



**FINAL**

**GENDER AND ENERGY NEEDS ASSESSMENT**

**TERAINA AND TABUAERAN**

**JUNIOR SECONDARY SCHOOLS**

**AND**

**ISLAND COUNCILS**



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## Introduction

The Gender and Energy Needs Assessment for Teraina (Washington Island) and Tabuaeran (Fanning Island) Island Councils and Junior Secondary Schools was conducted under the EU-GIZ Adapting to Climate Change and Sustainable Energy (ACSE) project titled “*Solar Hybrid in Boarding Schools In Kiribati*”. The project is funded by the European Union (EU) and implemented by The Pacific Community (SPC) in close partnership with the Government of Kiribati. GIZ Pacific provides additional administrative and technical support to the project and EU-GIZ ACSE programme.

This Assessment aimed to:

- Collect baseline information on the existing energy supply and demand;
- Assess the governance ( management) and technical( carpentry, electrical) capability of the institutions;
- Assess the potential site for solar panel arrays and storage for batteries and inverters;
- Report on the gender and energy needs to contribute to the technical design of the solar pv systems for the two islands;
- Meet with relevant stakeholders and identify the roles on the implementation of the project; and,
- Discuss a Memorandum of Understanding to specify the different roles and responsibilities.

The mission team comprised of Project Technical Assistance Team (PTT):

- Koin Etuati, SPC Project Manager for the EU-GIZ ACSE project; and,
- Craig Bohm, GIZ Technical Advisor to Kiribati.

A Technical Team from Energy Planning Unit of the Ministry of Infrastructure and Sustainable Energy (MISE) also visited the two islands separately, due to lack of inter island flights. The MISE mission took place from the 3 to 16 May 2018. A Terms of Reference (ToR) was developed for the technical visit and the technical report on the solar pv design system presented for the two islands. The MISE technical team comprised of;

- Kireua Bureimoa Kaiea, Energy Planner who visited Teraina; and,
- Beria Oromita, Energy Supervisor visited Tabuaeran.

The gender and energy needs assessment mission took place between 16 to 24 May 2018; six (6) days spent on Teraina and two (2) days on Tabuaeran. This report is the outcome of the Gender and Energy Needs Assessment.

## Mission Rationale

MTSS was originally selected by the Government of Kiribati (GoK) to receive a solar hybrid energy system under the EU-GIZ ACSE programme. Before the energy system could be procured and installed, the Government informed the project that asbestos had been found in some school buildings and that the Ministry of Education (MoE) was closing the school.

The project partners, through the Office of the Beretitenti, formally informed that MTSS is closing for the year 2018 and the options below to consider:

- Install a 10 kW solar system in the Junior Secondary School (JSS) on Tabuaeran Island in the Line Islands Group. The system would service both the school and Island Council office; the Island Council providing critical administration services to the school.

- Install a 5 kW solar system in the JSS on Teraina Island, near Tabuaeran Island.
  - The technical team noted that the JSS system could also cater the energy needs of the Sunlight Primary School, which is located 10 meters away from the JSS. The Primary school has a strong building and a locked room as storage room for the solar system components (solar batteries and inverters.)
- Install a 5 kW solar system at the associated Teraina Island Council office. The distance between the school and the council was considered too far to install one shared system between the JSS and the office.
  - Some other essential services close to the island council premises considered. These are the police station and the health centre.

### Methodology

The PTT conducted focus group discussions at both the JSS and the Primary Schools on Teraina Island. One-to-one interviews were conducted at the island council, the police post, guesthouse and medical centre to collect energy baseline needs and future demand. Refer to Annex 1 for people consulted at Teraina.

A site inspection of the solar panel proposed sites achieved through walk-through inspections of the area including surrounding buildings. Additional information on the site appropriateness was gathered through one-to-one discussions with relevant stakeholders including the clerks and the principals of the schools and staff of the island councils and schools.

A similar methodology on collation of baseline gender and energy needs including future demands for Tabuaeran Island Council and JSS. The PTT undertook face-to-face interviews and walk through inspections of premises at the Island Council and at the JSS. Refer to Annex 2 for people consulted at Tabuaeran.

## Background

The Republic of Kiribati comprises three groups of islands, the Gilbert Group, the Line Group and Phoenix Group that are spread across a vast area of ocean. There are three inhabited islands in the Line Group; these are Teraina, Tabuaeran, and Kiritimati Islands. Other uninhabited islands are Caroline Island (Millennium Island), Flint Island, Malden Island, Starbuck Island and Vostok Island. Kanton Island is the sole inhabited island of the Phoenix Group. Kanton is part of the Phoenix Islands Protected Area (PIPA), which was declared by Kiribati Government in 2006.

