL VTC	8:00	[Signature]	4:40 pm 10:00 PM
8	Cyprian Dademo	KWATO VTC	8:00	[Signature]	10:00 pm
9	Lina Tarubi	UMI Voc. Ctre	8:30	[Signature]	4:30 pm
10	Richond Kababa	UMI Voc. ctre	8:30	[Signature]	10 pm 7450885
11	Rachel Pena	NPIPNG	8:30	[Signature]	10:00 PM
12	Jinky Baltazar	NPIPNG	8:30	[Signature]	10:00 pm
13	Sammy Onom	Ogelberg TVET	8:30	[Signature]	4:30 pm -10:00
14	Steven Yambundimi	TVET INSPECTOR UMI	8:30	[Signature]	10:00 pm
15	Urex Masina	MT. Hagen Tech	8:00	[Signature]	10:00 pm
16	Joseph Kisokau	POMTECH	8:00	[Signature]	10:00 pm
17	Daniel Bernard	Pom Tech coll	8:00	[Signature]	10:00 pm
18	Job Kum	Pom Tech coll	8:30	[Signature]	16:30
19	Maria Tetu	LIMANA VC	8:00	[Signature]	10:00 pm
20	Sr Maria Gorethy Leison	LIMANA VC	8:00	[Signature]	10:00 pm
21	Janet Gaima	TVET HO	8:00	[Signature]	10:00 PM
22	Raymond Grangin	NDOE	8:00	[Signature]	10:00 pm
23	Thomas Aiye	NDOE	8:00	[Signature]	10:00 pm
24	Johnson Killis	CCDA	8:00	[Signature]	16:30
25	Darlen Lovi	UPNG	8:30	[Signature]	
26	Gary Hamou				
27	Aiden Arakua	UPNG	8:30	[Signature]	
28	Damien Sonny	UPNG	8:00	[Signature]	
29	Violet Gerega	TVET	8:00	[Signature]	10:00 PM
30	VERNON UWEFA	UPNG CORE	10:30	[Signature]	
31	JESSE TABALI	UPNG CORE	11:30	[Signature]	



University of Papua New Guinea
Centre of Renewable Energy

TVET Training of Trainers (ToT) on Sustainable Energy

Emmaus Conference Centre, Don Bosco Technical Institute (DBTI), National Capital District

PARTICIPANTS REGISTRATION LIST

DATE : Wednesday 09th June 2021

NO	NAME	ADDRESS	TIME IN	SIGNATURE	TIME OUT
1	Pelega Leka	KOPALAO VTC	8:00	[Signature]	8:30
2	Matan Dindi	Gotecco	8:00	[Signature]	8:32
3	Tasman Dau	NDDBE TVET	8:00	[Signature]	8:30
4	Joseph Batia	Woolnough VTC	8:00	[Signature]	8:00
5	Dominic Korah	Madang Tech College	8:00	[Signature]	8:00 pm
6	Paul Mangau	Madang Tech Coll	8:30	[Signature]	8:00
7	Maria Taudiri (Mokowalemi)	BOLUBOLU VTC	8:00	[Signature]	8:30 pm
8	Cyprian Dademo	KWIATO VTC	8:00 am	[Signature]	8:15 pm
9	Lina Tarubi	UMI VTC - MOKOBE	8:00 am	[Signature]	8:32
10	Richond Kababa	UMI VOCATIONAL	8:00 AM	[Signature]	8:15 pm
11	Rachel Pena	NPI PNG	8:00 am	[Signature]	9:00 pm
12	Jinky Baltazar	NPI PNG	8:00	[Signature]	9:00 pm
13	Sammy Onom	Capehang TVET	8:00	[Signature]	8:00 pm
14	Steven Yambundimi	TVET INSPECTOR	8:00	[Signature]	8:15
15	Urex Masina	MT-HAGEN TECH	8:30	[Signature]	8:15 PM
16	Joseph Kisokau	Powitech	8:15	[Signature]	8:32
17	Daniel Bernard	PowTech office	8:15	[Signature]	8:30 PM
18	Job Kum	PowTech college	8:15	[Signature]	16:00
19	Maria Tetu	Limana V Centre	8:00	[Signature]	8:15
20	Sr Maria Gorethy Leison	Limana V Centre	8:15	[Signature]	8:15
21	Janet Gaima	TVET HQ-FOL	8:00	[Signature]	8:20 PM
22	Raymond Grangin	TVET HQ	8:00	[Signature]	9:00 pm
23	Thomas Aiye	TVET HQ	8:00	[Signature]	08:00 pm
24	Johnson Killis	CCDA	8:00	[Signature]	11
25	Darlen Lovi				
26	Gary Hamou				
27	Aiden Arakua	UPNG	8:	[Signature]	8:15
28	Damien Sonny	UPNG		[Signature]	
29	Violet Gerega	TVET	8:00	[Signature]	8:20 PM



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PARTICIPANTS REGISTRATION LIST

DATE : Thursday 10th June 2021

NO	NAME	ADDRESS	TIME IN	SIGNATURE	TIME OUT
1	Pelega Leka	KOTAKA VTC	8:00	[Signature]	9:30
2	Matan Dindi	GOTECO	7:58	[Signature]	9:30 pm
3	Tasman Dau	NDOE-TSOD	8:00	[Signature]	9:30 pm
4	Joseph Batia	Woolnough VTC	7:54	[Signature]	9:30 [Signature]
5	Dominic Korah	MARANG TECH. COLLEGE	8:00	[Signature]	9:30 pm
6	Paul Mangau	MARANG TECH. COL	8:00 pm	[Signature]	9:30 pm
7	Maria Taudiri MOKWALENA	BOLUBOLU VTC	8:10	[Signature]	9:32 pm
8	Cyprian Dademo	KUATO VTC	7:45 am	[Signature]	9:30 pm
9	Lina Tarubi	UMI VOC. CENTRE-MIKES	7:45 am	[Signature]	9:21 pm
10	Richond Kababa	UMI VOCATIONAL	7:45 AM	[Signature]	9:32 pm
11	Rachel Pena	[Redacted]	8:00 am	[Signature]	9:34 pm
12	Jinky Baltazar	NPIPNG	7:50 AM	[Signature]	9:33 pm
13	Sammy Onom	D. S. Sany TVET	8:00	[Signature]	9:30 pm
14	Steven Yambundimi	TVET INSPECTOR	7:47	[Signature]	9:30 pm
15	Urex Masina	Mr. Hagen Tech	8:00	[Signature]	9:30 pm
16	Joseph Kisokau	RIMTECH	8:00	[Signature]	9:30 pm
17	Daniel Bernard	Pom Tech College	8:00	[Signature]	9:00 pm
18	Job Kum	Pom Tech College	8:00	[Signature]	9:00 pm
19	Maria Tetu	FINUNA VOC CENTRE	7:45	[Signature]	10:00
20	Sr Maria Gorethy Lelson	Finuna Voc Centre	8:00	[Signature]	10:00 pm
21	Janet Gaima	TVET HO	8:00	[Signature]	9:00 pm
22	Raymond Grangin	TVET HO	8:00	[Signature]	10:00 pm
23	Thomas Aiye	TVET HO	8:00	[Signature]	17:00
24	Johnson Kilis	CCDA	8:00	[Signature]	11
25	Darlen Lovi	UPNG CORE	7:45	[Signature]	
26	Gary Hamou				
27	Aiden Arakua	UPNG	8:35	[Signature]	5:00
28	Damien Sonny	UPNG	8:00	[Signature]	
29	Violet Gerega	TVET	8:00	[Signature]	5:00 pm

