

SEI API Training Plan For the Pacific Islands December 2022

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Acronyms

ACP	African Caribbean Pacific
ADB	Asian Development Bank
APTC	Australia-Pacific Training Coalition
CITTI	Cook Islands Tertiary Training Institute
COM	College of Micronesia
CMI	College of the Marshall Islands
DFAT	Department of Foreign Affairs (Australia)
EQAP	Education Qualifications and Assessment Programme
EE	Energy Efficiency
EU	European Union
FNU	Fiji National University
FSM	Federated States of Micronesia
GEF	Global Environmental Facility
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German aid)
GGGI	Global Green Growth Institute
GSES	Global Sustainable Energy Solutions
IFC	International Finance Corporation
KIT	Kiribati Institute of Technology
MFAT	Ministry of Foreign Affairs and Trade (New Zealand)
NGEF	National Green Energy Fund (NGEF)
NUS	National University of Samoa
PACTVET	Pacific Technical and Vocational Education Training
O&M	Operations and Maintenance
PCC	Palau Community College
PCREEE	Pacific Centre for Renewable Energy and Energy Efficiency
PIC	Pacific Island Country
PICT	Pacific Island Country or Territory
PNG	Papua New Guinea
POIDER	Promoting Outer Island Development through the Integrated Energy Roadmap
PPA	Pacific Power Association
PRQS	Pacific Register of Qualifications and Standards
PSETC	Pacific Sustainable Energy Training Centre (proposed)
RE	Renewable Energy
RMI	Republic of the Marshall Islands
SAPS	Stand Alone Power Systems
SEI API	Sustainable Energy Industry Association of the Pacific islands
SINU	Solomon Islands National University
SPC	Pacific Community
TIST	Tonga Institute of Science and Technology
TMTI	Tuvalu Maritime Training Institute
TNQAB	Tonga National Qualifications and Assessment Board
TVET	Technical and Vocational Education Training
UNDP	United Nations Development Programme
UNITECH	University of Technology PNG

USAID	United States Agency for International Development
USP	The University of the South Pacific
VIT	Vanuatu Institute of Technology
VOCTEC	Vocational Training and Education for Clean Energy
VREP	Vanuatu Rural Electrification Project
WB	World Bank

1. Introduction

The Sustainable Energy Industry Association of the Pacific Islands (SEI API) has been promoting the need for solar training for system designers, installers and maintainers since SEI API was established in 2010. The private solar industry companies and the electrical power utilities in the region require a well-trained technical workforce to meet the needs of their customers and to support national energy objectives.

Skills training is often provided as certificate level 1 to 5 courses. These provide a level of training appropriate for those new to the field, often school leavers, to obtain suitable practical training to enter an industry. However, the sustainable energy industry is already established. Private companies, government energy departments and power utilities often need their staff upskilled and/or new staff capable of undertaking specified tasks. To help meet this needed training, countries including Australia, New Zealand and United States provide training for the sustainable energy in the form of skillsets. The skillset typically defines a task that can be performed after a person has successfully completed the training, an example being to design a grid connected PV system.

Global Sustainable Energy Solutions Pty Ltd (GSES) has acted as the secretariat of SEI API since 2012. GSES is an Australian based sustainable energy training and consultancy company. In Australia GSES is a Registered Training Organisation (RTO), publisher of training resource books, and has been conducting solar training internationally since 1999. GSES has been the training partner for SEI API.

For the Pacific region GSES has developed the following training related reports:

- Pacific Renewable Energy Training Initiative (PRETI) for the United Nations Development Programme (UNDP) in 2005 (developed with Dr Herb Wade)
- Training Needs/GAPS Analysis on Sustainable Energy in Pacific Countries: three individual reports for the European Union (EU), Pacific Technical and Vocational Education Training (TVET) project known as EU-PactVET:
 - Current Training Report (September 2015)
 - Current and Future Markets and Training Needs Report (September 2015)
 - Syntheses Report (September 2015)

In 2017 GSES/SEI API prepared the funding proposal titled *Building Training Capacity for Solar Energy in Pacific Islands Technical Colleges*. This was submitted to Australia Department of Foreign Affairs and Trade (DFAT).

In 2019 the current SEI API Executive Officer, Mr Geoff Stapleton was a reviewer/adviser for the Pacific Regional Infrastructure Facility (PRIF) project titled: *Scoping Study: Establishing a Regional Energy Training Program and Centre in the Pacific*.

During the ongoing Covid-19 period GSES/SEI API developed the following training proposals, discussion papers and request for funding:

- Proposal for Development of Solar Training in Papua New Guinea (April 2020)
- Draft Pacific Community (SPC) sustainable energy capacity building project proposal titled *Pacific Sustainable Energy Industry and Technical and Vocational Education and Training* (PSEITVET; (November 2020)
- Draft in-country training requirements for the Pacific Power Authority (PPA)/Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) Licensing Roll Out (February 2021)
- Discussion Paper on Development of Solar Training in Papua New Guinea (February 2021)
- Fiji Renewable Energy Training Plan (March 2021)

- Discussion Paper on a Proposed USP-TAFE /GSES Training Agreement (March 2021)
- Proposal to Establish a Solar Training Centre at USP Pacific TAFE in Fiji (October 2021)
- Request for Funding for Establishing: Regional Sustainable Energy Training Centre at USP-Pacific TAFE Suva Fiji (May 2022)

This training plan has been developed based on the experience gained in conducting training, undertaking various solar PV related visits to PICs and other countries over the last five years and developing the various reports and proposals.

2. Summary of Training Needs for Fourteen Pacific Island Countries

In September 2015 GSES prepared a report titled *Current and Future Markets and Future Training Needs on Sustainable Energy in Pacific ACP countries* for the European Union Funded Pacific Technical and Vocational Education Project. That report included a country-by-country summary regarding the training required in each country, based on an analysis of the status of the various sustainable energy sectors within each country at that time.

Table 1 provides a summary of the training needs identified at that time. (Note: Timor Leste was included in the reports developed in 2015. However, it is not among the countries SEI API is covering)

Over the next twelve-plus months SEI API will review this table, and update where necessary, to determine whether all the training courses identified in 2015 are still required in the respective countries. However, the need for the PV related courses (grid and off-grid) listed in Table 1 are still relevant and the reason they are the initial focus for the Pacific Sustainable Energy Training Centre (PSETC). PV is also the main renewable energy technology the PICs plan to install in the next decade (where hydro is not viable). At some stage SEI API will also assess the training needs of those PICTS not included within the EU's African Caribbean Pacific (ACP) group of countries. Some of the territories are French speaking, which would present challenges since the training resources discussed within this plan are currently only in English.

Table 1: Summary of Training Requirements Across Pacific Island Countries

Training Course	Cook Islands	FSM	Fiji	Kiribati	Nauru	Niue	Palau	PNG	RMI)	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Design and Installation of Grid Connected PV Systems	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Operation and Maintenance of Grid connected PV Systems	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Design & Installation of Grid Connected Energy Storage (commercial & residential size)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Design and Installation of Off – Grid Systems (includes solar only and PV/Fuel Generator hybrids)	yes	yes	yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	yes
Operation and Maintenance of Off Grid- Systems (includes solar only & PV/Fuel Generator hybrids)	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Operation and Maintenance of Wind Farms	no	yes	yes	no	no	no	no	no	no	yes	no	yes	no	Decommissioned
Operations and Maintenance of Hydro Plants	no	maybe	yes	no	no	no	no	yes	no	yes	yes	no	no	yes
Design , Installation and Maintenance of Micro-Hydro	no	maybe	yes	no	no	no	no	yes	no	no	yes	no	no	yes
Operations and Maintenance of Biomass/Biogas Plants	no	Maybe-	yes	Maybe-	no	no	no	yes	no	no	no	Maybe	no	Potential
Operations and Maintenance of Geothermal Plants	no	no	yes	no	no	no	no	yes	no	no	Potential	no	no	Potential
Selection and Installation of Solar Water Pumping	unknown	unknown	unknown	yes	unknown	unknown	unknown	yes	unknown	unknown	unknown	unknown	unknown	unknown
Selection and Installation of Solar Water Heaters	yes	yes	yes	yes	unknown	yes	yes	yes	yes	yes	yes	yes	unknown	yes
Energy auditing and applying energy solutions	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Abbreviations: FSM = Federated States of Micronesia; PNG = Papua and New Guinea & RMI = Republic of the Marshall Islands

Note: “Maybe” has been used because there have been some projects and therefore training may be required in the future.

3. Overview of Sustainable Energy Training Courses Conducted in the Pacific in last 10+ years

This section of the plan provides an overview of sustainable energy training that has been conducted in the Pacific in the last 10 years. This section references a study GSES undertook in 2015, provides a summary of two Pacific focussed sustainable energy training projects that have been undertaken and summarises the courses that GSES has conducted in the Pacific region since 2015.

Note that 'sustainable energy' generally refers to both renewable energy (RE) systems and improved energy efficiency (EE). PICT energy policies, plans and investments are overwhelmingly focussed on a transition from fossil fuels to RE. There have been national, donor agency and CROP¹ efforts to improve EE but the bulk of funding, and probably all loans for sustainable energy in the region, have been for RE. This plan focuses on RE training but updates will include EE.

3.1. 2015

In September 2015 GSES prepared a report *Current Technical Training in Pacific ACP² Countries*. The report was prepared for the European Union (EU) Funded Pacific Technical and Vocational Education Project. For the report a desktop study was undertaken to identify Technical and Vocational Education Training (TVET) institutes in the ACP Pacific countries.

Forty-one different Institutes were identified, of which 16 (39%) were in Papua New Guinea. Many are classified as universities, but it is unknown how many of these are suitable to operate as TVETS.

Eight of the 41 (nearly 20%) were campuses developed for Australia Pacific Technical Cooperation (APTC) programme of which only three were potentially suitable to conduct sustainable energy training courses. The various University of South Pacific (USP) campuses³ located outside Fiji were not included in the forty-one that were identified.

For the 2015 training report, a survey was conducted to identify sustainable energy training courses that had been conducted in the previous five years, that is from 2010 onwards. A total of 82 courses were identified. These are listed in the annexes (87 pages) of that report which are available upon request.

Thirteen of the 82 courses were conducted as part of the Vocational Training and Education for Clean Energy (VOCTEC) Pacific Off-Grid Solar Training Courses. Further information on the VOCTEC project is provided in the following section.

3.2. VOCTEC

Though the VOCTEC training courses were referenced in the 2015 report, more detail is provided because it provides good lessons learned regarding the introduction of training courses and building capacity through training-of-trainers within PICTs.

¹ CROP is the Council of Regional Organisations of the Pacific. The key CROP agencies involved in the energy sector are PPA (for power utilities), SPC (for PICT government agencies) and USP (for training) though others have had RE and/or EE activities from time to time.

² ACP stands for African, Caribbean and Pacific group of states. The 15 Pacific countries include: Cook Islands, Fiji, Federated States of Micronesia (FSM), Kiribati, Nauru, Niue, Palau, Papua New Guinea (PNG), Republic of Marshall Islands (RMI), Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu and Vanuatu

³ USP has 14 campuses, of which three are in Fiji, and the rest in eleven other PICTs.

VOCTEC Pacific ran from 2012 to 2014, funded by the United States Agency for International Development (USAID) and the New Zealand Ministry of Foreign Affairs and Trade (MFAT). The project was led by Arizona State University (ASU).

The aim of the project was to strengthen the sustainability of off-grid solar investments across 10 PICs, through partnerships to build the capacity of training institutions in those 10 PICs in delivering off-grid solar training to local solar technicians. Through the VECTEC project, ASU provided 11 training institutions across the 10 countries with instructor (train-the-trainer) training, as well as a syllabus, assessment materials, hands-on training toolkits and funding support. This enabled the local institutions to host solar technician training.

The five-day training courses focussed on small off-grid solar home systems. USP conducted two train the trainer courses in 2013 and 2014 with 30 trainers being trained. Palau Community College (PPC) conducted one train the trainer course in 2014. A total of 136 technicians were trained across nine countries as shown in Table 2.

Table 2: Summary of VECTEC Courses

Course Number	Training Institute	Number of Participants
1	University of South Pacific, Fiji	18
2	Vanuatu Institute of Technology, Vanuatu	13
3	Solomon Island National University, Solomon Island	15
4	Fiji National University, Fiji	16
5	Palau Community College, Palau	11
6	College of Marshal Islands, Marshal Islands	15
7	National University of Samoa, Samoa	13
8	Papua New Guinea-Unitech, Papua New Guinea	12
9	Kiribati Institute of Technology, Kiribati	11
10	College of Micronesia-FSM, Micronesia	12
Total		136

All of the courses were funded through VECTEC project but SEI API does not know if any of the above institutes conducted more of these courses after VECTEC finished.