Christmas Island is the main capital island for the Line and Phoenix Group and the Ministry of Line and Phoenix Development (MLPD) oversees the development of these islands. Each island has an Island Council that governs the welfares of its local populace and reports matters and needs to the national government. Travel to Teraina and Tabuaeran is possible both by air and sea from Christmas Island. There are two flights a week to the islands, which are only serviced by Air Kiribati Limited. However, the rationing of fuel on the islands can limit the inter-island flights between Teraina and Tabuaeran. Fuels and food commodities are transported by sea using government and private boats such as the Kwai.

According to the January 2018 health census, Teraina Island has a population of 1,368 people, some 816 males and 822 females and 310 households (Ministry of Health, pers. com.). Table 1 shows the population distribution by village.

*Table 1. Teraina population by village*

Village	Total number of Households	Total Population	Male	Female
Maketari	78	416	221	195
Arabata	55	266	118	148
Tangkore	74	356	175	181
Uteute/Tekaratura	27	174	96	78
Kauamwemwe	43	194	74	120
Abaiang	33	232	132	100
<b>Total</b>	<b>310</b>	<b>1638</b>	<b>816</b>	<b>822</b>

As of January 2018, Tabuaeran Island has a population of 1,951 people and 401 households (Ministry of Health pers.com.). Table 2 shows the population and households by clinic wards.

*Table 2. Tabuaeran population by clinic ward*

Clinic Ward	Total households	Total population
Paelau	166	742
Napali	118	538
Aramari	117	671
<b>Total</b>	<b>401</b>	<b>1951</b>

## Productive Needs and Interests

The main income activities at the household level on both Teraina and Tabuaeran islands is copra, which is a highly subsidised commodity with a government purchase price of AUD \$2.00 per kilogram. Other income is derived from paid work by national government and local government or island council. Other funds paid out includes pensions for elderlies from the state fund or national budget. The PTT noted, through observations, that some households are able to afford motorbikes, Ipads, and

tablets, which are considered luxury items in most of the outer islands of Kiribati. People on Teraina and Tabuaeran islands seem to have a high disposable income through copra harvesting, and through additional seaweed farming on Tabuaeran Island.

There is no electricity grid on the island and therefore access to modern energy services for productive needs is minimal. Most households use basic lighting systems such as portable solar tube lights with adaptors for charging mobile phones and tablets. The most common type of lights locally are called 'Love from Taiwan' lights, as most were distributed as gifts from the Republic of China (Taiwan). In some households, 12 volts LED tube lights with 12 Volts solar batteries and inverters were used. There is limited use of energy for productive activities at a household level, and income generating activities, such as weaving mats, stop after sunset due to the lack of reliable sources of affordable electricity.

On both Teraina and Tabuaeran Islands, the fisheries sectors are currently highly productive due to the active use of 15 kW solar hybrid energy systems that now power two new ice plants and chest freezers, one ice plant on each island. The installations at the beginning of the year completed by the MISE.

Money collected from the ice plants contributes to the local fund revenue. The Tabuaeran Island clerk informed the PTT that the replacement of solar equipment are the responsibility of the island councils. On Tabuaeran Island, the council established a revolving fund to cater for any future maintenance and part replacements their ice plant may need.

Both island councils have installed solar energy systems to run satellite internet services. On Teraina, the island council charges \$5.00 a day to access the internet, starting at 4.30pm through to 8.00am the following morning. Tabuaeran Island Council charges \$5.00 for four hours or continuous or discontinuous use. However, the use of internet is intermittent but community members use small ipads, phones and tablets and tend to use low-bandwidth services, mostly for communicating with family.

Most government services still rely heavily on paper-based record systems, perhaps because internet services are so slow, and thus the move to digital, computer-based platforms is occurring only slowly as well.



*Figure 1. Teraina Island council staff with laptops and internet wirings*

The Teraina Island Council solar system for internet use is not serving its purpose due to some technical issues. The lack of capacity in electrical engineering is an ongoing issue on the island and this will be a risk too in this project. The council island internet and guest house connects to the Ice plant solar system, and this might affect the system as the demand included in the design. So hopefully, this project is to prevent any further use of the Ice plant solar system for the island council internet use and guest house.



