Module 6 - **Trainers Guide**

Renewable Energy Project Financial Management

ENGLISH – PAPUA NEW GUINEA

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Other information in this module is drawn from materials that are publicly available online, and any misrepresentation is truly regretted. Inclusion in this module does not constitute endorsement by GGGI or the authors. Information provided in the module has been adapted by the authors and any mistakes are the authors' own. Readers should always check for latest information with the relevant authorities as standards and requirements keep getting updated.

Cover photo source: https://www.maxpixel.net/Home-Coin-Investment-Money-Finance-Business-Bank-2724238.

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GLOSSARY

AC - Alternating Current, is a type of electricity produced by big generators for big devices like TV or washing machine.

Bookkeeping - Keeping a record of cash coming in and out, of a business.

Charge - To connect wires to a battery to make its voltage go up. It is normally connected to the solar panel to charge.

Charge Controller - Something that controls the charging of a battery and stops it from overcharging.

Current - It is what flows in the wires to give us power together with voltage.

DC - Direct Current, is a type of electricity produced by solar panels. The DC power can directly run lights and small devices.

Grant - Money given for a project, but does not have to be returned.

Inverter - Something that changes dc electricity to ac electricity.

Load - Anything that takes power from the battery or solar panel. It can be a light, fan or fridge. Anything that uses electricity is a load.

Loan - Money given for use but has to be returned later on, with interest.

Mounting - Something used to hold components in place – like we use something to hang pictures. Similar, to fixing the panels to the roof properly with mounting so it does not fly away.

NGO - Non-Government Organization – these are organizations that help communities.

Overcharge - If you keep charging the battery when it is full – just like a bucket gets too full of water and overflows – the battery will get damaged.

Power - It is the energy given by something over a certain time.

Project - Some important work we do for a fixed time, example building a house is a project.

PV Array - It means many solar panels connected together.

Solar Panel - Also called 'PV module' or PV panel. They are the shiny blue plates that convert suns energy to electricity.

Sponsor or Donor - An organization or person who donates money for a project.

Voltage - Voltage in wires combines with current to give us power.

The "Renewable Energy Projects Financial Management" training module is an introduction to the basics of renewable energy finance process.

Upon completion of the course, you will achieve the following learning outcomes:

- Identify Existing RE Projects or Potential for new RE Projects in the Community.
- Demonstrate basic level understanding of financial management in renewable energy projects.
- Identify opportunities for access to funds for RE community projects.
- Demonstrate basic understanding on revenue and expenses of a renewable energy project.
- Understand how to engage with relevant government, donors, and development partners for assistance to renewable energy projects.

HOW TO USE THIS GUIDE?

The trainer guide is provided with the class notes and includes activities which need to be done after each section of the course. The guide acts as a recommendation only. After seeing the situation on the ground in each community, the experienced trainers may use their judgment to modify their delivery and assessment techniques to achieve better results.

The Trainer Guide provides detailed notes written in the form that can be directly delivered to the learners. However, the very detailed notes are intended to broaden the knowledge of the learner as well. You are not required to read each paragraph from the Trainer Guide, but you are expected to know the materials sufficiently to train others. Firstly, you must know what key concepts the learners need to learn. These are normally called learning outcomes. The learning outcomes are all listed at the start of the Trainer Guide, and you must ensure that at minimum, every learner achieves those 5 learning outcomes. You are required to take at least a week to go over the TG and go through the activities in the Learner Workbook. During the actual training you can refer to the Trainer Guide and explain it to the learners in your own words. If you are unsure of something always refer to the TG notes. Also note to take heed of the time recommended for each session and activity.

In case where learner literacy levels are low, trainers are advised to adapt to the situations and modify activities as appropriate. It is advisable to keep a continuous record of competencies of learners. All competencies are achieved when learners fulfil all learning outcomes.

HOW TO CONDUCT ACTIVITIES

- Activities are best done in groups or pairs. It is recommended that in each group there is at least one who is more literate or a more active learner who can help to translate and explain the training contents to learners who are slower to understand.
- You may divide the learners into groups of at least 2 and preferably 3-4 learners and ask them to carry out a rigorous discussion within the group. Some activities can be given to the groups for overnight preparation. The trainer needs to be aware of the dynamics of relationships in the community when dividing learners into groups. Sometimes women and youth are not free to share their views when the men from the communities are present. The trainer should ideally ask learners for their guidance when organising them into groups for discussions.
- Ideally the learners may present the results of their activities to the class and have a class discussion based on their findings.
- It is not necessary that all groups present in the same activity.
- However, it is important that all groups are given opportunity to present or verbally discuss their answers.
- At all times, encourage learners to be interactive and participative in class.
- Learners must be encouraged to be vocal and to contribute actively in class discussions.
- To better improve learning, the learners must be encouraged to strongly inquire about the topics through questions.
- The activities allow trainers to observe if the learners have achieved the learning outcomes. If possible, do keep record of the learner's achievement of learning outcomes so that you can help them learn better. A sample record table is given in this guide.
- Adapt existing activities and/or alternative suitable activities in case the desired literacy levels of learners are not met or the desired resources are not available.

TEACHING TOOLS

The following tools/items may be required to enhance learner learning:

- Laptop/ computer and projector to play videos or present notes to the whole class. This will depend on availability. In case this is not available, you are recommended to take large prints of the key concepts and display to the learners while teaching.
- Provide each learner with pen or pencil, and paper to allow them to participate.
- Whiteboard and markers or black board and chalk can be made available to allow both facilitator and learner to state a point.
- The Learner Progress Record sample given below can be used to observe learners, note their feedback, and assess if they have achieved the specific learning outcome. This recording is useful for both the learner and trainer so you can focus on those who are falling behind. Note there are no marks to be awarded and the record is only to improve learning. This is entirely optional.

TABLE 1: Learner Progress Record Template optional for trainers to use.

Learner Progress Record (Optional)	Date:
Learner Name:	
Trainer Name:	
Learning Outcome	Achieved Outcome (Yes or No) and Comments
1. Identify existing RE projects or potential for new RE Projects in the Community.	
2. Demonstrate basic level understanding of financial management in renewable energy projects.	
3. Identify opportunities for access to funds for RE community projects.	
4. Demonstrate basic understanding on revenue and expenses of renewable energy project.	
5. Understand how to engage with relevant government, donors, and development partners for assistance in renewable project.	

LESSON PLAN AND TIMES

TABLE 2: Lesson Plan and recommended timing of each session

Chapter	Lesson Type	Recommended Time
1. Introductions	Theory and activity 1	30 minutes
2. What is Renewable Energy Finance	Theory	20 minutes
	Activity 2	15 minutes
	Activity 3	45 minutes
3. Funding Opportunities	Theory	30 minutes
4. Revenue and Expenses of Renewable Energy Projects	Theory	30 minutes
	Activity 4	120 minutes
5. Engaging Donors for Funds	Theory	30 minutes
	Activity 5	70 minutes

1

Ice Breaker Introduction

Trainers must understand that the learners are attending the module have taken time from their usual daily activities which sustains their livelihood. Most will also be very nervous and unclear regarding what the module is all about. Hence the trainer must ensure that the learners are comfortable and not too nervous. It is important to make them feel at ease so that they can focus on the module and absorb as much knowledge as possible.

Tell them that this is an informative module and there will be no tests or marks in this. You must inform them that this module is being run so that they can take the information to help themselves to transition to renewable energy. Even if they do not use it, they can always use the knowledge to help others. In any way this module will better equip them to help grow their communities. Tell them to be at ease and focus on enjoying the day and asking as many questions as they want. Also tell them to not worry too much about complicated things as you will guide them through this.

ACTIVITY 1

Introduce yourself briefly to the learners. Ask if they are all comfortable at the venue. One by one ask them their names and tell them to give some details about themselves – such as what they would normally be doing at that time and what they hope to gain from the module at the end of the day. In addition if time permits – ask them what they think about Renewable Energy Financial Management. There is no correct answer, and the goal of this activity is simply to get them relaxed and engaged into the session. You may crack few light jokes as laughter always lightens the mood and helps learners relax. Ask the learners about their prior experiences in RE Financial Management and how much they know about the topic. Also ask them what they wish to gain from this training session and record their answers on paper so that it helps the trainer in setting a direction to the course. This input will help the trainer direct the training to the learners needs.

2

What is Renewable Energy Financial Management

2.1 Renewable Energy

Renewable energy is energy that is harnessed from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.[1]

2.2 Financial Management

Financial management means planning, organizing, directing, and controlling the financial activities such as procurement and utilization of funds of the enterprise. It means applying general management principles to financial resources of the enterprise[2]. A renewable energy project is no different and requires analysis to identify return on investment. There is no golden rule, method, or standard set financing of renewable energy projects. Each individual renewable energy project requires its own unique funds and conditions to be financially viable.