3.3.EU PacTVET

The European Union funded Pacific TVET training project started in 2014 and was completed in 2018. For Sustainable Energy, four certificate level courses were developed:

- **Certificate 1** in Sustainable Energy is a generic qualification aimed at those who seek entry to work in the energy/sustainable energy sector working with RE sources and RE technologies (RETs).
- **Certificate 2** in Sustainable Energy is a generic qualification aimed at those who are working or seek entry to energy/sustainable energy sector, working with RE sources and RETs.
- **Certificate 3** in Sustainable Energy is aimed at those who may already be working in a field related to energy/sustainable energy or those with relevant work experience who wish to pursue a career in sustainable energy. Learners at this level must elect to study in one of the following fields: Energy Efficiency, Solar, Biomass, Hybrid Wind, Micro Hydro Power.
- **Certificate 4** in Sustainable Energy is aimed at those who may already be working in a field related to energy/sustainable energy or those with relevant work experience who wish to

pursue a career in sustainable energy. Learners at this level must choose one of the following: Energy Management, Biomass, Hybrid Wind, Micro Hydro Power or Solar. Certificate Level 1 and 2 courses were conducted in Vanuatu and Tonga and possibly other locations.

SEI API's view is that these courses are too general and not sufficiently practical and detailed for vocational training. For this reason, SEI API through the World Bank (WB) funded Sustainable Energy Industry Development Project (SEIDP) developed 19 training units aimed at upskilling technicians and engineers already working in the industry and those wishing to enter the industry. However, SEI API believes that further work could be undertaken on the 4 certificates to improve them so that they can meet the needs of the industry, and could be used to introduce school leavers and those with no knowledge of sustainable energy to the industry.

In 2023-2024 SEI API will investigate the updating of certificate courses to meet the needs of industry.

3.4. Global Green Growth Institute (GGGI)

The Global Green Growth Institute (GGGI) is an intergovernmental body based in Korea with a Pacific regional office with in Suva, Fiji. There is a substantial GGGI PIC effort in sustainable energy. In May 2022 GGGI launched ten training modules, with detailed trainer guides and simplified local language translated Learner Workbooks on topics such as Green Economy General Principles, Green Business Basics, Energy Efficiency Basics, Inclusive Development, Renewable Energy General Principles, RE Financial Management, Solar in the Community, Solar Operations and Maintenance basics, Pico-Hydro in the Community and Pico-Hydro Operations and Maintenance basics.

The training was provided in Fiji, Vanuatu, Solomon Islands and Papua New Guinea. In each country eight experienced local community trainers attended a two-week workshop on training of trainers. Of these, four trainers were hired to travel to remote rural communities to deliver the training courses.

Table 3 provides a summary of the training presented at the final regional workshop in December 2022.

Table 3: Summary of GGGI Training

Country	Number of Training Courses Conducted	Number of community people trained.
Fiji	5	1901
Vanuatu	5	1524
Solomon Islands	6	2309
Papua New Guinea	5	1834

SEI API plans to review this training material from GGGI because it meets both the needs for community awareness training and also basic O & M training. SEI API previously identified the need for sustainable energy awareness training courses and will liaise with GGGI to investigate whether the GGGI materials are suitable for this purpose. The O & M training could be applied to training system owners and/or basic technicians who are located in the remote communities to provide the first level of maintenance and systems troubleshooting.

SEI API will also work with GGGI to promote their training material throughout the PICTs

3.5. GSES conducted courses since 2015

GSES has conducted the following training courses in the Pacific since the 2015 report was prepared.

1. **Electrical Safety Training, Kiritimati (Kiribati) September 2015.** GSES was contracted by IT Power Australia (Now ITP Renewables) to conduct a 3-day course for electricians and other stakeholders in Kiritimati on electrical safety. Ten people attended the training.
2. **Operations and Maintenance Training for Grid Connected PV Systems, Kiribati Institute of Technology (KIT), Kiribati May 2016.** GSES was contracted by CBS Power Solutions to conduct a 2.5-day Operations and Maintenance training for trainers from KIT and staff from Kiribati Solar Energy Company, Ministry of Public Works and Utilities (MPWU) and Public Utilities Board. 15 people attended the training.
3. **Design and Install Grid Connected PV Systems Training, Nauru August 2016.** GSES was contracted by Nauru Utilities Corporation to conduct the 2-week design and install grid connected PV systems course. Twelve people attended the course which included installing a system.
4. **Operations and Maintenance Training for Grid Connected PV Systems, Energy Storage Training and Scada Training: Pohnpei (FSM) June 2018 and Samoa July 2018.** GSES was contracted by the Pacific Power Association (PPA) to conduct the following courses in each country:
 - a. 4-day operation and maintenance of grid connected PV systems training
 - b. 1-day course on introduction to Energy Storage Systems
 - c. 2-day training course on Scada systems

Twenty people from the power utilities in the North Pacific attended the course in Pohnpei (FSM), while 28 people from power utilities in the South Pacific attended the courses in Samoa.
5. **Design and Install Off-Grid PV Systems, Vanuatu July 2018.** The Vanuatu Department of Energy (DOE) required technicians' design and installation of off grid PV systems through the Vanuatu Rural Electrification Program (VREP) to be PPA/SEI API accredited. Twenty-two (22) technicians from industry and staff from DOE engaged GSES to conduct the 5-day theory course while an experienced local solar trainer, Mr Wade Bevan from a Vanuatu private training centre (now director of Vanuatu Institute of Technology) conducted the practical sessions.
6. **Operations and Maintenance Training for Grid Connected PV Systems, Niue, August 2018.** GSES was contracted by NZ MFAT to conduct a 4-day training course on operation and maintenance of grid connected systems for 4 staff from the Niue Power Corporation.
7. **Solomon Islands National University (SINU).** In January to March 2020 GSES conducted the four grid connect (PV and batteries) and off grid training courses provided under the GIZ funded license agreement. The training was funded through the EU-GIZ Adaptation to Climate Change and Sustainable Energy Programme (ACSE). Twelve people attended the training although the objective was to train the SINU trainers to conduct the courses.
8. **Community College of Micronesia.** In January and February 2020, GSES conducted grid connect training courses provided under the GIZ funded license agreement, funded through ACSE. The training included installing grid connected systems in the four states of Micronesia. Twelve people attended the training however the objective was to train community college trainers to conduct the courses.
9. **Grid Connect Training for PNG Power, March 2021.** GSES partnered with GSES India to conduct online training on grid connect systems for staff from PNG Power. The training was part of an International Finance Corporation (IFC) funded roof-top solar project.
10. **Operations and Maintenance Training for Grid Connected PV Systems, PNG Power, Australia July 2022.** GSES hosted 6 engineers from PNG Power in Australia in July 2022. This included visiting solar systems and undertaking O&M training. This was part of an IFC-funded roof-top solar project.

Prior to the agreement with USP Pacific TAFE (refer to section 6.2) in July 2022 GSES had 27 registrations for their online courses in 2021-2022, broken down as follows:

- 1 from Cook Islands doing GCPV
- 7 from Fiji doing GCPV
- 2 from Nauru doing GCPV
- 5 from Solomon Islands doing GCPV
- 6 from Solomon Islands doing Off-Grid (known in Australia as stand-alone power system (SAPS))
- 3 from Papua New Guinea doing Off-Grid (SAPS)
- 3 students from Vanuatu doing Off-Grid (SAPS).

3.6. Sustainable Energy Industry Development Project

As part of the World bank funded *Sustainable Energy Industry Development Project (SEIDP)*, GSES on behalf of SEIAPI conducted thirty-two 4-day workshops/training on the technical guidelines in 12 countries. Six hundred and thirty-three (633) different people attended one of these workshops.

The Cook Islands were not one of the countries included in this project however, the local utility company, Te Aponga Uira (TAU), funded two 4-day works to be conducted for their staff and other stakeholders within Cook Islands. Approximately 35 different people attended one of these workshops.

4. Technician Accreditation Program

The SEIAPI accreditation program was launched in May 2012, and it was relaunched in 2014 as the PPA/SEIAPI accreditation program. The current guidelines can be downloaded from: <https://www.seiapi.com/wp-content/uploads/2022/02/SEIAPI-PPA-Accreditation-Program-V3-15062021.pdf>

The scheme is similar to the Australian program through which individuals are either accredited as designers or installers or both. It also breaks down to technology application levels and currently includes:

- Design Grid Connect PV Systems
- Install grid connect PV Systems
- Design Off Grid Level 1 (Solar Home Systems)
- Install Off Grid Level 1 (Solar Home Systems)
- Design Off Grid Level 2 (Stand-alone systems with/without Inverters)
- Install Off Grid Level 2 (Stand-alone systems with/without Inverters)
- Design Off Grid Level 3 (Hybrid Power Systems)
- Install Off Grid Level 3 (Hybrid Power Systems)

A small number of companies and individuals have obtained accreditation. The Vanuatu Department of Energy has made it a requirement for designers/installers supplying off-grid solar systems within the Vanuatu Rural Electrification Programme and this has resulted in 27 people from Vanuatu currently registered for off-grid training being provided by USP Pacific TAFE.

A current SEIAPI objectives is to work with PICT Governments to either have:

- them recognise the accreditation program with the outcome that they require all designers and installers of the systems to be accredited through the PPA/SEIAPI scheme or
- the relevant in-country regulator develops a “solar technicians license”.

In both scenarios technicians will be required to undertake the relevant training course to obtain their accreditation. Relevant training courses need to be available in the PICTs to support the SEIAPI

objective in promoting technician accreditation (or technician licensing) while PICTs (and project funders) adopting accreditation will increase the demand for training.

5. Pacific Training Units

Quality training courses should be developed and conducted meeting the requirements specified in accredited Training Units⁴. In 2018/19 as part of the World Bank funded Sustainable Energy Industry Development Programme (SEIDP) GSES/SEI API developed 19 training that were accredited through Educational Quality and Accreditation Programme (EQAP) and listed in the Pacific Register of Qualifications and Standards (PRQS). The units and their respective Pacific Qualification Framework levels are as follows:

Grid Connected PV System Training Units

PPAGC100 Designer of Grid Connected PV Systems	Level 4
PPAGC200 Installer of Grid Connected PV Systems	Level 4
PPAGC301 Operator and Maintainer of PV systems (Grid-connected) *	Level 4

Off Grid PV Power System Training Units

PPAOG101 Designer of Off-Grid PV Power Systems (DC Load SHS)	Level 4
PPAOG102 Designer of Off-Grid PV Power Systems (Stand-alone Solar Systems)	Level 4
PPAOG103 Designer of Off-Grid PV Power Systems (Hybrid Power Systems)	Level 4
PPAOG201 Installer of Off-Grid PV Power Systems (DC Load SHS)	Level 4
PPAOG202 Installer of Off-Grid PV Power Systems (Stand-alone Solar Systems)	Level 4
PPAOG203 Installer of Off-Grid PV Power Systems (Hybrid Power Systems)	Level 4
PPAOG301 Maintainer of Off-Grid PV Power Systems (DC Load SHS)*	Level 3
PPAOG302 Maintainer of Off-Grid PV Power Systems (Stand-alone Solar Systems)*	Level 4
PPAOG303 Maintainer of Off-Grid PV Power Systems (Hybrid Power Systems)*	Level 4

Grid Connect with Batteries Training Units

PPAGB501 Designer of Grid Connected PV System with batteries	Level 5
PPAGB402 Installer of Grid connected PV system with batteries	Level 4

Energy Efficiency Training units

PPAEE400 Energy Efficiency – Residential and Small Commercial Applications*	Level 4
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Micro-Hydro Training Units

PPAMH501 Designer of Micro Hydropower Systems*	Level 5
PPAMH402 Installer of Micro Hydropower Systems*	Level 4

Solar Water Pumping Training Units

PPASP400 Selection and Installation of Solar Water Pumping Systems*	Level 4
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Solar Water Heating Training Units

PPASH400 Selection and Installation of Solar Water Heaters*	Level 4
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Training resources have not been developed for the 9 Training Units marked with a *. Section 7.6 outlines the new courses that will be developed.

⁴ In EQAP the term “Unit of Learning is applied, however in this document the term “Training Units” is applied. In technical training these documents specify the competencies that should be taught and assessed within a training course. In Australia they are referred to as Unit of Competency while other countries might use other terminologies.

6. Current Initiatives to Support Solar Training Courses to be Available in the PICTs

GSES has been conducting training courses internationally since 1999. These face-to-face courses have covered off-grid PV systems & hybrid systems, grid connected PV systems and grid connected PV systems with battery energy storage. In Australia GSES has offered blended online and face-to-face practical courses since 2008. The online courses cover the theory and include online assessments and written assessments for the design courses.

GSES has conducted both versions of the training in the Pacific region and SEI API member companies see the need for both being available for their staff. To facilitate this, GSES has signed two agreements in the last 3 years to support solar based technical training courses being available within the Pacific region. The two agreements are described below.

6.1. GIZ Funded PPA License Agreement

In 2019, the German agency for international cooperation Gesellschaft für Internationale Zusammenarbeit (GIZ) purchased a once off license agreement for the resource material for the four GSES face-to-face training courses listed in Table 4. The agreement is between GSES and PPA and it allows all Pacific based training centres free access to the resources listed below after they sign a separate agreement with GSES that the material is for that training centre only. Agreements have been signed with Solomon Islands National University (SINU) and the College of Micronesia (COM), Pohnpei. Train the trainer courses were provided by GSES in 2020 for both SINU and the College of Micronesia.