The Tabuaeran's solar system for internet is working well as the council have changed the inverter. Both councils have similar systems and would have similar problems but there is no existing centralised mechanism in place to maintain these expensive equipment including the solar systems for the ice plants. The project has discussed the options of identifying a trained technician on Christmas Island that can frequently provide technical support to the proposed systems. However the resource needs to be budget for in both the island council and the JSS. The Tabuaeran island Council has proposed a Memorandum of Understanding to alienate the roles and responsibilities of each institution as well as their direct ministries in the energy system sustainability.

The Ministry of Education (MOE) and the MISE was noted that there is no IT personnel on Teraina but Tabuaeran has a island council position to provide support with internet access and maintenance thus Internet use is 24 hours for the community, however the cost will be the limiting factor.

At the Teraina Junior Secondary School (Taimanin Teraina JSS), energy use is limited to a small solar system with battery use for laptop and printing; however the school is in need of a bigger energy system that could power the photocopier machine and lights in staff room that would allow teachers to use at night or in the afternoon. Because Teraina get many rain days, the classrooms and staff room usually get dark in the day- time and not conducting to a learning and work environment.

The Tabuaeran Keina Tiito Junior Secondary School (JSS) have small solar system and battery that runs two laptops, desktop computer and a printer. The generator gen-set that the school hires twice a year powers the photocopier. The cost of hire and fuel costs the school AUD500.00<sup>1</sup> annually and the money is collected through fund raising activities. There is no energy system for the classrooms or teachers quarters. Every year, Form 3 students board in the school maneaba during exams times.

The trading vessel, SV Kwai, is currently the only commercial trading vessel servicing Teraina and Tabuaeran Islands. SV Kwai travels to these remote islands with most needed cargoes such as food, phones, Ipads, et cetera, but also transports consignments of project supplies and fuel, including aviation fuel for Air Kiribati.

The SV kwai, sails between Honolulu, Christmas Island, Tabuaeran, Teraina and the Cook Islands once every 3 months. The vessel is relatively aged and can at times, be unreliable. Further, Teraina Island has no port or jetty facility and is surrounded by very rough seas, thus making the landing of goods not always possible and often unreliable. This makes project work challenging, but also the provision of accessories to service energy systems (engine parts, lighting accessories, light fittings etc) often difficult to procure.

SV Kwai also only stocks electrical supplies purchased in Hawaii, following American standards, and not Australian or New Zealand standards. Kiritimati Island however, supplies from Fiji, and thus has electrical goods that meet AU or NZ standards. If Teraina or Tabuaeran Islands want to use these supplies, e.g. 240v electrical equipment, then they have to order them, and pay extra freight costs, from Kiritimati Island.

#### [Institutional structure](#)

Kiribati is a patrilineal society with men culturally considered as heads of households. Decision making is discussed within the family and between wife and husband but usually the husband as head of the households make final decisions. In some cases, women became decision makers and sole income earners of a households when they are single mothers as they are widowed, divorced or separated.

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<sup>1</sup> Hire cost is AUD50.00 /day and fuel is AUD30 a day and hired for 3 days a term, a cost of \$240.00 per school term ( 3 terms in a year)



Both islands have active gender groups such as the Old Men Group, the Women Group, Youth Groups and church or faith-based groups.

### **Teraina and Tabuaeran Island Councils**

The two island councils have similar institutional structures; the mayor being the head of the island council. The mayor's term in office is four years and aligned to the National parliamentary terms in office.

Both mayors are males and all village councillors are male. A councillor is selected from each village. Teraina has seven villages and Tabuaeran has eight villages. Council meetings are held twice every year, however the council members sit on sub-committees. Sub-committees include the Island Development Committee, School Committee, Health Committee, School Improvement Planning Committee and Social Committee.



*Figure 2. Teraina Island Council buildings*

The gender group representatives participate in the council meetings and sub committees meetings. The Island Community Worker is a staff of the island council and acts as the secretariat. The women's group on Teraina is called Nei Buron (Prawn) whilst on Tabuaeran it is called Nei Tiiwita (Seaweed). The men's group on Teraina is called "Te Bau n Teraina" while Tabuaeran men's group is "Maurin Tabuaeran. It is interesting to note that Christmas Island women's group is Nei Baneawa ( Milkfish) and the men's old group is called "Marewen Okon Kiritimati". The women's group name symbolises the most unique or important item on the island. The freshwater prawn is only found on Teraina, seaweed on Tabuaeran and milkfish on Christmas Island. The mens group names also symbolises the highest level of dignity given to the old men.

