



United Nations

**ECONOMIC AND SOCIAL COMMISSION
FOR ASIA AND THE PACIFIC**

**RENEWABLE ENERGY TRAINING
in
PACIFIC ISLAND DEVELOPING
STATES**

***- An analysis and proposal for long-term
provision of timely, relevant and targeted training
on renewable energy***

***Prepared for the
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This paper has been prepared without formal editing. The views and opinions expressed in it do not necessarily reflect those of the United Nations.

Acronyms Used

ADB	Asian Development Bank
APACE	Appropriate Technology for the Community and Environment
ATCDI	Appropriate Technology and Community Development Institute
CATD	Centre for Appropriate Technology Development
CDM	Clean Development Mechanism
EPU	Energy Planning Unit (Tonga)
ESCAP	Economic and Social Commission for Asia and the Pacific
ESCO	Energy Service Company
EU	European Union
FEA	Fiji Electricity Authority
FSED	Forum Secretariat Energy Division
FSM	Federated States of Micronesia
GEF	Global Environment Facility
GHG	Greenhouse gas
GREA	Guadalcanal Rural Electrification Agency
IPP	Independent Power Producer
IRETA	Extension and Training in Agriculture and Rural Development
JICA	Japan International Cooperation Agency
NGO	Non-Governmental Organisation
NZ	New Zealand
OTEC	Ocean Thermal Energy Conversion
PEDP	Pacific Energy Development Programme
PIC	Pacific Island Country
PICHTR	Pacific International Center for High Technology Research
PIDS	Pacific Island Developing States
PIEPSAP	Pacific Islands Energy Policy and Strategic Action Planning
PIREP	Pacific Islands Renewable Energy Programme
PREFACE	Pacific Rural/Renewable Energy France-Australia Common Endeavour
PNG	Papua New Guinea
PPA	Pacific Power Association
PREP	Pacific Regional Energy Programme
PV	Photovoltaic (Solar energy)
PWD	Public Works Department
REG	Rural Energy Research Group (PNG)
RMI	Republic of the Marshall Islands
S.P.I.R.E.	South Pacific Institute for Renewable Energy
SEC	Solar Energy Company (Kiribati)
SELF	Solar Electric Light Fund (International NGO Solar Programme)
SIVCEC	Solomon Islands Village Electrification Council
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat for the Pacific Community
SPREP	South Pacific Regional Environment Programme
UNDP	United Nations Development Programme
UNESCO	United Nations Education, Scientific and Cultural Organisation
USA	United States of America
USP	University of the South Pacific
VFEP	Village First Electrification Programme (Solomon Islands)

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FOREWORD

At the Workshop on Sustainable Energy Policies and Strategies for Pacific Island Developing States (PIDS) held in Suva, Fiji, in February 2002, participants expressed a strong need for capacity building on renewable energy. The importance of the provision of continuous, adequate training on renewable energy was stressed.

A fact-finding mission by the Economic and Social Commission for Asia and the Pacific (ESCAP) to a number of PIDS found that a number of renewable energy projects had not been sustainable. This was often due to the lack of appropriate local ownership and involvement in management and technical backup. Failures were attributed to the inadequate attention given to the needs for local training and institutional involvement for project development and implementation. Because of the small populations and high migration rates of most PIDS, it is difficult to build and maintain such capacity at the national level. A sustained mechanism is needed to provide basic training on renewable energy for PIDS.

Against this background, ESCAP in 2002 initiated a project to support the development of a sustained mechanism for the provision of appropriate training for renewable energy project development, implementation and evaluation and other training pertaining to renewable energy resources and technologies. An initial consultation on project activities and implementation strategy was held in Sigatoka, Fiji, in August 2002.

To date, project activities have included an assessment of training needs pertaining to renewable energy development, two pilot training workshops, one organized by the South Pacific Applied Geo-science Commission (SOPAC) on solar energy project development and one organized by the University of the South Pacific (USP) on wind energy conversion systems.

Building on the results and lessons learned from these activities, ESCAP, with the assistance of Mr. Herbert Wade, an international consultant, and with inputs from with a number of stakeholder organizations in renewable energy training in the Pacific sub-region, has produced this paper. The paper is intended to spur discussions on modalities for developing the training processes and training capacity needed in order to meet a substantial part of the energy demand in PIDS through renewable energy.

Based on analysis of past and ongoing activities and the existing capacities of Pacific Island Developing countries, the paper puts forward a proposed programme for the development of a sustainable renewable energy training process. We invite the representatives from Pacific Island Countries and organizations present at the Regional Energy Meeting, 2004, to discuss the proposed programme, including possible endorsement and options for raising funds for its implementation.

ESCAP wishes to acknowledge with appreciation the valuable contribution made by the consultant and the constructive and useful comments provided by the member organizations of the Energy Working Group of the Council of Regional Organizations in the Pacific in preparing the paper.

I. INTRODUCTION

While past use of non-hydro renewable energy in the Pacific has focused on small scale remote power systems, demands are rapidly shifting towards the use of renewable energy for mainstream energy development. Though rural electrification using solar energy still has great potential for improving the lives of rural people in FSM, RMI, Kiribati and Melanesia, the effect of rural energy development on the national energy economy for those countries will be small. For renewable energy to be a real part of the energy future for the region, large scale use of grid connected hydro, wind, biomass, geothermal and solar PV will be necessary. The training requirements for these technologies are very different both in scope and in scale from those of the past, where bringing together a few technician trainees on an outer island to learn how to install and maintain fifteen or twenty solar systems was considered to be high quality training. The scope is much larger, not just because of more technologies and larger installations, but also because every country in the region has the opportunity and need to participate, while in the past, only a few countries have been serious about renewable energy implementation.

The shift from small scale pilot projects that require one or two training sessions for three or four persons to implementations requiring dozens of people and a continuous training capability is starting to take place now, and is expected to accelerate over the next decade as the economic and environmental pressure to replace fossil fuels with renewable energy increases. The days when the PIDS can leave the responsibility for training of renewable energy personnel to regional organisations are over. For the future, the number of persons to be trained will be too large and the need for continuity of training within each country too great for the main training responsibility to be regional. There will have to be a local capacity for this training designed to specifically fit the needs of each country and it will have to be sustained for the long term. Unfortunately, that capacity does not presently exist in the region, and substantial external support will be required for its development.

The programme proposed in this document is intended to be a first step in that direction, concentrating on the planned development of training and expanding the capacity of the existing institutions within the Pacific Region to deliver competent and timely training for sustained, large scale renewable energy use in the PIDS.

Once the capacity is developed through a regional process, the demand for training should be sufficient to sustain that capacity through funding by implementing organisations. Though regional organisations will need to remain as advisors and to provide intermittent support for specialised training, the bulk of all training should be capable of provision at the local and sub-regional level.

Contents

The programme roots go back more than 20 years with many diverse experiences combining to provide the programme proposed in this paper with a sound base of real experience in the Pacific. So, a brief history of renewable energy in the region and the problems training programmes have faced is provided in Chapter II with more detailed information in Annex I. Chapter III considers the process that can be used for capacity building and the capacity presently available that can be tapped. Chapter IV Outlines the programme proposal with estimated budget and expected outputs. For readers not already familiar with the Pacific context, a description of the main training resources available in the Pacific is provided in Annex II.

II. BACKGROUND

Renewable Energy Development in the Pacific

Because of the difficulty and high cost of conventional electrification and the very limited electrical demand of the rural populace, the Pacific was one of the earliest regions of the world to attempt organized rural electrification using solar photovoltaics. As early as 1985, the high cost and unreliability of fuel delivery, the difficulty and cost of reticulation and the problems of engine and grid maintenance on remote, sparsely populated islands made the use of solar photovoltaics more socially and economically attractive than diesel power, the only practical alternative for electrification. The oil price shocks of the 70's and 80's underscored the vulnerability of the Pacific Islands to wildly fluctuating oil prices and the negative effects such fluctuations could have on their fragile, developing economies. Therefore when the donor community, particularly the European Union (EU), France and the United States of America (USA), offered assistance in implementing solar rural electrification, the island nations welcomed the opportunity.

As pioneers, the island countries had no model to follow so the Pacific effectively became a laboratory for renewables based rural electrification. A wide variety of equipment was tried for biomass gasification, biomass combustion, biofuels, biogas, wind and solar power with a number of different institutional models used for their operation and management. Since there were no successes to emulate and no failures to avoid, every attempt was essentially an experiment. As should be expected in such a situation, the early years saw far more failures than successes in delivering services to the rural areas of the Pacific Islands by using renewable energy.

Many of these early project failures included technical problems that were not related to inadequate local capacity, but by 1990 most of those had been ironed out. Then problems of maintenance and sustainability became the major issues with inadequate capacity for the management and technical support of projects becoming the main problem. For these small rural projects, the largest including only a few hundred users, training needs were modest so training programmes provided by project implementer organisations and supplemented by intermittent regional training activities have been adequate. For example, such local training capacity was developed in Tonga and Kiribati where the implementing organisations routinely provided training for the small number of local technicians needed to operate and maintain the small scale rural solar electrification projects they had in place.

By the end of the twentieth century, plans were in place for large scale development of renewable energy both for its traditional role of rural electrification and for developing its much larger potential to supplement and ultimately replace conventional energy for grid based power generation and transport (see Table 1). This implies an equally large increase in both the scope and scale of training required for the future. The success of those plans to make renewable energy a sustainable replacement for fossil fuels will largely depend on the capacity of implementers to design, manage and maintain the technologies used. Clearly, a major effort will be required to develop that capacity through sustainable training and support systems that meet the needs of the wide range of personnel that will need to be involved in renewable energy development for the Pacific Region.

Renewable Energy Training – Requirements and Problem Areas

The most basic requirements for successful training are that the training:

- reaches the right people
- at the right time
- and
- delivers the right content.