FIGURE 1: **Risks for RE Technologies[3]**

Typical RE risks of the different RE technologies	
RE type	**Key Risk Issues**
Geothermal	• Drilling expense and associated risk (e.g. blow out) • Exploration risk (e.g. unexpected temperature and flow rate) • Critical components failures such as pumps breakdowns • Long lead times (e.g. planning consents)
Solar PV	• Component breakdowns • Weather damage • Theft / vandalism
Small hydro-power	• Flooding • Seasonal / annual resource variability • Prolonged breakdowns due to offsite monitoring (long response time)
Windpower	• High upfront costs • Critical component failures • Wind resource variability • Offshore cable laying
Biomass power	• Fuel supply availability / variability • Resource price variability • Environmental liabilities associated with fuel handling and storage
Biogas power	• Resource risk • Planning opposition associated with odor problems
Tidal/wave power	• Survivability in harsh marine environments • Prototypical / technology risks, Various designs and concepts but with no clear winner at present • Small scale and long lead times
Source: UNEP - Financial Risk Management Instruments for Renewable Energy Projects, Summary Document, 2004	

Renewable energy projects require substantial amount of funds and usually varies on the type of renewable energy technology. These projects are capital intensive and having a longer time for return on investment, usually pose an extended period of risk. Typical risks are shown in the Figure 1. The financing option is limited in many developing countries for renewable energy technology thus renewable energy financial management is important to secure funds.

2.3 Renewable Energy Project Framework

Generally renewable energy projects have the following Processes involved,

1. Identify Project:
   - Energy requirement identified
   - Resources for potential renewable energy identified (e.g., available water stream) which determines the potential renewable energy technology (e.g., for water steam, hydro energy)
   - Agreement of all stakeholders (if not installed individually)
   - Identification of site(s)
   - Assess how much it will cost
2. Funding:
   - Identify the beneficiaries
   - Determine who will fund (e.g., individual loan, government grant)
   - Sometimes a power purchase agreement (PPA) can be signed so that excess energy can be exported (sold) to grid
3. Building:
   - Identify who will build (e.g.: villagers or a contractor)
   - Installation completed
   - Tested and commissioned
4. Own and Operate:
   - If an external agency has financed the project, they may run and charge until they recover their cost. Upon recovery of cost, the ownership can be transferred.
   - If locally financed, villagers or individual households will own and operate.
   - If a PPA is signed, the additional energy is exported, and the money obtained can be used to pay loans used to buy and install the system.

1 PennState Extension, "What is Renewable Energy?", https://extension.psu.edu/what-is-renewable-energy

2 Management Study Guide, "Financial Management, Meaning, Objectives and Functions, https://www.managementstudyguide.com/financial-management.htm)

3 UNEP- "Financial Risk management Instruments for Renewable Energy Projects Scoping", Summary Document,2004, https://wedocs.unep.org/20.500.11822/9450

2.4 Identify Renewable Energy Projects

Renewable energy project is any activity that is unique and is carried out to produce energy from sources which are replenished. Existing renewable energy projects are any activities that are being carried out to produce energy in a sustainable way using renewable energy sources.

The potential for new renewable energy projects is dependent on many aspects as follows:

1. What is the energy source?

The energy sources could be solar, hydro or wind for small community projects. It is dependent on where you are located and what you have access to.

FIGURE 2: Solar Energy[4]

FIGURE 3: Sirinumu dam in Central Province that Produces hydro energy[5]

2. How much energy is required to be produced?

The total amount of energy required is calculated on how much energy is required in a household and how many households in a village need energy.

3. Is the source sufficient to produce the required energy?

It is important to understand how much energy the source can produce. If it's a solar system, then there will be no issues and each household can have its own solar system but if it's a hydro system, then water stream has to be sufficient to produce enough energy for either a household or for a community.

4. What will be the system capacity?

Looking at the energy requirement in a house, system capacity can be found and likewise you can identify the total power requirement for household or for a community. Local department of energy will have details available to help calculate the total system capacity. For PNG, the local department of energy would be the department of Petroleum and Energy at the national Level[6], at the Provincial level, the Provincial Works division is the responsible division to help calculate the total system capacity of any households or community.

5. How much it will cost?

Once the power requirement is known and the type of system (e.g.: Solar or Hydro) identified, then quotations are obtained from local suppliers. Local department of energy will have list of preferred suppliers.

6. Who will fund it?

Once the value of the project is identified, funding needs to be identified. Funding can be from villagers, or they can apply for government grants or funds from donors. Again, local government and department of energy can provide some guidance on the available funds and grants.

7. What will be the payback period?

The payback period means; in how many years your investment will be repaid. For example, you want to install a solar system which costs K500 to install. Once you will install this system you will save K10 per month in fuel. So, in a year you will save K120. So, the payback period will be:

$$\text{Payback Period (years)} = \frac{\text{Total installattion Cost}}{\text{Yearly Cash inflow}}$$

$$\textit{Payback} = \frac{\text{K500}}{\text{K120}} = 4.16 \textit{ years} \text{ (4 years, 1 month and 28 days)}$$

4 Source: Europe for Culture, 2018, http://anoeuropeu.patrimoniocultural.gov.pt/index.php/resultados-do-ano-europeu-do-patrimonio-cultural-2018/

5 Sirinumu Dam, TripAdvisor, https://www.tripadvisor.com/Attraction_Review-g294118-d15661829-Reviews-Sirinumu_Dam-Port_Moresby_Papua_Region.html#/media-atf/15661829/365843729:p/?albumid=-160&type=0&category=-160

6 Adapted from Papua New Guinea Department of Petroleum &Energy, https://petroleum.gov.pg/

However, if you are getting loan to install than the total cost will no longer be K500. So, if you are getting a loan with an interest rate of 20% per year for a period of 5 years, then your extra yearly cost will be:

$$\text{Interest cost per year} = \frac{\text{Interest \%}}{100} \times \text{Loan amount}$$

Interest per year = $^{20}/_{100}$ x 500 = K100 *per year*

So, in 5 years' loan term you will pay additional K500 (5 years x K100). Now overall cost of your project is K500 (loan amount) + K500 (interest) = K1000.

Shorter payback period is better. Every renewable energy technology has a lifetime, so you do not want to have a payback period close to the system lifetime. For example, if a solar system has a lifetime of 10 years, you don't want your payback period above 7 years, otherwise you will not be able to use your system free.

This means that if the above payback period is 4 years, 1 month and 28 days, and the expected life of the system is 10 years (meaning after 10 years the system may not operate), you will use free energy for 5 years, 10 months and 3 days.

8. What are other benefits:

The other benefits are that you will have clean energy, you will have access to energy every time, good quality light etc.

2.4.1 Budget Template

A budget is a financial plan (an estimate of income and expenditure) for a defined period. For renewable energy, a simple template can be used to record the important information as follows:

Description		Description	
What is the energy source		Expected cost of installation (labour)	
Identify power requirement (kW)		Expected cost of materials and components	
Individual or Village Project		Maintenance / replacement cost	
Grant, Loan or Cash		Duration of project	
If loan, what deposit is required		What is current energy cost	
How much saving will be from using this renewable energy		Payback Period	

2.4.2 Managing Funds

In some cases, power purchase agreements provide a good source of income for renewable energy projects to utilise for future repairs and replacement of components. In this regard prudent financial management is very important. Here are some tips for managing the cash flow in renewable energy projects:

- Ensure that all income generated, and all expenses made is recorded by a nominated treasurer. A committee must exist consisting of a chairman/woman, treasurer secretariat & other committee members to approve use of funds and all income and expenses must be recorded.
- Keep all receipts and invoices as proof of expenses or income. This must be kept properly to allow the committee or any stakeholder to see these whenever required.
- Ensure that the committee looking after that renewable energy project meets every month to be briefed on the financial status so as the technical aspects of the project, i.e., how much money has come in and how much used so as how to continue operate and maintain the system.
- Each year the committee should present an audited report of finances to the stakeholders and use this chance to elect new committee members to look after the project if there is interest from stakeholders to join the committee.

ACTIVITY 2

1. Now (in 7 above) your loan amount including interest becomes K1000. Using the annual saving of K120, calculate the payback period.

Answer:

$$Payback = \frac{K1000}{K120} = 8.33 years \text{ (8 years, 3 months and 29 days)}$$

ACTIVITY 3

1. Suppose your village discussed in a village meeting that they want to install a renewable energy system for the village. The power requirements are as follows:

    b. There are 10 households in the village.

    c. Each household requires 50 watts' power.

    d. Each household will have DC power only with light and for radio.

    The village has access to a stream. Your village head found a catalogue from the Department of Energy which has some information on renewable energy systems and their price. The information is as follows:

    a. A 600W pico-hydro (turbine and generator) system costs K700.

    b. Other cost to have the pico-hydro system (wiring, battery, controllers) operational will cost K1300.

    c. A 75W solar panel, battery and controller costs K180 including installation.

    Each household in your village has fuel cost of $5/week to provide light and K2/week for radio battery.

Since you have attended this course from your village, the village head wants you to advise him:

i. What is the total power required in the village?

Answer:

The total power requirement in the village =
10 household x 50 watts = 500 Watts.

ii. What will be the simple payback if village decides to install pico-hydro and villagers will contribute to buy the system.

Answer:

Total cost for pico-hydro system = K700 + K1300 = K2000.

Each house spending per week = K5 + K2 = K7.

Each house per year spending = K7 x 52 weeks = K364.

$$Simple\ Payback = {}^{Cost\ of\ Investement}/_{Savings\ per\ year}$$

$$Simple\ Payback = {}^{K2000}/_{K364} = 5.49\ years\ (5\ years\ and\ 6\ months)$$

iii. What will be the simple payback if village decides to install solar system and villagers will get a loan from banks at an interest rate of 20% per annum for a repayment period of 5 years.

Answer:

Total cost for solar system = K180 x 10 = K1800.