There are two members of parliament from Tabuaeran and one member from Teraina who are representative at the national government and all MPs are male. However, in terms of the island council's workers, both councils have female clerks. There are more female staff (8) at the Teraina Island Council than males (2) while Tabuaeran have almost equal number of males (17) compared females (15).

Clerks are appointed by the state or national government and provide advice to the mayors in the administration of the council in terms of governance, policies and laws and by-laws. Clerks rotate after a four-year term and are transferred to other islands at the end of their term.

### **Junior Secondary Schools (Teraina and Tabuaeran)**

The Taimanin Teraina JSS and the Sunlight Primary School have women principals. The primary school has 14 female teachers, no male teachers. The JSS 9 teachers, 6 female and 3 male teachers. There are no other paid support staff.

The Keina Tiito Tabuaeran JSS has a male principal with a total of nine teachers; 5 male and 4 female. There are no other paid support staff.



*Figure 3. Teraina JSS maneaba*



*Figure 4. Teraina JSS Laptop and printers*



### **Teraina Guest house**

The Teraina Guest House is owned and operated by the Teraina Island Council. The guesthouse is an important income-generating facility for the council, providing accommodation for guests, mostly government and project staff, who visit the island. The guesthouse is an old building constructed by the manager of the Burn Philips and Co. during the early 20<sup>th</sup> century of the copra industry on Teraina. The guesthouse has four rooms, a bathroom with toilet and a kitchen with storage room. The house is very basic and requires lots of maintenance and repair.



*Figure 5. Teraina Island Council Guest house*

The building's current energy demand for lighting is met with a 12 V solar lights charged direct with solar panel or via 12v deep cycle 100a/h battery charged by a separate solar panel. Water for the guesthouse for bathroom and toilet is source from a nearby well and is pumped using a 12 v pump.

Additional water is sometimes brought by bucket from wells further away from the guesthouse, which are less contaminated with salt.

There are no current rainwater harvesting.

### **Teraina Police Station**

The police station is manned by three police officers and 3 specials constables and 3 village wardens who work on a part-time basis. Police are responsible for implementing the state/national laws and Council by-laws. The police station is located close to the Island council premises and is owned by the island council. MISE has asked that the PTT include the police station when calculating the energy demand for the island council.

The energy demand of the station is very low and is limited to lighting only. The island council provides support for printing of papers either through the court clerk office or main island council office.



*Figure 6. Teraina Police Station – no electrical wiring and power points*

### **Tabuaeran Police Station**

The police station on Tabuaeran has similar structure to the one at Teraina and is built right next to the island council building, but on a separate structure. Energy demand is similar to the Teraina police station, needs lighting only, and the premises does not currently house any electrical wiring.

### **Tabuaeran Island Council Maneaba**

Tabuaeran Maneaba is a meeting place for all villages, families and island council and could accomodate hundreds of people. The Maneaba is used throughout the year and provides income for the council as groups pay \$10/month. The future energy needs includes lights and a power point.

The calendar of planned events for the maneaba, provided to the project by the Island Development Officer and Island Community Worker, is presented in Figure 8..