SEI API has been promoting this agreement to training centres around the Pacific but have identified the need to work with the in-country training institutes and the relevant agency to have the training unit standards adopted in each specific country's education framework before they can offer the training.

Table 4: Summary Courses available under the PPA/GIZ agreement with GSES.

Course – skillset	Duration – Days ³
Grid-Connected PV Systems - Design & Install (GC PV)	10 (15)
Grid-Connected PV Systems with Battery Storage - Design & Install (GCwB)¹	10 (13)
Stand Alone Power Systems (Off-grid) Design & Install (SAPS)	15 (18)
Hybrid Systems - Design and Install (HS)²	5 (8)

Notes:

1. Successful completion of GC PV is a prerequisite to participating in GCwB.
2. Successful completion of SAPS is a prerequisite to participating in HS.
3. Days are indicative. GSES has prepared other agendas for longer courses and these are shown in brackets. However, the trainer's guides are based on the number of days not shown in brackets.

In Australia, GSES conducts the above courses online. The hybrid course is included within the stand-alone power systems (off grid) course. These courses all meet the relevant Units of Competence within the relevant Australian National Training Package. The courses also meet the relevant Unit Standards within the Pacific as described in section 5.

The following course resources are supplied in respect of each complete course/skillset:

- Course Agenda
- The lectures (PowerPoint presentations)

- In class exercises/tutorials
- Practical session activities, descriptors and outcomes
- Assessment sheets
- Assignments
- Examinations
- Trainers' guide

The courses are aimed at engineers and electricians/technicians who have already completed training in electrical basics and therefore assume at least a basic level of electrical knowledge in participants.

The courses can be offered to both university students and electricians/technicians. The University courses focus primarily on design whereas the training for electricians/technicians focus on installation and practical hands-on training.

SEI API has been promoting this agreement to training centres around the Pacific and have also identified the need to work with the countries to have relevant training unit standards adopted within each specific country's education framework before they can offer the training.

Solomon Islands National University (SINU) and College of Micronesia have signed agreements with GSES (refer to section 3.4) and training is being offered. SEI API/GSES has started discussions with the Papua New Guinea Solar Association and a number of training centres in PNG on how to have the training available in PNG.

In 2022 SEI API met with the Vanuatu Institute of Technology (VIT) and Tonga Institute for Science and Technology (TIST) with the aim of having the training courses available through them.

SEI API will be visiting other countries and their respective training centres in 2023.

6.2. Partnership Agreement between GSES and USP Pacific TAFE

In July 2022 GSES signed a partnership agreement with The University of the South Pacific (USP) Pacific TAFE. Under this agreement USP Pacific TAFE is offering the following online courses:

- Grid Connected PV Systems – Design Only, Install Only and Design and Install
- Stand Alone Power Systems (SAPS also known as Off-Grid) - Design Only, Install Only and Design and Install
- Battery Storage Systems for Grid Connected PV System - Design Only, Install Only and Design and Install

The stand-alone course covers PV only solar systems and also PV-fuel generator hybrid systems and if required this course can be broken down into the following courses:

- Off-Grid PV Power Systems (DC Load Solar Home System or SHS)
- Off-Grid PV Power Systems (Stand-alone Solar Systems)
- Off-Grid PV Power Systems (Hybrid Power Systems).

Since signing the agreement there have been 40 registrations for the online courses as follows:

- Off-Grid - Design and Install
 - 16 from Vanuatu
 - 2 from Solomon Islands
- Off Grid -Design Only
 - 6 from Vanuatu
 - 5 from Solomon Islands
- Off Grid- Install Only

- 5 from Vanuatu
- Grid Connect - Design and Install
 - 2 from Solomon Islands
 - 4 from Fiji

SEI API is working with GSES and USP Pacific TAFE to determine how the practical courses will be conducted for those undertaking the install courses.

Under the agreement Suva-based Mr Sandip Kumar will be the initial tutor/trainer for the USP Pacific TAFE solar courses. Mr Kumar and GSES will also train future trainers employed by USP Pacific TAFE to conduct solar training.

SEI API has liaised with GSES and determined that the following 12 short online courses currently available by GSES in Australia will be put online through USP Pacific TAFE by early 2023:

- AS/NZS 5033:2021 Updates – Online Short Course (3 hours)
- Solar Hot Water Systems (3 hours)
- Communications, Monitoring and Control (4 hours)
- Fault Current Analysis for Commercial Solar (2 hours)
- Introduction to PV Syst: Grid-Connected PV Systems (6 hours)
- Operation and Maintenance of PV Systems (3 hours)
- Power Cable Selection for PV Systems (5 hours)
- SketchUp for Solar PV Systems (6 hours)
- Solar Battery System Fundamentals (4 hours)
- Solar Sales Essentials (2 hours)
- Utility Scale Solar Projects (8 hours)
- Solar Power System Fundamentals (20 hours)

6.3. Resource Booklets

GSES produces training resource books which are used by students when undertaking the relevant courses. These are not included within the above referenced agreements because GSES maintains the copyright and undertakes regular updates to meet required changes within the industry along with changes in relevant standards and guidelines. The booklets can be supplied under direct agreements with the training centres where they can print the booklets for their students.

The three booklets are:

- Grid-Connected PV Systems - Design & Install;
- Grid-Connected PV Systems with Battery Storage - Design & Install; and
- Stand Alone Power Systems (Off-grid) - Design & Install.

There are three versions of the grid connected PV systems and off grid booklets:

- Australian version based on Australian/New Zealand Standards.
- USA version based on National Electrical Code (NEC).
- International version based on International Electrotechnical Commission (IEC) standards.

7. Plan for Ongoing Provision of Sustainable Energy Training in the PICTS

As indicated in Section 6, sustainable energy training in the PICTS needs to be available through the following delivery methods:

1. Online courses (theory only courses)
2. Face to Face courses (theory and practical courses)
3. Blended courses with theory online and face to face practical sessions

To provide the training, both course resource materials and trainers are required. Some resource materials are already available (refer to section 6), while the development of new training course resources is described in section 7.5 and the practical training equipment requirements are detailed in section 8.4.

This section describes how the three training delivery methods of training can be provided with the support of a regional training centre.

7.1. Regional Sustainable Energy Training Centre

The 2005 report titled *Pacific Renewable Energy Training Initiative* identified the need for a regional centre that could develop training materials and provide support to trainers and training institutes in the PICTs. The 2019 report titled *Scoping Study: Establishing a Regional Energy Training Program and Centre in the Pacific* recommended a regional training centre located in Fiji to support the training needs of the power utilities.

In 2018, GSES hired Mr Sandip Kumar who had been lecturing on renewable energy at the Fiji National University (FNU). Mr Kumar is now a trainer/tutor for GSES operating from Fiji and he supports GSES in its role as SEI API secretariat. One of the long-term objectives in hiring Mr Kumar was to have a quality sustainable energy trainer located in Fiji who could support GSES/SEI API's objective of building and maintaining RE training capacity within the region.

Fiji has at least 17 private companies selling and installing PV systems. Two of these have been undertaking projects in many of the other PICTs. These companies have grown over the years and also suffer from the regional issue of losing staff who move to Australia, New Zealand or elsewhere. The two companies have regularly asked SEI API when training will be available in Fiji. With 17 companies and the power utility (Energy Fiji Limited) requiring on-going training, ongoing in-country training is required.

The 2015 *Current and Future Markets and Training needs Report* prepared for EU-PacTVET project identified Fiji as requiring a permanent training centre, and this has been verified by subsequent studies.

SEI API approached USP Pacific TAFE to offer sustainable ongoing energy training because:

1. USP Pacific TAFE focuses on workforce training;
2. USP has campuses located in a dozen PICTs; and
3. USP has excellent audio/video and internet services.

USP Pacific TAFE did not have any buildings dedicated to conducting practical RE training nor for storing the practical equipment. Hence a project to construct a new facility to be known as the Pacific Sustainable Energy Training Centre (PSETC) was developed. SEI API is working with USP Pacific TAFE and various funders to develop the PSETC.

SEI API will support PSETC to:

1. Offer the face-to-face courses that are available through the GIZ funding agreement.
2. Build on the online training courses available through the GSES agreement.
3. Train future trainers who will teach at the centre.
4. Use these trainers as the trainer-of-trainers from other PICTs.
5. Provide support to trainers in other PICTs.
6. Develop new training courses and materials required to meet the needs of the sustainable energy industry, electrical utilities and other stakeholders throughout the PICTs.

7.2. Online Training

As detailed in section 6.2, online training is now available through USP Pacific TAFE. Ignoring PNG (population 8.9 million) the total population of all the other PICTs is 3.4 million. Only one training centre providing online training is required to meet the current needs of the PICTs and this can be provided by USP Pacific TAFE through the PSETC.

As indicated in section 6.2 Mr Kumar will be the initial tutor/trainer for the USP Pacific TAFE solar courses. Mr Kumar will also train future trainers employed by USP Pacific TAFE to conduct solar training.

7.3. In-country Face-to-Face Training

Some courses require face-to face training and some students prefer it, and there are three potential delivery modes:

- Training conducted at the PSETC;
- Training provided at an in-country training institute by in-country trainers; or
- Training conducted at an in-country training institute by a PSETC trainer travelling to the country.

The small and variable populations of the PICTs, as shown in Table 5, is a major challenge to having face-to face sustainable energy training programs available throughout the region.

Table 5: PICTs Populations by Country (2022)

Country or Territory	Population
Paua New Guinea	8,934,475
Fiji	894,961
Solomon Islands	712,071
Vanuatu	294,908
French Polynesia	278,908
New Caledonia	273,015
Samoa	198,646
Guam	176,644
Kiribati	118,744
Federated States of Micronesia	105,503
Tonga	99,780
American Samoa	56,813
Northern Mariana Islands	56,608
Marshall Islands	54,590
Palau	17,930
Cook Islands	15,281
Nauru	11,690
Wallis and Futuna	11,441
Tuvalu	10,580
Niue	1,562
Tokelau	1,506
Pitcairn Island	51
TOTAL	12,325,707

Note: Source *SPC Population Dashboard* - Data as of June 2022

Training being available in every single country is a worthwhile objective. However, with populations varying from about 1500 (Tokelau), excluding Pitcairn Island, to about 9 million (PNG), it is not cost effective to have full time training personnel available in each country for a wide range of energy technologies and their applications. It is impractical and unsustainable. GSES has had first-hand experience in various countries where a funding agency has wanted trainers "trained", but the demand for these training services did not materialise and, after a few years, the training skills are lost.

Even in countries with larger populations, there will be insufficient demand for a full-time trainer in the technologies and applications. However, one or two trainers might cover a number of technologies and their applications, justifying part time or full-time regional personnel positions. In some countries there will already be trainers conducting electrical or other suitable technical training and these trainers could be upskilled.

There may be only one (or perhaps two in the future) regional sustainable energy training centres offering a wide range of cost-effective training. However, travel costs between the PICTS are expensive adding considerably to costs if all trainees must travel to a single centre and be accommodated. Therefore, in some cases the trainer would travel to the smaller PICTs.

After a person completes a training course, subsequent refresher training or further professional development) is often required. If these were only available at the regional training centre, travel costs will be high.

For these reasons having a range of training conducted within each country through travelling trainers makes sense, and allows a larger number of people to be trained.

It can also be difficult for regional training centres to provide some training (e.g. RE system maintenance), in local languages, but training provided in each country with a local translator can overcome this obstacle.

In conclusion face-to -face training courses should be conducted in country. However, it can be difficult to decide which countries should have courses conducted by local trainers in the local language at an in-country facility centre and which countries require a trainer travelling to that country. This was investigated during the 2015 Training Needs/Gaps Analysis on Sustainable Energy in PICs.

The *Current Training Report* (September 2015) identified the training resources available within the countries. Table 6 lists technical training centres in the 14 countries which could potentially be used for in-country training. Many countries often have small workforce training centres located on outer islands or in remote regions. These have not been listed in table 5 however they can be a useful resource for PSETC and the in-country training institute. During 2023 SEI API will attempt to identify potential smaller training centres that could support the training of remote and/or outer island technicians.

Table 6: Existing in-Country Training Institutes where Training Can Potentially be Provided.

Country	Institution
Cook Islands	Cook Islands Tertiary Training Institute
Fiji	University of South Pacific – Pacific TAFE
FSM	College of Micronesia
Kiribati	Kiribati Institute of Technology
Palau	Palau Community College
PNG	University of Technology PNG
PNG	University of PNG
Republic of the Marshall Islands	College of the Marshall Islands
Samoa	National University of Samoa
Solomon Islands	Solomon Islands National University
Tonga	Tonga Institute of Science and Technology
Tuvalu	Tuvalu Maritime Training Institute
Vanuatu	Vanuatu Institute of Technology

If any of the above centres are unable to host in-country training conducted by trainers from the PSETC, there are other options. As noted, USP has 11 campuses located around the Pacific (outside of Fiji) and there are numerous Australian Pacific Training Coalition (APTC) campuses located through the Pacific that could be used.

