6. APPENDIX B

| 6.1. | ORGANISATION STRUCTURE OF EU | B-2 |
| 6.2. | PROJECT IMPLEMENTED UNDER EU | B-3 |
| 6.3. | UNELCO IN BRIEF             | B-4 |
APPENDIX

MAP OF VANUATU

POPULATION STATISTICS

DATA TABLES – INSOLATION, ANNUAL RAINFALL, SUNSHINE

ORGANIZATION STRUCTURE OF THE ENERGY UNIT

PROJECTS IMPLEMENTED BY DONORS WITH EU – FONDEM/ACCT, JICA AND AFD

UNELCO IN BRIEF

ESTIMATED COST BREAKDOWN OF PROJECT – FORMULA SHEET

SOLAR SIZING SHEET

WHO GUIDELINE FOR THE SELECTION OF APPROPRIATE VACCINE

REFRIGERATION POWER SOURCE – 1998 STANDARD.
ABBREVIATIONS

ACCT  Agence de Cooperation Culturelle et Technique
AFD  Agence Francaise de Developpement
AUSAID  AUSTRalian Agency for International Development
EU  Energy Unit
FONDEM  Fondation Energie pour le Monde
JICA  Japanese International Cooperation Association
MOA  Memorandum of Agreement
MOU  Memorandum of Understanding
NEDP  National Energy Development Plan
PREFACE  Pacific rural Renewable French Australia Common Endeavour
SPC  Secretariat of the Pacific Community
PWD  Public Works Department, Vanuatu
TORBA  TORess and BAnks Island group province
UNELCO  Union Electrique
VRPP  Vanuatu Rural Photoholtaic Project
WHO  World Health Organisation

ELECTRICAL TERMS AND OTHER TERMS

V,  Volt  Unit for Voltage, or potential difference unit
A,  Amperes  Unit for Current
Ah  Amp-Hour  Indicate the Capacity of a battery
Ω,  Symbol of Ohm,  the unit for resistance
R  Resistance
W, Wp  Watt, Watt-Peak, Peak Watt
Kw, KW  KiloWatt
MW  MegaWatt
Wh  Watt Hour
CO2  Carbon Dioxide
LIST OF FIGURES

Appendix A  Map of Vanuatu
Appendix B  Organization Structure of the Energy Unit
Appendix C  Map of Allocated Proposed Sites
Figure 1  Synthesized Schedule of Project Implementation – Phase 1: Installation and Implementation
Figure 2  Structure for VRPP- TORBA solar project management and responsibility in brief
Figure 3  75Wp standard system for Solar Home Systems – Facility Staff Houses
Figure 4  150Wp standard system for Community Solar Systems – Public Facilities
Figure 5  Detailed location of sites
Figure 8  Graphical Representation of Cost Breakdown
Figure 9  Graphical Representation of Projects already implemented in Vanuatu
Figure 10  Graphical view of insolation data and average daily solar radiation

LIST OF TABLES

Table 1  Table of Allocated Project sites
Table 2  Estimated Project Cost
Table 3  System Sizing
Table 9  Projects Implemented by Donors with EU – FONDEM/ACCT, JICA and AFD
Table 10  Population Statistics
Table 11  Data Tables – Statistics, Insolation, and Annual rainfall

LIST OF FORMULAS

Section 1  Solar Sizing – Formula Sheet
Section 2  Estimated Cost Breakdown – Formula Sheet
FORWARD

This feasibility study report is based on a project proposal\(^1\), submitted by the Government of the Republic of Vanuatu, through the Energy Unit for funding under the sponsoring agency - Secretariat of the Pacific Community’s (SPC) Australian and French-funded Pacific rural Renewable Energy France-Australia Common Endeavour [PREFACE]. The proposal, requested donor assistance for the electrification through solar energy to the proposed locations at the islands of Ambrym and the Banks islands. Refer to the Map of Vanuatu –A-2, Appendix A.

Vanuatu like most other developing countries involved with rural electrification is continuing to pursue the rural electrification program as part of its economic development efforts and prosperity.

The proposal will further extend the program of rural electrification by viable utilization of renewable energy resources. The implementation of the project will have a great impact on the socio-economic standard in the rural areas, which is necessary to recognize and therefore benefit the citizens by improving their quality of life.

With Energy Unit (hereafter will be referred to as EU) being the implementing agent and responsible for energy matters for the republic, the proposed project is in line with one of EU’s action plan. That is to electrify rural areas by installing solar systems in demanding rural communities.

A feasibility study team comprising two Energy officers of the Energy Unit and a renewable Energy Expert from SPC carried out a 10-day brief study in Torba Province; outcomes of the study trip are mentioned in this following report.

PREFACE is a joint initiative of the Australian and the French governments aimed at advancing the social and economic development of the SPC region through the use of sustainable renewable energy technologies. Its purpose is to increase the utilization of sustainable renewable energy technologies, in particular solar photovoltaic and wind energy technologies, in island and rural communities. Thus the program fully fits Energy Unit’s action plan to electrify rural areas by installing solar systems in demanding rural communities.

The strategies for PREFACE are grouped under four components:

- Project Inception involving an initial phase during which project staff will refine the review of the sector and prepare appropriate implementation plans.
- Information, Training and Support focussing on awareness raising, training and information sharing.
- Demonstration Installations aiming to increase the utilization of renewable energy technologies by the practical demonstration of a small number of replicable and sustainable renewable energy systems with a particular emphasis on sustainable financial and management structures.
- Project Management aiming at ensuring that the project’s goals and objectives are achieved within planned budget and timeframe.

\(^1\) Refer to the Proposal Request Report Submitted by Vanuatu, April 2000 on the Proposal Section
ACKNOWLEDGEMENT

It has been an intensive and worthwhile experience as a trainee under the SPC/PREFACE team during the course of fully preparing this document. Without the sound advice from the two well experienced Renewable Energy Advisors to SPC it would have probably taken much longer to complete this feasibility study report.

I therefore would like to thank Mr. Jean Michel Durand and Mr. Solomone Fifita for having invited me in SPC Noumea and assisted me in completing this report.

The working environment could not have been better.

The PREFACE team style of working, organisation and management has had a great impact in regards to my alertness, promptness, motivation and teamwork approach. This will contribute to how I may approach future projects that I may have to design or be involved in.

The PREFACE team has shown great interest in improving the human resources development of the local engineers in the respective island nations, including interest on encouraging young engineers on energy matters in the field of rural renewable energy.

So once again thank you and I acknowledge the above two PREFACE advisors for the contribution they have made to my development in the rural renewable energy sector.

Marlene Kalmet
Project Engineer
Energy Unit
Port Vila, Vanuatu

Preface@vanuatu.com.vu
EXECUTIVE SUMMARY

1.1. PROJECT PROFILE

1.1.1. Summary of Proposal Endorsed by the Energy Unit to SPC/PREFACE

This feasibility study report is based on a project proposal submitted by the Government of the Republic of Vanuatu for funding under the sponsoring agency - Secretariat of the Pacific Community’s [SPC] Australian and French-funded Pacific rural Renewable Energy France-Australia Common Endeavour [PREFACE]. The proposal, requested donor assistance for the electrification through solar energy to the proposed locations at the islands of Ambrym and the Banks islands. Refer to the Map of Allocated project sites –C-1, Appendix C.

Proposal 1: Individual Solar Home System type project – Sesevi Village, Ambrym
Proposal submitted for Ambrym Island requested individual solar home system type project, estimated to be US$268,192. The system to be implemented with the JICA solar Home System standard approach.

Proposal 2: Community Project – Electrification of Public Facilities in the Banks Island Group
Proposal submitted for Banks Island requested a community project to electrify 3 Health Centers and 7 Schools, estimated to be US$169,760. The systems requested are as follows:

For Schools: Lights and power points for video system to use for educational purposes and for telecommunication (radio transceiver or telephone)
For Health Facilities: Lights and power points for refrigerators for vaccine storage and for telecommunication (radio transceiver or telephone).

1.1.2. Criteria and Conditions used to Select preferred project site by SPC/PREFACE

The selected project site to be electrified was TORBA province, which is made up of the Torres and Banks Island group.

Criteria for selecting Proposal 2:

In accordance with the Energy unit energy action plan for electrifying rural community, where priority is given to rural community projects
In accordance with PREFACE strategy cap.iii of demonstration Installation where a community project has been planned for the Melanesian group. PREFACE is already addressing solar homes systems projects in both Tonga and Marshall and had to address also community systems to meet its Project Design Document requirements.

1.3 Proposed Project Sites after 10-day feasibility study – TORBA Province

After conducting a 10-day feasibility study, results obtained are as follows:

1.1.3. School Facilities

10 Schools should be electrified
Each allocated school building on site should be equipped with 2 PV modules of 75Wp and two 12V batteries.
Only two classrooms of highest priority (class 5 and 6) should be equipped with a maximum of 4 lights per room per site. Lights will be fluorescent lights of 13W, 12VDC rating...
Each school site should have access to a switch for stereo/radio for educational purposes of no more than 75W rating.