*Figure 7. Tabuaeran Island Council Maneaba*

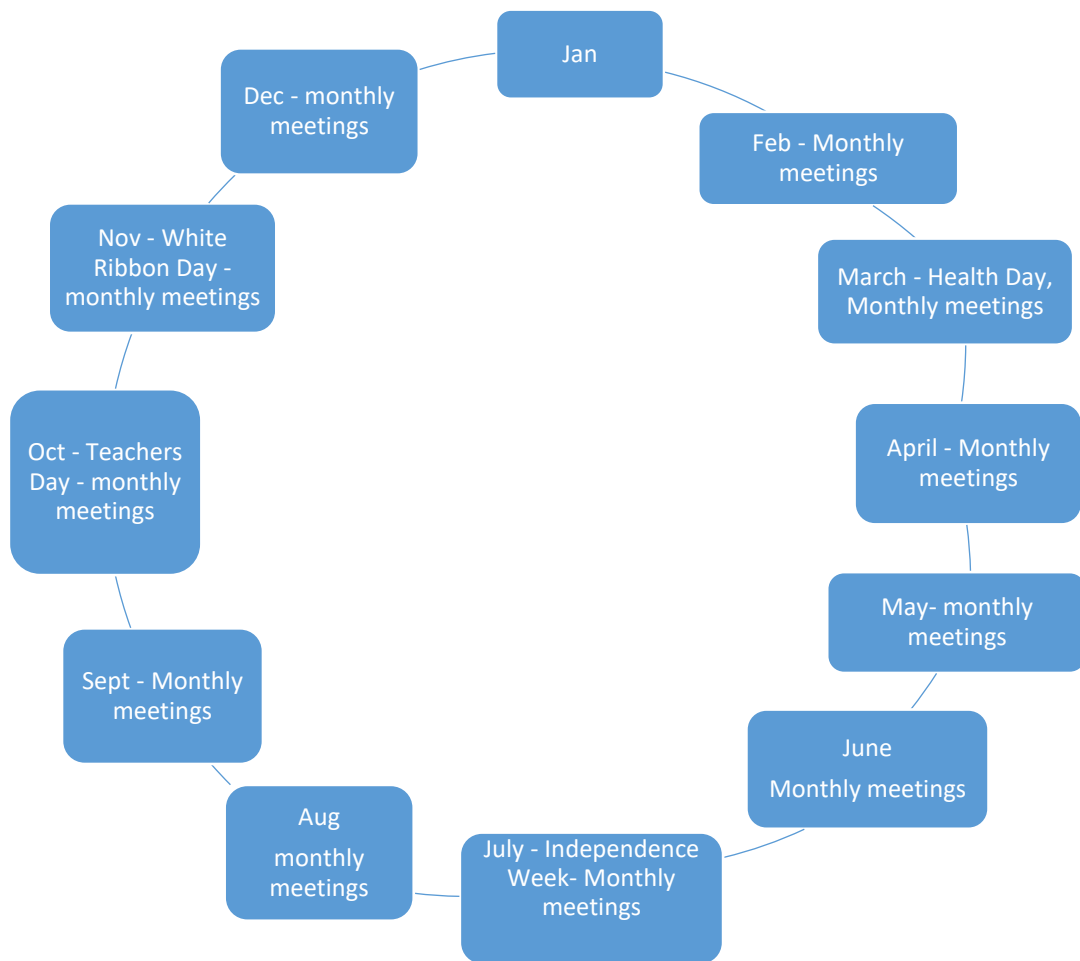


Figure 8. Tabuaeran Island Council Maneaba Calendar of Events

Once a month, the gender, old men, youth and women group all hold their meetings in the maneaba. Further, council sub-committee meetings, such as for health and education are also held in the maneaba. The island council staff use the maneaba to conduct aerobics every Wednesday as part of the Government health initiatives.

Many of these activities use a portable generator to power lights and PA system and the cost of fuel for conducting these activities is an additional expense on the island council. One of the challenges and current issues facing this facility is the lack of water and sanitation (toilet facilities). However, in terms of the energy needs, the project will include the maneaba with connections to have a 240V power point as well as lightings. The power points and lights will be managed by the island council and will be the responsibility of the Island council watchman to monitor the energy use including billing, once energy meters are installed. The monitoring activity to include turning off the main switch for the power point and lights usages to be managed from the main switch, which is to be housed at the island council power room or clerk's office.

Tabuaeran Island Council does not own a guesthouse; however, there are two private guesthouses and two church group guesthouses on the island. The future demand of the guest house is not included but considering that the current energy demand is well below the anticipated capacity of the proposed system (10Kw), the guest house energy needs could be accommodated.



## Teraina Medical Centre



*Figure 9. Teraina medical centre, a medical dispensary (left) and obstetrics ward (right)*

The Teraina Island Medical Centre is located some 200 meters from the island council premises. MISE asked the PTT to assess the facility's energy needs to ascertain its eligibility for connection to the island council's solar system.

The medical centre currently does not have access to proper lights for its dispensary, obstetrics ward or two inpatients wards, though it is serviced by one small solar panel and a 12v chest freezer.

Due to its distance to the island council, including the lack of electrical wirings inside the buildings, the project team decided that the centre would best be served by a slightly larger stand-alone solar PV system. There is currently a small solar PV system installed at the island council, which is not working or is not in use and this system may be repaired and transferred to the medical centre by the project team.

## Tabuaeran Health Centre

The Tabuaeran Island Medical Centre is also at a considerable distance from the island council office. The facility is currently serviced by a small solar PV system, but the centre lacks adequate lighting or computer charging capacity. Similar to Teraina, the Tabuaeran Island Council currently operates a small solar system, which the project plans to relocate to the medical centre, once the new solar system is installed in the council. The medical centre is in need of proper lighting for urgent surgical needs and delivery of babies at night.