Current and Future Markets and Training Needs Report (September 2015) provided estimates of current and future demand for training for the various technology applications for each country. A *Synthesis Report (September 2015)* used the information from the first two reports to provide recommendations on how training could be provided in each country or for the country at a regional training centre

Country summaries for the 14 PICs countries from the synthesis report are reproduced as Annex 1. Table 7 provides an overview of the summaries.

Though the material is seven years old, it remains largely relevant, though demand for a range of RE training will have increased as national RE objectives and funding have expanded. SEI API will use this information as a starting point during 2023/24 to identify how training can be provided in each of the PICs and also for the Pacific Territories not listed.

Although the synthesis report identified countries where some training could be undertaken within a local training institute, SEI API will need to liaise with each of these training institutes to determine whether they want to provide the face-to-face training themselves or would prefer a trainer from PSTEC to travel to that country to conduct the training.

In Australia GSES practical trainers are sub-contractors and are electricians who operate their own businesses designing, selling, installing, and maintaining solar systems. They then conduct the 2–3-day practical training courses on a needs basis, typically once or twice per month. SEI API believes these people make the best practical trainers because of their ongoing in-field and in-country experience.

Even when the training institute has existing trainers who can conduct the face-to-face training, SEI API will attempt to identify individuals involved with regular installation of systems to support the in-country training institutes with the practical training.

Table 7: In-Country Training Potential Across Pacific Island Countries

Training Course	Cook Islands	FSM(1)	Fiji	Kiribati	Nauru	Niue	Palau	PNG(2)	RMI (3)	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Design and Installation of Grid Connected PV Systems	1	1	1	1	2	2	1	1	1	1	1	1	1 or 2	1
Operation and Maintenance of Grid connected PV Systems	1	1	1	1	2	2	1	1	1	1	1	1	1 or 2	1
Design & Installation of Grid Connected Energy Storage (commercial & residential)	1	1	1	1	2	2	1	1	1	1	1	1	1 or 2	1
Design and Installation of Off - Systems (includes solar only and PV/Fuel Generator hybrids)	1	1	1	1	3	3	1	1	1	3	1	1	1 or 2	1
Operation & Maintenance of Off-Grid Systems (solar only and PV/Fuel Generator hybrids)	1	1	1	1	3	3	1	1	1	1	1	1	1 or 2	1
Operation and Maintenance of Wind Farms	4	4	1	3	3	3	3	3	3	1	3	2	3	4
Operations and Maintenance of Hydro Plants	3	4	1	3	3	3	3	1	3	1	1	3	3	1 or 2
Design , Installation & Maintenance of Micro-Hydro	3	4	1	3	3	3	3	1	3	3	1	3	3	1 or 2
Operations and Maintenance of Biomass/Biogas Plants	3	4	1	4	3	3	3	1	3	3	3	4	4	4
Operations and Maintenance of Geothermal Plants	3	3	1	3	3	3	3	1	3	3	4	3	3	4
Selection and Installation of Solar Water Pumping	4	4	1	1	4	4	4	1		4	4	4	4	4
Selection and Installation of Solar Water Heaters	1	1	1	1	4	2	1	1	1	1	1	1	4	1
Energy auditing and applying energy solutions	1	1	1	1	1	2	1	1	1	1	1	1	1 or 2	1

Codes: 1. Training could be provided by in-country training centre; 2 Training to be provided by trainer from PSETC; 3 In country training not required. 4 Unknown if training is required.

7.4. Practical Training for those Undertaking Online Courses

Some people will undertake the online training because they find that delivery model suitable even when face-to-face training is available within their country. Other people will undertake the online training because no face-to-face training is available within their country, and they do not want to wait until it might become available in the future nor travel to the PSETC to undertake the training.

Those who undertake the USP Pacific TAFE (PSETC) online training courses that include installation will need to complete a 3-to-6-day practical course before successfully completing the whole course.

The three ways a person will be able to undertake the practical course will be:

- Travelling to the training facility at USP Pacific TAFE, (PSETC when completed) in Suva, Fiji;
- Undertaking the course at an in-country training institute that has agreed to conduct the practical training either using their own trainer or a local practising installer;
- Having a trainer from USP Pacific TAFE (PSETC), or other institution or country, travel to the relevant country to conduct the practical training course.

SEI API will be liaising with all in-country PICT training institutes to identify those that could provide the practical training or host the equipment and work with a PSETC trainer who would travel to the country and conduct the training.

Regardless of the mode of instruction and the trainers, practical training requires appropriate equipment to be available for the training to be conducted. This is detailed in sections 8.4.

7.5. Incorporating Resilience Requirements in Training Courses

Sustainable energy training courses that have or are being conducted have not explicitly addressed resilience to climate change but this has been a high priority for the PICs for infrastructure in general for some time. In recent years the PICs have pushed donors to focus future infrastructure aid on resilience/adaptation to climate change.

As solar systems designed & built now should be designed & installed to remain functional for 30 years, they should be designed for conditions expected in 2050, not today's climate. This requires some rethinking of the appropriate training. As an example: for rural systems, that would include studying maps to see what is expected to be flooded in 30 years.

In 2023, SEI API with GSES will review the existing training courses to see how resilience training is incorporated into the existing courses and it will be included, when relevant, in all new courses that are developed.

7.6. Developing New Courses

GSES will remain the SEI API partner for developing training resource material and courses. Where GSES does not have the technical skills and experience for a particular technology application, SEI API will identify relevant partners who could develop training resources for the required courses.

In Section 6 it was identified that currently there are no training courses for nine of the training units listed on the PRQS.

SEI API and PPA members regularly confirm that they want courses relating to operation and maintenance (O&M) of grid connected PV systems and where relevant off-grid PV systems. A course relating to the O&M of grid connected PV systems has been developed and conducted three times for

PPA members but this was before the Training Units referred to in Section 6 were developed. In 2023 SEI API/GSES will map Training Unit PPAGC301 to the existing training course to identify where there might be gaps between the recommended competencies and those being taught. A course meeting the requirements of the training unit will be developed and made available to training institutes.

The off-grid courses currently being taught do include maintenance. However, in 2023 SEI API/GSES will map the three Training Units PPAOG301, PPAOG302 and PPAOG303, to the existing training course to identify where there might be gaps between the recommended competencies and those being taught. The three courses meeting the requirements of the three Training Units will be developed and made available to training centres.

SEI API through its various consultations with its members, PPA and other stakeholders have identified that the following four courses need to be developed and offered in the PICTs:

- Operation and maintenance of both grid connect and off grid systems.
- Utility scale storage systems.
- Inspection of grid connected and off-grid systems.
- Awareness course for various stakeholders.

SEI API with the support of GSES and SEI API members plan to develop the above courses in 2023 so they can be offered through the PSETC and also in-country training institutes. SEI API will also liaise with GGGI with respect to the courses they have developed.

The O&M courses GGGI have developed will be mapped against the relevant training units listed on the PRQS. If not sufficient as yet, they could be used along with other material to develop the required O&M courses. However, the GGGI courses are at a basic level. They are useful for system owners and possibly outer island/remote technicians (Refer to Section 7.6).

The training modules *Renewable Energy General Principles* and *Solar in the Community* developed by GGGI could meet the requirement for the awareness course for various stakeholders.

SEI API will continue to consult its members and stakeholders to identify what additional new training courses are required.

As a result of in-country visits undertaken in 2022, SEI API has identified the need for electrical training being available within some countries. Ideally solar technicians should have already undertaken basic electrical training or are electricians. Though SEI API focus has been on building capacity for training in sustainable energy, it will need to work further with the electrical industry to identify how electrical training in support of sustainable energy can be available where required.

In promoting the introduction of sustainable energy training within countries, SEI API has consulted with the electrical training sections of existing training institutes. The electrical trainers could be upskilled to become sustainable energy trainers. In some countries it might be feasible to have electrical training being provided by the same trainers being upskilled to conduct the sustainable energy training.

7.7. Translations

The existing course materials are all in English and the technical level is aimed at technicians who are good at English and basic mathematics. However, for off-grid systems, basic O&M training is required for system owners and technicians who live on the outer islands and/or in remote villages who are not fluent in English or at the maths level required. Basic O&M courses are therefore required and materials often need to be translated into the local language.

The GGGI basic O&M training modules have been developed for PNG, Solomon Islands, Vanuatu and Fiji. In 2023 SEI API will work with GGGI to see how the basic O&M material could be used in other countries and whether they, or core sections of the material, need to be translated.

In 2023 SEI API will liaise with the in-country training institutes to identify smaller workforce training centres that could be beneficial in providing training for basic O&M in the local languages.

7.8. Conclusion

In conclusion SEI API has identified that the provision of sustainable energy training through the PICTs requires:

1. A regional sustainable energy training centre that can:
 - a. conduct face to face training within that country for in-country individuals and also some from other countries;
 - b. provide online training courses throughout the PICTs;
 - c. work with SEI API to develop new training courses and resources; and
 - d. provide support to other training centres and trainers.
2. In-country training institutes providing sustainable energy training courses when the market is large enough to warrant courses to be conducted on a regular basis.
3. A number of trainers who can conduct training within their own country and also travel to other countries to conduct the training.
4. Part-time practical trainers who are from industry and regularly involved with the installation of systems who can conduct training within their own country but also travel to other countries to conduct practical training courses.
5. Practical training equipment being available where installation training is being conducted.
6. Basic O&M courses being available in local languages for system owners and technicians located remotely and/or on outer islands.

8. Establishing Sustainable Energy Training in Existing Training Institutes

Table 6 provides a summary of the possible English-speaking PICs where training could be established for specific technology applications. This covers ACP countries and not the US or French territories. SEI API in coming years will investigate the training needs in the PICTs not covered by the 2015 training report. This section of the plan details what is required to build capacity within those training institutes that have indicated that they want to offer sustainable training courses in the future.

8.1. Confirming which Training Institutes

Though the 2015 reports identified what countries and in-country training institutes could provide training, the final decision on whether training is conducted, and what training is offered, must be made by the training institute.

SEI API is already liaising with the training institutes in Papua New Guinea, Solomon Islands, Vanuatu, Fiji, Federated States of Micronesia and Tonga regarding training being conducted at those institutes, and training needs. Currently this is focussed on the training resources made available through the GIZ-funded agreement between PPA and GSES. The long-term objective is to have other sustainable energy training courses available:

- The USP Pacific TAFE will become the Pacific Sustainable Energy Training Centre (PCSETC).

- Solomon Island National University (SINU) is already conducting the face-to-face courses offered through the GIZ funded agreement and GSES is working with the trainers to improve their skills. SEI API has been talking to local industry with respect to providing practical trainers.
- SEI API is working with the PNG Solar Association, the University of PNG (Port Moresby) and University of Technology (Lae) on how to incorporate the face-to-face training within their existing courses. However, a lot more work is required to be undertaken before sustainable energy training is available in PNG.
- The College of Micronesia in Pohnpei is offering the grid connected PV systems training course however the trainers still need to be trained at some time in the future for conducting the off-grid courses.
- The Vanuatu Institute of Technology (VIT) in Port Vila will conduct the practical off grid PV system training courses for the 21 individuals who are currently undertaking the install only training courses with USP Pacific TAFE. VIT will decide in the future whether they will offer the face-to-face courses.
- SEI API has met with the Tonga Institute of Science and Technology, and they want to offer the face-to-face courses.

SEI API will liaise with the remaining training institutes listed in Table 6 along with training institutes in the PICTS not included in the 2015 study on whether they do want to offer face-to face training and conduct the practical training sessions or host training being conducted by overseas trainers.

8.2. Accreditation of Courses and/or Training units

Countries with their own training frameworks typically require any TVET course to be accredited within their framework. This is why the training institutes within PNG were unable to immediately use the training resources provided through the GIZ funded PPA/GSES agreement. While in Tonga SEI API will be working with TIST to have the Training Units that are listed on the PRQS accredited through the Tonga National Qualifications and Assessment Board (TNQAB). This will then allow TIST to offer the face-to-face training courses.

While SEI API is identifying which in-country training institute will be offering the training, SEI API will find out if that country has their own training framework with relevant administrative body. Working with the in-country training institute SEI API will determine whether the PRQS listed training units need to be accredited within that country and if so SEI API will then commence the process for submitting the training units (or courses) for in-country accreditation.

8.3. Training the Trainers

The in-country training institutes will require their trainers to be trained. The easiest way to do this is to have the trainers undertake the relevant course offered by USP Pacific TAFE (PSETC).

The intention is that the sustainable energy trainers should already be trainers at the in-country institute. Ideally, they will be teaching electrical or similar courses. However someone conducting any technical training would generally be suitable. It is not envisaged that the trainers will be newly hired dedicated sustainable energy trainers unless the demand for sustainable energy at that in-country institute grows to the point where that is required.

Depending on what training will be offered in-country, the in-country trainers could complete the relevant online courses available through USP Pacific TAFE. The practical session and train the trainer sessions could then be conducted either by:

- The PSETC conducting the course where numerous in-country trainers could attend; or
- A PSETC trainer travelling to the in-country training institute.