If any of those three factors is absent, the training effort is unlikely to be effective. Specific problems with much of the regional training in the past have been that one or more of these factors have been absent. Specific examples include (a) participants sponsored by a regional programme for overseas photovoltaic technical training who were from countries that had no photovoltaics (PV) programme and no plans for one in the future. (b) a highly technical course on wind power provided to the region far in advance of any likely wind installations in most of the participating countries; (c) training materials intended for high level policy makers that concentrates on describing technologies rather than the effects of the use of the technologies on the national economy and development.

Training to develop the technical and management capacity needed for large scale renewable energy development in the Pacific Islands must overcome several serious obstacles. The more serious of these obstacles are:

- *Relatively rapid turnover of personnel, particularly field maintenance personnel.* A common problem with technically trained personnel is their increased mobility. Technical skills are in demand and personnel with technical training and experience frequently are able to move up to better positions locally or to immigrate to more developed countries. While renewable energy projects usually provide adequate training for project personnel at the time of project installation, when the original personnel leave and new staff is hired, good quality training for the new personnel is needed but is rarely available. This has directly led to project failure in several instances.
- *Small size of most of the Pacific Nations.* With typically around 100,000 or fewer persons in a country, it is not economically practical to maintain advanced technical training facilities for non-mainstream technologies since their demand for training is only for a small number of persons each year. Despite the expectation of rapid growth, renewable energy is not mainstream at this point in time and locally based training in renewable energy technologies is not available except in the largest countries and even then typically only for solar photovoltaic technology.
- *Cost of access to Pacific Islands.* The Pacific region covers a huge area and travel between islands is expensive and usually represents the majority of the cost for regional training activities, not the cost of bringing in external trainers or hiring a top quality venue. For each of the four PEDP / S.P.I.R.E. regional courses, the cost of travel and participant subsistence was nearly 90% of the total training cost. As a result, arranging regional training programmes in order to aggregate the training needs of many countries is expensive and complex to arrange. Indeed, even to aggregate the trainees in a single multi-island country, such as the Federated States of Micronesia (FSM), can be very expensive.

- *Variety of technologies.* Until recently, the majority of the project effort made to introduce renewable energy to replace fossil fuels has focused on solar photovoltaics for small scale energy supply and hydro power for larger scale use. For renewable energy to become a major energy source for the Pacific Islands, biomass, biofuels, wind and geothermal energy will also need to be developed on a large scale.
- *Limited personnel in the region to act as trainers.* Although professional educators with competence in renewable energy are available in several countries at the university level for training high level technical personnel and managers, there are few professional trainers in the region for training the number of persons that will be needed to operate, manage and maintain the large number of new renewable energy installations planned. Most training has been through the use of external experts brought in for short term, one-off training sessions, manufacturer representatives who are not training specialists and who tend to relate only to their own products, and local persons who have received some training in the subject but are not themselves professional trainers. Adding to the problem is the frequent need to provide training in the local language where village based maintenance personnel participate. Throughout the region, English is clearly a second language, and communication in English is not as effective as through the local language.
- *Unique physical and cultural conditions.* Although there are well developed training materials available from the USA, Europe and other industrial countries, the physical and cultural conditions of the Pacific Nations are sufficiently different to make it inappropriate to bring in trainers who are not familiar with the Pacific Island conditions or to import training materials without careful review and modification to fit local requirements. Both trainers and training materials require adaptation to the Pacific environment before they can be fully effective.
- *A lack of any planning for the continual development of training activities.* For about 10 years, there has been no regional training plan nor have there been country plans for renewable energy training. Much of the training that has taken place in the past decade is a repetition of earlier training, often provided to the same people as received similar training a few years earlier. There has been little directed training support for specific projects after their initial installation and there has been almost no support for the development of local training capacity. There has been no coordination of training, no rational training development process and little follow up effort to determine whether or not training activities have actually had any long term benefits.

As an indication of the training structure that has been in place in the Pacific for the past ten years that illustrates both the problem of turnover of staff and of the *ad hoc* nature of energy training in the Pacific, see Annex III, “Training within the Fiji Department of Energy, 1994-2002”.

Review of Renewable Energy Training Programmes in the Pacific

Long range planning for capacity development has not been typical of PIDS training programmes. With the notable exception of the PEDP / S.P.I.R.E./ FSED cooperative training programme of 1986-1994, renewable energy training in the Pacific has typically been either opportunistic and *ad hoc* (trainers, budgets and conditions come

together to make it reasonable to hold a training session), or has been associated with a specific project. Annex I summarises past and current programmes that include a significant training component except for the PEDP / S.P.I.R.E. / FSED joint programme, which is the only long term training programme for renewable energy that has been carried out according to a specific long range plan. That programme is summarised below as an example of a capacity development process that followed a planned path and, through close cooperation between several agencies, made the most of the regional resources available at the time.

The PEDP / S.P.I.R.E. / FSED Photovoltaic Training Effort 1985-1994

The Pacific Energy Development Programme (PEDP) was the first long term Pacific regional capacity development programme. It was developed and managed by the Economic and Social Commission for Asia and the Pacific (ESCAP) from 1982 to 1992 with funding largely from the United Nations Development Programme (UNDP). The PEDP was based in Fiji and was intended to assist the Pacific nations develop the capacity to create energy policy and carry out renewable and conventional energy projects from inception to sustainable operation. PEDP operations varied over the years but typically included staff experts in petroleum, biomass, photovoltaics and policy development who were available on call to support the needs of the PIDS.

S.P.I.R.E. was established in 1983 in Tahiti as a research and development institute to support renewable energy in the French Territories through component testing, technical design, training and research. Funding from France provided for a substantial technical facility and an experienced, high level technical staff.

It was recognised early on by both PEDP and S.P.I.R.E. that for there to be successful renewable energy implementation in the Pacific, a long range capacity development process that followed a specific plan would be necessary if the regional training needs were to be met effectively. In 1985, at the Regional Energy Meeting in Apia, senior staff from PEDP and S.P.I.R.E. met to discuss a cooperative effort to develop a plan for long term capacity development for rural solar energy implementation in the region. The plan that resulted was intended to develop capacity at all levels for the implementation of solar photovoltaics for rural electrification in the Pacific region, the renewable energy technology and application that was considered most likely to be sustainable in the 1980s.

In 1986, the first regional solar energy training course was developed and funded jointly by PEDP and S.P.I.R.E. and held for two weeks at the S.P.I.R.E. facility in Tahiti. Participants included at least two persons from each country responsible for renewable energy project development and implementation. The participants were selected and specifically invited by the course organisers, not nominated by PIDS governments. The course concentrated on solar technology and included about half “hands-on” and half theoretical training.

As the next step, PEDP further developed the technical training materials and S.P.I.R.E. developed a portable PV training “suitcase” that included in miniature all the components of a typical solar lighting system. A graduated field training process was instituted with initially (1987) a “roving” training programme that developed a technician training process and sent a PEDP trainer to 18 islands (14 PIDS) to train solar project personnel in installation and maintenance of solar home systems using local language texts that were translated from the PEDP training materials and using simultaneous translation in the classroom training sessions. Local trainers worked with the PEDP trainer for their skill development and taught the “hands on”

component of the training under the supervision of the PEDP trainer. Approximately 500 persons were trained in basic solar technology during this programme. The feedback from the programme was used by PEDP to develop further improved training materials and by S.P.I.R.E to design an improved training “kit” that matched more closely the training needs of the PIDS.

In 1989, PEDP and S.P.I.R.E. jointly fielded an expert team to visit the PIDS to train trainers to provide a local capacity for field technician training of the type provided by PEDP in the 1987 programme. The expert team remained in each country for one month and worked with existing training institutions to develop a photovoltaic technology training capacity within the target institutions and used the trainers from those institutions to provide a field technician course to local participants. Institutions included a telecom training facility (Solomon Islands), trade schools (Palau, the Maldives, Marshall Islands (RMI)), energy offices in government (Kiribati, Federated States of Micronesia, Cook Islands, Vanuatu, Papua New Guinea, and Tonga) and a non-government organisation (NGO) training centre, the Centre for Appropriate Technology Development (CATD) in Fiji.

In 1990, PEDP and S.P.I.R.E. jointly provided a two week training course in project development and management for, where possible, the same group of persons who attended the 1986 technical course. That course concentrated on the design of rural electrification projects using solar PV including practical work with computers for economic analysis and project management, case studies and actual project design exercises.

Also in 1990, PEDP and S.P.I.R.E. was joined by the Forum Secretariat Energy Division (FSED) when S.P.I.R.E. proposed to FSED that the several million dollars remaining in the FSED managed Lomé II Pacific Regional Energy Programme (PREP) project be used to develop a comprehensive regional training project that involved qualified target PIDS in all aspects of project design, component purchasing, installation and training.

The EU funded PV Follow-Up Programme of 1992-1994 that resulted from S.P.I.R.E.'s proposal allowed S.P.I.R.E. and PEDP to conclude their long term programme with training that included actual projects implemented in five countries (Fiji, Tuvalu, Kiribati, Tonga and PNG). The projects were managed by S.P.I.R.E. and were developed as a large scale training exercise with all aspects of project design, component selection and implementation including participation by the target country personnel. A one week short course was also provided by S.P.I.R.E. in component specification and tender evaluation with participants evaluating the EU tender responses received under the project.

Training in installation and maintenance was included in each country using local trainers supported, if needed, by S.P.I.R.E. experts. Though PEDP was closed in 1992, the training materials used by S.P.I.R.E. in the country training programmes were mostly based on PEDP efforts.

Though the exact cost of the nine year programme was not under a separate budget, toward the end of the programme S.P.I.R.E. estimated the total training programme cost (excluding the Lomé II hardware component but including the training associated with it) at around US\$1.8 million.