### Systems Governance

The PTT invested considerable time helping beneficiaries establish governance arrangements for the new solar systems. The PTT will formalise these arrangements into Memorandum of Understanding (MOU) between the beneficiaries and between beneficiaries and the respective central ministries – MISE, MoE, MIA.

#### Teraina Island Council System - 5kW

The Teraina Island Council has its maintenance sub-committee. Current members of the committee include the Mayor, Island Councillors, Mechanic/Carpenter, Clerk, Medical Assistant and Island Education Coordinator. There will be a person in charge of the maintenance plan; in particular on checking of cables, cleaning of panels, and associated activities, and to advise the clerk on the system usages check list of electrical appliances connected to the system both at the island council and at the guesthouse. There is no electrician on the island and this is a risk to the proper maintenance of the system.

The project is encouraging the council to invest in training one person about solar system operations - their use, operation and maintenance. Several solar lighting and water pumping systems are present on the island there is increasing grounds for the island council to make this investment, perhaps in coordination with the schools and other solar system operators.

A MISE-employed water technician is present on Teraina Island but he does not have any equipment or tools, so has limited capacity to support the council with water or electrical maintenance work.

#### Teraina Island Schools System – 5kW

The project will install the system in the Sunlight Primary School, as the school is secure and modernised, and the energy then shared, by cable, with the neighbouring Teraina JSS.

During the PTT mission, the two schools met and formed a joint energy governance group. The project will train this group in the daily operation and maintenance of the system. The schools will together organise a maintenance sharing arrangement. However, since the system are being stored at the Sunlight Primary School the principal will be responsible for looking after the system assets.

#### Tabuaeran Island Council System – 10kW

The Tabuaeran Island Council will use its maintenance group as the energy governance group, similar to the Teraina Island Council.

#### Solar Array sites

The PTT team met with both EPU technicians briefly in transit (at airports) and were given a brief update on the planned solar array sites, which the PTT then inspected and discussed, in detail with different beneficiaries. The results are presented below.

Table 3: Solar array site assessment

System	Proposed solar array site	Agreed with beneficiaries on further assessment	Comments
Teraina Island Council	Between the guesthouse and the Island council premises	Between the main island council office and the ice plant	<p>Council expressed concern that the first proposed location would interfere with community events that took part in that area.</p> <p>The new site is closer to the power room for the solar system and would be a good site for a 'solar café', created by mounting panels on a carport structure, thus allowing people to sit beneath it and use the internet service provided from the adjacent building.</p> <p>The new site helps contain the 'footprint' of the council facilities by putting build structures closer together.</p> <p>The fisheries ice plant assistant was also supportive of the proposal.</p>
Teraina Island schools	Sunlight Primary	Sunlight Primary School roof top	Some concern from JSS, as they would like to host the solar system in the JSS, but eventually they



	School roof top		recognised that the primary school facility was in better condition than JSS buildings.
Tabuaeran Island Council/JSS	In front of the council office	Beside the island council office	<p>The area in front of the office is very exposed and there was a high risk of soccer balls damaging the panels. The council conveyed that they had to relocate a satellite dish out of this same area because of damage from soccer balls.</p> <p>The new site is closer to the power room for the solar system and would be a good site for a 'solar café', created by mounting panels on a carport structure, thus allowing people to sit beneath it and use the internet service provided from the adjacent building.</p> <p><i>Further discussion after the visits entailed the solar panel are to be mounted on the is. council roof top as it will be more cost effective compared to erecting a new structure – Refer to technical design report for Tabuaeran.</i></p>



Figure 10. Proposed solar panel site (behind the clerk office), Tabuaeran (Left), Proposed site is between the Ice plant ( with solar panels) and Island Council Building No. 1 Teraina



Figure 11. Proposed solar panel arrays for JSS and Primary School – Roof top installation

## Gender and Energy needs

### Lighting and Electrical Wiring Needs

Teraina and Tabuaeran institutions, the island council offices and Junior secondary schools targeted for this project have no installed electrical work, except one of the classroom building at the Teraina Sunlight Primary School. The team therefore carried out an assessment of the electrical wiring required, the light switches and power points that would be installed to allow the solar pv system to be operational. In addition to the electrical needs, the team also assessed the location of each power points and light switches and draw up a schematic diagram and are provided in Annex 3.A and 3.B.

### Baseline Energy Use

The baseline energy use are categorised as gender needs; practical needs, strategic and productive needs.

Practical needs include energy access to improve every day activities and providing services more efficiency in classrooms, health centre, police station and the island council.