Having the practical sessions and train the trainer courses conducted at the PSETC would be the most cost effective. However, some training institutes might prefer having the training at their institute.

Instead of having the in-country trainers undertake the online courses, the full face to face courses could be conducted by the PSETC and all the trainers attend. This delivery mode would be expensive because the face-to-face training for all 4 courses plus train the trainer sessions will take about 9 weeks.

For some countries the practical courses might be conducted in country in cooperation with another funded project. For example, SEI API is in discussions with the project manager of Global Environment Facility/United Nations Development Programme (GEF/UNDP) funded *Promoting Outer Island Development through the Integrated Energy Roadmap (POIDIER)* project in Kiribati. This involves training in design, installation and maintenance of solar mini grids being installed in the outer islands. The trainers from the Kiribati Institute of Technology could attend that training instead of having to travel to Fiji.

Once the training is completed the in-country trainers could conduct the relevant face-to-face courses available through the PPA/GSES agreement. The PSETC trainers and SEI API will provide ongoing support to the trainers. Training of trainers for all other courses that are developed will follow a similar structure.

8.4. Practical Training Equipment

Courses relating to the installation of systems requires the participants to undertake real and/or simulated installation during the practical sessions. Whenever an installation course is developed there must be installation relevant equipment at each institute that is conducting the training.

SEI API is currently focusing on the training immediately required by our members and the PICT electric power utilities, and these courses are:

- Grid Connected PV Systems – Design Only, Install Only and Design and Install
- Stand Alone Power Systems (SAPS) (Also known as Off-Grid) - Design Only, Install Only and Design and Install
- Battery Storage Systems for Grid Connected PV System - Design Only, Install Only and Design and Install

For the practical sessions each in-country training institute requires equipment suitable for the courses they are conducting. This includes:

- Complete grid connect PV system with PV array mounted on a training roof that could be dismantled and mounted each course.
- Inverter and battery bank suitable for the Grid Connect with Batteries training.
- Complete off grid hybrid system including generator (or an AC powered alternator to simulate a generator), however the grid connected array and battery bank used for Grid Connect with Batteries training could be used for the off-grid training though other equipment would still be required
- Eight solar home systems (2 modules each) complete with a self-supporting upright board suitable to support the array frame and modules, controller and lights (with battery installed at the base of the stand).

The practical training shall involve practicing installing an array on a typical roof, with installation appropriate for Category 5 hurricane winds. For safety reasons, the roof will be located just off the ground similar to the example shown in Figure 1. The cost of this roof is included in the grid connect system equipment price shown in section 9.2.



Figure 1: Example of Simulated Roof

An example of the solar home system training board is shown in figure 2.

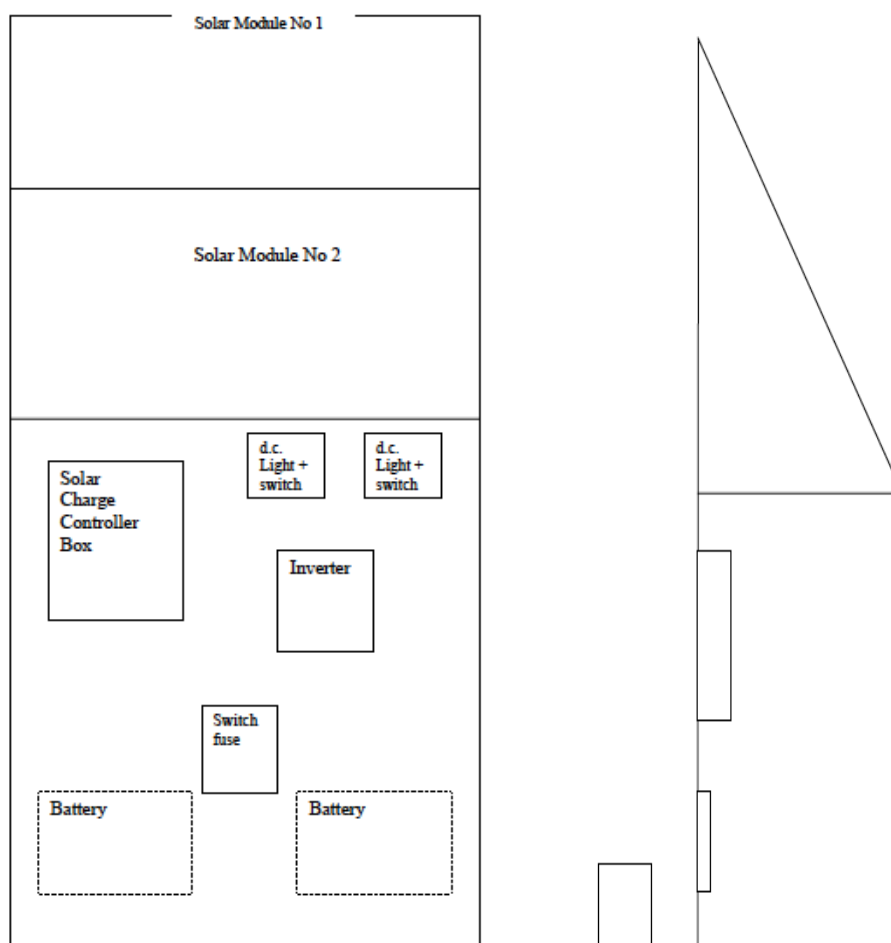


Figure 2: Solar Home system Training Board

The grid connected system and off-grid hybrid system could be permanently installed so that they provide power to the training institute when training is not being conducted. For countries that only

have a need for grid connect training, the system could possibly be installed at the one of the sites owned by the power utility.

In addition to the practical equipment each training centre will require tools, meters etc along with consumable items like cable, conduit etc.

Annex 2 details the required practical equipment, required tools and testing equipment (including budgetary pricing). The budgetary prices were obtained when preparing the proposal for the regional sustainable energy training centre to be established at USP Pacific TAFE.

9. Cost to Train the Trainers and Provide Practical Equipment

As indicated in Section 1, reports and proposals relating to building training capacity have been developed in the past. Some of these related to building capacity in one specific PIC while others described building capacity in every country. This section of the report provides a budget estimate of the costs involved in building capacity at in-country training institutes within 13 PICs. It is currently unknown whether all training institutes would proceed with offering solar training. However, for the overall budget estimates it has been assumed that they will proceed.

The budget estimate does not include Fiji because that pricing is included in the proposal for developing the regional sustainable energy training centre. That proposal did include an option of providing practical training equipment in Kiribati, Nauru, Samoa Tonga and Tuvalu but the costs for those countries are included here. No training institutes were identified in Nauru and Niue and hence there is no budgetary cost for training the trainers in those countries. However practical training equipment for Niue and Nauru has been included.

Solomons Islands has some equipment, but the PV array is already mounted on the roof of the training building, so it is not easy to practice roof top installation and they do not have solar home system (SHS) kits and installation boards. The simulated roof top systems with inverter and the solar home system kits are included in the pricing for Solomon Islands. This is similar for FSM; a grid connect system has been provided under a previous project but it is unknown whether it is located on a simulated roof as recommended by SEI API in this plan. The equipment cost for grid connected PV systems for FSM has been included in the budget.

Solomon Islands trainers (CINU) are currently being trained in the four courses provided under the GIZ funded PPA/GSES agreement as part of a previous project. The trainers at FSM (COM) have previously been trained in conducting the grid connected PV systems course but those relating to the off-grid course or the Grid connected with batteries course. Hence the budget shown in this section does not include the training of trainers in Solomon Islands or for training trainers in FSM in grid connected PV systems.

Vanuatu does have some off-grid system equipment, but it is located at a private training centre, not at VIT. The costs for all the required equipment are thus included for Vanuatu in case it is not possible to have the existing equipment available for VIT's use. (Note the training is at a private institute because Wade Bevans was conducting solar training there but is now principal of VIT)

The cost for the tools and test equipment is included for each country except for Nauru and Niue because the PSETC trainer can take the tools and test equipment with them when undertaking practical training in those two countries.

9.1. Training the Trainers

SINU in Solomon Islands originally had four trainers attend the train-the-trainer courses conducted by GSES in early 2020. However, when SEI API visited SINU in October 2022, they only wanted two trainers to undertake the GSES refresher course. When SEI API visited TIST in Tonga in November 2022, they stated they would like four trainers to undertake the relevant training but needed funding. Though it would be good having four trainers to be trained at each in-country training institute, SEI API believes that two should initially suffice. In the future additional trainers could be trained by the local trainers. For the purpose of estimating budgets, it is assumed that countries will have two local trainers trained.

Table 8: Potential Number of In-Country Trainers to be Trained.

Country	Institution	Number of Trainers to be Trained
Cook Islands	Cook Islands Tertiary Training Institute	2
FSM	College of Micronesia	2
Kiribati	Kiribati Institute of Technology	2
Palau	Palau Community College	2
PNG	University of Technology PNG	2
PNG	University of PNG	2
Republic of the Marshall Islands	College of the Marshall Islands	2
Samoa	National University of Samoa	2
Solomon Islands	Solomon Islands National University	Already being trained
Tonga	Tonga Institute of Science and Technology	2
Tuvalu	Tuvalu Maritime Training Institute	2
Vanuatu	Vanuatu Institute of Technology	2
Total		22

Note: Nauru and Niue do not require local trainers at this stage.

The train the trainers' courses will be a blended course where the trainers undertake the theory online and attend a two-week practical course at PSETC. The two-week practical will include sessions covering how to conduct the face-to-face courses.

Though Samoan trainers will only be conducting courses related to grid connected systems, they will attend the full two-week practical courses because they will be conducting grid connect with battery courses in the future and hence some sections of that course are similar with the off-grid courses. Samoa also has some off-grid systems on Apolima island, so the trainers will develop the skills for O&M on those systems.

Table 9 shows the cost of undertaking the various online training courses through USP Pacific TAFE. This is the cost for the online training only. Table 10 provides a breakdown of the cost per country for undertaking these courses. The trainers will be asked to complete all the courses within 6 months of starting and to undertake them in the following order:

- Grid Connected PV Systems –Design and Install
- Battery Storage Systems for Grid Connected PV System - Design and Install
- Stand Alone Power Systems (SAPS also known as Off-Grid) and Design and Install

Table 9: Cost for Undertaking Individual Online Courses.

Online Course	Cost per participant	
	FJD	AUD
Grid Connected PV Systems –Design and Install	\$995	\$675
Battery Storage Systems for Grid Connected PV System	\$995	\$675
Off Grid Power systems also known as SAPS	\$1,495	\$995
Total for all 3	\$3,485	\$2,345

Table 10: Total Cost for In-Country Trainers Undertaking Online Courses (Australian dollars)

Country	Institute	Number of Trainers	Cost per Course (AUD)			Totals
			GC- D & I	GCwB D & I	SAPS D & I	
Cook Islands	Cook Islands Tertiary Training Institute	2	\$1,350	\$1,350	\$1,990	\$4,690
FSM	College of Micronesia	2		\$1,350	\$1,990	\$3,340
Kiribati	Kiribati Institute of Technology	2	\$1,350	\$1,350	\$1,990	\$4,690
Palau	Palau Community College	2	\$1,350	\$1,350	\$1,990	\$4,690
PNG	University of Technology PNG	2	\$1,350	\$1,350	\$1,990	\$4,690
PNG	University of PNG	2	\$1,350	\$1,350	\$1,990	\$4,690
RMI	College of the Marshall Islands	2	\$1,350	\$1,350	\$1,990	\$4,690
Samoa	National University of Samoa	2	\$1,350	\$1,350		\$2,700
Tonga	Tonga Institute of Science and Technology	2	\$1,350	\$1,350	\$1,990	\$4,690
Tuvalu	Tuvalu Maritime Training Institute	2	\$1,350	\$1,350	\$1,990	\$4,690
Vanuatu	Vanuatu Institute of Technology	2	\$1,350	\$1,350	\$1,990	\$4,690
TOTAL		22	\$13,500	\$14,850	\$19,900	\$48,250

There is the potential for 22 trainers to be trained, the aim is to conduct two two-week practical train the trainer courses with a maximum of 11 trainees at each.

For budgetary purposes:

1. It is assumed that airfares from Cook Islands, FSM, Palau, and RMI would be A\$4000 because these might require a couple of flights to reach Fiji from the respective country.

2. It is assumed that airfares from all other locations will be A\$2000
3. It is assumed each trainer will require at least 14 days in Fiji and those travelling from the Cook Islands, FSM, Palau and RMI will have two extra nights in-transit somewhere. The per diems used are based on the UN listed rate of US\$230 (A\$340) for Suva.

Table 11 shows the total costs for the trainers attending the practical train the trainer courses in Fiji at the PSETC.