Total cost with Loan @ 20% for 5 years:

First you find the interest amount that you will pay per year: K1800 x 20/100 = K360.

Then you calculate how much interest you will pay in 5 years: K360 x 5 = K1800.

Total loan amount to pay to bank in 5 years = K1800 interest + K1800 for loan = K3600.

$$Simple\ Payback = {}^{K3600}/_{K364} = 9.89\ years\ (9\ years\ and\ 11\ months)$$

3

Funding Opportunities

Sometimes we have good ideas about improving the quality of life in our community. Most ideas require funds to be implemented. There are two ways to get funds for a project. You could raise private capital or get public access funding.

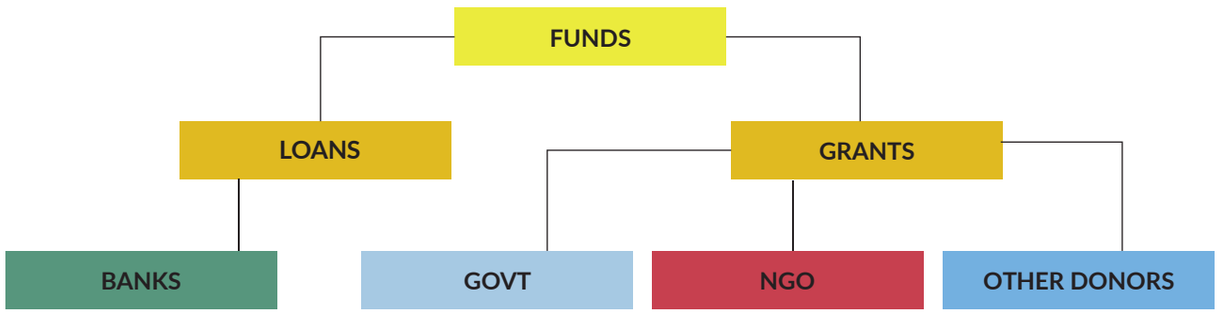
Private capital is when a person pays their money for a project, for example a PV solar home system (SHS), or when a group of villagers put in money to pay for a project, – for instance pico-hydro for the community. Private investments are rare in the region however not entirely missing. The bulk of the projects are funded through public access funds of governments and donors.

Private investments still have a lot of risks in the Pacific region or PNG for the matter.

Under public access funding – these funds are available to the public upon successful application which go through a selection and/or application process. Public access funds are available as loans and as grants.

Loans are funds that have to be repaid along with an interest amount added. Grants are funds which do not have to be repaid. The figure below shows some sources of loans and grants.

FIGURE 4: Loans and Grants[7]



Let us start looking at some of the sources of the funds and how we can contact them to obtain funds for our community projects.

3.1 Loans

Loans are offered by most of the local and regional banks (Bank of PNG, Westpac, ANZ, Kina Bank, Bank South Pacific, My Bank etc.) for small projects. However commercial banks require a guarantor or security to give out a loan. A security is anything valuable the bank can take in case you fail to pay the loan.

In some Pacific Island countries' governments have setup risk sharing schemes for banks to easily give loans for renewable energy projects.

In this case for PNG, the National Government in collaboration with the Bank of South Pacific (BSP) & the National Development Bank (NDB) have recently in 2020 provided funds to these two national banks to give as loans to nationals engaged in Small and Mid-size Enterprises (SME's),[8] that is inclusive of those willing to start a community Renewable Energy Project. They can generate and sell power and that will help them to repay the loan over the set payback period.

In countries where banks are supported by such schemes, bank loans are a source of funds for renewable energy projects.

FIGURE 5: companies can get loans as well as individuals[9]

3.2 Grants

Some of the most common funding for community based renewable energy funds comes through grants. Grants can be from various sources. Let's look at some sources of grants.

7 GGGI, FIJI.

8 Adapted from Business Advantage Fiji, October 2020, https://www.businessadvantagepng.com/package-delivered-government-gives-first-k100m-to-help-papua-new-guinea-smes/

9 CBS Power Solutions, May 2021, https://www.worldbank.org/

3.2.1 Governments

Governments usually receive external grants, or they may use their revenue to create grants to promote renewable energy projects. Governments normally open up schemes and advertise through Newspapers, TV, radio and over the internet. For example, in PNG the government of PNG in partnership with the Australian Government have set a new off-grid electrification Program titled 'Powarim Komuniti'. This has been developed as a grants program to incentivise innovative & inclusive projects in remote parts of PNG not served by the National electricity grid with the aim to support communities access to clean energy and connect 70 % of the country to electricity by 2030 as part of Australia's commitments under the PNG Electrification Partnership.

In general, getting a grant can be hard work. There is a lot of paperwork to be filled before you get a grant. The main aim of the paperwork is to find out how the grant will benefit the community and if the project is feasible

3.3 Donor Agencies

NGO's and Donor agencies also provide grants for RE projects. Some of the active donor agencies that you can reach out to in the region are:

3.3.1 Korea International Cooperation Agency (KOICA)

KOICA provides funding in the region at different levels and for a wide range of fields ranging from energy to health to education. In terms of energy, the mission for KOICA is "Contributing to Carbon dioxide (CO_2) reduction through sustainable energy and realizing inclusive growth". The major programs listed by KOICA are:

- Establishment of micro –grid systems.
- Distribution of solar Home Systems.
- Distribution of Clean Cook Stoves.
- Promotion of renewable energy resources, mainly solar and hydro.
- Establishment of micro-grid systems.
- Establishment of grid-connected power generation systems.
- Development of institutions for renewable energy promotion.
- Transmission and distribution of automation and efficiency improvement.
- Heating and thermal efficiency improvement.
- Capacity building and R&D infrastructure support.

However, you must contact their Pacific office based in Suva Fiji, to find out how they are funding projects in the region and to find out if your proposed project proposal is eligible for a grant.[10]

FIGURE 6: KOICA funded Capacity Building trainings on Renewable Energy Technologies & Green Economics in Keapara Village, Central Province, PNG[11]

3.3.2 The Department of Foreign Affairs and Trade Australia (DFAT)

Its objective is to help developing countries reduce poverty and achieve sustainable development. It also provides policy advice and support to the Minister and Parliamentary Secretary on development issues and plans and coordinates poverty reduction activities in partnership with developing countries.[12]

3.3.3 Climate Change Fund (CCF) (Asian Development Bank (ADB)

The CCF was established in May 2008 to facilitate greater investment in developing member countries (DMCs) to effectively address the causes and consequences of climate change. The CCF is a key mechanism for pooling resources within ADB to address climate change through technical assistance (TA) and grant components of investment projects.[13]

10 Adapted from Korea International Cooperation Agency, http://www.koica.go.kr/sites/koica_en/index.do

11 Image taken by KOICA Project team conducting Pilot capacity building trainings for Sustainable Implementation for Renewable Energy technologies for rural energy access, 02nd Oct 2020, Central Province, Papua New Guinea

12 Australian Government Department of Foreign Affairs and Trade, https://www.dfat.gov.au/

13 Asian Development Bank, "Climate Change Fund", https://www.adb.org/what-we-do/funds/climate-change-fund

3.3.4 Global Environment Facility (GEF)

In most cases, the GEF provides funding to support government projects and programs. Governments decide on the executing agency (e.g., civil society organizations, private sector companies, and research institutions). There are many issues to consider when seeking GEF funding. Who should I contact? Is my country/organization eligible for funding? Who will implement the project? What type of project should I consider? To help with these and other questions, please see their website or ask your local government official.[14]

3.3.5 NZ AID or Ministry of Foreign Affairs and Trade (MFAT) New Zealand

MFAT New Zealand also sponsors community related projects in the South Pacific. Ministry of Foreign Affairs and Trade (MFAT) is the public service department of New Zealand charged with advising the government on foreign and trade policy and promoting New Zealand's interests in trade and international relations. FAT works in collaboration with over 30 other Government agencies to deliver development cooperation across the Pacific.[15]

3.3.6 European Union

Fund management companies, financial institutions, project developers or individuals that intend to develop a clean energy investment fund or expand an existing fund into clean energy can submit proposals to seek finance. Developers of clean energy projects can also submit proposals for investment funds. Proposals are expected to:

i. Present a financially sustainable business plan generating a fair return for investors and a realistic pipeline,
ii. Specify environmental and socio-economic impacts,
iii. Focus on small and medium sized clean energy projects (< 30MW) and companies,
iv. Require long-term patient investment capital,
v. Locally grounded, professional fund management team, preferable with a track record in the clean, energy sector, or at least the capacity to become qualified or to liaise with other parties for that purpose.[16]

3.3.7 Agence Française de Développement (AFD - France)

Applications are submitted by the local contracting authorities to the AFD offices that identify the project. A feasibility study, including a technical study, marketing survey, and financial projections, are carried out.[17]

3.3.8 International Climate Initiative (Germany)

The programme is run by the German Ministry of Environment and provides financial support to international projects in climate change mitigation, adaptation, REDD+ and biodiversity conservation. Financing will seek to ensure that its investments will catalyse other funding streams and encourage private sector participation.[18]

3.3.9 Japan International Cooperation Agency (Japan)

The Japan International Cooperation Agency (JICA) is advancing its activities around the pillars of a field-oriented approach, human security, and enhanced effectiveness, efficiency, and speed. Established as an Incorporated Administrative Agency under the Act of the Incorporated Administrative Agency - Japan International Cooperation Agency (Act No. 136, 2002), JICA aims to contribute to the promotion of international cooperation as well as the sound development of Japanese and global economy by supporting the socioeconomic development, recovery, or economic stability of developing regions.