Total estimated cost for electrifying School facilities $AUD 60,000

1.1.4. Health Facilities

3 Health Centers should be electrified
7 Dispensaries should be electrified

All Health facilities should be equipped with 2 PV modules and two 12V batteries per site.
All Health facilities should be equipped with a maximum of 8 lights. Lights will be fluorescent lights of 13W, 12VDC rating.
All Health facilities should be equipped with a mobile 20W Halogen light for maternity and medical examination purposes.
All Health facilities should have switches for telecommunication purposes, more so for radio transceivers with a maximum power consumption of 75Wp. Existing radio transceivers on site will be incorporated into the installed 150Wp system to be installed.

Total estimated cost for electrifying School facilities $AUD 60,000

1.1.5. Staff Houses

40 houses belonging to allocated public facilities sites should be electrified. i.e. 32 houses belong to the Education facility and the other 8 belong to the Health facilities.

All staff houses should be equipped should a single 75Wp PV module and a single 12V battery.
Each staff houses should have up to 6 lights of 8-13W, 12VDC rating
Each staff house should be equipped with a dc-dc convertor for powering a radio-tape. Radio to be utilized may not be more than 20Wp, nor operated more than 6 hours per day.
Staff with solar system should be charged a monthly fee of Vt1000 to be directly deducted from their salary. All staff met during feasibility study agreed on such arrangement.

1.1.6. Project Budget and Characteristics

Total estimated cost for electrifying Staff Houses $AUD 120,000
Total Capital Cost of Overall Project is $AUD 367,629 equivalent to XCF249,987 ($AU1 = 0.68XCF)
Yearly Maintenance Cost is 6% of the capital cost which is $AUD 14,338 equivalent to XCF9749.84
Yearly Maintenance cost will be covered accordingly by the Ministry of Health, Education and Involved Staffs.

The total Peak Watt for the project is 6000Wp.
Existing panels already on-site will be en-cooperated into the project system.
As may be observed, the proposed outcome of the feasibility study is far from that proposed by the government.
According to the actual study taken, there was more necessity for lighting to the proposed allocated school and health vicinities.
No refrigerator for vaccine purposes will be used due to the following reasons:
According to WHO standard sheet (refer to Annex I), there is no need for refrigeration as there is enough availability of LPG gas currently used to power the refrigerators.
It would be more costly to the health ministry as the requirment for LPG will not be eliminated. There is plan for the use of autoclaving (sterilization by gas).
Costly beyond donor allocated budget. Installation of solar refrigerator for vaccine purposes must be made by companies having had experience with solar for more than 20 years.

### 1.1.7. Impact of Solar Project on Project Vicinity

The solar project will have an effect on the social status of the community and the users individually, i.e. those with access to the electricity system will feel an aura of pride knowing they have a higher, improved standard of living.

The electrified sites will be able to provide better health and education services to the locals who have been for a long time isolated from better service facilities.

It will contribute greatly to the development status of the province.

Because of the improved standard of living by the utilization of this solar system, the locals will be able to enjoy (independent of peer group or gender difference) the easy and improved access to lighting.

The facilities equipped with radio will be able to have up to date news outside the realm of the site.

School children and patients will have access to better facilities, therefore improve their standard of access to facilities.

Safety of the system is good hence there is less chance of being burned or hurting oneself badly due to difficulty of making light etc (as it happens with typically used kerosene and traditional lighting practices).

Ladies will be able to enjoy longer hours of weaving and making handicraft, as with some of the men themselves.

Family members will be able to gather together in the evenings or with other members of the community, with more pleasure.

Preparation food will be easier and with more care.

Sick patients be it at home or at the health facilities or elsewhere with solar system, will be able to be catered for.

Preparation of festivals held in the evenings and such thing as kava preparation will be easier with access to better and more convenient lighting.

Preparation of garden, fishing and others is easier in the early or late hours of the day without possible accident or hassle.

Last but no least, this solar system is environmentally friendly due the less amount of carbon dioxide released compared to kerosene and diesel fuel which release more amount of CO2 i.e. a reduction of approximately 6.6 tons of carbon dioxide emission.

### 1.1.8. Criteria for the Selection of Installation and Maintenance Company

Please refer to the detailed outline in the report context under appropriate heading for more details.

---

* 1KWh/diesel generator = emission of 0.75Kg of CO\textsubscript{2} per day; amount of CO\textsubscript{2} emission reduced =

\[0.75\text{CO}_2 \times 6000\text{W/sys(tot)} \times 4\text{h/day} \times 365\text{days} = 6.6\text{M}\]
1.1.9. Schedule of Project

The following schedule doesn’t include final project design, call for tenders and selection process of supplier.

<table>
<thead>
<tr>
<th>MONTH</th>
<th>1</th>
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<td>In-Plant Inspection</td>
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<td>On-Site Final Inspection</td>
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Figure 1: Schedule of Project Implementation

1.2. Organization, Management and Structure of the Project

Overall Management will be the responsibility of Energy Unit, being the responsible body for decentralization of electricity to the rural communities. Energy unit will ensure that both parties, respectively, abide the commitments to payment and to maintenance service from the users and to electrical company.

1.2.1. Maintenance and Installation of the project will be the sole responsibility of the selected private electrical company combined.

Figure 2: Structure for VRPP- TORBA solar project management and responsibility in brief
1.3. COUNTRY PROFILE WITH REFERENCE TO RURAL ENERGY

Vanuatu like most other developing countries involved with rural electrification is continuing to pursue the rural electrification program as part of its economic development efforts and prosperity. Now with alternative energy source production technology already available in the commercial world, the government of the republic has for a number of years now, shown great interest in the implementation and utilization of renewable and indigenous energy sources as part of decentralization of electricity to the rural communities.

The government has set up an organisation in 1985 known as the Energy Unit to be the responsible governmental body for all energy related matters especially in the rural areas. The Energy Unit comprise currently of 4 permanent staff, 3 contract staff and a number of technical advisors from donor countries all with the high demanding job of looking after all energy matters. The unit is responsible for the decentralization of electrical power to the 80% of the population living in the rural areas.

Since early 1992, the unit has overseen 3 solar photovoltaic projects (FONDEM/ACCT, JICA and AFD funded projects) with total of some 500 stand alone systems being implemented in both individual solar home systems and community systems. In 1994, the unit oversaw the Sarakata Hydro Power station being implemented consisting of two turbines each having a capacity of 300KW. The money generated from the hydropower by saving fossil fuel is to be utilised for the further expanding, by decentralisation, of electricity power to the rural areas using alternative, cheaper and environmentally friendly sources of energy to oil-based fuels.

Vanuatu has a rich and diverse potential energy resource base, which, however, is yet to be qualified and quantified. Biomass from natural vegetation, residues from forestry and agriculture, followed by hydro, geothermal, solar and wind. Also being a nation consisting of islands surrounded by sea, wave energy is another potential resource.

Energy demand is high in both rural and urban Vanuatu; therefore it is forecasted that if projects for rural areas are successful, then further electrification by same power generating sources will be expanded. The only obstacle to be tackled now is to reduce the high cost of electricity currently being charged to both the urban and rural users.

2. COUNTRY PROFILE

2.1. General Background

The republic of Vanuatu, formerly known as the New Hebrides under the joint British-French condominium and now a member of the British Commonwealth comprises of a Y-shaped chain of 83 islands of which 68 are inhabited. This small South Pacific island nation lies between latitude 13° and 23° South and longitude 166° and 172° east of the Greenwich i.e. approximately 2,300 kilometers off the East Coast of Australia. Total land area measures 12,189 square kilometers with mostly mountainous hilly and rough terrain. The country has an Exclusive Marine Economic Zone of 680,000 square kilometers. The nations only significant urban centers are the capital, Port Vila on the island of Efate and Luganville on Espiritu Santo [refer to Map of Vanuatu, Appendix A, A-2].

Vanuatu is sub-divided into 6 provincial areas and 2 municipalities with each province caring for a number of small islands [refer to Appendix A, A-2] and municipalities caring for the 2 urban townships. An elected body voted in by each of their respected provincial population, governs each of the provincial area for a period of up to 2 years. The same applies for the municipalities.

2.2. Topography and Climate

As previously mentioned, Vanuatu islands are mostly of volcanic origin, therefore mountainous, hilly with rough terrain. This has allowed Vanuatu to have fertile soil, which the economy has greatly exploited by means of agriculture therefore has been and still is the greatest source of income to the country’s economy.

The Y-shaped archipelago comprises 13 large islands and 70 smaller islands stretched Northwest to the Southeast over some 850 Kilometres of ocean. Most of the rugged islands are covered with dense forest. Most of this natural environment and its inhabitant are being studied, researched and classed appropriately.
These studies and researches are a vital role to many sectors of the country such as the agricultural development hence economical development of the country.

The country’s Exclusive Economic Zone must be regarded as an important potential resource for future development. Little is known yet of ocean and bed mineral resources.

The country’s known land-based mineral resources are manganese, pozzolana and construction materials such as limestone. Explorations are underway to determine the extent of potential deposits of copper, gold and silver as well to ascertain the possibilities of exploiting geothermal energy.

The climate varies from tropical in the north to subtropical in the South. Southeast trade winds prevail. Frequent calms are often experienced followed by North and East winds.