Lessons learned from the PEDP / S.P.I.R.E. / FSED experience

The PEDP / S.P.I.R.E. / FSED training was carried out over almost a decade with mostly the same persons involved throughout the period of the programme. This continuity of experience and the wide range of training types that were involved provided information of value for future PIDS training programmes. Some of the more important lessons learned include:

1. Repetition and review is needed and should be spread over several training sessions; a single exposure to training in a new subject is not adequate for long term retention or confident use by participants.
2. A planned progression in training that is directed to the same target group is needed since one single training session is rarely enough to assure adequate capacity development when new technologies or techniques are involved.
3. Constant feedback from implementing organisations regarding training needs is essential to keeping training relevant.
4. Hands-on training is more effective than classroom training but sufficient classroom training must be included to ensure that there is full understanding of the hands-on component. As a general rule, at least half of training activities should be of the hands-on type and it should as closely as possible emulate the actual equipment or activities the training is intended to support.
5. Participants should not be accepted if not clearly appropriate for the training to be provided. Accepting unqualified trainees or trainees not likely to use the information wastes resources and dilutes the effect of the training for the rest of the participants. Ideally participants should be pre-selected and individually invited based on known training needs. This is particularly important when a planned, progressive training sequence is being followed.
6. Local trainers supported by external experts are more effective for local training than external experts brought in as trainers. Local trainers are better able to communicate with participants, they are more sensitive to cultural aspects of the training and the use of local trainers helps further develop local training capacity.
7. It cannot be assumed that there is sufficient competence in English even among well educated PIDS trainees to follow rapid and complex lectures and presentations.
8. Testing of recipient's grasp of presented information on at least a daily basis should be used to ensure that the instruction is being understood and participants are ready to progress to new material. If tests indicate a lack of understanding, immediate review of that material is essential.

Pacific Renewable Energy Training Programme assessment

Project specific training has been relatively effective in supporting the early stages of individual projects, particularly as recently seen in the Pacific Rural/Renewable Energy France-Australia Common Endeavour (PREFACE) and GEF Fiji programmes; though none of the project oriented training activities have included development of the long term training capacity needed for project sustainability.

On a regional basis, it is clear that the PEDP / S.P.I.R.E. long term capacity development programme (later joined by FSED through the Lomé II PV Follow Up project), provided the primary base for successful photovoltaic projects in Kiribati,

Tonga and Fiji and had long term benefits in other PIDS. The technical training materials produced under that programme remain in use throughout the Pacific, and the excellent training in rural household photovoltaic systems, which is offered routinely by CATD in Fiji, by the Energy Planning Unit (EPU) in Tonga, and by the SEC in Kiribati, is a direct outgrowth of the 1989 institutional training initiative under that regional programme. None of these programmes, however, included capacity building for large scale use of grid connected solar, wind, biomass, biogas or geothermal energy or the large scale development of biofuels, the task that confronts the Pacific in the 21st Century.

Table 1 – Sample of PIDS renewable energy plans and goals for the next decade indicating the increasing scale of renewable energy development for the future

PIC	Stated goal or plan for renewable energy use	Status
Cook Islands	Wind power for Rarotonga, utility grade PV power for Pukapuka	Feasibility studies complete or underway
Fiji	4,000 Solar Home Systems for rural electrification FEA 100% renewables	Project document submitted to ADB Joint venture for large scale wind in place, expressions of interest for developing geothermal and solar power requested
FSM	Rural electrification using solar and biofuels	EU funding proposed
Kiribati	All outer island electrification by renewables	By 2005 about 20% complete with project documents for further major expansion being prepared in 2004.
Nauru	Renewable energy for grid supplementation	EU funding proposed
Niue	Large scale, grid connected wind power	EU Funding proposed for 10-15% of power generation to be by wind
Palau	Renewable energy for large scale street lighting	EU funding proposed
PNG	Major expansion of gold mine geothermal facility	Private sources
RMI	Majority of outer island electrification by renewables	Several million US\$ of EU funding and local budget expected to be committed shortly
Samoa	3-5 MW of Biomass/biofuels and hydro	Feasibility studies completed, underway or feasibility studies funded and soon to begin
Solomon Islands	Excellent biomass/biofuel, hydro and solar resources	Conceptual only with several feasibility studies underway or completed; no specific large scale renewable energy projects in the pipeline
Tokelau	100% renewables for the future	100% renewables statement made in the draft energy policy expected to be approved shortly by the Fono. Installation of 10kW solar for power generation on Fakaofu in 2005 with UN funding and staged increases intended if the pilot is shown to be technically reasonable
Tonga	Addition to and upgrade of outer island solar	New Zealand (NZ) funding for Niuas in place and plans being developed for other island group expansion and upgrade of solar home systems.
Tuvalu	Addition of solar to existing grid systems	Under consideration (the original proposal provided by Tuvalu Electricity Corporation for outer island electrification included the concept of making the systems into hybrids in the future)
Vanuatu	Excellent geothermal, small hydro, biomass/biofuel and solar resources	Conceptual only with several feasibility studies underway or completed; no specific large scale renewable energy projects in the pipeline

This is a challenge that the Pacific Island Countries (PIDS) will find hard to meet. Human resources are limited, the existing technical skills base for renewable energy development is small and there is little local capacity for the development of the skills needed for large scale renewable energy implementation of multiple technologies. Though the *ad hoc* training efforts and limited externally sourced training has been more or less adequate to sustain the small number of renewable energy pilot projects of the past, this approach will not be sufficient for the future. The pilot projects of the past have been mostly carried out by Government energy offices, allowing regional training efforts to be focused on a small, relatively unchanging group of people. Large scale projects will have to be carried out by diverse private and public organizations that must be able to access training on demand, not waiting months or years for the appropriate training to be made available. Meeting such training needs requires the development of significant in-country and sub-regional capacity to train and maintain the training of a relatively large number of renewable energy technicians, supervisors and support personnel leaving dependence on external training only for those high level personnel needed for project design and top level supervision that are too few in number to permit local development of training capacity.

Increasing the capacity for in-country training and utilisation of the existing training institutions for renewable energy training in individual PIDS, on a sub-regional basis, and on a regional basis, is the focus of the programme proposal put forward in Chapter IV. The goal of the programme is to provide planned training development to support the rapidly increasing training needs foreseen for the future.

Training Resources available in the Pacific

Although few renewable energy programmes exist in Pacific training institutions, there are many training institutions that can provide renewable energy training if properly developed. These include:

University of the South Pacific. With a well developed distance learning programme, USP has the capability of delivering higher level training to almost all PIDS as well as the usual university on-campus programmes for diplomas, certificates and degrees.

Local Universities. There are a number of other universities that serve only their home country. Most have science or technical programmes that can be developed to include renewable energy.

Trade and vocational schools. Almost all PIDS have at least one school devoted to the training of electricians, mechanics, plumbers, etc. that can incorporate lower level training for technicians working in the field of renewable energy.

Corporate, Utility, Telecom and other training facilities. These include the solar rural electrification training provided by the Tonga EPU and the Solar Energy Company of Kiribati, solar power training as in the Solomon Islands Telecom training centre and training centres developed by several PIDS utilities such as at FEA in Fiji.

Other public and private training institutions. These include such organisations as the Centre for Appropriate Technology Development (CATD) in Fiji, the marine training centres in several PIDS, the Don Bosco schools in several PIDS, some NGOs and private training companies focusing on business and computer technology.

Regional Organisations. Pacific Islands Forum Secretariat, PICHTR, PPA, SOPAC, SPC, and indeed most regional organisations serving the Pacific have developed and delivered training programmes to PIDS.

Donor organisations. ESCAP, EU, UNDP, UNESCO and other donors have developed and delivered training programmes to PIDS, often in association with development projects.

Manufacturers and vendors. Training has been developed and provided by various vendors and manufacturers for delivery to PIDS particularly where high cost technical products, such as biomass boilers; require speciality training for their installation, operation and maintenance.

Annex II provides further information on Pacific training resources.

III. RENEWABLE ENERGY CAPACITY BUILDING PROCESSES AND RESOURCES IN THE PACIFIC

Formal training

Types of training needed

A wide range of training types are needed to facilitate large scale renewable energy development. When renewable energy is being implemented on a large scale, these include those shown in Table 2 as a minimum.

Table 2 – Summary of PIDS training needs, target groups, content and training provision requirements

Training type	Training level	Summary of typical content	Frequency of provision	Possible provider
Energy planning	Senior energy officers, senior management in business	Socio-economic analysis, surveying methodology, resource assessment, renewable technology characteristics, data collection and analysis	Infrequent (e.g. Biannually)	University with regional organisation assistance
Project design and management	Mid-level energy officers and middle managers in business	Detailed knowledge of renewable technology characteristics, needs assessments, budgeting, scheduling, economic and financial analysis, finance, human resource management, computer tools for project management	Infrequent (e.g. biannually)	University with regional organisation assistance
System design	Senior technical personnel	Performance estimation methods, component characteristics, operating efficiencies, resource availability, potential problem areas, failure modes and risks,	Annually or on demand	University or Technical school
Specification and purchasing of components	Senior and mid-level technical personnel	Fitting specifications to needs and environmental constraints, purchasing methodology, tender preparation and evaluation, critical and non-critical specifications, warranty needs, information needs, standards and certifications	Frequent (e.g. every 6 months) or on demand	Technical school
Installation services	Mid and low level technical personnel	Guidelines for installation of the target technology, Critical points for proper installation. Alternate methods for unusual circumstances	Continuously available or on demand	Trades school or vendor training and operator OJT
Maintenance services	Mid and low level technical personnel	Troubleshooting and maintenance procedures, use of test equipment, identification of incorrect operation, user interaction	Continuously available or on demand	Trades school and operator OJT
Business skills for renewable energy implementation	Businesses interested in developing renewable energy	Market assessment, product pricing, after sales support, record keeping and analysis, marketing of the product or service, obtaining and efficiently using finance, forecasting of cash flows, development of service businesses	Annual	University or business school
Finance of renewable energy systems	Businesses interested in developing renewable energy	Sources of finance, incentives and special conditions for renewable energy, CDM and its effect, accessing grant funds, preparing financial applications	Infrequent	University or business school

Participant groups for training

Since renewable energy development is not part of the general educational experience for Pacific Islanders, just about everyone must receive some aspect of education about renewable energy and its application if the technologies are to be accepted and their applications are to be sustainable.