JICA also runs the "Introduction of Hybrid Power Generation System in PICs 2017 – 2022" in the Pacific.[19]

3.3.10 USAID

USAID leads international development and humanitarian efforts to save lives, reduce poverty, strengthen democratic governance, and help people progress beyond assistance. USAID works to help lift lives, build communities, and advance democracy. USAID's work advances U.S. national security and economic prosperity; demonstrates American generosity; and promotes a path to recipient self-reliance and resilience.[20]

14 Global Environment Facility (GEF), "Least Development Countries Funds-LDCF", https://www.thegef.org/topics/least-developed-countries-fund-ldcf
15 New Zealand Foreign Affairs &Trade https://www.mfat.govt.nz/en/
16 Global Energy Efficiency Renewable Energy Fund (GEEREF), https://geeref.com/about/what-geeref-is.html
17 Agence Francaise De Development, https://www.afd.fr/en
18 International Climate Initiative (IKI), https://www.international-climate-initiative.com/en/about-iki/iki-funding-instrument
19 Japan International Cooperation Agency (JICA), https://www.jica.go.jp/english/countries/oceania/index.html
20 USAID From the American People, https://www.usaid.gov/pacific-islands

3.3.11 IUCN

The International Union for Conservation of Nature (IUCN; officially International Union for Conservation of Nature and Natural Resources) is an international organization working in the field of nature conservation and sustainable use of natural resources. It is involved in data gathering and analysis, research, field projects, advocacy, and education. IUCN's mission is to "influence, encourage and assist societies throughout the world to conserve nature and to ensure that any use of natural resources is equitable and ecologically sustainable".[21]

There are many other donors which we do not have time to discuss, or which may come into the country later on. The best way to go is to contact the local government representative and meet with government officials, non-government organizations and even universities to get more information about grants and donors.

3.3.12 Australian Aid (AusAID)

Australian Aid is the brand name used to identify projects in developing countries supported by the Australian Government. As of 2014 the Department of Foreign Affairs and Trade (DFAT) has been responsible for Australia's official development assistance (foreign aid) to developing countries including PNG and other Pacific Island countries.[22]

In PNG, AusAID has funded many development projects including in the area of Renewable Energy Projects such as the Australian Partnership Project titled 'Powerim Komuniti'.

Pawarim Komuniti – is a new Off-Grid Electrification Program funded by the PNG-Australia Partnership to support access to clean energy in rural and remote communities in Papua New Guinea (PNG). The program is part of Australia's commitment under the PNG Electrification Partnership to help PNG meet the target of connecting 70% of the country to electricity by 2030.[23]

21 International Union for Conservation of Nature, https://www.iucn.org/regions/oceania

22 Australian Government, Department of Foreign Affairs and Trade, https://en.wikipedia.org/wiki/Department_of_Foreign_Affairs_and_Trade

23 PNGAus Partnership, "Pawarim Komuniti Papua New Guinea Off- Grid Electrification Program", www.pawarimkomuniti.org.pg

4

Revenue and Expenses of Renewable Energy Projects

4.1 Renewable Energy Projects

While previous chapters give you contacts and leads on sourcing funds for a project, any potential donor or investor will need some estimates of costing in a project. In renewable energy projects the cost is broken up or factored into two main parts – Revenue and Expenses.

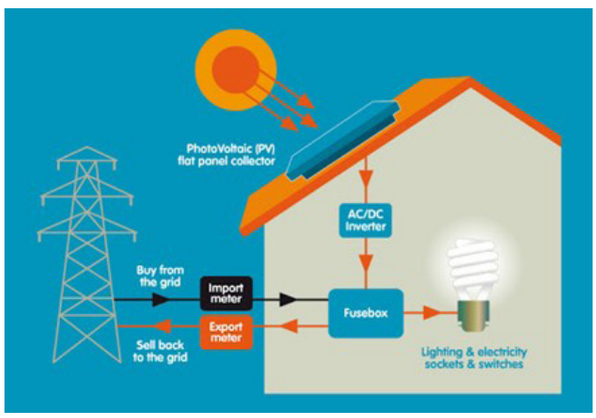
4.2 Revenue in renewable energy

The revenue is the money the project generates or saves. For example, installing solar PV means that the energy source is free, but it is important to also note that there are other associated costs that include initial investment costs and ongoing costs for maintenance and replacement of parts. Compared to using a diesel run generator to generate energy you would have paid a bill for the electricity or paid for ongoing fuel costs for a generator, now it is free every month due to use of Solar Power. In this case the cash saved, is the revenue of the project. For example, if you save K50 a month on buying diesel fuel for generators or paying for grid electricity, then that is the income or revenue you have generated.

The revenue can also come in the form of offsetting diesel fuel costs in case you used to rely on diesel generators before. Additionally, in community projects, to pay for maintenance you will need to charge a small fee or bill for use of energy, and this is also the revenue of the project.

In case your RE project becomes grid connected, in some instances you can sell to the grid and get paid for the units of energy you sell. This is not yet widely used in PNG but there are upcoming Renewable Energy projects that may sell electricity to the main PNG Power grids in the near future like the PNG Biomass Project in Morobe Province.

FIGURE 7: **Grid connected solar can allow you to sell to the grid** [24]



4.3 Types of Costs

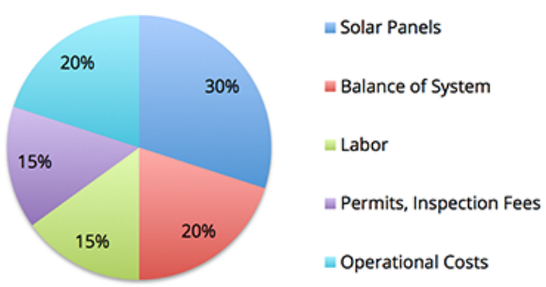
There are many expenses to consider in renewable energy projects. The largest expense is the capital expense for installation of the project. But even after installation, the expenses are still incurred. Let's look at some expenses in RE projects:

- Capital Expense for installation: This expense involves the initial sizing, design and purchasing of equipment along with labour and transport costs. This is very large cost in most projects, and this is the expense which is normally covered by grants.

FIGURE 8: **Capital costs in hydro projects are high as they involve Dam constructions**[25]

- Operating Costs or Expenses: This involves all expenses to efficiently run the renewable energy project after installation phase has completed. This is normally 10 to 20% of the overall cost of the project. This is not always funded by grants and this cost needs to be met by the community in most times. For example, a diesel generator installed for a school would have purchase of fuel as its operating cost. Another example, the cost or expenses for a simple solar power project can be stated as follows:

FIGURE 9: **Costs involved in solar PV systems**[26]



24 Adopted from RJ SOLAR, "What is Solar PV and how does it work?", http://www.rjsolar.co.uk/

25 Panasian Power, http://panasianpower.com/

26 VU PHONG, "How much does a Solar Power System Cost?", https://vuphongsolar.com/how-much-does-a-solar-power-system-cost/

- Maintenance costs: This is important in renewable energy projects and has a larger share than operating costs. For example, even after a solar PV system has been installed, the battery may need to be replaced in just one year. A technician may be hired to carry out maintenance and checks on the system.

Hence, we can see that the overall expenses in a project are made up of these 3 expense categories. We can simply say that all expenses can be added.

FIGURE 10: Total Expense calculation[27]

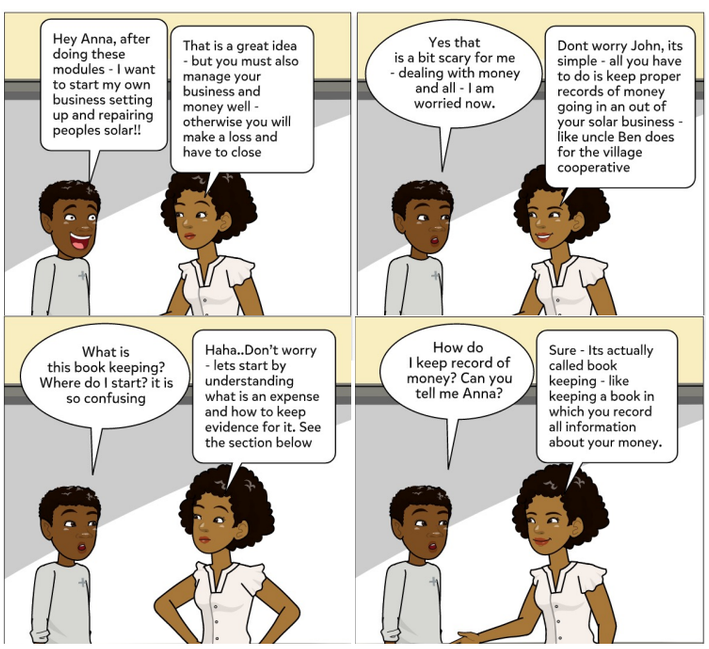
The main idea for the sustainability of the project is that in the long run – the revenue should be either greater than expenses or equal to it. Grants to fund operating costs are not very common so the project must have some revenue to save up for maintenance which would come from the end-users/ consumers.