Table 11: Total Cost for In-Country Trainers Attending Practical Courses (Australian dollars)

Country	Institute	Number of Trainers	Airfares (AUD)	Per Diems (AUD)	Totals (AUD)
Cook Islands	Cook Islands Tertiary Training Institute	2	\$8,000	\$10,880	\$18,880
FSM	College of Micronesia	2	\$8,000	\$10,880	\$18,880
Kiribati	Kiribati Institute of Technology	2	\$4,000	\$9,520	\$13,520
Palau	Palau Community College	2	\$8,000	\$10,880	\$18,880
PNG	University of Technology PNG	2	\$4,000	\$9,520	\$13,520
PNG	University of PNG	2	\$4,000	\$9,520	\$13,520
RMI	College of the Marshall Islands	2	\$4,000	\$9,520	\$13,520
Samoa	National University of Samoa	2	\$4,000	\$9,520	\$13,520
Tonga	Tonga Institute of Science and Technology	2	\$4,000	\$9,520	\$13,520
Tuvalu	Tuvalu Maritime Training Institute	2	\$4,000	\$9,520	\$13,520
Vanuatu	Vanuatu Institute of Technology	2	\$4,000	\$9,520	\$13,520
TOTAL		22	\$56,000	\$108,800	\$164,800

The practical training courses will be conducted by Mr Stapleton and Mr Kumar at the PSETC (when completed). Table 12 provides a breakdown of the costs for each two-week training course.

Table 12: Costs for SEI API/GSES Conducting Train the Trainer courses

Cost	Trainers' fees	Airfares (AUD)	Per Diems (AUD)	Total (AUD)
Cost per 2-week course	\$22,000	\$2,000	\$4,760	\$28,760
Total for 2 courses	\$44,000	\$4,000	\$9,520	\$57,520

Assuming that 22 trainers are trained with two practical training courses, then the total cost would be **A\$270,570**.

Note: As mentioned in Section 8, for some countries, it might be able to conduct the practical training in country in co-operation with another funded project, for which in country training is required as part of that project. SEI API in early 2023 will investigate what projects are being provided by donors throughout the region for which such training is required.

9.2. Practical Equipment

The total cost for the training equipment for both grid connected PV systems and off-grid PV systems (incl Hybrid) as detailed in Annex 2, including some consumables such as cables etc, is summarised in Table 13.

Table 13: Training Equipment for Grid Connect and Off-Grid PV Practical Courses

Item No.	Description	Cost (AUD)
1	Grid Connect Training Equipment as per Annex 2.1 of Equipment List	\$18,650
2	Off Grid Training equipment- Full Course Including Hybrids as per Annex 2.2 of Equipment List	\$39,650
3	Off grid Training – Small Solar Home Systems as per Annex 2.3 of Equipment List	\$19,600
4	Tools as per Annex 2.4 of Equipment List	\$1,150
5	Testing and Safety Equipment as per Annex 2.5 of Equipment List	\$14,250
6	Consumables/Miscellaneous	\$3,500
	Total	\$96,800

Though Nauru and Niue do not have the need for in-country training capacity there will still be the need for either in-country training by a PSETC trainer travelling there or the course participants travel to PSETC for the training. For the benefit of budgeting practical training equipment has been assumed to be available for training in Niue and Nauru. The only training would be for grid connected PV systems and grid connected with batteries.

For Samoa, only grid connected training equipment (PV and batteries) would be required.

However, for all three countries grid connected battery system practical sessions might be required in the future. Costings for this equipment have therefore been included and it is estimated at \$15,000 per system.

For Nauru and Niue (where no training institute has been identified) it is recommended that the equipment is housed with the relevant power utilities, that is the Nauru Utilities Corporation and Niue Power Corporation.

Table 14 provides details of the practical equipment costs per country and the total overall costs if all countries receive practical training equipment.

Table 14: Training Equipment per In-Country Training Institute

Country	Institute	Grid Connect PV Equip	Grid Connect w Batts Equip	Off Grid Equip	Tools and Test Equipment	Consumables	Totals
Cook Islands	Cook Islands Tertiary Training Institute	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
FSM	College of Micronesia	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
Kiribati	Kiribati Institute of Technology	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
Nauru	NUC	\$18,650	\$15,000			\$3,500	\$37,150
Niue	NPC	\$18,650	\$15,000			\$3,500	\$37,150
Palau	Palau Community College	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
PNG	University of Technology PNG	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
PNG	University of PNG	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
RMI	College of the Marshall Islands	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
Samoa	National University of Samoa	\$18,650	\$15,000		\$15,400	\$3,500	\$52,550
Solomon Islands	Solomon Islands National University	\$18,650			\$15,400	\$3,500	\$37,550
Tonga	Tonga Institute of Science and Technology	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
Tuvalu	Tuvalu Maritime Training Institute	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800
Vanuatu	Vanuatu Institute of Technology	\$18,650		\$59,250	\$15,400	\$3,500	\$96,800

TOTAL		\$261,100	\$45,000	\$592,500	\$184,800	\$49,000	\$1,132,400
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9.3. Summary

If training capacity is built in the 13 PICs as described in this section, the total cost would be A\$1,402,970 broken down as shown in Table 15.

Table 15: Budget summary for Building Training Capacity in 13 PICs

Item	Budgetary Cost (AUD)	Percentage of Total Budgetary Cost
22 in-country trainers undertaken online training courses	\$48,250	3%
22 in-country trainers undertaken practical training and train the trainers course at PSETC	\$164,800	12%
GSES/SEI API Trainers conducting the Practical Training Course and Train the Trainers	\$57,520	4%
Practical Equipment provided to the in-country training institutes.	\$1,132,400	81%
Totals	\$1,402,970	

10. Sustainability of the Pacific Sustainable Energy Training Centre

In May 2022 SEI API prepared the *Request for Funding for Establishing: Regional Sustainable Energy Training Centre at USP-Pacific TAFE Suva Fiji*. A major component of that proposal was the need to construct a new building which would now be called the Pacific Sustainable Energy Training centre (PSETC). An anonymous donor and Australian DFAT are considering funding that request. However, like any project, the question that always need to be answered is: Will it be sustainable?

This document the *SEI API Training Plan for the Pacific Islands* has also identified that funding of A\$1.4 million is required to build training capacity in 13 PICS (not including Fiji), so the same sustainability question needs to be answered.

This section of the training plan identifies what needs to be undertaken to make this training plan along with the PSETC sustainable.

10.1. Brief Overview of Sustainable Energy Market -Need for Training

Numerous reports, studies, workshops and seminars over the last 10 plus years have identified the need for sustainable energy training being available within the PICTs.

Various multilateral and bilateral donors have provided over USD1 billion in support for solar projects across the PICTs since 2010. Many of these systems have been installed by private Pacific Island based companies who require their staff to be trained.

Many of the systems have been connected to the various power grids throughout the Pacific. These systems have therefore become assets of the 22 power utilities, and therefore the staff of these utilities are also in need of training.

Off-grid systems have been installed in the unelectrified regions and these require trained local technicians or even training system owners who can maintain the systems in these remote islands and communities. The system owners and local technicians should be supported by the private company that undertakes the installation

During the 4th Pacific Energy Ministers Meeting, held in Apia, Samoa in 2019 the Pacific Energy Ministers endorsed the development of the *Framework for Energy Security and Resilience in the Pacific (FESRIP) 2021–2030*. Most PICTs have formal renewable energy targets for their power generation, often through their Nationally Determined Commitments (NDCs) through the UN Framework Convention on Climate Change (UNFCCC). The commitments are ambitious and several PICs have recently strengthened their NDCs. All create a growing demand for the installation of renewable energy systems that will require billions of dollars in investments.

The result is that there will be an ongoing and increasing need for training for private industry, the power utilities, government officials, non-governmental organisations, community leaders and other relevant stakeholders.

In preparing this plan SEI API has not estimated the size of this market to justify the need for training. There are numerous reports by donors and governments on the level of investment needed in renewable energy within the PICTs.⁵ These are somewhat dated, incomplete, and not always consistent but they agree that the need is considerable, and must grow over time, if the ambitious targets are to be met, and even if they fall well short of ambitions.

10.2. Demand for Training

Section 7 outlined a plan for providing training in the PICTS comprising a regional training centre (PSETC) and in-country training institutes. Another question from a sustainability perspective is, will there be sufficient demand to warrant a regional training centre in Fiji and in-country training being available in the 11 other PICs as outlined in Section 7?

The 2015 report *Current Technical Training in Pacific ACP Countries* identified 82 courses being conducted between 2010 and 2015. Section 3 listed 11 courses that GSES has conducted between 2015 and 2022. SEI API has not documented how many individuals have been trained in these courses but considering that the VOCTEC project alone trained 136 technicians, it would be fair to estimate the total number to be in the many hundreds.

The SEIDP guidelines workshops (including those in the Cook Islands) referenced in section 3.6 had over 650 different individuals attending 34 workshops conducted in 13 countries. Feedback from all of these workshops was that more in-country training was required.

The community energy training recently undertaken by GGGI reportedly had over 5000 attendees in four countries, though this has not been confirmed and seems high. Only a small percentage were technicians but, even if the total is exaggerated, it suggests considerable interest by communities in understanding the solar systems being installed within their villages.

⁵ Some years ago, the Energy Working Group of the Sydney-based Pacific Region Infrastructure Facility (PRIF), which includes nearly all key donors and lending institutions active within the energy sector in the Pacific, maintained an extensive database of all energy infrastructure investments and proposed projects in the region. This is no longer updated.

SEI API believes, based on past experience, that demand for in-country training is high and will increase further over the next few years. Section 10.5 discusses the financial sustainability of the in-country training.

The regional centre (PSETC) will provide the online training, for which the demand within the Pacific region is high. For the existing design and Installation courses relating to grid connected and/or off grid PV systems, 40 people have registered with USP Pacific TAFE since 1st July 2022. Prior to agreement between GSES and USP Pacific TAFE, 27 people from PICs had registered for online courses with GSES in 2021/2022. This shows that there is demand for these online courses although they have yet to be widely publicised.

Workshops, seminars and reports have also identified that there is a need for sustainable energy courses for government workers and other stakeholders as well as shorter professional development courses for those already trained. USP Pacific TAFE will be listing another 12 short courses online in 2023 (Refer to Section 6.2) aimed at professional development and introduction. These short online courses have not been available in the Pacific before so the demand is unknown. This will be marketed throughout the Pacific and considerable interest is anticipated.

As noted earlier there are at least 17 private companies selling solar systems in Fiji and Fiji's sole power utility (Energy Fiji Limited) is expanding grid-connected renewable energy. Fifty-three different people attended the SEIDP workshops that were held in Fiji. However, there is no technician level sustainable energy training available in Fiji, hence local training is required. There is expected to be ample demand for the online and face to face training in Fiji through PSETC.

10.3. Lessons Learned

Many of the courses that have been conducted in the Pacific have been funded by donors and those attending generally did not pay a fee. The effect of people receiving something for free can result in the training not being valued and it could also reduce the numbers willing to pay for training because they prefer to wait for the next "free" course.

GSES and SEI API are aware of this but do believe that people should pay for training even if it is partly subsidised through some form of assistance. For this reason, in the last few years, training enquiries have been directed to courses where the user pays. As indicated earlier, 67 people in 2021-2022 have registered for online courses which charge a fee. SEI API is aware that a few course participants had fees paid for through donor-funded projects but many were paid for by private companies or power utilities. The Vanuatu Department of Energy through the National Green Energy Fund (NGEF) funded 100% of the online course fee for two people from each of Vanuatu's private solar companies. Three companies paid for four other staff to undertake the training. The private companies all pay for the practical course being held at VIT. Hence, it is apparent that that private industry and power utilities are prepared to pay and not wait for "free" training. However, some support might be required in some countries to reduce the cost of the training.

As shown in Section 3 there have been numerous technical training courses conducted throughout the Pacific. These have met some of the training need often it focussed on specific projects and was ad hoc rather than ongoing. Though private industry and power utilities have had some staff trained, they have an ongoing need for training because trained staff leave, they require refresher training, they need updating in new technologies and control systems, and the expansion of RE systems requires new planning, design, installation and O&M employees. Any industry with ongoing sales/installation valued in the millions of dollars requires training being available regularly and this is normally provided by established training institutes. In the Pacific region, though the market is

growing and would be valued annually in the millions of dollars, training being available regularly has not eventuated. Finally, the demand for high-quality training will increase when, as expected, governments require that designers, installers and O&M staff have been formally certified with regular updates of the certification.

The region had two projects that focussed on building capacity within TVET, one being the USAID funded VOCTEC project and the other the EU funded Pacific TVET. So why did these not provide the ongoing training that is required by private industry and the power utilities?

VOCTEC trained trainers at many of the training institutes listed in this training plan. However, SEI API is unaware if any of the institutes still conduct the training. SEI API is interested in following up to determine exactly why, and will contact the training institutes to find out. Some possible reasons SEI API the courses have lapsed and which are relevant to this plan are:

- The training was funded by the project at no cost to the trainees, who may have awaited the next “donor” funded course. SEI API does not know if this was the case, but the training centres might not have considered conducting further courses for a fee.
- The courses were based on small ‘solar home systems’ which remain relevant for some countries, the current demand for training by SEI API members is in grid connected PV systems or off grid systems that includes hybrid systems (e.g., diesel/PV).
- The training centres might not have marketed the courses and possibly did not reach out to industry within the country to determine how often the training should be conducted to meet local demand.
- Some organisations should have worked with the training institutes promoting the training to the industry and relevant stakeholders. That is, projects aiming at building capacity in sustainable energy training need a plan for long term sustainability.
- VOCTEC was managed by a reputable training institute but did not have the mandate or funding to produce local-language materials, although many trainees lacked competence in technical English. The project design may not have been optimal.