Under the heading of “training” comes a broad range of requirements, from the education of high level decision makers in the economic, political, social and

developmental effects of the use of renewable energy technologies on down to the basic operational training that must be provided to the users of the technologies and the information delivery to the general public who in the end must pay for the projects.

The primary target groups for training in connection with renewable energy development are shown in Table 3.

Table 3 – Target groups and their characteristics.

Target group	Characteristics	Typical approach training	Number of participants
Policy developers and high level decision maker (Senior energy officers, senior management in business)	Senior elected officials and high level civil servants. Top management at utilities and major public and private organisations. Diverse educational and experience background.	Very short term, multiple exposure approach through special sessions at high level meetings	Small. Requires regional or external training development
Project designers (Senior technical personnel)	Technically trained, usually with a university degree. Mid to high level civil servant or middle to upper management in a public or private organisation.	Medium term University level courses and short term specialty courses externally provided	Small. Requires regional or external training development
Project managers (Mid-level energy officers and middle managers in business)	Low to mid-level civil servants or middle management in a public or private organisation	Local courses in management and administration with specialist training from project implementers	Medium. Local training possible for most countries with some regional, specialised training.
Supervisory personnel (mid level technical personnel)	Several years of operational experience with the technology, specialised technical background, administrative and analytical skills required.	On the job training, Local training in administrative and supervisory skills, short externally developed intermediate level technical training programmes	Medium. Local training appropriate. Sub-regional specialised training may be useful.
On site operators and technicians (low level technical personnel)	Limited prior education, competence in English cannot be assumed	Local trades schools and implementer training programmes	Large. Local training required
Users	Diverse backgrounds. Competence in English cannot be assumed.	Only specific information needed to ensure proper use of energy provided.	Large. Local training required.
The general public	Diverse backgrounds. Competence in English cannot be assumed.	General information to ensure understanding and acceptance	Very large. Local programmes required.

Training of trainers

Essential to the training of the actual participants in the development of renewable energy is training of the renewable energy trainers. This is to some extent true at all educational levels but especially so for the local trade schools where there has typically been no experience at all with training on renewable energy technologies. It is, however, these local educational institutions that will have to form the basis of training and education for large scale use of renewable energy technologies in many PIDS. Without their active participation, there cannot be sufficient competent personnel at the basic operating and maintenance level to assure long term sustainability. Therefore, there must be a well defined and consistent effort to upgrade the skills of teaching staff at local technical training institutions, assist in the integration of renewable energy concepts into existing courses and curricula, develop

new courses where necessary and ensure that there are adequate facilities to support needed renewable energy training.

Sharing of Experience

Though the renewable energy experience in each PIDS is limited, the Pacific region has a very diverse experience base covering nearly all the renewable energy technologies available to any PIC. A formal process for the sharing of that experience through a regional organisation would be of great value to countries embarking on the development of an unfamiliar renewable technology.

There also needs to be a process in place whereby operators of renewable energy projects would regularly provide feedback regarding the performance of system components to a regional organisation that will in turn disseminate that experience to other users of the renewable technology in the region and to the suppliers and manufacturers of products supporting that technology. Information about component performance is very useful to other users of the technology to help ensure that specifications for future projects lock out components known to perform poorly in PIDS conditions. Feedback to manufacturers and suppliers of components is essential if they are to improve their products to meet PIDS needs and for them to understand the reasons behind unusual or especially stringent specifications for purchases by the PIDS.

The secondment of inexperienced personnel to work with experienced personnel in other PIDS or other more experienced local organisations has been shown to be of value in the past and offers another important means of sharing renewable energy experience.

Independent expert advice

The small size of the PIDS makes it unlikely that high level expertise in renewable energy technology will be developed and maintained locally. Developers of renewable energy systems find it difficult to determine whether or not manufacturer claims for their technologies are accurate, and whether or not proposals from outside organisations are appropriate for PIDS use. Readily available, external expertise that is independent from manufacturers, suppliers or other biased information sources is needed to assist PIDS in evaluating the many renewable energy products, proposals and services offered by outside sources.

Conclusions

Based on discussions with energy officers from the region and with persons having long term experience in energy programmes for the Pacific and evaluation of the many programmes that have included energy related training and capacity building as part of their effort, the most successful programmes appear to have been PEDP with advisory and training assistance to governments and energy offices, S.P.I.R.E. with its advisory and training assistance to project managers/energy planners and Lomé III PREP with its mix of advisory and training assistance to utilities. In all three instances the success was due to the mix of resident experts able to provide independent advisory services and the provision of focused and well developed training services that fit the needs of the PIDS at that time.

Therefore, it is proposed that a programme that is intended to successfully support large scale renewable energy development in the Pacific also include both advisory services and training development activities.

IV. PROPOSED PROGRAMME

Rationale

Table 4 lists the primary training barriers that were summarised in Chapter I, and indicates how the proposed programme intends to reduce each barrier to a manageable level. It is emphasised that the concept is barrier reduction, not barrier removal. The complete removal of barriers is almost never possible except at unacceptable cost. Barrier reduction to the point where their effect is acceptable is the approach taken here.

Table 4 – Methodology for barrier reduction for renewable energy training

Barrier	Barrier reduction mechanism
Rapid turn over of personnel	Training for types of personnel present in larger numbers (e.g. local service technicians) available continuously or with a delay not to exceed a few months.
Small size of the PIDS	The programme would utilise existing institutions, there would be no creation of new entities for training. USP distance learning facilities would be used to maximum advantage. The regional programmes would continue to provide highly specialised training external to the countries but in a coordinated fashion to take maximum advantage of training opportunities and to fit as closely as possible with the timing needs of the countries. Sub-regional facilities would be developed where appropriate to meet special technology training needs to cover the advanced training for several nearby PIDS.
Cost of access to the PIDS	Emphasise local training development and distance learning to minimise the need for international travel to or from PIDS for training. Develop sub-regional training centres specialising in renewable technologies suitable for sub-regions. For example, a biomass development centre serving Melanesia or a solar rural electrification centre in RMI to serve FSM, RMI and Kiribati development of outer island electrification using solar home systems.
Variety of technologies	Include full time staff specialists in the primary renewable technologies for the region (biofuel/biomass, solar/hydro, Grid connected wind and solar). Arrange training to fit only the technology needs of each country. For example Tuvalu would probably develop training for solar and biofuels while Niue may develop only training for wind power. Typically, the larger the country the more types of renewable energy resources there are to be tapped but also the more training institutions there are for development of that training.
Limited personnel for trainers	Use virtually all training institutions available in a country to support renewable energy training by developing programmes for training of trainers for all classes of educational institutions. Utilise USP's distance learning facilities to the maximum to allow effective training without locally present trainers. Utilise DVD based training courses for specialist material that will be used over and over. Provide access to Internet information data bases.
Unique physical and cultural conditions	The programme staff will be resident in the Pacific and will have the time to understand the unique requirements for Pacific training processes. Bringing in short term experts will be reasonable for technical component development, e.g. course modules for trade schools, but resident experts will be needed to make the decisions regarding overall content and delivery mechanisms that fit the needs and resources of the PIDS.
Lack of planning for training both at the regional and at the local level	A primary activity for the first year of the programme will have to be a detailed training needs assessment and forecast for each of the countries and for the region that is further developed into a comprehensive training plan. This plan is expected to be a "rolling" plan that is reviewed periodically and extended.

Programme Structure

The overall goal of the programme would be to set in motion a renewable energy training and capacity building process that, once fully established, could operate with

minimal external expertise or funding. This process is expected to take an absolute minimum of three years and a five year programme is proposed as the optimum.

The intent of the project is to develop capacity within local and sub-regional training institutions and not to create institutions where none exist. Training of participants will take place under the programme but mainly to provide on the job experience for the training institutions that are to carry on after this programme ceases. The personnel attached to the project will be responsible for ensuring that the necessary components are developed to allow the local institutions to take over and continue to provide renewable energy training with a minimum of added effort or cost. Because years of effort will be necessary to overcome the bureaucratic and operational hurdles that exist in attempting to carry out local training development in each PIDS, the specialist personnel will need to be able to focus full time on the project. Contracting for external expertise will only be practical for short term tasks such as development of training modules, informational packages, etc.

It is clear that this will need to be a major effort with its own budget and personnel and is not a programme that can be easily integrated into existing regional efforts. Initial comments from various regional organisations also make it clear that for the programme to work, it must be under one roof. The approach used for PIEPSAP, where a fiscally independent programme with its own personnel and internal structure is managed by an existing regional organisation, is considered to be the most efficient and realistic approach for a regional training development programme. For this type of programme it is recommended that SOPAC be the host organisation since it has been designated as the lead agency for renewable energy programmes, it has demonstrated a willingness to freely make available the information it develops – an essential trait for a programme of this type – and because it has considerable internal experience with training programmes in general.

Programme Outputs

For large scale, sustainable development of renewable energy in the Pacific, focused training programmes that specifically meet the targeted needs of each country will be vital. For this to happen, it will be important to:

1. Develop a long range plan for capacity development intended to facilitate the large scale integration of renewable energy into the mainstream energy economies of the PIDS.
2. Provide for a regular assessment of country needs for training and the development of an ongoing regional energy training plan always extending at least two years into the future.
3. Have an ongoing review of the effectiveness of training activities and include ongoing upgrading of efforts as a result.
4. Develop a clearinghouse for external training programmes in energy that can bring together the persons in the region needing specific training, the organisations providing that training and the funding sources to support the training.
5. Prepare high quality information packages and presentations for policy makers and high level decision makers explaining the role of renewable energy in development, climate change, private enterprise and national security. Since these persons frequently change and technologies change, the information services will have to be continuously available and kept up to date.