FIGURE 11: Revenue must be equal to or greater than expenses[28]

4.4 Basic Bookkeeping

Bookkeeping is essential in many businesses. You may have cooperatives in your area in which you may also be members. How do you think they keep a record of cash coming in and going out of a cooperative? – Yes, they also use bookkeeping or a system of having records for future reference. It is safe to say that when dealing with money – everything needs to be recorded.

Let's do a simple role play – or you could just read out the conversation between Anna and John below.



27 GGGI, Fiji.
28 GGGI, Fiji.

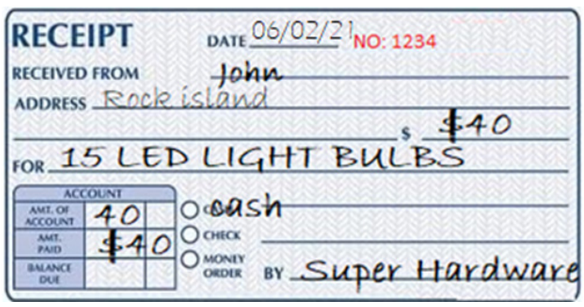
4.4.1 Expenses

Whenever you purchase anything or pay for boat hire or wages – any time money goes out of your wallet, we call it an expense. It is important to keep a record of expenses. Also keep the evidence of expenses.

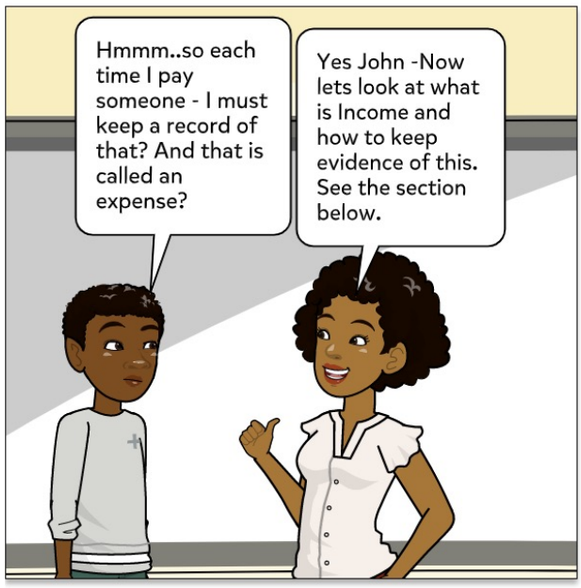
4.4.2 Evidence of expense

For example, if you buy 15 LED light bulbs from the town store called Super Hardware for K40 – you will pay the store owner and bring the bulbs to the village. But what about the evidence to prove that you have bought the bulb from Super Hardware? For this reason, you must always ask for a receipt. A receipt is a piece of document that proves that a money has been exchanged for something between two people.

FIGURE 12: Sample receipt you may get when you buy something[29]



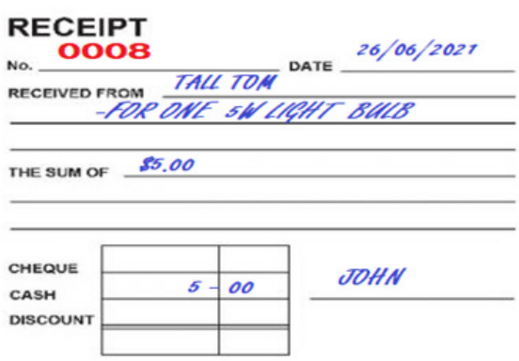
Cash receipt or simply receipt is very useful to keep a record of things in your business. Also, if any of the items do not work properly – you can always use the receipt to show you bought the item from the store and together with the warranty ask them to fix it. Most receipts normally have a receipt number written on them – they will have a copy of the receipt with the same number in case you have to query later on. Example the above receipt number is "1234".



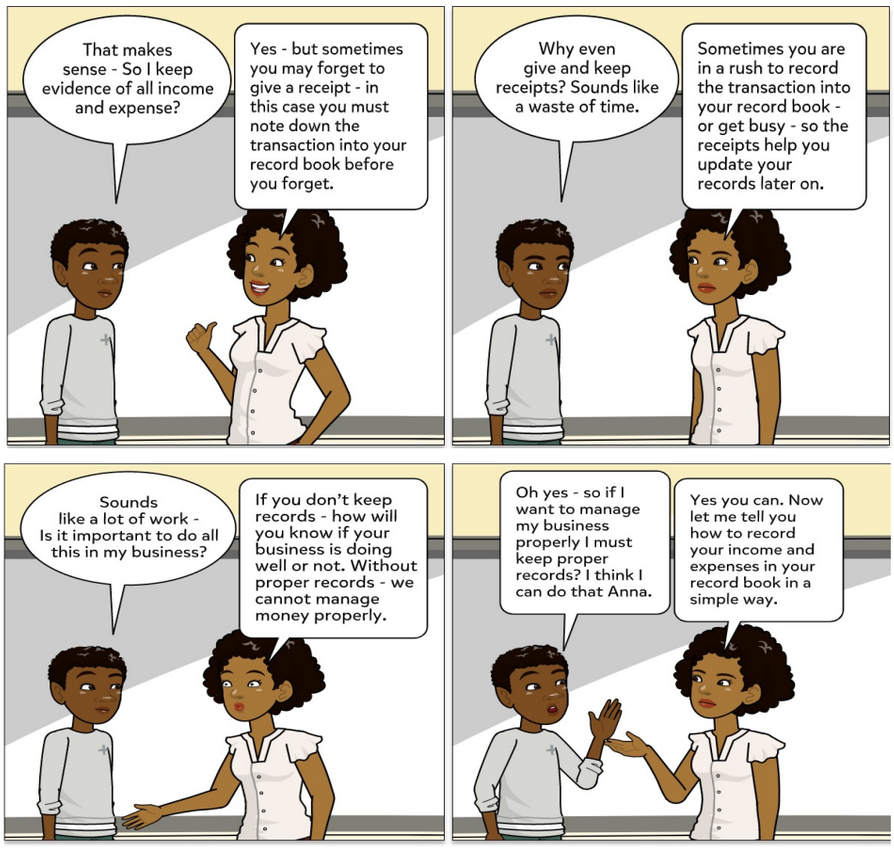
4.4.3 Income

When someone gives you money and money come into the business that is called income. Just like you get a receipt when buying goods or services you must keep a receipt book to give receipts to others when they pay you. For example, if you sell any item to another person or they do any work for you in exchange of money give them a receipt. Normally receipt books come with carbon paper which makes a copy of the receipt – give this copy to your customer. For example, if you sell one 5W light bulb to Tall Tom – you will write out a receipt in your receipt book and give a copy of it to Tom. Later you will use the original to update your record book. Most receipt books have receipts with the receipt number written on them in red. This number is useful to keep in your records.

FIGURE 13: Sample receipt you can issue from a receipt book[30]



29 GGGI, Fiji.
30 GGGI, Fiji.



4.4.4 Single Entry Bookkeeping

You should know that there are many ways of bookkeeping. But the simplest one is called single entry bookkeeping. In single entry we simple subtract the expenses from the income. You can draw out the tables in a book or you can buy a simple ledger book for bookkeeping. The table would look something like that in the figure below.

FIGURE 14: Sample single entry bookkeeping table[31]

DATE	DESCRIPTION	RECIEPT NUMBER	INCOME $	EXPENSE $	ACCOUNT BALANCE

Each column is labelled with what must be placed into it. Suppose Johns father gave him K100 to start his business in selling solar lighting products and doing installation for people – is this money income or expense for John? Yes, its income. Let us fill out the record book.

31 GGGI, Fiji.

FIGURE 15: Sample entry of an income into business records[32]

DATE	DESCRIPTION	RECIEPT NUMBER	INCOME $	EXPENSE $	ACCOUNT BALANCE
15/05/21	Cash from Dad for Business start		100		100

The first entry was for income of K100 which John's father has given to help him start his solar business. This is actually called 'capital'. The first entry then becomes the account balance. Now let us put in the expense John makes when he buys the 15 light bulbs for K40 from Super Hardware. Always remember in single entry we add income and subtract expenses from the account balance. In some books expense is also written with a negative sign.

FIGURE 16: Sample entry of expense and finding new balance[33]

DATE	DESCRIPTION	RECIEPT NUMBER	INCOME $	EXPENSE $	ACCOUNT BALANCE $
15/05/21	Cash from Dad for Business start		100		100
20/06/21	Bought 10 bulbs from Super Hardware	1234		40	60

Subtract expense from account balance

Hence, we subtracted the expense of K40 from the account balance of K100. This makes the new account balance to be K60 and we write it in the same line under account balance. Next let's think of when John sold one light bulb to Tall Tom. Look at the receipt above which John gave to Tall Tom where Tall Tom paid K5 for one light bulb.

FIGURE 17: Sample entry of another income and update of records[34]

DATE	DESCRIPTION	RECIEPT NUMBER	INCOME $	EXPENSE $	ACCOUNT BALANCE $
15/05/21	Cash from Dad for Business start		100		100
20/06/21	Bought 10 bulbs from Super Hardware	1234		40	60
26/06/21	Sold one 5W bulb to Tall Tom	8	5		65

Add income to account balance on above line

You see we added the K5 to the account balance of K60 and the new balance becomes K65. Let us see a figure where John has done this for a month with different expenses and incomes.