Productive needs include accessing or using energy to improve income generating activities, while strategic needs focus on energy needs and access that would improve the knowledge and empowerment of the individuals.

Energy Needs	Primary School (Teraina Island)	Junior Secondary Schools	Island Councils
<i>Practical Needs</i>	Solar Water Pump ( 240 V AC pump) for student use	Water caters from well or water tanks	Solar water <sup>2</sup> pump ( portable 12 Volt at guest house
	Lights	Lights	Lights
			EFTPOs <sup>3</sup>
<i>Strategic Needs</i>	Lights	Lights	Lights
	Printer	Printer	Printer
	Laptop	Laptop	Laptop
	Photocopier	Photocopier	Photocopier
		Projector <sup>4</sup>	Internet use
<i>Productive needs</i>	Fundraising activities – PA system	PA systems for use during fundraising activities	Guest house (Teraina Only)
		Project for Movie	Internet use
			Ice plants

The energy sources and uses on both islands are limited to portable solar systems (such as Love from Taiwan systems), solar home systems with inverters and batteries and small gen-set that runs electric machines such as photocopiers and household fridge. A 12 V solar battery are common sight in most places, including the guesthouse, the medical centre, the JSS maneaba and the Air Kiribati Limited agent.

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<sup>2</sup> Well water at the Guest House is a more saline and not use for drinking and cooking. Its use is limited to toilet as is also used for bathing and washing. There is an urgent need to rehabilitate a water tank at the guest-house.

<sup>3</sup> EFTPOs use only on Tabuaeran

<sup>4</sup> Use only on Teraina JSS – donated to the school

Both islands have access to internet use through solar power that runs the modem, power points and other charging. The solar systems were donated to the island councils and includes a 140W x 2 panels.

The Teraina system has not been working for quite some time and the internet system is powered from the Ice Plant solar system, while the Tabuaeran system is working properly. The Tabuaeran council had purchased a new inverter three months ago when the system did not work. This maybe the current problem for the Teraina internet system. Currently there are no solar technician on either island, but Tabuaeran has an IT technician and water technician, both whom have some competency with electricity but no clear mandate to install or manage new infrastructure, other than to make the IT room functional. The IT room also acts as an internet café and is a considerable source of income for the council.



The two islands have a 15kW solar hybrid system (260W x 60 panels) installed at the Ice Maker Plant. These systems were installed early 2018 under the Kiribati Italian Renewable Energy Programme implemented by the Energy Planning Unit of the Ministry of Infrastructure and Sustainable Energy.

Tabuaeran ice plant maker was not functioning for a couple of months this year, but was recently fixed when the technician from EPU came to the island to conduct the solar pv design for the EU-GIZ ACSE project.

*Figure 12 – Solar energy power system for internet – Tabuaeran island Council*

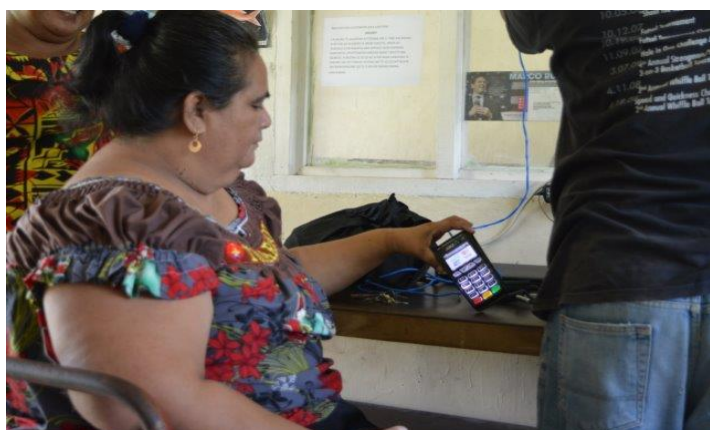


Figure 13. EFTOP use by the Island Council Treasurer – Tabuaeran Island Council



Figure 14: Ice plant inverters and batteries and energy use freezers – Teraina island Council

The two medical health centres on the islands have 12 Volt fridges to store vaccines and these are in working order. The health centres are both in need of efficient and appropriate lighting systems for the delivery of babies and attending to sick people at night; in particular, cases that required immediate attention during night times such as major injuries.

Light is also required for wards that accommodate inpatients. Safety lights required for the medical centres. Teraina Island also has one additional medical clinic, recently built but without lighting, while Tabuaeran Island has two medical clinics, both which also require lighting systems. These clinics are outside the scope of the EU-GIZ ACSE project, but where opportunities arise to improve lighting conditions at these clinics, the project will take advantage of them.