6. Prepare information packages and curriculum components for general educational use over the long term (expanding existing public school energy information programmes).
7. Provide advisory services to assist project developers and private enterprise in obtaining independent expert advice regarding renewable technologies, project structures, business methods and other information not readily available to governments and businesses in the region. The important technical areas that need to be covered presently include rural electrification with solar PV, solar thermal systems for water heating, small hydro for village electrification, grid connected wind systems, grid connected solar systems and the use of agricultural energy products including biomass combustion, biomass gasification and biofuels.
8. Assist PIDS trade schools through the curriculum development process in order to allow them to provide both short term training and renewable energy content that is integrated into existing trades curricula for local technicians and businesses. This will include actual preparation of course modules, instructor training, provision of essential facilities for renewable energy training and ongoing support for completing the lengthy bureaucratic process for the addition of new content to existing courses.
9. Assist USP develop courses for USP extension delivery (and local delivery where appropriate educational institutions exist) focusing on business aspects of renewable energy including but not limited to rural marketing of energy technology and services, operations management of Energy Service Company (ESCO) type businesses, business plan development and financial management for ESCO type businesses.
10. Locate suitable institutions and develop sub-regional training centres focusing on renewable technologies relevant to that sub-region such as a centre focusing on biomass in Melanesia to serve PNG, Solomon Islands, Vanuatu and Fiji or a centre focusing on solar home system use for rural electrification to serve FSM, RMI and Kiribati.
11. Develop courses for USP extension delivery (and local delivery where appropriate educational institutions exist) for energy planners including a general course in renewable energy technology as well as specialist courses in energy project development and management, policy development and implementation, economic analysis of energy options and energy survey principles and practices.
12. Establish a secondment programme expanding on that already provided through SOPAC to allow countries with successful renewable energy programmes to receive interns from other countries for on-the-job training.
13. Develop and deliver common training programmes as needed for multiple countries requiring external expertise (e.g. tender evaluation training for the five countries to be part of the EU ACP programme) and not appropriate for development through local or sub-regional institutions.
14. Coordinate training development with projects planned by donors, regional organisations, international financial institutions and private enterprises.
15. Other training related activities determined during programme operations.

It is noted that almost none of these items can be considered new or even untried in the Pacific. Most of these have been recognised for many years as being rational components for PIDS training. Unfortunately, the budgets have been small, the regional impact equally small and the efforts have followed no capacity development plan that attempts to ensure that the “right people receive the right message at the right time”. Few of these items can provide significant benefit if done in isolation. It is necessary that there be a combination of different capacity building components acting together to result in long term, large scale benefits.

Personnel requirements

Although a great deal of the work will need to be carried out by short term specialists under contract, a permanent expert staff of at least four persons will be required in order to provide the advisory and support services that must be an integral part of the programme. These four experts will be required to spend much of their time in the field since the project is specifically focused on the development of local training capacity. That cannot be done at a distance, each of the 14 countries of the region will require at least one month of field time to develop the training capacity supported by each of the three programme specialists. With one to three months of time needed between country visits, this activity alone requires up to two years from each specialist.

Four senior experts would thus be available to provide direct advisory assistance to businesses and government agencies and would manage the development of the specific training tasks within each of their categories. Three of the experts would focus on working in the field to develop local training capacity and one would focus on planning, coordination, management of short term contractors and administration.

Programme Manager

The programme manager should be a senior level person with broad experience in renewable energy technology applications in developing countries and have specific experience in the provision of technical training to persons with English as a second language and in a developing country context. Prior Pacific experience is strongly preferred.

The programme manager would be responsible for overall coordination of training activities, development of the ongoing regional training plan, hiring of external specialists for training development and delivery and general management of the resources made available to the programme.

The Programme Manager should have specific expertise in business development in developing countries and will be responsible for business advisory services to the PIDS businesses and for the development of long term training programmes for renewable energy business development. The Programme Manager will spend the bulk of work time at the project base.

Utilities Expert

The utilities expert should have a number of years of experience with small utility operations, the use of Independent Power Producers (IPPs) by small utilities and have direct experience in the integration of renewable energy, notably wind and solar photovoltaics, into small utility operations as hybrid generation systems as well as for solar or wind supplementary generation. The utilities expert would be responsible for providing utilities of all sizes with technical advice, management advice and

operational advice in the integration of renewable energy into utility operations. Since IPPs and cogeneration will be important components in the large scale use of renewable energy for power generation, the utilities expert must be experienced in IPP/utility interactions including payment structures, contractual arrangements and risk abatement for both the IPP and the utility. Though the PPA would be the obvious location for such a person, there would be many conflicts with the confidentiality of utility information and member limited services, should PPA choose to continue such policy. To be successful, this programme must be open and freely accessible to any organisation that is or aspires to be a provider of grid delivered electricity including such “utilities” as the outer island power systems of the Cook Islands, the community operated power systems of the Ha’apai Group in Tonga, the Community-Centre operators of PNG, the PWD operating the Provincial Centre power systems of Fiji and existing and potential IPP operators from the private sector.

Biomass Energy Expert

For the large scale replacement of fossil fuels by renewable sources, biomass is one of the most important resources available to the Pacific countries. In particular biofuel development holds great promise for fossil fuel use reductions and the provision of major GHG benefits. Therefore a senior expert with broad expertise to develop local training capacity and advise countries in biomass based technologies including gasification, combustion and biofuels will be needed both to provide direct advice to governments and private enterprise and to develop a locally and sub-regionally focused, long term training programme sufficient to maintain the needed skills for implementing biomass technologies in the Pacific sustainably.

Rural Energy Expert

For about half of the PIDS, rural energy development remains a development priority. A senior expert with experience in the development of rural energy through photovoltaics and small hydro will be needed to establish a local training capacity and provide advisory services to private enterprise and governments as well as to develop local and sub-regional long term training programmes for maintaining the capacity to implement and maintain rural energy systems.

Support staff

It is anticipated that some of the support activities, notably financial accounting and travel arrangements, will be handled by the regional organisation hosting the programme.

Contracts and Administrative officer

Because most of the actual course and information development processes will have to be contracted to external developers who are professional educators and information delivery specialists, a number of contracts will need to be prepared and managed. This will be the primary task of the contracts and administrative officer. Additional tasks will include office management and administrative support to programme staff and liaison with the host organisation’s administrative system.

Short term staff

It is likely that in the early years of the programme, there will be a need for additional support staff due to the high level of development activity that will be taking place. After the first 12-18 months of operation, this can be expected to decrease and as the

programme shifts more and more of its operations to local organisations, the activity level of the programme can be expected to gradually decrease.

Indicative Budget (USD)

This programme represents an estimated total cost of US\$3,209,000 spread over five years, about the same as the Lomé III capacity building programme that was of similar breadth of scope but was directed mainly at utilities. It is assumed that some of these costs would be co-financed by donors, such as the EU, France, Australia, New Zealand and Japan, to provide training support for their projects. Though there is no way to predict the acceptance by donors of this regional training development concept, the EU has indicated a continuing and large scale support for renewable

Table 5 – Indicative Budget (US Dollars)

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Staff	\$520,000	\$480,000	\$480,000	\$350,000	\$300,000
Contractors	\$300,000	\$250,000	\$100,000	\$75,000	\$50,000
Travel	\$65,000	\$40,000	\$40,000	\$35,000	\$20,000
Communications and overhead	\$24,000	\$20,000	\$20,000	\$20,000	\$20,000
TOTAL	\$909,000	\$790,000	\$640,000	\$480,000	\$390,000

energy activities in the Pacific directed toward the signers of the Cotonou Agreement¹. Without the provision of substantial training, the risk of project failure will be high. The EU will therefore need to spend substantial funds in the development of European supported training activities associated with their hardware projects if there is no local capacity for that training. That burden could be shifted to a Pacific regional programme for the same or lower cost. With the further promise of long term availability of training, France also has historically provided major funding for capacity development through S.P.I.R.E., SPC and other Pacific agencies and has indicated a strong interest in local capacity development that addresses the goal of poverty reduction – something that local training capacity development can accomplish.

Programme results

After the completion of the programme, there should be continuing and sufficient renewable energy training made available through USP and other universities, trade schools, NGOs and regional organisations to provide the capacity needed to support large scale renewable energy use. Since once the initial hurdles of preparation and facility development are over, the great majority of these training activities can be self-funding; external support will be needed mainly for overseas training activities, scholarships for high level training and upgrading of course materials on about a five year cycle. Those tasks can be handled under existing regional programmes with the level of fiscal support currently in place. With the development of sufficient capacity to manage most if not all mid to low level training, SOPAC should be able to carry out the other tasks, such as updating the regional capacity development plan, assessing needs for training, reviewing the effectiveness of existing training, maintaining a clearinghouse for overseas training, continuing its personnel

¹ Cook Islands, Fiji, FSM, Kiribati, Marshall Islands, Niue, Nauru, Palau, PNG, Samoa, Solomon Islands, Tonga, Tuvalu.

secondment programme and continuing to provide specialist courses that cannot be provided locally in a manner that fits into the long range capacity development plan.

However, the advisory services for the support of project developers and businesses will be lost with the closing of the programme, and five years will not be sufficient time to develop the necessary local expertise though certainly the experience gained will help close the gap. A much smaller but still vital follow-on project should be developed as part of this programme to provide at least an additional three to five years of support for the continued provision of independent advice to project developers and business through SOPAC or other regional programme. The follow-on project could be expected to use external experts not necessarily resident in the region and paid on the basis of need for their services rather than retained under long term contract.

V. ANNEXES

Annex I – Review of Pacific Programmes with Significant Renewable Energy Training Content

Completed programmes

European Community Lomé II Pacific Regional Energy Programme (Lomé II PREP). The Lomé II PREP of the European Community acted primarily as a programme to demonstrate various renewable energy technologies throughout the Pacific region. Commencing in 1982 and spanning over 14 years, the PREP was hardware oriented and provided training only directly in association with specific hardware implementations.