32 GGGI, Fiji.
33 GGGI, Fiji.
34 GGGI, Fiji.

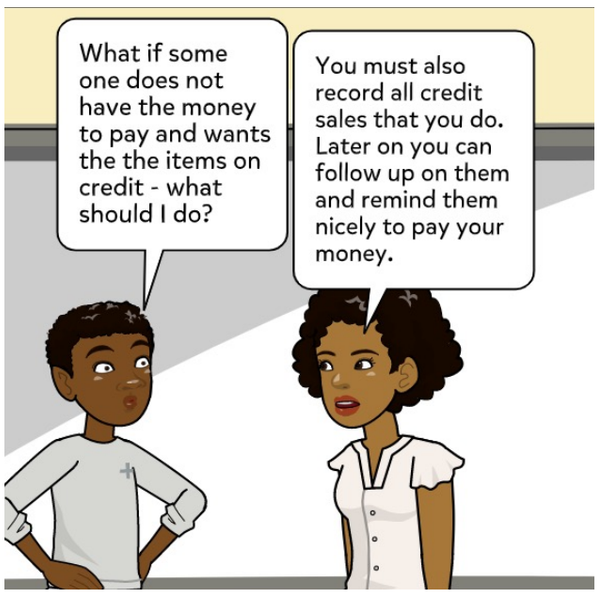
FIGURE 18: Sample of how closing balance at end of month can be found[35]

DATE	DESCRIPTION	RECIEPT NUMBER	INCOME $	EXPENSE $	ACCOUNT BALANCE $
15/05/21	Cash from Dad for Business start		100		100
20/06/21	Bought 10 bulbs from Super Hardware	1234		40	60
26/06/21	Sold one 5W bulb to Tall Tom	8	5		65
29/06/21	Sold six 5W bulbs to village cooperative	9	30		95
29/06/21	Paid Pita to deliver the bulbs to store			5	90
30/06/21	Balance at end of June		135	45	90

At the end of the month, we normally have a look at the record book just to see how we are doing. We add all the expenses and write it on the line where we state the ending balance of the month. For example, for John we can see that till date he has made K150 in income and spent K45 in expenses. When we subtract expenses from income, we can know the profit we have made. Hence, in case of John: K150 minus K45 is K105 profit which he has as his balance.

In some cases, we do not treat the starting capital as income. Therefore, if we just take the transactions for June for Johns business and remove the K100 income – he has K45 expenses and K50 income. So just for that month his profit is K5. It is useful to take profit for each month separately so John can know how he did in each month.

Proper record keeping allows us to know how the business is doing. Suppose you want to buy some things – you must know if you have enough money in the business. Without proper record keeping we cannot know how the business is doing as we will get confused with all the income and expenses.

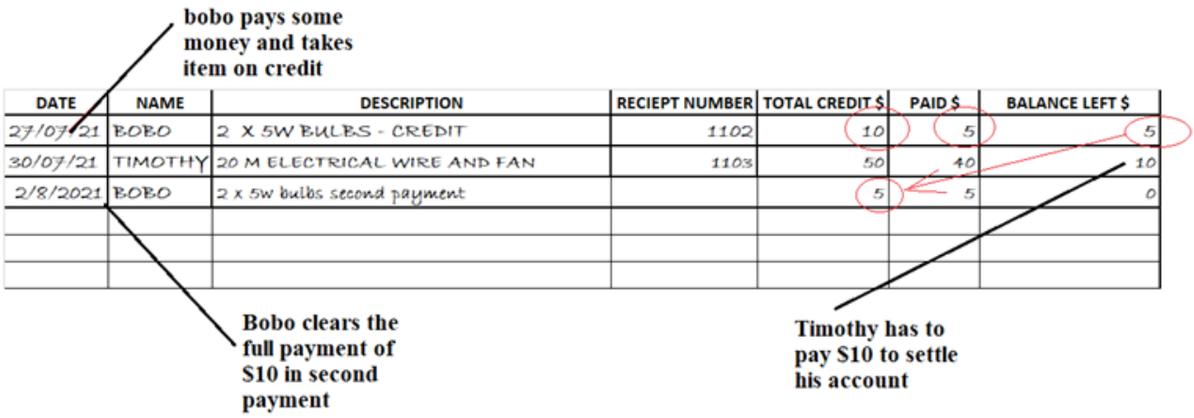


4.4.5 Selling on Credit

Sometimes when people don't have the money to pay and promise to pay later for the goods or services – we say they have taken things on credit. It is important to keep a good record of people who have taken items on credit. A simple credit record can be of the following type. Imagine two people in Johns village – Timothy and Bobo buy some items but cannot pay full amount. So John allows them to pay the balance later. This has to be recorded into the credit sales book or creditors record. See the example below.

35 GGGI, Fiji.

FIGURE 19: Sample record table for keeping credit sale records[36]



ACTIVITY 4

Consider the following case study and try to do a simple bookkeeping or cash record keeping table. You may seek the help of your trainer. You can always go back to the notes on bookkeeping to help you do this activity. This is a very useful activity for any small business or project.

"A small community project was being planned at a village near Doa. Villagers decided to set up a community solar power system cooperative. The cost of the panels would come to around K300 each. Each panel could generate around 300W. The village system needed to generate around 3000W power. They also needed battery backup of around 10 x 100Ah batteries. Each battery costs around K450 each. Wires and other balance of system cost around K2000 along with simple lights for 10 houses. The local technicians said they could setup the system in 7 days. So, 3 technicians need to be hired for K50 a day each for 7 days. The original system installation would be paid for by a government grant of K10,000. The solar system would need the battery to be replaced in 7 years' time and to cater for this and other maintenance, the village have decided to charge the 10 households K2 a month as a surcharge to raise funds for replacing components. Every 6 months a technician is needed to inspect the system at cost of K220.

Imagine you are the accounts person for the community solar cooperative. Try to make a simple bookkeeping record based on the above information for the first six months of the project. Use the bookkeeping record to decide if the households need to increase their contribution to the cooperative or not? Is the K2 a month payment enough for the long run and upkeep of the solar system?

Date	Description	Receipt Number	Income $	Expense $	Account Balance $

Answer:

First the learners must itemize each cost, so they capture it easily. Allow them to work in groups and the to cross check their calculations with other groups. They can write down a rough draft first before they fill the records table in their workbook.

Date	Description	Receipt No	Income (K)	Expense (K)	Account Balance (K)
7/8/21	Government grant received in bank	425639	10000	0	10000
15/8/21	Purchase 10 X 300w solar panel from KV Solar	7856	0	3000	7000
15/8/21	Purchase 10x 100AH Battery from KV Solar	7857	0	4500	2500
16/8/21	Purchase of lights, wires, connectors from A1	236	0	2000	500
18/8/21	Paid to technician Mr. Simon for works on installing	1012		350	150
21/8/21	Monthly contribution for members of cooperative - July		(K)20		170
22/8/21	Monthly contribution for members of cooperative - August		(K)20		190
21/9/21	Monthly contribution for members of cooperative - Sept		(K)20		210
23/10/21	Monthly contribution for members of cooperative - October		(K)20		230
21/11/21	Monthly contribution for members of cooperative - Nov		(K)20		250
21/12/21	Monthly contribution for members of cooperative - Dec		(K)20		270
15/01/22	Technician payment for inspecting the solar system	1023		220	50
15/01/22	Closing balance at six months		**10,120**	**10,070**	**50**

From the bookkeeping activity, learners can see that only K50 is left after 6 months. Even though they will raise K120 again in 6 months' time from contributions, they will only have K170 by next six months which is not enough to pay the technician to come and do maintenance on the solar system. So, they should increase the contribution or try to find some other way to increase income to be able to maintain their community solar system. They also need to raise and keep money for the change of K4500 worth of batteries in 7 years' time. The community will be better placed if they plan this ahead.

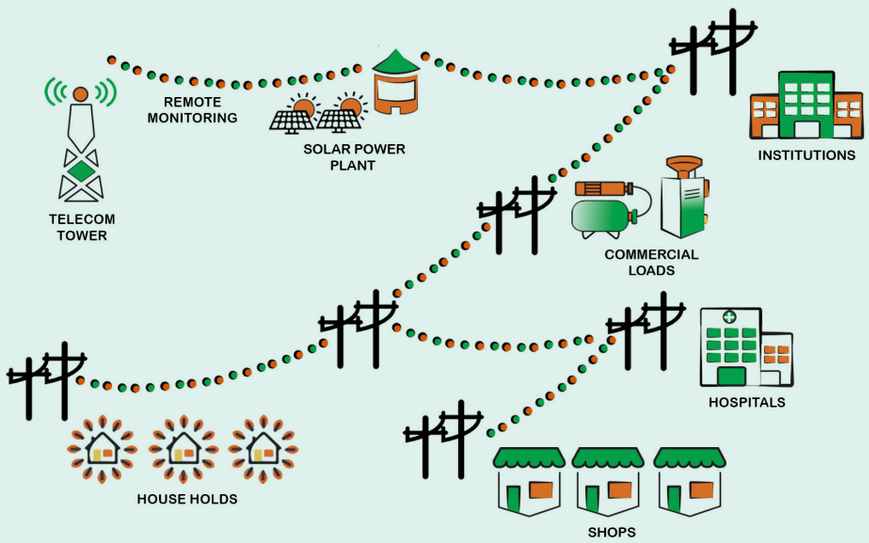
CASE STUDY: A simple financial comparison of Solar Mini-Grid systems

Providing power to remote and rural locations by extending the utility grid (power lines) is often very expensive due to large distances, difficult terrain (mountains, rivers etc) or even may not be possible if the community is separated by the ocean. So how can we provide clean utility type power at a larger scale to these remote locations? The answer is to use mini-grid systems.