The average temperature is 24.5 °C with an average year round humidity of 83%. The annual rainfall ranges from 2300mm to 3800 mm; significant variation can be observed throughout the country. Cyclones can occur between December and April. The summer period is between May and November.

### 2.3. Population

The 1999 census result indicates a population of approximately 186,678. The population density is 14 persons per square kilometre with a growth rate of 3.3% per annum. The urban population is only 24.5% in 1998, with the remainder of the population, i.e. the rural population being dispersed along coastal areas of the islands of the archipelago or on smaller islands offshore from the larger, leaving the interior virtually uninhabited. The population density amongst the rural areas is uneven with high densities in some location leaving other areas sparsely populated.

Regardless of family planning measures, Vanuatu displays high rates of population growth, which places pressure on the environment and the economy to generate sufficient jobs, improve living standards, and social services for the expanding population. Furthermore, the rural population has limited communication links with the urban centres.

During the inter-censial period, the resulting percent in the urban areas reflect greatly the urban migration (external migration is negligible).

The ethnic population of this country make up 98% of the total population while the remaining percent are those of non-ethnic residents. Refer to Appendix A, A-4.

### 2.3.1. Administration and Legislation – Drift of the New Hebrides to the Republic of Vanuatu

During 1774, Captain James Cook sighted most part of the southern islands and it was then that he named the island group the New Hebrides after the isle of the New Hebrides off the coast of Scotland. From 1906, Vanuatu was colonised and governed by the newly emerged Anglo-French New Hebrides Condominium. Under this unique colonial system, there were the British, French and joint civil divisions. After 74 years under the joint rule of the French and British the New Hebrides attained it’s independence from the Condominium government in 1980 to become an independent state with a Westminster-style constitution with a single legislative chamber, the parliament.

Because the culture and traditions of the people of Vanuatu is an important part of the country and its wellbeing, the National Council of Chiefs is an important advisory body to the council of Ministers. It is composed of custom chiefs. This council advises on custom and tradition as well as the preservation and promotion of the country’s culture and indigenous matters.

Vanuatu is further sub-divided into 6 provincial areas and 2 municipalities with each province caring for a number of small islands [refer to Appendix A, A-2] and municipalities caring for the 2 urban townships. An elected body voted in by each of their respected provincial population governs each of the provincial area for a period of up to 2 years. The same applies for the municipalities.
2.4. National Economy in brief

The country has a dual economy comprising the agriculture sector and a commercial sector.

Agriculture plays more prominent role than in other Pacific island economies. The agriculture sector comprises the small subsistence holders, established plantation forestry, large farms and ranches. The small monetary sector comprises the Trading, Manufacturing, and banking, shipping services, tourism and offshore financial services. As can be noted Vanuatu has sought itself to establish itself as a tax haven to attract foreign private capital.

An estimated 45% of the land area can be considered potential resource for future development. Both the climate and the soils are conducive to agriculture and livestock husbandry. However, since land ownership is closely integrated into the indigenous culture, it restricts the use of land for economic development to a slower pace. Hence, in the development of indigenous energy resources, the land tenure system must be well understood and respected. Vanuatu has a rich and diverse potential energy resource base, which, however, is yet to be quantified. Biomass from natural vegetation, residues from forestry and agriculture, followed by hydro, geothermal, solar and wind. Also being a nation consisting of islands surrounded by sea, wave energy is another potential resource.

2.5. Energy Profile

2.5.1. Energy Sector – The Energy Unit

Energy Unit was implemented more than 10 years ago, in 1985. The unit was setup to look after energy matters for the country. EU is responsible for the policy making and to oversee the decentralization of electricity. EU does so by utilizing renewable energy and other forms of electrical energy producing power systems to the rural areas of the country, that are not part of the UNELCO concession area. EU being the responsible body for rural electrification has utilized renewable energy such us the solar power system to electrify a number of rural sites to allow the local people to further improve their basic living standards, socio-economic level and also provide jobs to locals. Improving the standard of living and providing jobs should assist in reducing the urban- migration trend.

EU works closely with aid donors and other private investors who are involved in rural electrification.

Since 1992, the Unit has been involved in a number of rural electrification projects that were funded by aid-donors such as JICA, FONDEM and AFD utilizing Solar Power Systems for the electrification of individual homes and community facilities. Approximately 500 stand alone solar systems have been installed through the EU to date. Refer to AppendixB, B-3 for the current solar installation sites and number. In 1994, the unit was involved in the first hydro scheme for the country- the Sarakata hydro Power, which went into operation in 1995. The hydro power station was installed with two turbines each having a capacity of 300KW.

Renewable energy is being exploited not only to improve the socio-economic standard in the rural areas but also to reduce the dependency on petroleum fuels at the same time reduce carbon dioxide emission from those petroleum fuels.

The Ministry of Lands, Natural Resources and Environment manages the Energy Unit. EU is equipped with a marginal number of staffs hence now taking steps to ratify this problem as from the beginning of 2001. Refer to AppendixB, B-2 for the EU breakdown – Management and Organisation Structure. Increasing the number of staff would greatly benefit the unit in terms of better management of the unit and it’s projects

At present EU is equipped with a permanent Principal Officer, an economist, two technicians, and contracted secretary, executive officer and an electrical engineer.

1.6.2. Energy Production and Consumption

Energy in its many forms is utilised by the population for electricity, cooking, and many more. For the two urban areas the most common form of fuel sources for energy production are Diesel fuel for land and sea vehicles and for electricity, followed by LPG and biomass for cooking.
For the rural areas, biomass is the most widely used form of energy source for cooking followed by kerosene for lighting and cooking, thereafter are dry cell batteries and diesel fuel for lighting and LPG for cooking and refrigeration.

Kerosene and some other oil-based fuel are also utilized in aeroplanes.

Energy Unit being the main body for implementing and overseeing electrification of rural areas has utilized solar power energy to provide electricity to a number of rural community facilities and individual homes since the late 1980’s. The solar power systems installed are exploited mainly for basic lighting purposes to allow users to further improve their basic living standards and assist in reducing the urban migration drift.

**Urban Areas**

The two municipalities of Port Vila and Luganville and their closely surrounding areas are electrified by the privately owned electricity Power Company **UNELCO**. **UNELCO**- Vanuatu, is a subsidiary of Lyonnaise des Eaux, a French – owned firm based in Paris through a Pacific Lyonnaise holding (EEC New Caledonia, Electricité de Tahiti, UNELCO and Wallis and Futuna Utility). Electricity supply system is entirely diesel-based in Port Vila and consists of 11.48MW urban power system. A second urban system rated at 2.84MW for Luganville where the supply system comes from a combination of a hydropower generation system and diesel-based generator. At the beginning of this year (January 2000), **UNELCO** has been contracted to electrify two other small townships of Lenakel in Tanna and Lakatoro in Malekula so work has already taken place for the network installation of the electric system. Refer to Appendix B, B-4 for a Brief Note on **UNELCO**.

**Rural Areas**

Small isolated distribution grids based mostly on small diesel generation sets and operated locally by provincial governments and/or with the Public Works Department (hereafter will be referred to as the PWD) provide the remainder. For other remote consumers such as academic institutions, hospitals, and resorts often provide their own power supply from diesel fuel generators and/or solar installations. The most widely used energy fuel source is biomass (from natural vegetation and debris) for cooking followed by kerosene for lighting and cooking. Dry cell batteries are also widely used to power lights and radio. The amount of kerosene, batteries, diesel fuel and other sources of fuel consumed by the rural population for private or community purposes cannot be estimated nor averaged due insufficient data and the varying degree of use by the rural population. But more importantly due to poor record keeping of rural energy production and consumption.
2.5.2. Installed Urban Power and Power Capacity

INSTALLED CAPACITY (MW)
Following are installed capacity for the two urban centres of Vanuatu.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>HYDRO Run-of-River</th>
<th>Storage</th>
<th>Pumped Storage</th>
<th>THERMAL Diesel (Port Vila)</th>
<th>Diesel (Luganville)</th>
<th>Total</th>
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<tr>
<td>1989</td>
<td>6.37</td>
<td>-</td>
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<td>6.37</td>
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Source: UNELCO - Vanuatu. Due to lack of appropriate and sufficient data, further forecasting cannot be made.

Due to lack of sufficient data and no appropriate apparatus in the rural areas, installed capacity at the rural areas cannot be provided.

1.6.4 The Electric Tariff Rate

1.6.4.1. URBAN ELECTRIC TARIFF
The tariff rate structure and level for Port Vila are determined by a price adjustment formula included in a concession agreement made between the Government and the Private Electric Power Generating Company – UNELCO VANUATU.

The tariff rate in Port Vila is adjusted quarterly according to the complex tariff formula in the concession agreement. In Luganville, CES operates without an agreement, and the company does not submit detailed statistical reports to the government. Therefore, most of the rates provided below are mostly for Port Vila.