Pacific Energy Development Programme (PEDP). The first regional capacity development programme was developed and managed by ESCAP from 1982 to 1993 with funding largely from UNDP. The programme was based in Fiji and was intended to assist the Pacific nations develop the capacity to create energy policy and carry out renewable energy projects from inception to sustainable operation. PEDP operations varied over the years but typically had on staff experts in petroleum, biomass, photovoltaics and policy who were available on call to support the needs of island governments. As a part of the programme, a graduated training process was instituted for solar energy with initially (1987) a “roving” training programme that developed a training process and sent experts to 18 islands (14 countries) to train solar project personnel in installation and maintenance of solar home systems. Approximately 500 persons were trained in basic solar technology during this programme.

In 1989, PEDP fielded a larger expert team to visit the countries to train trainers to provide a local capacity for field technician training of the type provided by PEDP in the 1987 programme. The expert team remained in each country for one month and worked with existing training institutions to develop a photovoltaic technology training capacity within the institutions. Institutions included a telecom training facility (Solomon Islands), trade schools (Palau, Maldives, RMI), energy offices in government (Kiribati, FSM, Cook Islands, Vanuatu, PNG, Tonga) and an NGO training centre (Centre for Appropriate Technology Development – CATD – in Fiji).

South Pacific Institute for Renewable Energy (S.P.I.R.E.). Though initially established in 1983 to support renewable energy in the French Territories, S.P.I.R.E. and PEDP cooperated in developing a training programme for energy officers in the Anglophone countries. The first regional PV technology training by S.P.I.R.E. was held in Tahiti in 1986 and further training programmes in PV Project Design and Management and PV Project Tender Specification and Evaluation were held in 1990 and 1992 respectively. As PEDP, S.P.I.R.E. retained experts to support Island energy offices on demand on problems with renewable energy implementation. After 1995, S.P.I.R.E. was dramatically reduced in scope and no longer provided regional services.

Forum Secretariat Energy Division (FSED). Until its shift to SOPAC in the late 1990s, the Forum Secretariat maintained an energy group that provided intermittent training for energy offices primarily in energy policy development, energy database development and maintenance, petroleum pricing issues and support to renewable energy projects that were managed by the Forum Secretariat. In the early 1990s, the FSED worked in close coordination and cooperation with PEDP and S.P.I.R.E. in the support of renewable energy activities in the Pacific Region.

European Union Lomé III Pacific Regional Energy Programme (Lomé III PREP). While the Lomé II PREP was hardware oriented with a small training component, the Lomé III PREP was exclusively intended to provide capacity building through training and technical support with a focus on conventional energy and utilities. The programme operated from about 1993 to 1997 and emphasised capacity building for Pacific national power utilities through training and the provision of external expertise. A small allocation in the programme supported Pacific islanders to attend international training courses in renewable energy technologies but no local capacity building for renewable energy was included.

Secretariat for the Pacific Community (SPC). Formerly the South Pacific Commission, the SPC is located in Noumea. The SPC includes both the Francophone and Anglophone countries of the Pacific. Some renewable energy projects were established in the 1980s and 1990s as part of the SPC rural development effort. Trainings were provided in association with those projects. In the early 2000's, the PREFACE project (jointly funded by France and Australia and managed by SPC) provided village scale photovoltaic projects to Vanuatu, Tonga and RMI and a small wind project to support the power grid on Mangaia, Cook Islands. Some excellent project oriented training was associated with that project as well. The SPC provided one of the few training opportunities for biofuel use and preparation as part of the two coconut oil biofuel pilot projects the SPC funded in Fiji.

In 2000, SPC began phasing out its energy programme and no longer does significant work in that sector though there remain programmes in forestry and agriculture that could be relevant to biomass and biofuel capacity development.

GEF Fiji Project. From 1999 to 2002, the Global Environment Facility (GEF) funded a project at the Fiji Department of Energy that specifically was intended to develop the institutional structure for large scale renewable energy development in rural Fiji. Initially the project focused on implementing hybrid technologies but was expanded to include all renewable energy technologies with emphasis on developing an institutional structure that could partner government with the private sector in the implementation of rural energy systems. Training for renewable energy business development, hybrid technology, renewable energy resource assessment and photovoltaic technology for household solar was included under the project. The business training included trainees from Tonga and the Cook Islands (funded by the PREFACE project) as well as the trainees from Fiji.

Continuing programmes

Centre for Appropriate Energy Development (CATD). Initially developed and operated by the Hans Seidel Foundation of Germany and presently operated by the Ministry for Fijian Affairs, the CATD has as its purpose the development of rudimentary technical skills for Fijian villagers. Small engine maintenance, basic carpentry, plumbing and other basic technical skills are taught to small groups of men from Fijian villages who, upon completion of the course of study, are expected to return to their respective villages and act as local “handymen” to take care of the basic technical needs in the village. In 1989, PEDP trained instructors at CATD and provided equipment needed for the training of village technicians responsible for maintaining home PV systems. That programme has continued through to the present. The CATD site has also been the venue of several local and regional renewable energy training programmes, though not taught by CATD staff.

University of the South Pacific (USP). The USP is a regional university with primary campuses in Fiji, Samoa and Vanuatu and facilities in all the Anglophone Pacific Nations except FSM, Palau and Papua New Guinea (PNG). Courses on renewable energy have been offered by the Physics Department since the early 1980's and more recently by the Technology Department. In the late 1980's an Energy Studies Group emphasising renewable energy was formed and operated for several years doing research into renewable energy for the Pacific and providing assistance to regional programmes in energy. Several regional training courses in renewable energy technology, including one on wind energy sponsored by ESCAP in 2004, have been provided by USP using external funding.

PNG University of Technology (Unitech). Located in Lae, Unitech is the primary university level technical training institution in PNG. Unitech has had small research programmes in renewable energy, notably micro hydro and agriculturally related energy sources, since the 1980s and has provided intermittent training in renewable energy directly and through its Appropriate Technology and Community Development Institute (ATCDI). Outreach is also planned through its proposed Rural Energy Research Group (RERG).

Pacific Power Association (PPA). Organised in 1990 with support from PEDP, the PPA was intended primarily to provide a forum for the exchange of experience among the power utilities of the Pacific. In addition, the association provides the opportunity for training of utility personnel as a group rather than individually. Though the PPA has developed no internal training capacity, it can organise training programmes for utilities if externally funded. Renewable energy has been a subject of discussion at several of the annual PPA meetings and specific training for utility based renewable energy is to be offered through the PPA to member utilities in 2004 and 2005. Training programmes have not been opened to non-members of PPA.

South Pacific Applied Geoscience Commission (SOPAC). Currently SOPAC is the lead agency for the coordination of energy related programmes to the Anglophone Pacific. A wide variety of training programmes are provided though not as a part of a specific capacity development plan but rather when funding is offered by a donor or when associated with a specific project managed by SOPAC. The training may be a "pass through" effort such as the EU sponsored PV training offered in 2002 at CATD where SOPAC only arranged logistics for the training or the training may be directly organised by SOPAC as was the late 2003 ESCAP Pilot Training Programme on Photovoltaic Project Development. Although clearly understanding the training needs of the region and supportive of a wide range of capacity development activities, SOPAC is hampered by funding and human resource limits and a lack of a comprehensive capacity development plan for the region that ensures logic and direction to its efforts.

Pacific Islands Energy Policy and Strategic Action Planning (PIEPSAP). A Danish funded programme operating under SOPAC that is intended to assist PIDS in the development of energy policy and strategies. Capacity building for policy and national strategy development is one important focus for the programme though not specifically for renewable energy. PIEPSAP is being executed by SOPAC but has its own budget and staff complement. The programme began in September 2004 and at the time of this writing had not fully developed its action plan.

South Pacific Regional Environment Programme (SPREP). SPREP is the regional programme focusing on environmental issues. Because of the recent emphasis on climate change and greenhouse gas (GHG) emissions, SPREP programmes now

include reduction of GHG emissions through the use of renewable energy. Its Pacific Renewable Energy project (PIREP) has as its goal the development of a regional approach to the removal of barriers to the widespread utilisation of renewable energy technologies in the PIDS. To date no training programmes in renewable energy have been implemented but plans for barrier removal include country-specific capacity building components.

United Nations Educational, Scientific and Cultural Organisation (UNESCO). Since 2002, UNESCO has been developing a “toolbox” of training materials for renewable energy development that include texts, videos and other media. The intended audience ranges from high level decision makers, government energy planners, technical personnel who install and maintain renewable energy equipment and the general public. Though the “toolbox” includes generic materials that can be used anywhere, the focus is on the Pacific Islands.

National Training Programmes for Photovoltaics. Both Kiribati (Solar Energy Company) and Tonga (Energy Planning Unit) have long term training programmes for field personnel involved with the maintenance and operation of solar home systems. Both have based their training on materials developed jointly by S.P.I.R.E. and PEDP that has been translated into the local language. Since their training programmes are in the local language, they are unfortunately not practical for use by other countries of the region.

Annex II - Existing Training Resources in the Pacific

If renewable energy is to become a major energy source for the Pacific, the number of trainees that must be processed will be large with numbers equal to or even greater than those now employed by national utilities. Clearly, the existing training facilities and professional trainers already in the Pacific must be used as much as possible. As Table 2 shows, the different participant groups will require different types and levels of training, so there is likely to be an opportunity for all types of training institutions to participate.

University Level Energy Programmes

University degree and certificate programmes that focus on renewable energy technology, project management, energy service business and other longer term programmes that develop renewable energy career paths can be important for the long term. For short term, lower level training, Universities are generally not the best choice being expensive, generally inflexible and tending to emphasise academic rather than practical aspects in teaching. The universities considered here all have existing energy related programmes and appear ready to participate in renewable energy capacity building programmes. For the long term, other universities of the region such as those in Tonga, Samoa and PNG should be considered for renewable energy capacity building efforts or their development into sub-regional specialty training centres focusing on renewable technologies appropriate for the sub-region around their location.