The EU PacTVET project has developed certificate level courses and the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) is working with some countries to have these accredited within their national frameworks. Other mature industries arrive at a point where training is mainstream and those in the industry know that they can hire people who have been trained in accredited training institutes. This should have been the objective of PacTVET. Though some countries have continued to offer the level 1 and 2 courses, these do not meet the industries’ requirements for people trained to perform specific tasks. It is for this reason, among others, that the project was not successful in leading to practical, ongoing sustainable energy training that meets the needs of the industry.

However, SEI API believes it can be built upon. The initial focus of this SEI API training plan is to build the capacity within the region in skillset training that meets the current needs of the industry and power utilities. Once that is done then SEI API aims to work with PCREEE and the Pacific Community (SPC) to modify these certificate courses, so they meet the need of introducing new people into the sustainable energy industry.

10.4. Operation of the PSETC

The 2005 *Pacific Renewable Energy Training Initiative (PRETI)* and the 2019 *Scoping Study: Establishing a Regional Energy Training Program and Centre in the Pacific* each recommended a regional training centre. Establishing the PSETC at USP Pacific TAFE meets this objective.

Though the PSETC building will be an asset of the USP Pacific TAFE, the operation of the PSETC will be a partnership between USP Pacific TAFE, SEI API and GSES. This partnership will operate as follows:

- The online courses (including new courses going online in early 2023) currently being offered by USP Pacific TAFE is through a partnership agreement where the profit is shared between GSES and USP Pacific TAFE. This might change in the future to a license agreement where GSES obtains royalties. In either arrangement the training resource material is updated by GSES.
- Online training courses and face-to-face courses in Fiji are conducted by USP Pacific TAFE.
- GSES/SEI API will train the trainers at USP Pacific TAFE and provide them support.
- SEI API will consult with the many stakeholders within the Pacific to identify what new training courses could be developed.
- New training courses will be developed in co-operation between the three partners.
- SEI API on behalf of PSETC will liaise with the in-country training institutes, helping them to identify what training courses should be conducted within the respective country.
- PSETC/SEI API/GSES will train the in-country trainers and provide ongoing support to the trainers.
- SEI API will take on the lead role of promoting the PSETC and the in-country training institutes throughout the Pacific region.

SEI API believes that this partnership will be beneficial to the sustainability of PSETC and training throughout the region because:

- USP Pacific TAFE through the USP network is well known throughout the Pacific and is already conducting workforce development courses for a fee;
- GSES is a successful experienced private training company that has been conducting user pay training courses and developing training resource material for over 20 years;
- SEI API has already been operating for 12 years and the PSETC will meet one of the main objectives of SEI API, that is ensuring Pacific based training is available for its members and hence SEI API will be proactively making sure that the centre is a success.

The PSETC will start with one full time trainer hired and trained by SEI API/GSES. A second trainer will be selected from the existing electrical training staff, who will be trained as a back-up. The full-time trainer will be supported, where necessary by Mr Sandip Kumar. Extra full-time trainers will be hired as the demand grows. When the practical courses are conducted there will be two trainers, the full time PSETC trainer and Mr Sandip Kumar.

10.5. Financial Sustainability of the In-Country Training

Table 16 provides a summary of the investment needed by country to:

- provide equipment into each of the 12 training institutes in the 11 countries and at the 2 power utilities in 2 other countries and
- train trainers in 11 training institutes (does not include SINU)

Table 16: Investment in Building Capacity in Individual Training Institutes or Countries

Country	Institute	Investment in Building Capacity
Cook Islands	Cook Islands Tertiary Training Institute	\$125,163
FSM	College of Micronesia	\$123,813
Kiribati	Kiribati Institute of Technology	\$119,803
Nauru	NUC	\$37,150
Niue	NPC	\$37,150
Palau	Palau Community College	\$125,163
PNG	University of Technology PNG	\$119,803
PNG	University of PNG	\$119,803
RMI	College of the Marshall Islands	\$119,803

Samoa	National University of Samoa	\$73,563
Solomon Islands	Solomon Islands National University	\$42,343
Tonga	Tonga Institute of Science and Technology	\$119,803
Tuvalu	Tuvalu Maritime Training Institute	\$119,803
Vanuatu	Vanuatu Institute of Technology	\$119,803
TOTAL		\$1,402,970

The investment in the training of the trainers and equipment is only undertaken when the training institute agrees to offer sustainable energy training. If a training institute does not want to conduct the face-to-face training but agrees to allow their institute to host other trainers conducting training when required then the investment for that training institute should be undertaken and that is shown in Table 14.

Unless the sustainable energy training demand grows significantly, the trainers that will be trained within each training institute should already be employed by the institute conducting other courses, ideally electrical training. These trainers would only be used for sustainable energy training when there is a demand for a course to be conducted. The costs to the training institute at that time in using these trainers plus any in-house chargers for overheads should be recovered by the fees that are charged to those attending the course.

If the training is being conducted by a PSETC trainer then the costs for the trainer's time, the travel expenses and any institute charges for overheads such as rent of training area should be recovered by the fees that are charged to those attending the course.

10.6. Sustainability of the PSETC

SEI API believes that this plan, along with the many previous studies and reports, has justified that a regional training centre such as PSETC is required. It is appreciated that the cost of building the new centre could not easily be recovered by course fees alone in the first few years. However, the cost of the building is minor compared to the investment as both grants and loans by donors in the installation of renewable energy systems in the Pacific in the last 10 years and the future private and donor investment that is required to meet the various renewable energy targets in the Pacific.

A confidential section of this training plan looked at the financial sustainability of the ongoing operation of the PSETC. That section identified the number of students required each year to meet the operational costs of the centre and based on the previous training experience of GSES those numbers are achievable.

11. Summary of Activities Required to Implement this Training Plan

Through this report there were activities identified that should be undertaken by SEI API/GSES in implementing this plan. Table 17 summarises these activities.

Table 17: Summary of Activities

Action Item No.	Action	Section Report	in
1	Review Table 1, and update where necessary, to determine whether all the training courses identified in 2015 are still required in the respective countries.	2	

2	Assess the training needs of those PICTs not included within the EU's African Caribbean Pacific (ACP) group of countries.	2
3	Investigate the updating of certificate courses to meet the needs of industry	3.3
4	Review the training material from GGGI and see whether it would suffice and add some of the proposed new training courses	3.4
5	Work with GGGI to promote their training material throughout the PICTs	3.4
6	Contact all the training centres and determine whether they would like to offer the face-to-face training course or be prepared to host a PSETC training conducting training at their centre	7.4
7	Review the existing training courses to see how resilience training is incorporated into the existing courses	7.5
8	Map Training Unit PPAGC301 O & M of Grid Connected PV Systems to the existing training course to identify gaps (if any) between the recommended competencies and those being taught.	7.6
9	<p>Develop the new training units related to:</p> <ul style="list-style-type: none"> • Operation and maintenance of both grid connect and off grid systems. • Utility scale storage systems. • Inspection of grid connected and off-grid systems. • Awareness course for various stakeholders. <p>The O & M courses will be developed based on the existing GSES (GC) and GGGI (Off Grid) courses</p> <p>The training modules titled <i>Renewable Energy General Principles</i> and <i>Solar in the Community</i> developed by GGGI could meet the requirement for the awareness course for various stakeholder.</p>	7.6
10	The O & M courses GGGI have developed will be mapped against the relevant training units listed on the PRQS.	7.6
11	Work with the electrical industry to identify how electrical training can be available where required.	7.6
12	Work with GGGI to see how the basic O &M training material could be used in other countries and whether they need to be translated.	7.7
13	Liaise with the in-country training institutes to identify smaller workforce training centres that could be beneficial in providing training for basic O & M courses in the local languages.	7.7
14	<p>Liaise with all the other training institutes listed in Table 6 along with training institutes in the PICTS not included in the 2015 study on whether they want to offer face-to face training and conduct the practical training sessions or host training being conducted by overseas trainers.</p> <p>Note: SEI API is working with training centres in PNG, Solomon Islands, Vanuatu and Tonga.</p>	8.1
15	Identify what countries have their own training framework with relevant administrative body. Work with the in-country training institute to investigate whether the PRQS listed training units need to be accredited within that country and if so, commence the process	8.2

	for submitting the training units (or courses) for in-country accreditation.	
16	Train the Trainers if funding is available	8.3
17	Source practical training equipment if funding is available	8.4
18	Investigate what projects are being provided by donors throughout the region where training is required	9.1
19	Contact training institutes that conducted the VOCTEC training and find out about training has been conducted since and if not, why not?	10.3

Annex 1: Country Training Requirements from 2015 Report

This section reproduces the country training requirements from the 2015 Syntheses Report that was an output of the Training Needs/GAPS Analysis on Sustainable Energy in Pacific Countries undertaken for the European Union (EU), Pacific Technical and Vocational Education Training (TVET).

Some of the information would be dated however it is still relevant with respect to identifying countries with sufficient market potential for in-country training to be provided by existing in-country training institutes

Note: Refrigeration and air conditioning was included in the 2015 reports however these are not a focus for SEI API at this point of time.

Annex 1.1 Cook Islands Training

The Cook Islands Tertiary Training Institute (CITTI) indicated an interest in conducting training courses in Grid connected systems and off grid systems. CITTI conducts electrician courses, and so should be capable of up-skilling to be able to offer energy efficiency courses.

From the current and future market studies, Cook Islands have enough market potential that CITTI should be upskilled to be able to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Energy Auditing and Applying Energy Efficiency Solutions.

Further discussions should investigate whether refrigeration, air conditioning and solar hot water training could be implemented. Electrical staff could provide the electrical side of the training and experienced technician or technicians working in any of these three technologies could be trained to be part time trainers.

Cook Islands is a country with an established local industry. People from the industry should be encouraged to work with the training centres and also provide guest trainers.

Annex 1.2 Federated States of Micronesia

Trainers from the College of FSM were trained under the VOTEC project and will be offering training in off-grid PV systems.

From the current and future market studies FSM does have enough market potential that College of FSM should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid Connect PV systems
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

If the Hydro system is rehabilitated in Pohnpei, then staff from Pohnpei Utilities Corporation will require training on the maintenance and operation of the system. Since this training is required for a one-off system, there is no real need to develop resources to conduct this training. This type of training should be conducted either in-house by Pohnpei Utilities Corporation staff who should have been

trained by the company which re-habilitated the system, or, if they do not have the capability, outside resources should be brought in to conduct training on that particular system. Staff travelling to a regional training centre, e.g. Fiji or say PNG would also be a solution.

If the Wind system is installed in YAP, staff from Yap State Public Service Corporation will require training on the maintenance and operation of the system. Since this training is required for a one-off system, there is no need to develop resources to conduct this training. This type of training should be conducted either in-house by Yap State Public Service Corporation staff who should already have been trained by the company which installs the system or, if they do not have the capability, outside resources should be brought to conduct training on that particular system. Staff travelling to a regional training centre, e.g. Fiji, would also be a solution.

Annex 1.3 Fiji

Fiji has two Universities having technical training sections. These are:

- University of the South Pacific (USP) with a section called Pacific Technical and Further Education -
- Fiji National University (FNU) which has two technical training sections
 - Technical Training Division and
 - National Training Centre and Productivity Centre

In the last 5 years, FNU has conducted courses in the following areas:

- Renewable energy technologies (e.g. solar PV, solar water heaters, biogas, wind power and micro-hydropower)
- Energy efficiency (e.g. refrigeration and air-conditioning maintenance, motor mechanic, electrical wiring and rewiring of electric motors, efficient land and water transport systems)

FNU has an ongoing electrical course, which includes the use of tools to repair actual equipment and wiring practice for single and three phase systems. From previous contact with FNU, GSES is aware that they have conducted some solar courses, but they did not provide any further details. The course they conduct is approved by the University Senate and is classed as a Level 3 course.

During the VOTEC project, seven trainers from USP and FNU were trained to conduct off-grid solar training courses and, of these 7 trainers, 5 have conducted training.

From the current and future market studies Fiji does have enough market potential that both FNU and USP could be up-skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Operation and maintenance of wind farms
- Maintenance and Operation of Hydro Power Plants
- Design, Installation and Maintenance of Micro-hydro plants
- Operation and Maintenance of biomass/biogas plants
- Sizing , Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Fiji is planning the installation of geothermal power systems. Geothermal power plants require the application of many different skills. GSES believes this training initially will be provided by international training organisations (e.g. from New Zealand). However as the number of these systems increases, FNU and/or USP should be up-skilled to provide training in the Operation and Maintenance of geothermal plants.

Fiji, having the two technical training sections at USP, should become one of the countries that produces local trainers who can travel to other countries to conduct in country training courses. Trainers from Fiji should be identified to fulfil these roles, however they should also be trained to be the trainer of trainers in other countries.