The average tariff rate for the two urban systems of Port Vila and Luganville between 1998 and 1999 were:
2.5.3. Basic Energy Rate for general-purpose consumers:
32.76 Vatu plus a minimum demand charge of 594 Vatu per kVA

Bulk Supply (i) (High Voltage industrial) for High Voltage consumers:
Port Vila = 21.25 Vatu per kWh; demand charge per KVA = 758.75 Vatu

Therefore, the demand rate for 1997 and 1998 should be higher than the above stated value.
Luganville = 22.58 Vatu per kWh; demand charge per KVA is normally higher than for Port Vila.

2.5.4. Commercial and Low-voltage Industrial consumers:
Port Vila = 26.4 Vatu per kWh; demand charge per KVA = 607 Vatu

Therefore, the demand rate for 1998 and 1999 should be higher than the above stated value.
Luganville = 29.27 Vatu per kWh; demand charge per KVA is normally higher than for Port Vila.

Residential rate i.e. for small domestic consumers:
For the first 60KWh/month = 19.31 Vatu
For 61KWh to 120 kWh / month = 29.70 Vatu
For more than 120 kWh/month = 50.49 Vatu
Street Lighting:
For Port Vila = 16.32 Vatu per kWh

Sports Fields
For Port Vila = 30.35 Vatu per kWh

Others:
For Port Vila:
Energy Charge per kWh = 29.14 Vatu
Demand Charge per KVA = 576.65 Vatu

It can be observed that the tariff rate for urban electricity in Vanuatu is higher than the marginal norm and is continuing to increase periodically.

1.6.4.2. RURAL ELECTRIC TARIFF
For private homes supplied from government and private operated generators in rural areas are paying tariffs which probably only cover the fuel costs. These rural electricity systems are not metered and the operation costs of the generators are not properly recorded. For private homes in the rural villages where solar systems are installed by the government and JICA they are charged a monthly tariff rate of 1500 Vatu for the use of 4 lights or 1000Vatu per month for the use of 3 8Watt lights excluding the 18W halogen light, after paying an initial installation fee of 9000 Vatu.

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1 Unless otherwise specified, the tariff rates provided are for the period of 1998 to 1999. Where tariff rates for passed years are provided, take note that for the following years the tariff rates would be higher.

2 Based on the 1994 tariff rate
2.6. **Main Uses Of Electricity for Average Household**

For the urban Power supply, the majority of consumers in Port Vila are the small user consumers who make up for 57% of the consumer total for 1997 and 1998 period these small user consumers use 64% of the subscribed power to all consumers. For an average household in the urban area, electricity is mainly used for lighting, audio-visual, cooking and communication (telephone) purposes. The average monthly consumption for the High Voltage users is 21.775MWh followed by 0.318MWh for Low Voltage users in Port Vila. For Luganville, the average monthly consumption is 20.962MWh and 0.321MWh for High Voltage and Low Voltage users, respectively.

In the Rural area, consumption of energy is insignificant compared with the two urban centers. Average rural household would use electricity mainly for lighting purposes.

The average monthly consumption for rural consumers is difficult to determine due to lack of metered power utility hence lack of appropriate information.

2.7. **Trend of Energy Supply and Demand**

Power generation accounted for about 29% of diesel fuel, of which 25% was for urban power supply, in Port Vila and Luganville, and 4% for rural power supply including self generating industries. All power has so far been produced by diesel generating sets, with the exception of a hydro power generating system located at Santo Island and a number of photovoltaic systems installations at some of the rural communities around the country. Within the two urban areas for 1997 to 1998, Port Vila and Luganville, electricity is supplied from extensive grids. Whereby Luganville's power generating system includes 6 diesel generating sets with its largest generator having 720 kW of installed capacity and a hydro generating system consisting of two turbines each having a capacity of 300KW, and a peak load demand of 1.35MW. The largest is the Port Vila power supply with the current installed capacity of 11.48 MW (based on KVA with a power factor of 0.964), and a peak load demand of 7.2MW. The Port Vila Power system has the largest two generators out of it’s total of nine diesel generators. Each of the two largest generators has an installed capacity of 2.17MW. The extensive urban power networks some 343.19Km of lines and cables where electricity is provided at Low (380/230V) and High (5.5KV) voltage to more than 5570 consumers.

In 1990, there were approximately 50 government-owned and 50 private power generating systems ranging from 3 to 100KVA. Power supplies to the two urban centers have continued to increase annually in accordance with the increasing urban migration and other developments within the country.

In regard to rural electrification, it can be observed that in the rural areas the demand for electrification hence electrical energy is great. Therefore, in future there is a forecast for expansion of photovoltaic systems to rural areas and diesel generating systems. This will allow a better living standard for the rural population and hopefully allow fair distribution of electric energy to rural areas, and hopefully this will reduce the urban migration in the long run and allow development to be distributed fairly around the nation.

1.6.6.4. **Impact of Energy**

Please refer to the Executive Summary, under proper heading for the Impact of Energy but Briefly again, the impact Electrical Energy has are:

- Improved Standard of Living
- Better Social Status – pride due to better lighting
- Improved community services, hence better outcome
- Better understanding of energy source
- Better living standard comes with a cost
- Provide better training and knowledge to users if vital
- Access to electricity that may otherwise be available only in the town centers
- Carry out daily functions of the evening better

Energy in all forms has an effect on the society and lifestyle. Influence and impact of energy comes in many forms as itself, energy has an impact on everyone. With solar energy now being one of the most common but new technology utilized by the rural population after kerosene, there is great effect on both the user and the distributor of that power.
Further electrification of the communities with solar systems will allow the rural communities to improve their basic living standards on top of a more environmentally friendly fuel source. Following are some impact points generally observed in the society when solar energy is used.

**Impact on Elders**
Elders accustomed to reading some form of literature at night with the use of kerosene lamp or some other low intensity light source can now read under better light intensity with less effort and damage to the eyes.

Because the lights have switches it is of easier access by the elders, hence better for their safety.

Elderly ladies accustomed to preparing food and/or vegetable market products very early in the morning can now get better accessible lights making it easier for the preparation, including better selection of food products to be sold at the market.

**Impact on Children**
Children can now socialize longer in the evening with their families under better illumination, assisting in their social and communication development. Children can prepare their homework and study better under good light. This prevents stress on the eyes and other forms of problem such as inhalation of waste smoke gas from the kerosene lamp, where waste smoke from kerosene have an indirect influence on coughing and more.

**Impact on Youth**
For youth still in school it can assist them in their study. Better illumination is better study and therefore improvement in their overall academic performance.

Social gatherings such as youth choirs and more will allow them to carry out their activities with more enthusiasm. Therefore, have more energetic and positive impact from and to the community.

**Impact on Adults**
Adults can therefore spent more time together, and with the family. Training of children which normally takes place in the evenings can now be done with more enthusiasm and with better outcome.

Socializing of family members and community members usually occurs in the late evenings therefore with better lights can socialize better, more so if there was video or radio, the community population can also enjoy the luxury of electricity that may not otherwise be possible.

The men benefit from the lights especially in the preparation of fishing gears and other garden utensils that they may need sooner or early next day. Also if there was radio, they can be up to date with the latest news from abroad.

Men drinking kava may find it easier to prepare kava drink due to better lighting and also finding their way around the house after drinking kava or attending some other form of function- this is also true for women.

**Impact on Women**
Women commonly involved in weaving and handy craft will find it easier and convenient to carry out weaving and doing handicrafts. Since weaving and other crafting is done mostly late at night better lighting vicinity will assist them greatly, as they will able to carry out this part of their daily or weekly chore more efficiently and better.

Preparation on food products for the market in the early hours of the morning or for fishing or gardening is now a lighter responsibility.

Since women do the cooking in most cases, preparation of food is greatly assisted by better and more efficient lighting.

Social gathering in a house with good lighting is not only a sign of better standard of living for the owner but also more welcoming for the guests, women with the better lighting facilities tend to improve other factors of a house.
Impact on Men
Men can prepare their fishing and garden gears late at night or in the early hours with convenient lights.

Men can prepare and find their way home and around the home after kava drinking or when attending other functions – as with women.

Impact on the Community
It will increase their living standard and make it easier for the locals in general. Some communities who have to pay for the service will have to start implementing ways to generate a more regular source of income to be able to also cover the rental cost of the system.

Community functions will be lighter to prepare when there is no need to worry about lights and availability of electricity for entertainment.

Electrification of the rural communities will also bring great pride to them.

The community as a whole will be introduced to a new technology and therefore aware of the importance of these new alternative and environmentally friendly source of energy for electrical purposes.

Since solar installations used widely in the rural areas are of stand-alone types, there are fewer problems with land tenure issues and other land and customary matters.

The cost of having better lighting and for other electrical purposes comes at a cost; therefore income generation methods may be ratified to meet thee costs.

Impact on the Distributors
Electrical companies selling the system to the community will have to increase their stock especially when the demand is ever increasing. They will have to continue expanding their knowledge in regards to energy production.

Distributors may bid for tenders called by the energy unit, who is responsible for electrification of rural communities and has utilized greatly the use of solar systems.

Impact on Energy Unit
Since solar energy is new to the republic, donor aided projects already implemented for solar power generation has had a great impact on Energy Unit. The impact of this energy technology comes from the installation of the system to the effect of the output on the users.