USP

Established in 1968, the University of the South Pacific (USP) has 12 member countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Samoa. FSM, Palau and PNG are not members. The main Campus is in Suva, Fiji, and there is a second large campus in Samoa where the School of Agriculture and the Institute for Research, Extension and Training in Agriculture and Rural Development (IRETA) are located. The University's Law Department and Pacific Languages Unit are at the USP complex in Port Vila, Vanuatu. USP has as a great strength its extension programme that reaches almost all the Anglophone Pacific countries. The programme includes local instructors for popular courses, interactive classes by video via satellite, video taped instruction for local learning, correspondence courses and non-interactive but real time satellite based instruction. If courses can be developed that fit within existing academic programmes, adding those courses is not expensive. If special courses are developed independently of USP academic programmes, they could be delivered but at high cost and with USP courses a higher priority for satellite bandwidth.

USP local facilities including classrooms and audio visual equipment can be rented for special classes at reasonable cost.

There has been discussion for some time regarding the possibility of establishing "Centres of Excellence" at USP including such a centre for energy. The emphasis for such a centre would be research though it is probable that development of courses and other training materials could be contracted to the centre.

Of particular interest are the non-technical programmes that focus on business and management. It appears likely that a selection of existing courses in these fields could be of particular value to companies contemplating renewable energy as a business and

their delivery through the distance learning system could aid through out the Pacific in the development of private businesses focusing on renewable energy.

PNG University of Technology (Unitech)

Unlike USP with their academic focus, Unitech has a strong practical and development oriented technical programme, particularly as relates to energy from agriculture or forestry and energy from hydro. When developing course modules for intermediate and advanced renewable energy training for biofuels, biomass gasification, biomass combustion, biogas and small hydro systems, Unitech probably can assist. Unitech has also participated in programmes for the use of solar energy in lighting and water pumping for rural areas.

Technical School Level

National Polytechnic Schools

Almost all the Pacific Island Countries have some type of vocational-technical school system. Some, such as FSM, Tonga, Samoa and Fiji, have more than one. These “trade” schools appear to provide the best opportunity to provide in country training for renewable energy. Integrating training modules for the specific renewable technology is not difficult since only those parts of the renewable technology that are different from the standard technology need to be addressed. For example, inserting a PV training module into a an electrician’s course (as was proposed by PEDP/S.P.I.R.E. in 1989) would only require a few days special training on the solar components, the installation of a PV system and some emphasis on maintaining low voltage electrical systems with batteries. Integrating a solar water heating training module into a plumbing course (as has been attempted by SOPAC) or a PV training module into an electrician’s course would lead to all graduates of that specific trade having at least basic training in the renewable energy technology. Though there are few technical barriers to integrating renewable energy into the PIDS trade schools, there tend to be major administrative barriers to overcome since the development of new curriculum modules requires multiple approvals at many levels, usually including the Ministry of Education. This is a process that goes well beyond the basic development of course modules. It needs to be carried out by professional educators who understand the system and can be expected to take a minimum of two years to accomplish after presentation of the course modules for integration.

Marine Training Centres

Tuvalu, Kiribati, Tonga, Fiji and several other countries in the region have well developed training facilities specialising in the training of workers for the marine shipping industry. The staff and facilities of these centres understand the methods needed to teach relatively complex technical activities to persons with minimal technical backgrounds and should be considered as possible training sites for intermediate level technical courses in renewable energy technologies.

Village Technician Level

The training of village technicians usually requires on-site instruction in the local language. Local trainers associated with the operating organisation are most likely to be the training providers. But those trainers will need training themselves from organisations experienced in both the technology being taught and with the techniques for training poorly educated local persons to maintain technical equipment properly.

CATD

In Fiji, the CATD currently provides training for village “handymen” including training in basic solar PV for households. They may be a good choice to develop a training of trainers programme for solar PV but have no experience with other renewable technologies.

Private Sector

Power and Telecom Utilities

Training facilities are often found in power utilities and telecommunications companies. Both businesses are candidates for using renewable energy and their training facilities could be developed into renewable energy training facilities for the parent company and for the provision of external short courses at the senior technician level.

NGOs

Although the PIREP survey found no NGOs providing training in renewable energy, several NGOs indicated an interest in developing a training capacity if external funding were available. Particularly, they indicated an interest in the development of training at village level for users of renewable energy systems and for village technicians. Examples of NGOs that are working in renewable energy and already include some aspects of information transfer are the Village First Electrification Programme (VFEP) and the Solomon Islands Village Electrification Council (SIVEC); both presently concentrate on village scale hydro development in the Solomon Islands and evolved from the Appropriate Technology for the Community and Environment (APACE) NGO. Also in the Solomon Islands is the Guadalcanal Rural Electrification Agency (GREA), a PV implementation agency evolved from the Solar Electric Light Fund (SELF) activities on Guadalcanal.

The Pacific International Center for High Technology Research (PICHTR) in Hawaii has provided project related technical training in Fiji for the Nabouwalu hybrid project and the solar home system projects in Vanua Levu and has expertise in OTEC and ocean energy development.

Private Training Centres

In most of the PIDS there are a number of private training centres, usually oriented towards the development of computer and other office skills. They tend to be small in size and focus narrowly but within that narrow scope often provide much better training than public training institutions. Some of the specialised training components that will be required within business development training programmes may be handled by private training centres.

Manufacturers and vendors

Although past experience in the region with vendor and manufacturer training for solar home systems has not been good, when larger installations such as multi megawatt biomass boilers, geothermal installations or large wind machines are involved, the only reliable training source will be the manufacturers and their agents. Training of this type is a part of the overall installation process and will not require special effort as part of the regional training development process. It will be important that local training specialists are associated with the manufacturer’s training to ensure

that language problems do not interfere with the training process and to help overcome any special training problems that may exist in the target country.

The Internet and Computer Learning

At the present time, the slow and often unreliable Internet connections available on most PIDS make attempting to use the Internet for course delivery frustrating and generally ineffective. The Internet can be used as a resource for trainers and, if the interface is well designed and has rapid response, could be valuable for some student purposes but a significant budget for Website or Internet delivered course development is not recommended under this programme.

CDROM or DVD based training programmes can be effective for very limited scope training (e.g. troubleshooting a specific technical device). Video tape has not been a very good medium for training delivery because of the frustrations of accessing specific parts of the programme plus there is the typically short life of videotapes and players in the Pacific environment. DVDs however, offer instant access to specific locations in a programme and both the players and the media are much more robust than tape.

Donor Programmes

For the past several years, the Government of Japan has sponsored Pacific Islanders to attend a “Middle Management Meeting/Training” in Japan relating to energy technology. Lasting several months, participants visit Japanese industrial facilities, nuclear power plants and other sites of energy related interest and receive advanced short courses at Japanese educational centres. Other overseas training programmes are offered from time to time through donor funded programmes. As they stand, they are part of the *ad hoc* offerings and are not integrated into any planned or focused training programme. If these training programmes could be better tied to real activities in the region, meeting the “the right people, the right time and the right subject” criteria, their value to the region would be considerably enhanced.

Annex III - Training within the Fiji Department of Energy 1994-2002

The Department of Energy (DoE) in Fiji has arguably the best developed energy office in the Pacific. With a relatively large staff (currently around 28 positions of which about 10 have some responsibility for renewable energy implementation) located in Fiji where many regional training courses are provided, the DoE has access to and the ability to send someone to virtually all renewable energy training provided for PIDS. The formal training provided to Fiji DoE staff from 1994-2002 is listed below though the participant names have been changed to numbers to make it easier to follow staff changes. Note (a) the sources of renewable energy training are largely external and *ad hoc* in nature (no clear plan or graduated series of trainings are included) (b) much of the staff changes every few years; (c) few training programmes in renewable energy have been repeated as staff changed, (d) most administrative training appears planned, is locally based and was repeated regularly.

Though all training can be expected to improve personnel performance, a bold type font indicates training obviously directly relevant for renewable energy, a regular type font indicates administrative training or energy efficiency training.

1994:	Participant	Course/Workshop	Venue
15-18 Mar	1	Human Resource Management	GTC
30 May	2	Energy Management Training Attachment	IEMC
1-5 Aug	3; 4	National Regional Energy Demand & Supply Database	Forum Secretariat
2-12 Aug	10	Study Meeting on Appropriate Energy Sources for Rural Areas	Manila, Philippines
8-18 Sep	1	GTZ Energy Counselling Project	Vanuatu
26-30 Sep	4	Regional Training Workshop on Energy Survey	Bangkok, Thailand
1995:	Participant	Course/Workshop	Venue
30 Jan-17 Feb	4	Use of Satellite Remote Sensing Data for Study of Wave Climate	Oceanor, Norway
6-10 Feb	5	Windows 3.1 Orientation	ITC
20-24 Feb	6 & 7	Windows 3.1 Orientation	
10 Mar	8, 1	British Wind Energy Trade Mission	Auckland, NZ
5-6 Apr	11	Security Liaison Course	GTC
1-12 May	9, 10, 14, & 3	Rural Electrification Planning	Forum Secretariat
18-27 May	1	World Geothermal Congress	Florence, Italy
4-21 Jul	1, 14 & 16	GTZ 3rd Mission Preparation of Hydro Pre-feasibility Studies	DoE
25-28 Jul	10, 15	Development & Implementation of an Energy Conservation Programme	Forum Secretariat
25 Jul-2 Aug	4	Asia Pacific Renewable Energy Symposium	Sydney, Australia
8-10 Aug	1, 15	Petroleum Sector Development: Policies for Improving Efficiencies	Forum Secretariat
27-28 Aug	3, 13	Microsoft Access	SPEC
29 Aug-1 Sep	15	Written Communication & Strategic Planning Management and Leadership	GTC
3-23 Sep	14	International Micro Hydro Training Course	Cebu, Philippines
16-20 Sep	1, 15	Petroleum Storage and Handling	Forum Secretariat
20-24 Nov	1, 14 & 16	Design of Civil & Hydraulic Structures for Micro Hydro Power Scheme Workshop	Forum Secretariat
21-24 Nov	3	Novell Netware 3.12 System Administrators' Course	Computech
27 Nov-1 Dec	10	Demand Side Management Marketing Training	Forum Secretariat
4-7 Dec	4, 3	Demand Side Surveys and Data Collection	Forum Secretariat
4-15 Dec	16	Photovoltaics for Rural Electrification	ATT, Thailand
1996	Participant	Course/Workshop	Venue
5-9 Feb	4, 3 & 15	Energy Policy and Planning - The Environmental Manual for Power Development	Forum Secretariat