Fiji is a country with a large well established and experienced local industry. People from the industry should be encouraged to work with the training centres and also provide guest trainers.

Annex 1.4 Kiribati

Kiribati has an established technical training centre, the Kiribati Institute of Technology (KIT) that has been conducting training courses over the last 5 years. Two trainers from KIT were trained under the VOCTEC project.

From the current and future market studies, Kiribati does have enough market potential that KIT should be up-skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Solar Water Pumping
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Kiribati also has an active local company, Kiribati Solar Energy Company and one of the staff was also trained under the VOCTEC project: these could also assist KIT.

Annex 1.5 Nauru

With the exception of the APTC Nauru Campus, there was no other training centre identified.

The current and future market identified that Nauru requires the following training courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operations and Maintenance of Grid connect PV Systems
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Nauru with a population of 9488 does warrant that there should be some local capacity to conduct courses on at least refrigeration, air conditioning and energy auditing and applying energy efficiency solutions. The trainer could be an experienced industry person who could travel to Fiji and obtain up training/skilling from one of the universities.

Once this capacity is available and some courses are conducted, a decision could be made on whether the trainer(s) could then be up-skilled to offer grid connect training. Prior to that it would be best if a regional trainer (section 8) travelled to Nauru to conduct these training courses.

Annex 1.6 Niue

There was no training centre identified

The current and future market identified that Niue requires the following training courses:

- Installation of Grid Connect PV systems
- Operation and Maintenance of Grid Connect PV systems

- Operation and Maintenance of Off-Grid PV systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

With a population of only 1,190, it is hard to justify building capacity for training in Niue. However this is one of those countries where a decision is required on whether training should be conducted in country by regional trainers or whether local people should travel to other countries for their training. GSES conducted a grid connect course in June/July 2015, however only 5 people attended. Whilst it may have been more cost effective to send these people to another country, the trainees benefited by installing, as part of the training, a system within Niue and also had the opportunity to visit one of the other large systems (where their skills for maintenance will be required). GSES does believe it is more effective training having regional trainers visit Niue to conduct the training courses. They then did see the local conditions and issues.

Annex 1.7 Palau

Palau Community College (PCC) has already introduced Design, Installation and Maintenance of Grid Connect PV systems and three trainers were also trained under the VOTEC project.

From the current and future market studies, Palau does have enough market potential that PCC should be up-skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Operation and Maintenance of Off-Grid PV systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Annex 1.8 Papua New Guinea

The initial study/survey only identified only the University of Technology PNG in Lae offering courses in sustainable energy, while the APTC College in Port Moresby offered electrician-training courses. However, there are a number of technical colleges located throughout PNG with the potential to offer courses. During the EU-PacTVET, the potential of their training centres needs further investigation and those that could provide some of the many courses need to be identified because, with a population of over 7 million, more than one training centre is required to meet the future demand. Trainers from University of Technology have received training through the VOTEC project. However, of the 3 trainers trained, only one has run an off-grid solar training course.

The University of Technology and other technical training centres (to be identified) should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Maintenance and Operation of Hydro Power Plants
- Design, Installation and Maintenance of Micro-hydro plants
- Operation and Maintenance of biomass/biogas plants
- Sizing, Installation and Maintenance of Solar Water Heaters

- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

PNG is planning the installation of geothermal power systems. Geothermal power plants do require people with many different skills and initially GSES believes this training will be provided by international training organisations (e.g. from New Zealand) however as the number of plants increase than centres in PNG should be up-skilled to provide training in the operation and maintenance of geothermal plants

Annex 1.9 Republic of Marshall Islands)

Republic of Marshall Islands (RMI) has an established technical training centre, the College of Marshall Islands (CMI). Two trainers from CMI were trained under the VOTEC project.

From the current and future market studies RMI does have enough market potential that CMI should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Annex 1.10 Samoa

Samoa has an established technical training centre, the National University of Samoa (NUS). One trainer from NUS was trained under the VOTEC project.

From the current and future market studies Samoa does have enough market potential that NUS should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Operation and Maintenance of off-grid PV systems
- Operation and Maintenance of Wind Power systems
- Operation and Maintenance of Hydro Power systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Annex 1.11 Solomon Islands

Solomon Islands has an established technical training centre, the Solomon Islands National University (SINU). Three trainers from SINU were trained under the VOTEC project.

From the current and future market studies, Solomon Islands has sufficient market potential that SINU should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems

- Operation and Maintenance of Off-Grid PV systems
- Operations and Maintenance of Hydro Power systems
- Design, Installation and Maintenance of Micro-Hydro Power systems
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Annex 1.12 Tonga

Tonga has an established technical training centre, the Tonga Institute of Science and Technology (TIST). Two trainers from SINU were trained under the VOTEC project.

From the current and future market studies Tonga does have sufficient market potential that TIST should be up skilled to offer the following courses:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Operations and Maintenance of Biomass systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

If the Wind system is installed in Tonga than staff from Tonga Power will require training on the maintenance and operation of the system. Since this training is required for a one off system there is no real need to develop resources to conduct this training. This type of training should be conducted either in-house by Tonga Power staff who should have been trained by the company which installs the system or if they do not have the capability then outside resources should be brought to conduct training on that particular system. Staff travelling to a regional training centre e.g. Fiji would also be a solution.

If the landfill system is installed in Tonga than staff from Tonga Power will require training on the maintenance and operation of the system. Since this training is required for a one off system there is no real need to develop resources to conduct this training. This type of training should be conducted either in-house by Tonga Power staff who should have been trained by the company which installs the system or if they do not have the capability then outside resources should be brought to conduct training on that particular system. Staff travelling to a regional training centre e.g. Fiji would also be a solution

Annex 1.13 Tuvalu

During the study/survey the Tuvalu Maritime Training Institute was identified as a potential training centre.

From the futures and market report it was identified that Tuvalu requires the following training courses:

- Installation of Grid Connect PV systems
- Operation and Maintenance of Grid Connect PV systems
- Installation of Off-Grid systems
- Operation and Maintenance of Off-Grid PV systems
- Refrigeration
- Air conditioning

- Energy Auditing and Applying Energy Efficiency Solutions

Further consultation should be undertaken with the Tuvalu Maritime Training Institute to determine whether they could be up skilled to conduct the training courses or whether regional trainers travel to Tuvalu to conduct the required training courses.

Annex 1.14 Vanuatu

Population: 258,521

Vanuatu Islands has an established technical training centre, the Vanuatu Institute of Technology (VIT). Two trainers from VIT were trained under the VECTEC project.

From the current and future market studies Vanuatu has sufficient market potential that VIT should be up skilled to offer the following course:

- Design, Installation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Grid Connect PV systems with energy storage
- Operation and Maintenance of Grid Connect PV systems
- Design, Installation and Maintenance of Stand Alone energy systems
- Operation and Maintenance of Stand Alone energy systems
- Operations and Maintenance of Wind Power systems
- Operations and Maintenance of Hydro Power systems
- Design, Installation and Maintenance of Micro-Hydro Power systems
- Sizing, Installation and Maintenance of Solar Water Heaters
- Refrigeration
- Air conditioning
- Energy Auditing and Applying Energy Efficiency Solutions

Vanuatu is planning the installation of geothermal power systems. Geothermal power plants need personnel with many different skills, and GSES believes this training initially will be provided by international training organisations (e.g. from New Zealand), however as the number of plants increase than VIT should be up-skilled to provide training in the Operation and Maintenance of geothermal plants

Annex 2 Practical Training Equipment and Costs

(All totals rounded to nearest hundred dollars). The prices were obtained at the time of preparing the proposal for the Pacific Sustainable Energy Training Centre. They were obtained in Fiji dollars; the Australian dollar price is also provided. The equipment was selected based on equipment that is currently being installed by the SEI API members. The final equipment brands and models could change.

Annex 2.1 Grid Connect Training Equipment

Item No.	Item Description	Qty	Price (FJD)
1	Supply of 3.95kWp/600VDC/240VAC On-Grid System - 10 x 395W Trina Solar Panel TSM -395W DD15M - 1 x 4kW AC Single Phase Inverter – SMA Sunny Boy SB4.0-1AV-41 - Aluminium roof mount PV structure – 6 clamps per module - AC & DC protection, including cables/conduits and balance of system components.	To Suit	\$15,086.34
2	Supply and Installation of Timber Ground Mount Structure - 6m x 7m Ground mount structure with metallic roof for simulated 'roof'. PV array dimension is 4m x 5m, 1m on each side of array has been allowed for participants to work around the frame. - Inclusive of labour cost.	To Suit	\$12,278.70
3	Supply of Auxiliary Items - 1 x 50W Solar Panel - Everexceed ESM 50-156 - 1 x High Precision Rheostat suitable for 50W Module - 100W 5ohm 4.5A	1 1	\$51.45 \$377.36
	Total (rounded off)		FJ\$27,800 A\$18,650

Annex 2.2 Off Grid Training equipment

Item No.	Item Description	Qty	Price (FJD)
1	Supply of materials for off grid system installation and training - Victron Smartsolar 250V/70A MPPT charge 1. controller suitable to accommodate panels that is to be used for Grid Tie Training 2. - Victron 24V 3000VA 32A inverter/charger 3. - 2V Sonnenschein seal Lead Acid C20 600Ah	1 1 12	

	- DEK Single phase 6.6kVA Generator	1	
	- Protection Devices (Breakers, Fuses)	4 sets	
	- Cables (4mm ² solar, 6mm ² solar, 35mm ² Battery cable, 2.5mm ² TPS, 4mm ² TPS, 6mm ² TPS	1 coil each	
	4.		
	- 12V Flood 155Ah battery	1	
	- Hydro meter	1	
	5.		
	- Bi-carbonate soda, apron, protective googles, eye wash bottle	4 pcs each	\$54,275
	9% VAT		\$4884.75
	Total		FJ\$59,200 A\$39,650

Annex 2.3 Off grid Training – Small Solar Home Systems

Item No.	Item Description	Qty	Price (FJD)
1	*Supply of 8 Sets of Solar Home Systems <ul style="list-style-type: none"> - 16 x 155W 12V 36 Cell Solar Panel - Everexceed ESM 155-156 - 8 x 12V DC 240AC 300W Single Phase Inverter – Morningstar SureSine - 8 x 20A 12V Morningstar Sunsaver PWM Charge Controller - 8 x 12V 200Ah Everexceed Gel Lead Acid Battery - 8 sets of Aluminium PV structures - AC & DC protection, including cables/conduits and balance of system components. - 1 x Small AC load 	8 sets	\$29,184.65
	Total (rounded off)		FJ\$29,200 A\$19,600

*Note the SHS will be a 12V DC/240V AC system which is identical to the system installed by CBS for Department of Energy in Fiji

Annex 2.4 Tools

Item No.	Item Description	Qty	Price (FJD)
1	Pliers - CABAC PLIER HVEP230HL	1	\$54
2	Good quality set of screwdrivers (flat head and Philips head) - CABAC 8pc SCREWDRIVER SET HVSDK6	1	\$87.75
3	Cable cutter - CABAC CABLE CUTTER K40 UP TO 70mm	1	\$70.20
4	Cable stripper - CABAC CABLE STRIPPER KUS4	1	\$72.90

5	Set of metric spanners - GRIPWELL METRIC 14pc SPANNERS SET	1	\$60.75
6	Conduit cutters or equivalent - HACKSAW WITH BLADE	1	\$5.401
7	Rechargeable Battery Drill - MAKITA 18V BRUSHLESS HAMMER DRILL LI-ION DHP483Z	1	\$619.65
8	Set of Metal and Timber Drill Bits – 25pc set	1	\$60.75
9	Metric socket set with extension - METRIC SOCKET SET 27pc JK BRAND	1	\$236.25
10	Allen/hex metric key set - GRIPWELL ALLEN KEY METRIC 9pc SET	1	\$35.10
11	Hammer - Claw Hammer	1	\$40.50
12	Module connectors crimping tool	1	\$333.81
	Total (rounded off)		FJ\$1,700 A\$1,150

Annex 2.5 Testing and Safety Equipment

Item No.	Item Description	Qty	Unit (FJD)	Price	Total (FJD)	Price
1	Multimeter capable of measuring 20A DC current - Extech EX530	8	\$783.74		\$6,269.92	
2	Clamp meter capable of reading up to 20A d.c. - FLUKE-325/APAC	1	\$1,220.67		\$1,220.67	
3	mega-ohm meter (insulation resistance tester up to 1000V) - FLUKE-1503	1	\$2,004.26		\$2004.26	
4	Compass, irradiance meter, inclinometer - Seaward SS-200R	1	\$1,190.12		\$1,190.12	
5	Spirit Level	1	\$47.25		\$47.25	
6	Goggles	16	\$6.75		\$108	
7	Hand gloves	16	\$10.80		\$172.80	
8	Helmet	16	\$13.50		\$216.00	
9	IV Curve Tracer	1	\$5,500		\$5,500	
10	IR Camera (thermal imaging)	1	\$4,500		\$4,500	
	Total (rounded off)				FJ\$21,200 A\$14,250	