Systems catering for individual homes, known as the Solar Home system, have had a greater impact on Energy Unit to work closely with aid donors and implement better managing procedures for the sustainability of the project. The economical wellbeing of the system is also considered to try and reduce the tariff rate without greatly affecting the maintenance cost and sustainability of the systems. Awareness programs are to be further implemented for the communities and individuals so better understanding can be further established. A better method of surveying the energy demand from the communities is also necessary so allocation of appropriate sites can be made.

Energy Unit needs to work closely including better cooperation and understanding with the rural communities to avoid future obstacles and circumstances that may cause disruption and elimination of the project. More so to promote prolong sustainability of the project and better cooperation amongst the two involving parties. Energy Unit must implement ways to allow users to feel ownership of the systems installed in their homes, doing so will encourage users to care for the systems.

Furthermore, all projects already implemented have had an impact on the organization and management of the system. Therefore, the unit must improve itself in the above two points to further improve the services of the unit and therefore be able to manage the numerous projects already implemented in better, more efficient and professional approach.

A workshop being held by the SPC/PREFACE team known as the "Vanuatu Solar Photovoltaic Projects Workshop", from the 3rd to the 5th of October 2000 bringing together all the members involved in the solar projects assisted in the awareness on both sides of some effect of the solar projects. The meeting was successful and brought out many important points, which have greatly had an impact not only on the other parties present, but also, the Unit.
2.7.1. Some Problem Vanuatu’s Electric Power Industry is facing

Vanuatu is frequently commented on the high electric tariff rate along with communications. Of course, it is clear that the electricity rates in Vanuatu are the highest in the region. However, care must be taken when interpreting any figures. Reason since the quality of service provided could vary substantially; Vanuatu has a reputation of the supply of clean power, which is not the case in many of the other island nations. Secondly, in many Pacific island economies, there is a substantial element of public subsidy with tariff rates below long-run marginal cost; in Vanuatu, there is no subsidy. Thirdly, prices on fuel vary significantly from island to island depending on the distribution policy of the suppliers. Furthermore, import duties paid on fuel will have substantial implications on tariff; in Vanuatu, there are no duties. It is therefore hard to compare. Setting aside, the above factors mentioned it could be said that the electricity tariff is above the regional norm.

The country has only two points of entry for petroleum imports: Port Vila and Luganville; other islands obtain their requirements from the two centers. Due to the draught restriction in Port Vila Harbor, shipments into Efate are limited therefore construction of a new but separate wharf specifically for fuel tankers should allow better fuel storage and reduce transportation cost which in turn should reduce the tariff rates.

The remoteness and the varying degree of distance between islands have made it impossible for a centralized power system and distribution adding to the high cost of electricity.

Lack of competition with the major power generating company – UNELCO Vanuatu contributes also to the high tariff rates in the urban centres.

Financial constraints and lack of financial assistance have made the electrification of rural areas a slow and almost an impossible goal to achieve.

Lack of good reliable data collection from the rural areas being surveyed has made it hard to determine the potential of developing or implementing some of the indigenous energy resources.

2.8. NATIONAL ELECTRIC POWER DEVELOPMENT PLAN AND LOAD FORECAST

The national electric power development plan and load forecast for Vanuatu is not very clear. The future cannot be predicted with certainty therefore the energy demand projection will always be conditional. In most cases, the energy demand will be based on certain assumptions based on selected economic indicators. The following economic indicators can be used for determination or prediction in the short term of future consumption of electric power and its development:

- Population growth
- Economic growth rate
- Export earnings
- Tourist visitor days
- Major projects and industries
- Consumer prices of the various fuels
- Availability of the fuels
- Possibilities for fuel substitution
- Potential savings through improved energy conservation and management.

In regards to rural electrification, the demand for electrification is great and so there is forecast of further rural electrification by solar installations, hydro power systems. Further study will be conducted in the area of Wind and other indigenous renewable energy such as the geothermal energy at North Efate as part of the power development plan.

2.9. The National Socio-Economic Plan and The National Energy Plan:

It is the intention of the government to electrify not only the urban but also the majority of the rural communities in Vanuatu at reasonable cost.
Vanuatu has a rich and diverse potential energy resource base, which, however is yet to be fully quantified. The biomass from natural vegetation, residues from forestry and agriculture, followed by hydro, geothermal, solar and wind. In addition, since the islands of Vanuatu are surrounded by sea, wave energy is another potential resource. Therefore the national energy plan will include continuous feasibility studies and surveys on the above mentioned indigenous energy resources.

Future objectives of the national energy plan are to:

Ensure that adequate and reliable energy supplies are always available at a reasonable cost in order to assist the implementation of the National Development Plan;

Achieve net foreign exchange savings;

Establish social development for the benefit of the majority of the population.

The strategies for the implementation of the above objectives:

Minimize the overall costs of imported fuel supplies and energy-using equipment;

Promote more efficient energy utilisation;

Develop indigenous energy resources and substitution of imported fuels where cost effective (based upon long-term economic calculations).

Attain permanent improvements in foreign exchange balance and in energy conservation by employing energy efficient equipment and by encouraging appropriate utilisation pattern.

The government capability of planning, co-ordinating and implementing development projects should be improved considerably; including the number and experience of the staff of the Energy Unit whom part of it’s responsibility is for the policy making of energy matters in Vanuatu.

For many projects, short-term technical assistance is to be provided and private sector companies can implement other projects.

Further recruitment of energy officers and advisors are to be implemented.

A long -term solution for the institutional arrangements within the urban power supply industry is necessary to implement soon. To prevent rapid increase in the use of imported fuels in the rural areas for the emerging rural industry and for improving living standards in the villages, projects utilising indigenous energy resources will be given high priority.

The high costs of imported fuels have during the last decade offset the large part of the revenue from domestic exports. Therefore, a major objective for the National Energy development Planning is to rationalise the energy use, to bring down the cost of imported fuels, and to develop indigenous resources based on a long-term minimum cost strategy.

The Energy Unit that is responsible for the policy making and from the limited data and information available, there was a ten year National Energy Development Plan (NEDP) to establish a policy framework for the development of the Energy Sector, and to identify and consider promising energy development projects. The development projects and programs may have to be reviewed and amended frequently following project progress and important future factor variations.

The institutional development and continuos strengthening of the Energy Unit by means of further education and training for the local officers is an ongoing part of the development plan.

There have always been problems attached to household and rural energy, for example financial constraints, communications and environmental forces. Though these and other obstacles are obvious, there is lack of sufficient finance, insufficient technical training. Therefore, part of the energy plan is to continue to train all responsible personals and to continue to electrify the rural areas under projects funded by the government and/or non-government organizations including private and foreign investors.
3. PROPOSED SITE PROFILE

3.1. General Background – Proposal Summary

SPC PREFACE (Pacific Renewable Energy France and Australia Common Endeavour) received a request from the Vanuatu Energy Unit on April 2000 to consider funding of two solar photovoltaic projects, one part in Ambrym Island for a solar home system type project for the village of Sesevi and the second part requested was a community photovoltaic project to electrify a number of public health and public education facilities in the north most province of TORBA which covers the island groups of Banks and Torres.

The SPC/PREFACE has considered providing financial and technical assistance to the electrification of the community facilities in the TORBA province north of Vanuatu. The proposal submitted to SPC/PREFACE for the TORBA province photovoltaic project (hereafter will be referred to as the PV or solar project) is in accordance with the SPC/PREFACE demonstration installation project distribution for the Melanesia group where a community project is to be implemented.

Therefore a team consisting an SPC/PREFACE renewable energy advisor and two energy unit officers carried out a feasibility study mission to the TORBA province between the 6th -14th October 2000.

The feasibility study team met with appropriates personals from the province, health and education sections and visited a few schools and health sites. Thereafter selection of the number of sites to be electrified was made and conclusion made of the viability of solar refrigeration for the health centers.

A number of sites were observed to have already had installed solar systems for radio transceivers, lighting and telecommunication purposes but most of them were in either poor working condition or are no longer working due to poor system design, installation – wiring and maintenance practice.

Outcome of the workshop carried out by the SPC/PREFACE team in Vila on the 3rd to the 5th of October 2000 and the result of the feasibility study, have allowed the proposal for the management and the project approach of the potential project to be implemented in the TORBA province.

The project to be implemented is estimated to cost $AUD 367,629 dollars including margin.

Project will install systems in 10 schools, 3 health centers, and 7 dispensaries and 40 approved staff houses for the schools and health centers collectively.

3.2. TOPOGRAPHY and CLIMATE

TORBA is the most isolated furthest province from access to proper and better facilities compared to the other 5 provinces of the country. Situated Northmost of the country, the province is warmer and of a higher tropical ambience i.e. higher temperature and humidity levels. The province is situated -13.5° south in latitude from the equator and 167.5° in longitude East of the Greenwich.

Most of the islands are flat and of coral origin except for the numerous major islands such as Gaua and Vanualevu that are of volcanic origin therefore possess mountainous, steep and rough terrenes with highly dense forests. For the volcanic islands they have the advantage of having the more fertile soil, which are therefore cultivated for agricultural products. Due to the isolation from better facilities most of the islands do not have good road conditions nor access. Most of the roads are not sealed therefore are of clay and very few with limestone sealing. In regards to anchorage, for the volcanic islands, accessibility to good anchorage for the boats and ships is virtually impossible due to the high raised cliff edges and rock formations around the island, furthermore coral lagoons surrounding the islands make it further difficult to access the limited shorelines.