While we have discussed some actual solar mini-grid systems in the solar modules, in this module, we will try to see a very simplified financial side of a solar mini-grid system. We will try to understand the financial challenges of putting up such a system, what it takes financially to keep it running and most importantly the part local communities can and should play in order to ensure that the system works sustainably for a long time.

A solar mini-grid system is a larger AC type system that is installed to power an entire community, rather than just a single house.

FIGURE 20 : Solar mini grid system[37]



The quality of the power system is same as those provided from grid/power line in urban towns and cities, hence you can power all types of AC appliances on this, though there may be restrictions in place to prevent people from trying to power very large equipment that can overload or damage the power system. The system can include some form of tariff metering system that counts the amount of energy each household uses, and hence each household is required to pay for the energy they use.

The money collected from the metering system serves a very important function, as it usually goes back to the authority who installed the mini-grid system or the nominated power committee, which can be used to recover the systems cost of installation, do system maintenance, parts replacement, or pay for other expenses associated with running the power system.

37 Source: https://www.taraurja.com/mini-grid-model/, Accessed o

Let us do a compare and contrast exercise between two systems. We will call these as **"System A"** and **"System B"**. We will try to look at the simplified financial aspects, basic technical information as well as the challenges faced during installation, operation, and maintenance periods. We will then discuss what the community can do to reduce or even resolve the challenges for the benefit of the whole community. After all, the power system benefits the whole community indeed.

Parameters	System A	System B	Comments
Technical Information			
Solar System size	5 kW	50 kW	This is total power of the Solar panels installed. (Note: 1 kW = 1000 watts).
Battery Capacity	45 kWh	200 kWh	This is the total size of solar batteries installed.
Backup Diesel Generator	10 kW	60 kW	This provides backup power to recharge batteries during prolonged poor weather, when the solar PV is unable to fully charge the batteries.
Number of households connected	50 households	50 households	This is the total number of households who are supplied power from the system.
Financial Information			
Project Cost	K250,000 PGK	K2.0 million PGK	This is total cost of installing the system.
Source of fund	Grant	Grant	Grant means funding was provided by government or some other organization. And that the community did not have to pay for the system.
Cost of using electricity	K2.00 PGK / unit	K0.50 PGK / unit	This is the per unit cost of electricity that each household has to pay. The more units you use, the more you pay. (Note: 1 unit = 1 kWh).
Total Revenue	K9,600 PGK/ year	K12,000 PGK/year	This is the total money collected each year from all households for using electricity. (Note: this amount is not fixed and depends on how much electricity the community uses).
Total Expenses	K2,400 PGK/ year	K3,000 PGK / year	This is the cost of buying and transporting diesel and cost of operating and maintaining the system (including salary for people who maintain it, monitor it, collect revenue, internet charges and transportation cost in case of any site visits etc).
Total Profit	K7,200 PGK/ year	K9,000 PGK / year	This is Total Revenue – Total Expenses.

Discussion Time

The trainer can group the learners and facilitate discussion based on the table below. To get things started, you can start by providing some examples using the points provided in "What can the community do?", but do not cover all points at once, as this will be a one-way discussion. Enable the groups to give a thorough process and help them come up with more realistic and valid points, including those listed below. There are no correct answers since each community is unique and can come up with their own unique solutions.

Discussion/Challenge	What can the community do?
1. The **Project Costs** are very high **(A: K250,000 PGK and B: K2.0 million PGK)**. It is very difficult for communities to raise this large amounts of money on their own. Even taking a loan will be very difficult and there is a huge risk of paying back.	• Recognize that Grants provide a huge relief to get such a system installed for free for the community, otherwise this system would not have been possible to install at all. • If such projects are to be implemented at the community level with foreign grants as special projects, it is important to include the Local and Provincial governments at the initial project phase for sustainability purposes. • If you have such a system already, consider yourself very lucky and do your best to take care of it. Remember, there are many communities who do not have this privilege yet and have to rely on other smaller and more expensive means of light and electricity, • If your community does not have electricity, try to work together with your community leaders and local government to put forward requests and proposals. Be patient, as these things take time to initiate. Most importantly, work together as one community. Your unity is your biggest strength. • Be open and reasonable to new ideas and requests and keep good communications with others who may be trying to do good for the community. For example, in order to install a solar system in the community, land space will be required. If the community works together in unity to provide this piece of land, then the project can be possible. There have been many cases of communities losing out because of internal conflicts, which has caused them to lose out on good opportunities. • **What else can you think of that will help your community increase its chances of getting such power systems installed or help make an existing system last longer?**
2. **System A** is much smaller (5kW) than **System B** (50kW). But both are serving the **same number of households each** (50 households each). This means that households in System A can only use very limited and small appliances (to avoid overloading the small system). Whereas households in System B can use larger appliances without overloading the system.	• The community must realise from the beginning that a solar mini-grid system has limited amount of energy for all to use. Hence, we must all **manage our expectations** and use electricity sparingly and wisely. • A system is sized up based on many different and complex things. Ideally, it should be sized to cater for all household's appliance energy needs, but this is very difficult to estimate since the community has never had electricity before. We must do a survey of each individual households need and then estimate the energy usage. If we underestimate, then this will result in a smaller and less costly system. Finding funding for small system will be easier but every household will have very limited energy to use, but at least the community will have electricity. On the other hand, if we overestimate, then we will come up with a larger and much more costly system, finding funding for which will be difficult or even impossible, resulting in no system at all. • As you can see, this is a balancing act. You cannot go too small, and you also can not go too large. Regardless of what system is installed, we all must do our part to reduce the energy we use. The less energy you use, the less it will cost you and the longer the system will run. An overloaded system will fail much faster than an underloaded one. • **What else can the community think of to ensure you can do energy savings, save money and help the solar system last longer?**

3. The **cost of using electricity in System A** is much higher **(K2.00PGK/unit)** than **System B** cost of **(K0.50 PGK/unit)**. Why is there a difference and why can't it be same for all communities?	• In an ideal world, the cost of electricity (also known as tariff) could be same for all. But in reality, the cost of electricity is based on the business model used, which looks at a lot of complex factors such as the cost of installing the system, cost of services at the location, transportation, means of funding (grant, loan, etc). This all means that every system is unique and requires its own way of functioning. • As an example, if a project is grant funded, then the initial cost of installing the system is not required to be paid back, which means that **cost of electricity** can be lower. On the other hand, if the initial system is installed by taking a loan, (let's say K2 million PGK loan from the bank), then the loan will need to be paid back by collecting money from the electricity sold. This will usually mean that the **cost of electricity** will be higher, to allow for faster loan repayment in a specific period. • The community is usually consulted well before a project starts and the cost of electricity is already discussed with everyone to determine if this will be affordable or not. As a community, you should seek clarifications on this to ensure there are no other hidden costs, how much electricity you will get for a specific amount of money and how long will it likely last based on the appliances you are using. Once again, you must set your expectations based on correct information, rather than getting surprised later. As always, conserving energy, using energy efficient appliances, and limiting your energy usage is the best approach to make your money spent on buying electricity last longer. • **What else can the community do to help raise more fund for the project to ensure self-reliance when it is needed in the future?**
4. Both Systems are making a **profit,** which means they are making more money than what is required to run the system. Why should we make profit? Why can't we reduce the **cost of electricity** to only make enough money to cover system running expenses and don't make profit?	• It is extremely important that the system is able to make and save enough money not only to cover the running expenses, but also collect extra money to take care of other larger costs that can occur. Inverters can break down and need costly repairs, a natural disaster can cause damage to solar panels that will need replacing. Even if no breakdowns or damage occurs, the system equipment will get old and fail eventually. • For example, let's say that **System A's** batteries fail in 5 years' time and new batteries cost K50,000 PGK to replace. **System A** is making a profit of K7,200 PGK/year, which means in 5 years, it has saved K7,200x5 = K36,000PGK This is not enough to replace the batteries and you need extra K14,000 PGK **Where will this extra money come from?** If you cannot find this money quickly, then the whole solar system will shut down and nobody will have electricity in the community. Similarly, an inverter may cost K15,000 PGK to replace, Solar panels may cost K300 PGK each to replace, etc. The government and external donors may not have money readily available to help. As such, it is extremely important for any project to be self-reliant and save enough money to be able to buy spare parts and do repairs themselves, in order to ensure that the systems keep running properly and continues to supply electricity to the whole community. Hence, every project must have savings through profit on their own. • Remember, while smaller systems produce less energy, their components are smaller and less expensive to repair or replace, compared to larger systems. • **What else can you think of that will help the community to be self-reliant and manage a solar system in a sustainable way, without needing external help when things break down?**