20-24 Feb	9	Use of Photovoltaic for Power Generation	ADB, Philippines
11-15 Mar	8	New Approaches to Public Sector Management	Tanoa Hotel, Nadi
16-19 Apr	10, 4, 9 & 1	Project Planning / Project Cycle Management	Forum Sec
30 Apr-3 May	11	Disciplinary Procedure, Counselling and Staff	GTC
14-17 May	12	Management of Executive s	GTC
22 May-1 Jun	13	Environmental Audit Training Attachment	Tonga & the Solomon Islands
17-21 Jun	1	Study Meeting on New Energy Sources	Tokyo, Japan
19-21 Jun	4	Transfer of Environmentally Sound Technologies & Activities Implemented Jointly	Osaka, Japan
24-26 Jun	13	Regional Workshop for Environmental Guidelines for Power Stations	FEA Training Centre
1st Semester	3, 14	Microeconomics (EC 101)	USP
1st Semester	13	Marine Biology	USP
1-5 Jul	11	Industrial Relations	GTC
30 Jul-2 Aug	15	Government Procedures	GTC
2-21 Sep	15	Energy Efficiency and Conservation	Seoul, Republic of Korea
11-18 Oct	4	Seminar on Energy Supply and Demand Outlook	Tokyo, Japan
4-15 Nov	15	PV/Diesel Hybrid Power Systems	Lae, PNG
16-28 Nov	1	Energy Management	Karachi, Pakistan
18-22 Nov '96	13, 3, 14 & 16	GTZ Hydro Training, Tendering & Contracting & Equipment for Small Hydro Power Application	Forum Secretariat
10-16 Dec	10	Symposium on Energy Sources in Rural Areas	Manila, the Philippines
14-20 Dec	9, 13	Use of Solar and Wind Energy for Rural and Remote Power Supplies	Noumea, New Caledonia
2nd Semester	14	Microeconomics (EC102)	USP
2nd Semester	6, 5	Diploma in Business Studies	FIT
1997	Participant	Course/Workshop	Venue
10 Feb-7 Mar	16	Electrical Wireman's Course (Stage 1)	FNTC
26-28 Feb	11	Management Planning	GTC
10-14 Mar	13, 15	Petroleum Product Pricing	Pacsoft Training Ctre
19-20 Mar	12	Effective Organization	GTC
26-27 Mar	12	Leadership	GTC
27.Mar	14, 15	Access Level 1 Course	Pacsoft Training Ctre
10-18 Apr	16	Project Planning & Management	Pacsoft Training Ctre
6-8 May	11	Occupational Health & Safety Care	GTC
12 May-5 Jun	15	Hybrid Power Systems	PICHTR, Hawaii
19 May-13 Jun	16	Electrical Wireman's Course - Stage 2	FNTC
12-13 Jun	11	Motivation Workshop	GTC
16-18 Jun	11	Industrial Relations	GTC
23-27 Jun	16	Sub-Regional Workshop Wind Energy Utilization	FSED
6 Aug-4 Sep	16	International Training Workshop on Solar Energy Application	GENRI Institute, China
7 Aug-18 Sep	13	Training Course on Biogas Technology	BRTC, China
3-4 Sep	12	Management Ethics	GTC
15 Sep-10 Oct	16	Electrical Wireman's Course - Stage 3	FNTC
16 Sep-13 Oct	9	Resource Conservation & Environment Protection	Japan
22-24 Sep	11	Performance Management System: Trainer's Workshop	GTC
22 Sep-11 Oct	14	Energy Efficiency & Conservation	Republic of Korea
18-21 Nov	8	HOD Workshop	GTC
9-10 Dec	12	Selection and Aptitude	GTC
1998	Participant	Course/Workshop	Venue
13.Jan	12, 6 & 5	Insurance Workshop on PSC Group Life Policy	Southern Cross Hotel
20-24 Jul	14	SPC/SOPAC Regional Energy Program Design for 1999-2004	Nadi
20-25 Jul	17	FNTC/Asian Productivity Organisation Seminar	Nadi
31 Jul-1 Aug	8	Financial Management Information System Projects	Warwick Hotel
18 Aug-18 Sep	10	SES Training - "Establishing the Workplace as an Effective Learning Environment"	GTC
28-29 Sep	??	Performance Management System Workshop (Refresher Course)	
13-16 Oct	10	Petroleum Seminar	Tanoa Intl Hotel, Nadi
5.Nov	8	Understanding the Role & Responsibility of being a Company Director	Centra Hotel
5-6 Nov	15	National Workshop for Fiji's Biodiversity Strategy& Administration Plan (BSAP)	Marine Studies Complex

8 Nov	18, 11	Human Resource & Payroll System Workshop	Noble House
16-18 Nov	All DoE Staff	Position Description Course	DoE
23-27 Nov	19	Archives Administration & Record Management	GTC
1999:	Participant	Course/Workshop	Venue
13 Jan-29 Feb	20	Technology for GHG Emission Mitigation	Japan
1-5 Mar	20	Sustainable Development	Japan
10-11 Mar	12	Conflict Management	CTD
14-27 Jun	15	International Biogas Training	China
19-21 Aug	15	Windows NT Administration	Pacsoft
31 Aug-3 Sep	15	Supporting Windows NT Technologies	Pacsoft
14-16 Sep	15	Global Conference on Renewable Energy	Denmark
2000	Participant	Course/Workshop	Venue
6-8 Mar	17	Appliance Labelling Symposium	New Zealand
6-17 Mar	20	International Course on Planning of Small Hydro Power	India
27-31 Mar	20, 21	Energy Database Workshop	SOPAC
12-18 Apr	10	Conference on Environment Energy	Japan
8-12 May	21	IGPO Training and Development Course	Australia
12 Jun-12 Jul	22	9th International Solar Energy Application Technology Training Workshop	China
20-26 Sep	17	Joint SOPAC/SPC Regional Energy Meeting	Kiribati
17 Sep-7 Oct	13	APO Course on Resource Recycle & Environmental Protection 2000	Japan
24-26 Oct	19, 17 & 32	Registry Procedure Course	CTD
6-8 Dec	12	PMS	CTD
11-12 Dec	21, 22	Government Procedures	CTD
2001:	Participant	Course/Workshop	Venue
16-18 Jan	10	Energy Subsidy Reform & Sustainable Dev. Challenges for Policy Makers	Thailand
21-22 Mar	22	Finance for Non-Finance Managers	CTD
10 Apr	31	Personal Development for Typists & Secretary	CTD
26-30 Apr	21	Leadership and Change	CTD
14 Apr-9 Aug	21	Solar Power Generation & Application Technology	Japan
22 May-6 Jun	23	International Solar Energy Application Technology Training Workshop	China
29-31 May	22	Regional Symposium on Energy Efficiency Standards and Labelling	Thailand
11-13 Jun	13	People's Management Course	Holiday Inn
12-14 Jun	19	Records Management	CTD
25-29 Jun	14	Energy Efficiency for Green Productivity Seminar and Workshop	Singapore
18-20 Jun	20	Strategic Planning for Natural Resources Dev and Management	Thailand
26-27 Jun	13	Sustainable Energy Seminar for ACP Island States (Framework of EC Development & Co-operation)	Dominican Republic
5-6 Jul	19	Stress Management	CTD
12-13 Nov	14	Use of Log Frames as a Planning Tool	CTD
23-25 Nov	24	Team Building	CTD
10-14 Dec	21	Workshop on Environmental Economics; Cost & Effectiveness	Philippines
2002:	Participant	Course/Workshop	Venue
29 Jan	20	Renewable Energy	Thailand
19-20 Mar	14	Policy Planning and Management	CTD-PSC
19-21 Mar	8, 14, 10 & 25	Workshop on Improving Fiscal Discipline and Financial Improvement in Government	Min of Finance
19-21 Mar	26	Workshop on Improving Fiscal Discipline & Financial Improvement in Government	Min of Finance
19 Apr	26	Basic Windows Training	Min of Finance
6-10 May	27	Theory Training on Installation & Maintenance of Renewable Energy System	CATD Nadave
9-10 May	22, 21	Logframe Training Programme Report	Tradewinds Hotel
13-17 May	28	Business Training (Opret Course)	CATD Nadave
13 May-9 Aug	29	Solar Power Generation & Application Technology	Japan
25-26 Jul	28	International Seminar on Energy for Sustainable Development	China
6. Aug	19, 30	New Postal Mailing System for Government	Min of Finance
12 Aug-25 Sep	20	International Biogas Training Course	China
5-8 Aug	22, 21	ESCAP/SOPAC Sub-Regional Workshop for Pacific on Strategic Planning & Management of Energy & Water Resource Development	Outrigger Hotel
19-23 Aug	27; 23	Practical Training on Installation & Maintenance of Renewable Energy Systems	Nabouwalu
2-6 Sep	21, 29, 22, 20, & 27	Renewable Energy Resource Assessment Training	DoE
8 Oct-11 Nov	21	International Small Hydropower Training Workshop	China
11-15 Nov	22	Green Energy for Green Productivity	India