The province has in total 13 islands with some smaller coral islands. The islands possess some of the most beautiful natural geographically molded settings.

TORBA province receives more than 4000mm of rain annually and is of higher risk to tropical cyclones compared to the southern islands of the country. The solar radiation is estimated to be a maximum of 4.6KWh/m²/day with a minimum of 3.9 kWh/m²/day therefore making it appropriate for solar power exploitation. The risk in regards to the weather is during the cyclone season. With the province being the
most cyclone prone zone with winds averaging 50m/s to 70m/s during a cyclone, careful strategy for implementing support structures for the solar system is essential.

3.3. POPULATION

The total population of the province from the 1999 census statistics result was 7,757 representing 4.2 % of the total population of the country and 5.3 percent of the total rural population. The change in percentage of the 1999 statistics to that of 1989 is a 29.6% increase in the population.

Most of the inhabitants are found in the larger four islands of the province, i.e. Gaua, Vanua Lava, Mota Lava and Mere Lava with the majority of the population being between the age of 16 to 55. The ratio of men to women can see the men outnumbering the women by probably three times more.

Majority of the population is of Melanesian descendant but with a several few from other background.

Most of the population lives in small-scattered village communities around the islands with only a few of these communities having better access to the limited facilities available on the islands.

Population tend to drift into the urban towns of Santo and Vila for employment and better education and health facilities. In reality it is assumed that about the same equal number of people from the province are residing elsewhere around the country.

3.4. ADMINISTRATION

Sola, Vanua Lava is the provincial administration center. Sola developed greatly in the last 5 years into a miniature township with the administrative center, a bank (National Bank of Vanuatu), a provincial court house, several shops selling basic preserved food products and clothes, and kava bars located in the commercial part of the small township.

The township is not far from the Sola airport about 5 minutes by public transport.

The administration of the province consists of a province president, a secretary general and other economic, accounting and office officials. The president of the province is elected into office by the province population for a period of 2 years. With the current implementation of a decentralization approach to running the country more national responsibility will be transferred to individual province therefore the provincial governments will play an important part in the implementation and wellbeing of the proposed solar project.

3.5. PROVINCIAL ECONOMY

Majority of the population are highly dependant on agricultural products especially copra followed by cocoa, kava and other sea products. Handicrafts from the region may also in future contribute to the economy of the province due to its increasing popularity.

Major part of the provincial budget comes from the national country’s budget with contribution from provincial taxes, rent of boats by locals and others, and other private investors to the province.

Most of the locals depend on local products for food and for other basic needs. Therefore, the necessity for money is for clothes, kerosene for fuel, batteries, preserved tinned food products, school fee contribution and transport if travelling to other non reachable areas by foot.

3.6. ENERGY PROFILE

Biomass fuel for cooking and lighting is the most abundant and widely used form of energy. Apart from Sola, which uses a diesel based generator; most of the rural communities have limited access to good lighting. Some parts of the province still use traditional methods for making fire and lighting.

Isolation from better facilities and access to fuel for lighting make it impossible. Ships and boats do not visit the islands regularly, in some cases ships visit only one a year contributing to the lack of proper utilities.
For schools and health there are very few sites who are using solar systems for radio transceivers, telephone and basic lighting.

3.6.1. Energy Production and Consumption

Being in the rural area and isolated, the amount of energy produced and consumed cannot be quantified as desired. Therefore, following words on the energy consumption and production are only through general observation.

Most of the energy utilized is from biomass followed by kerosene, dry cell batteries, oil-based fuels, and solar power energy.

Above-mentioned energy sources have been utilized for cooking, lighting, agricultural purposes and transportation to name a few.

In Sola there is a diesel-based fuel generator which is used to generate power to the shops and households around the township. A few of the shop owners own private mini generators used to power their refrigerators and provide light after the big township generator has been turned off.

Dry cell batteries of A size are sold at 100vt/cell, a normal torch requires at least 2 cells therefore costing 200vt for a period of up to 4 hours of good lighting from the torch. Kerosene costs 2500vt for 20 litres.

Biomass fuel is utilized for cooking and lighting. Many of the locals collect fire from the forest, which is laborious, and thereafter make open fires from it to cook and provide lighting. As previously mentioned biomass fuel is also used for agricultural purposes such as drying of copra. Coconut shells and dry wood are used to provide the heat required for drying copra.

Diesel based generators such as those of the boats and public road transport are also used and are the major consumers of diesel-based fuels followed by the township generator.

Solar systems are numerous, mostly existing in the public facilities to operate lights, radio transceivers, telephones and personal computers. Most of the existing solar systems are now using car batteries as storage banks, replacing the previously used sealed lead acid batteries.

LPG is utilized by health centers for vaccination purposes. Some individual houses have LPG for their cooking.

3.6.2. Energy Demand and Forecast.

Demand for energy is continuing to increase. Contributing factors to the energy demand include population increase rate, development requirements such as desire for better standards of living and facilities. Migration of people from the urban areas acquainted with better light and electricity facilities also contribute to the desire for better energy power utilities.

LPG demand is not obvious to that of solar, diesel-based generators and other electricity generating systems.

Biomass fuel utilization for electricity purposes may be considered in future due to the abundant source of biomass fuel.

In schools the necessity for proper lighting is obvious for those students preparing for exams and teachers preparing papers.

In Health facilities many still use torch-lights and traditional means of lighting to carry out functions such as maternity cases at night.

Hence, the need for electrical energy is in demand to allow for better standard of service from the facilities.

In regards to solar refrigeration for vaccination purposes, it has been concluded that it will not be installed due to the following points:

According to WHO Product information sheet, 1997 entitled – “Selecting an appropriate energy Source” for refrigerators clearly indicated that solar refrigeration is not necessary as there is just sufficient supply of LPG for current refrigerators and at reasonable price.

The need for LPG will not be eliminated by the use of solar refrigeration as autoclaving (method of using LPG for sterilization) of medical equipment’s will be introduced. Refer to Executive Summary.
3.6.3. Impact of Energy
It is similar to the impact it has nationally, refer to Executive Summary for details of impact and appropriate national topic.

3.6.4. Factors and Recommendation for Project sustainability

Risks to be considered for the TORBA solar project are:

Commitment of the involving ministries of health and education to the yearly maintenance cost.
Contract of facility workers is only 2 years per site, therefore staff members using the system will vary, hence may affect knowledge in using the system and respecting the system limits.
Isolation, making maintenance check on systems less regular.
Contracting local and/or foreign company to install and maintain the systems.
Awareness level of users regarding limitations of solar system.
Non-involvement of the provincial authorities.

3.6.5. Recommendations to implement the project:

Assurance from ministries to allow long term annual budget for maintenance cost. The team appropriate ministry personnels and received the assurance for commitment verbally, MOU must be made to further solidify the agreement made. With the commitment of public facility staffs using solar system, the ministry will be obliged to commit to its part of the annual maintenance cost.

Ministry recruiting public workers to the sites with solar system should notify clearly beforehand the commitment to the solar home system cost. Another recommendation is to automatically deduct the solar monthly fee of 1000vt from the users salary to the independent maintenance account at a private bank such as NBV.

Solar electric company (more so if of foreign origin) catering for maintenance of the project, to make a sub-contract with Telecom – Vanuatu as part of maintenance check. Maintenance check can be carried out simultaneously by the Telecom – Vanuatu technician when he/she is checking the telecommunication system solar sites and report promptly any fault finding to Maintenance Company. Recommended if there may exist difficulty in regular checking due to isolation.

Train a keen local person to be in charge of the maintenance per island, otherwise train a health or education committee personal per island to cater for systems per island.

Local and/or foreign company to install the systems must have good knowledge and background of solar system installation and maintenance. Screening of the companies to be involved in the installation and maintenance must be carefully done to avoid extra costs and other problems. Company must be able to provide quality work without extra cost, i.e. professional standard of work.

Users of the solar system are to be trained by the Energy Unit for the proper use and care of the solar system. Therefore, understand the limitations of the system hence getting the most out of the system without draining and further destroying the system.

Solar electrification in the rural areas is part of the decentralization of electricity. Therefore, the involvement of the provincial government in the project is necessary, especially when the country is implementing a decentralization approach in the governing of the country through the provincial governments. So the running cost of the project in future will be cared for on a provincial level therefore including the provincial government is recommended.

The ministries, provincial authorities and the private company catering for the maintenance must provide requested information that may be required for the project and/or is part of the project in a transparent and cooperative manner to the Energy Unit.
4. PROJECT PROFILE

4.1. Proposed Allocated Project Sites

From the feasibility study survey and the allowed budget for the project, a total of ten schools, ten health facilities and 40 individual staff houses belonging to the allocated facilities will be electrified.

Four sites are allocated at the Torres group while the remaining 16 sites are allocated at the Banks group.

The three sites at the Torres group include a dispensary, school and health center. For the Banks group the total number of schools will be eight and health facilities being eight.