5. What are other challenges faced by other real-life projects that we can learn from and what can communities do to help find solutions?	• Communities must be involved in internal conflicts, such as land issues, blaming the system owner or power committee for charging too much, mismanagement of fund collected, dishonest practices etc, all of which leads to the whole community's loss. As discussed already, it is very important to understand all sides of the story, keep good communication with everyone involved and ensure everyone is honest. • The power committee who takes care of such systems in the community are often misunderstood and blamed for issues that they are not responsible for. It is recommended that the power committee keeps proper financial records related to the system and have good communication with the community, such as regular community meetings to share and discuss financial and other relating matters. • Households try to temper with the pre-pay meters or try to bypass it in order to try to steal electricity without paying for it. This leads to loss of revenue for the whole community and creates a huge risk due to lack of funds. This has even caused total shutdown of many systems, as everyone stops paying for electricity due to few dishonest practices. It is very important for every community member that the only source of revenue is through electricity sales, which critically need to run and maintain the system or conduct repairs and replacements. • There is limited technical knowledge and capacity in the community to sufficiently operate and maintain the systems, which causes a lot of issues and can even lead to reduction in system life. Sometimes the only trained people in the community leave and no one else is left to take care of the system. It is also expensive to hire or bring technical people from outside the community to assist. The best thing the community can do is to take ownership of their systems and try to seek assistance to train and upskill local members in learning how to correctly operate and maintain the system. All projects usually always involve a capacity building and training component for locals. The community can get together to not only nominate men, but also have more youths and women to be part of the training. It is often seen that men and youths sometimes leave the community to try to earn a living for their families and only the women are left behind. Involving everyone in trainings ensures that the current and future generations feel part of the system and are able to continue to take care of such systems for as long as it takes. • **Do you know of other projects which had challenges? Can you suggest possible solutions for these challenges?**

5

Engaging Donors for Funds

Chapter 3 already discussed the various sources of funds that you can access, however there are many more that may be available in your country. You can get more information on this from your local government representative or the Department of Energy. These government bodies, NGO, donors, etc. often expect formal interaction with you in order to secure the funds. Communication plays a crucial role here. There are two main modes of communication to engage with your possible donor agency.

5.1 Verbal Communication

Verbal communication involves talking to government agencies or donors seeking funds. The communication must be formal to semi-formal for the donor to take you seriously. You must also have done your research about your project so you can be sure to explain the project clearly. This will give the donor confidence that you know about what you are doing.

5.2 Written Communication

Written communication is the most common way to communicate with potential donors. The most useful way is to email or write a letter to them. With written communication, you must be formal and specific about the proposed project. When you write to donors – ask them what kind of projects they fund, if they fund projects in your area, and ask for criteria they use to select projects. Typically, thereafter you would need to write to them seeking the procedure for a formal application for grants or loans. In most cases donor or funding agencies look for two types of written documents before they provide grants. A project concept note, or a more comprehensive project document.

5.3 Writing Proposals

Normally donors and agencies have their own proposal templates that need to be filled when seeking assistance. Let's look at a very simple proposal template here just so that we can practice. Do note that this is not to be used for actual applications – you must always use the proposal template given by the donor or agency.

Name of Project: Give the name of the project here – e.g.: Solar Power for Viwa Village **Project Leader:** Name of person or organization or village leading the project. – e.g.: village headman **Total amount requested:** total amount of money you need for the project – e.g.: $13,000 **Total timeframe of project:** how long will the project take – e.g.: 8 months
Summary: Give a brief summary of the project. Use about 300 words and tell what problem you are trying to solve. Tell what you want to do and how will it benefit your community.
Problem Statement: Discuss the problem you are trying to solve in detail.
Project Goal: Tell about the general goal of your project eg: To provide light to my community at night so children can study.
Project Objectives: Tell about the detailed things you want to do. These things should be measurable eg: Install 2000 W solar Pv system – here you have clearly stated the size of the panel in your objective.
Project Outcomes and benefits: Tell about what the end outcome of the project will be and who will benefit from this.
Plan of Work: Here we want to tell what work will be done and b when it will be done – normally we make a table for this.
Organization Details: Tell about your cooperative or village or team. Write about all the capabilities you have in your team.
Budget Breakdown: You will need to know all the expenses that will happen in the project. You may have to go around and ask the price of some things. List down all the expenses and try to approximate how much each expense will cost you.

Below is a sample project proposal filled out for you to read and understand before you try to make your own proposal.

Name of Project: Solar Power for Rock Island
Project Leader: John Keri
Total amount requested: $15,600
Total timeframe of project: 12 months

Summary: Rock Island does not have full time electricity at the moment. This means children get less time to study at night and people cannot listen to radio or tv news in the daytime. So, our cooperative called Rock Island Cooperative has decided to install a solar power system to have power all the time on Rock Island. We also want to stop harming the environment with all the smoke and noise from the generator. We want to setup solar for all the 30 homes on Rock Island along with lights and TV. The Cooperative has collected $4925 for this project and is requesting another $15,600 to complete the project.

Problem Statement: Currently there is no electricity on Rock island. The government generator comes on at 6pm and stops at 9pm. It makes a lot of noise and creates a lot of smoke. The students cannot read till late to complete their homework. People cannot listen to radio or TV news in daytime. Also, kerosene lamps are getting very dangerous to keep on at night. The fuel and maintenance of the old generator is also getting expensive. Sometime the fuel does not arrive from the mainland on time.

Project Goal: To provide an environmentally friendly source of electricity to the people of Rock Island.

Project Objectives:

1. Purchase 30 solar power systems of 50W each along with 3 lights.
2. Install the 50W solar power systems on all 30 houses with help of a technician.
3. Train local people to maintain the solar power systems.

Project Outcomes and benefits: The outcome will be that all houses on Rock Island will have electricity from solar which they can use all night safely. The children will benefit as they can safely and clearly read their books at night. The people can listen to important news and charge their phones so they can be in contact with the mainland.

Plan of Work:

Tasks to do	Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Determine how much power is needed in one home	■											
Size the solar power system		■										
Make a list of components needed for the project			■									
Ask local companies for quoations				■	■							
Cooperative discusses and finalizes company to buy from					■							
Pay the company and ask them to visit the village						■						
Company technicans arrive and put dc lights in all houses							■	■	■			
Technicians mount the solar panel and othe things on houses										■	■	
Commissioning of solar power systems and ceremony												■

(this form of table is commonly used – you state the tasks and shade the month in which the task will be done – you can also use weeks or days instead of months)

Organization Details: Rock Island Cooperative looks after the generator on the island so that all the houses can have light at night. All the household heads are cooperative members. Mr. John Keri is the head of the cooperative. Recently 10 people from the cooperative have been trained on Solar in the Community.

Budget Breakdown:

Item	Cost per Item (K)	Quantiy	Total Cost (K)
50W solar PV panel	150 / item	30	4500
Charge Controller 20A	90 / item	30	2700
Batery 30Ah	300 each	30	9000
DC light bulb kit of 3	20 each	30	600
Double core 10A wire	1.89 / meter	500	945
Boat hire cost	200 / trip	4	800
Technician cost	80 / day	20	1600
Food and catering cost	300 / day	1	300
Travelling cost	20 / trip	4	80
TOTAL COST			**(K)20,525**

ACTIVITY 5

Think about a possible renewable energy project that can take place in your community and create benefit for your community. It could be anything from solar to hydro installation or energy saving trainings. Now think of how you could fund such a project. From the list of donors discussed in this training, pick any one and draft out a proposal for that project. This can be done in teams. Even if you do not write down the proposal – write down the bullet points that need to be addressed under each section of the proposal. Present this orally and discuss about this in front of all trainees.

Answer: The answers will vary but they should try to satisfy all the points listed in section 5.3 above. While they may not have all the information, they can assume most of the details such as cost etc.

The learners should be encouraged to fill into the template given in their workbook. The sample proposal above can be a guide for this activity.

Name of Project: Project Leader: Total amount requested: Total timeframe of project:
Summary:
Problem Statement:
Project Goal:
Project Objectives:
Project Outcomes and Benefits:
Plan of Work:
Organization Details:
Budget Breakdown:

ADDITIONAL ROLE PLAY (Optional)

The women from the rural village of Karela have gathered at their newly built hall to discuss ways of purchasing solar equipment so they can use the hall in the evenings to make their handicraft.

Debbie: Thank you for coming to this meeting ladies – we are here to talk about how we might be able to raise some funds to buy a solar system that can light up this hall at night. At our last meeting, many of you said you could spare a few hours in the evening to finish the baskets and the fans that have been ordered by our sisters in town. Does anyone have any ideas?

Mary: Debbie, I think what we need to do first is get a quotation for the solar system that we need for this hall. Then we will have a better idea of how much we need to fundraise for.

Priscilla: I agree with Mary, Debbie – based on our needs, which is to use the hall every evening 7 days a week – we need to buy a good system. My son has just completed his electrical engineering studies – I will ask him to give us some advice.

Debbie: Thank you Priscilla – we will wait for his advice on the type of system we need to buy. Does anyone have any ideas on where we could get funding from?

Mary: I hear that the Department of Women have some funds to support women's income generation projects – we can submit our request for funding to them. I brought a form with me.

Debbie: That's great Mary – the form says we need to breakdown our budget for not just the system but also the maintenance of the system. Maybe Priscilla's son can assist with that as well.

Let's dismiss the meeting today and come back next week with the information from Priscilla's son.

The following week the women gather again

Priscilla: This is the information from my son – our total costs for the purchase of the solar system and the maintenance is $5000. We have also filled in the budget form which I have made copies of, for all of you to see.

Debbie: This is great Priscilla – we can now submit our proposal to the Department of Women and seek their assistance with funding.

Two months later the Minister for Women comes to their community to present the new solar system and the women are now able to meet in the evenings to do their handicraft. They generate income to support their families and meet basic needs.

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