<table>
<thead>
<tr>
<th>Island Group</th>
<th>Island</th>
<th>Site</th>
<th>Facility Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Health</td>
</tr>
<tr>
<td>Banks</td>
<td>Gaua</td>
<td>Losalava School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Santa- Maria School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vaget Bilingual School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mataka Health Center</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dorig Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mere Lava</td>
<td>Nergar</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LeQuel Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mota</td>
<td>Pasalele School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sarawia Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mota Lava</td>
<td>Telhei School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wongyeskei School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bemisas Health Center</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ureparapara</td>
<td>Shem Rolley</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lehali Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Vanua Lava</td>
<td>Hannington Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quat Vas (Sola) Dispensary</td>
<td>1</td>
</tr>
<tr>
<td>Torres</td>
<td>Loh</td>
<td>Robin School</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loh Health Center</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Hiu</td>
<td>Hiu Dispensary</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Martin School</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

Table 1: Allocated Sites to be Electrified
### 4.2. ESTIMATED SCHEDULE OF PROJECT COST

#### PREFACE FEASIBILITY STUDIES PROJECT COST SUMMARY

<table>
<thead>
<tr>
<th>Component</th>
<th>Sub component</th>
<th>Unit</th>
<th>Unit cost</th>
<th>Total cost</th>
<th>% of the item</th>
<th>% of Project cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment, transport and installation</td>
<td>Home Staff Systems (75Wp)</td>
<td>40</td>
<td>3,000</td>
<td>120,000</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health and school Facility Systems</td>
<td>20</td>
<td>6,000</td>
<td>120,000</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(150Wp)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spares, tools and other hardware</td>
<td></td>
<td></td>
<td></td>
<td>38,400</td>
<td>16%</td>
<td>10%</td>
</tr>
<tr>
<td>Training and workshops</td>
<td>4</td>
<td>5,000</td>
<td></td>
<td>20,000</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Project management</td>
<td></td>
<td></td>
<td></td>
<td>35,808</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Contingencies</td>
<td></td>
<td></td>
<td></td>
<td>33,421</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>367,629</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

#### FUNDING RESOURCES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th>367,629</th>
<th>100%</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PREFACE</strong></td>
<td></td>
<td></td>
<td></td>
<td>347,629</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td><strong>Recipient country</strong></td>
<td></td>
<td></td>
<td></td>
<td>20,000</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>367,629</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

The unit cost mentioned for Home staff and health and schools facilities are based on high standard technical design and so are based on cost of former system installed under solar project plus up to 20% extra (see data on former PV donor projects in annex)
Table 2: Estimated Schedule of Project Cost
4.3. SYSTEM TO BE IMPLEMENTED

4.3.1. Sizing for a standard 75W system for Community Facilities

Site: TORBA Province, 2001

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSUMPTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYSTEM VOLTAGE</td>
<td>12.5</td>
<td>Volts</td>
</tr>
<tr>
<td>AVERAGE HOURS OF OPTIMUM SUNSHINE</td>
<td>4</td>
<td>Hours</td>
</tr>
<tr>
<td>AVERAGE CONTINUOUS LOAD (for 4 hours/day)</td>
<td>50</td>
<td>watts</td>
</tr>
<tr>
<td>C100 RATING OF THE BATTERY BANK</td>
<td>150</td>
<td>Ahrs</td>
</tr>
<tr>
<td>% USABLE CAPACITY OF THE BATTERY BANK</td>
<td>50</td>
<td>%</td>
</tr>
<tr>
<td>NORMAL PEAK AMPS PER SOLAR PANEL</td>
<td>6</td>
<td>Amps</td>
</tr>
<tr>
<td>REQUIRED SYSTEM HOLD UP TIME</td>
<td>3</td>
<td>Days</td>
</tr>
<tr>
<td>CHARGING EFFICIENCY OF THE BATTERY BANK</td>
<td>80</td>
<td>%</td>
</tr>
<tr>
<td>CABLE LOSS EFFICIENCY</td>
<td>95</td>
<td>%</td>
</tr>
<tr>
<td>PANEL LOSS EFFICIENCY FOR TILT ANGLE, DUST, ETC</td>
<td>80</td>
<td>%</td>
</tr>
</tbody>
</table>

**CALculated SIZING**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM LOAD AMP HOURS</td>
<td>16</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>REQUIRED BATTERY CAPACITY</td>
<td>96</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>MINIMUM NUMBER OF PARALLEL BATTERIES</td>
<td>1</td>
<td>Banks</td>
</tr>
<tr>
<td>AMP HOURS REQUIRED FOR BATTERY RECOVERY</td>
<td>14</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>ARRAY PEAK AMPS REQUIRED</td>
<td>5</td>
<td>Amps</td>
</tr>
<tr>
<td>SOLAR PANELS REQUIRED</td>
<td>1</td>
<td>Panels</td>
</tr>
</tbody>
</table>

**ACTUAL SIZING**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL NUMBER OF BATTERY BANKS</td>
<td>1</td>
<td>Banks</td>
</tr>
<tr>
<td>ACTUAL NUMBER OF PANELS</td>
<td>1</td>
<td>Panels</td>
</tr>
<tr>
<td>RESULTANT SYSTEM HOLD UP TIME WITHOUT SUN</td>
<td>5</td>
<td>Days</td>
</tr>
<tr>
<td>RESULTANT SYSTEM HOLD UP TIME WITH SUN</td>
<td>6</td>
<td>Days</td>
</tr>
</tbody>
</table>

Note: This Sizing Still Needs to be Fixed, this is only tentative size.
4.3.2.  75 Wp system design

Figure 3: 75Watt System for Staff Houses
### 4.3.3. Sizing for a standard 150W system for Community Facilities

**Site: TORBA Province, 2001**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSUMPTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYSTEM VOLTAGE</td>
<td>12.5</td>
<td>Volts</td>
</tr>
<tr>
<td>AVERAGE HOURS OF OPTIMUM SUNSHINE</td>
<td>4</td>
<td>Hours</td>
</tr>
<tr>
<td>AVERAGE CONTINUOUS LOAD (For 4 hours/day)</td>
<td>75</td>
<td>watts</td>
</tr>
<tr>
<td>C100 RATING OF THE BATTERY BANK</td>
<td>150</td>
<td>Ahrs</td>
</tr>
<tr>
<td>% USABLE CAPACITY OF THE BATTERY BANK</td>
<td>30</td>
<td>%</td>
</tr>
<tr>
<td>NORMAL PEAK AMPS PER SOLAR PANEL</td>
<td>6</td>
<td>Amps</td>
</tr>
<tr>
<td>REQUIRED SYSTEM HOLD UP TIME</td>
<td>3</td>
<td>Days</td>
</tr>
<tr>
<td>CHARGING EFFICIENCY OF THE BATTERY BANK</td>
<td>80</td>
<td>%</td>
</tr>
<tr>
<td>CABLE LOSS EFFICIENCY</td>
<td>95</td>
<td>%</td>
</tr>
<tr>
<td>PANEL LOSS EFFICIENCY FOR TILT ANGLE, DUST, ETC</td>
<td>80</td>
<td>%</td>
</tr>
</tbody>
</table>

**CALCULATED SIZING**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM LOAD AMP HOURS</td>
<td>24</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>REQUIRED BATTERY CAPACITY</td>
<td>240</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>MINIMUM NUMBER OF PARALLEL BANKS</td>
<td>2</td>
<td>Banks</td>
</tr>
<tr>
<td>AMP HOURS REQUIRED FOR BATTERY RECOVERY</td>
<td>21</td>
<td>AmpHrs</td>
</tr>
<tr>
<td>ARRAY PEAK AMPS REQUIRED</td>
<td>7</td>
<td>Amps</td>
</tr>
<tr>
<td>SOLAR PANELS REQUIRED</td>
<td>2</td>
<td>Panels</td>
</tr>
</tbody>
</table>

**ACTUAL SIZING**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>VALUE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL NUMBER OF BATTERY BANKS</td>
<td>2</td>
<td>Banks</td>
</tr>
<tr>
<td>ACTUAL NUMBER OF PANELS</td>
<td>2</td>
<td>Panels</td>
</tr>
<tr>
<td>RESULTANT SYSTEM HOLD UP TIME WITHOUT SUN</td>
<td>3.75</td>
<td>Days</td>
</tr>
<tr>
<td>RESULTANT SYSTEM HOLD UP TIME WITH SUN</td>
<td>5.8</td>
<td>Days</td>
</tr>
</tbody>
</table>

Note: This Sizing Still Needs to be Fixed, this is only tentative size

**Table 3b. Tentative Sizing for a 150Wp System**
Figure 4: **150Wp System for School and Health Facilities**
4.4. Recommendation for Criteria for the Selection of Installation and Maintenance Company

In general following are some of the suggested criteria for selecting the appropriate company when calling for Tender. More criterion and detail will be given on the Tendering document.

- Bidding Company must bid for both Maintenance and Installation collectively. Bids not abiding this prime condition will not be considered.
- Separate contract will be signed for the installation and Maintenance services at separate occasions accordingly.
- Company must have previous and proper experience, and background with Solar systems installation and maintenance.
- Must provide total cost including the majority of added value.
- Bidder must be responsible for all occurring costs related with the preparation and submission of their bid. The clients will not be incurred with any of the costs nor be bound to it.
- All documents such as catalogues and others containing relevant information in relation to the tendered project must be submitted and of satisfactory level to the SPC/PREFACE and EU standard provided.
- All bidders must supply samples of the products to be used by the project, and submitted samples must be in line with the requirements of the contractors (PREFACE and EU).
- Foreign companies must have a local counterpart of approved technical standard to be eligible for bidding.
- Prospective bidders needing clarification on the bidding documents may notify the client by writing, fax or e-mail (will be given at tendering process)
- Bidders may submit alternative technical paper(s).
- Bidders must provide calculation of cost
- Language of document must be both in English and French.
- Provide necessary and requested documents relating to the project materials, material specification and provide other relevant documents accordingly.
- Company must provide a time schedule from installation date to the maintenance-checking timetable.
- Company must provide references of the company including background, company organization, past activities.
- List of experience with photovoltaic systems, more so in the design, supply erection and maintenance in tropical and/or south pacific and/or other developing countries.
- Provide spare-parts
- Refer to the appropriate section for the Evaluation procedure of the Criteria.
4.5. Schedule of Project implementation

Synthesized Schedule for Project Implementation

<table>
<thead>
<tr>
<th>MONTH</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<td>Mobilization</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-Plant Inspection</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Transportation and Erection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>On-Site Provisional Inspection</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>On-Site Final Inspection</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Schedule of Project Implementation

The management of the system will be overseen by the Energy Unit, while the installation and maintenance will be catered for by a private electrical company chosen. Ministries involved and staffs will cover the cost of maintenance.

In Conclusion  Assuming that the equipment’s used are of high quality, system properly designed and installed, the future of the project is highly dependant upon the commitment and cooperation between the involving parties.

A proper management strategy by the Energy Unit and PREFACE, a long-term commitment to specified responsibilities by the Ministries involved, respected staffs and the contracted company for the installation and maintenance, would allow this proposed project to be a sustainable and successful one.
5. APPENDIX

5.1. MAP OF VANUATU  A-2

5.2. POPULATION STATISTICS  A-3

5.3. DATA TABLES – INSOLATION, ANNUAL RAINFALL, SUNSHINE  A-4
MAP OF VANUATU
## 1999 POPULATION STATISTICS

### POPULATION STATISTICS - VANUATU

| Year | Resident | Male | Female | Ni-Vanuatu | Non Ni-Vanuatu | Port Vila | Luganville | Rural | Malampa | Penama | Sanma | Shefa | Tafea | Torba | Northern Population
|------|----------|------|--------|------------|----------------|-----------|------------|-------|---------|--------|-------|-------|-------|-------|----------------------|
| 1967 | 77,988   | 41,371 | 36,617 | 72,243     | 5,745          | 5,208     | 2,564      | 70,216| 17,407  | 13,968 | 12,785| 17,633| 12,436| 3,481 | 72,243
| 1979 | 111,251  | 59,074 | 52,177 | 104,371    | 6,880          | 10,601    | 5,183      | 95,467| 23,567  | 18,937 | 19,423| 26,860| 17,506| 4,958 | 104,371
| 1989 | 142,419  | 73,384 | 69,035 | 139,475    | 29,44          | 18,905    | 6,965      | 116,549| 28,174  | 22,821 | 25,542| 38,023| 22,414| 5,985 | 139,475
| 1999 | 186,678  | 95,682 | 90,996 | 184,329    | 23,49          | 29,356    | 10,738     | 146,584| 32,705  | 26,646 | 36,084| 54,439| 29,047| 7,757 | 184,329

#### Percent of Population

<table>
<thead>
<tr>
<th>Category</th>
<th>1989</th>
<th>1999</th>
<th>Total Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 15 yrs</td>
<td>44.80%</td>
<td>45.80%</td>
<td>44.10%</td>
</tr>
<tr>
<td>65 yrs and Over</td>
<td>2.90%</td>
<td>2.90%</td>
<td>3.60%</td>
</tr>
<tr>
<td>Occupied</td>
<td>44.70%</td>
<td>46.70%</td>
<td>44.40%</td>
</tr>
<tr>
<td>Crude Birth Rate</td>
<td>37</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Total Fertility</td>
<td>6.8</td>
<td>6.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Infant Mortality</td>
<td>123</td>
<td>94</td>
<td>45</td>
</tr>
</tbody>
</table>

### Province Island

<table>
<thead>
<tr>
<th>Province</th>
<th>Island</th>
<th>1989</th>
<th>1999</th>
<th>Total Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>TORBA</td>
<td></td>
<td></td>
<td></td>
<td>29.6%</td>
</tr>
<tr>
<td>Gaua</td>
<td></td>
<td>1,285</td>
<td>2,031</td>
<td></td>
</tr>
<tr>
<td>Vanua Lava</td>
<td></td>
<td>1,343</td>
<td>1,933</td>
<td></td>
</tr>
<tr>
<td>Mota Lava</td>
<td></td>
<td>1,047</td>
<td>1,146</td>
<td></td>
</tr>
<tr>
<td>Mere Lava</td>
<td></td>
<td>815</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>Mota</td>
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LOCATION SITE: Sola, TORBA Province (-13.5° latitude, 167.6° longitude)

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ANNUAL SUNSHINE, ANNUAL RAINFALL & INSULATION

ANNUAL RAINFALL – SANTO PEKOIA AIRPORT

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Means: 260.7 161.1 350.6 259.0 218.6 137.0 79.9 62.5 105.7 104.5 127.3 275.2 2141.9
Note: All data collected above are from the nearest location to the TORBA province.

ANNUAL SUNSHINE – SANTO PEKOA AIRPORT

VANUATU METEOROLOGICAL SERVICE

Station: PEKOA (SANTO)
Sunshine duration means per day (hours and tenths)

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Sunshine duration means per day (hours and tenths)
Station: PEKO (SANTO)
6. APPENDIX B

6.1. ORGANISATION STRUCTURE OF EU   B-2
6.2. PROJECT IMPLEMENTED UNDER EU   B-3
6.3. UNELCO IN BRIEF      B-4
Organization Structure of the Energy Unit

Leo Moli  
Principal Energy Officer

Planning and Management

Economist  
Donald Woulsese

Civil Engineer  
Vacant post

Electrical Engineer  
Marlene Kalmet  
(under Contract only)

Senior Technician  
Janjea Moli

Tecnician  
Kalpapau Mangawai

Rural Electrification

Technician  
Vacant

Executive Officer  
Fred Shedrack  
(Under Contract Only)

Office Assistant  
Emma Mala  
(Under Contract only)

Office Cleaner  
(Vacant)

Office Driver  
(Vacant)

Administration
1. TABLE 9: PROJECTS IMPLEMENTED BY DONORS with EU – JICA, ACCT/FONDEM, AFD

Vanuatu Rural Photovoltaic Projects – Brief Summary

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<th>UNIT</th>
<th>ACCT/Fondem</th>
<th>JICA</th>
<th>AFD</th>
<th>TOTAL</th>
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(i) Cost Per Project

[Figure 9: Graphical representations of projects already implemented]

FIGURE 9: GRAPHICAL REPRESENTATIONS OF PROJECTS ALREADY IMPLEMENTED

(ii)
Power Distribution


ACCT/Fondem
7%

AFD
46%

JICA
47%

Figure 9b: POWER DISTRIBUTION OF ALL PROJECTS

(i) Cost and Power per system

Vanuatu Rural Photovoltaic Project- Cost per Watt per System

Donors

AFD
108
123

JICA
102

ACCT/Fondem
7
289

Power Per System Per Project Cost per watt peak per system

Figure 9 c: COST PER POWER PER SYSTEM
A Brief History of UNELCO

In 1939, under the Condominium Powers of the French and British, UNELCO was granted a monopoly concession to operate as a public power utility in Port Vila. In 1974, the granted concession mentioned above was renewed for a 14-year period. In November of 1982, the Government of Vanuatu permitted UNELCO to transfer its concession agreement and its associated “Cahier de Charges” to “UNELCO – Vanuatu” jointly owned by UNELCO and Socivan, a subsidiary of UNELCO. Similarly, Compagnie d’Electricite de Santo (CES), of which 85% was owned by UNELCO, was responsible for the public power supply in Luganville up until 1990. In October 1986, the government renewed the agreement with UNELCO and extended its concession up to 2011. As part of the agreement, UNELCO has also taken over CES. Therefore, UNELCO is now solely responsible for the public electricity supply in both Port Vila and Luganville. The terms of the original concession exempting UNELCO from payment of taxes on capital equipment, spares, land and fuel have not been extended to UNELCO Santo. Hence, UNELCO is still paying taxes on Automotive Diesel Oil (ADO) used for power generation in Luganville. Only recently did the Government of Vanuatu purchase a 15% share of UNELCO. UNELCO and the government have recently formed a jointly owned company, HydroPower Development Ltd, designed to prepare and construct future hydro generating facilities. Refer to for further outline of the UNELCO company.