The police stations on the two islands are quite new infrastructures recently build next to the islands councils. Both stations have no electrical wirings and the project will allocate support for the much needed lights in these stations as they are contributing to the welfare of the island council and its populace.

#### Future Energy Demand

Each institution though, has different gender and energy needs. Tables 4 to 10 provide summaries of these needs and then matches them to the solar pv size required to meet the demand. Attached as Annex 4 to Annex 8 provides detailed Energy & Gender Needs Demand projections for all the targeted sites.

Table 4. Teraina Island Council including police and health center

	Daily load (kWh)	Installed PV capacity (kW)	Battery size @ 3 days without	Equipment cost
Solar PV sizing needs for the Council	9.02	3.61	2706	11,908.05

Table 5. Taimanin Teraina JSS

	Daily load (kWh)	Installed PV capacity (kW)	Battery size @ 3 days without	Equipment cost
Solar PV sizing for the JSS School	7.81	3.12	2343	8,934.64



Table 6. Sunlight Primary School Teraina

	Daily load (kWh)	Installed PV capacity (kW)	Battery size @ 3 days without sunlight (Ah)	Equipment cost
Solar PV sizing needs for the Primary School	4.74	1.90	1422	5,421.42

Table 7. Summary of Teraina Island council, JSS and Primary School Daily Energy Demand and installed capacity

Institution	Daily load (kWh)	Installed PV capacity (kW)	Battery size @3 days without sunlight (Ah)	Estimate Equipment cost <sup>5</sup> (Euro)
Island Council	9.02	3.61	2706	11,908.05
Taimanin Junior Secondary School	7.81	3.12	2343	8,934.64
Sunlight Primary School	4.74	1.90	1422	5,421.42
<b>Total</b>	<b>21.57</b>	<b>8.63</b>		<b>26,264.11</b>

Table 8. Tabuaeran Island Council

	Daily load (kWh)	Installed PV capacity (kW)	Battery size @ 3 days without sunlight (Ah)	Equipment cost
Solar PV sizing needs for the Island Council	12.62	5.05	3786	21,094.17

Table 9. Tabuaeran Keina Tiito JSS

	Daily load (kWh)	Installed PV capacity (kW)	Battery size @ 3 days without sunlight (Ah)	Equipment cost
Solar PV sizing needs for the School	5.18	2.07	1554	6837.60

Table 10. Summary on Tabuaeran Island Council and Daily Energy Needs and installed capacity

Institution	Daily load (kWh)	Installed PV capacity (kW)	Battery size @3 days without sunlight (Ah)	Estimate Equipment cost (Euro)
Island Council	12.62	5.05	3786	21,094.17
Keina Tiito JSS	5.18	2.07	1554	6837.60
<b>Total</b>	<b>17.8</b>	<b>7.12</b>	<b>5340</b>	<b>27,931.77</b>

## Discussion and Conclusions

The project originally focused on providing solar hybrid systems to the remaining two senior secondary boarding schools that did not receive systems under previous projects, particularly EDF10. Since now the project have moved out and focus on junior secondary school in the most remote areas.

<sup>5</sup> Estimate costs based on CBS quote for a 20Kw system of Euro79,693.71

The Government has also vision and targets of 100% RE for institutions in outer islands.

The energy demand for the island council premises is mostly for light and power point use for mobile and laptop for work use. Both JSS requires electricity for printers and computers as well as lights for studying and safety. The energy demand calculation is based on a 5 watts LED light for use in the rooms and a 3 watts LED light for security lights. Other electrical appliances (printers, laptops, photocopiers) were already available and the energy consumption (watts) on the existing equipment used to tabulate the energy demand needs. The number of new lights for both Teraina and Tabuaeran island councils and JSS are 79 and 69 lights respectively. It was agreed to replace the LED strip lights with LED bulb lights preferably with the bayonet bulb holder and using a 240 VAC.

The technical design envisaged for Tabuaeran is a 10kWh system capacity that is more than adequate for the current and future daily energy demand of 17.8kWh. On the other hand, the Teraina daily energy needs for both island council and the two schools is estimated at 21.57kWh. There will be two 5Kw solar systems proposed for Teraina. One installation at the island council premises and the second one at the Junior Secondary School. The 5kw solar pv system for the JSS is to cater for both the JSS and the Primary School.

## Annexes

### Annex 1. People consulted on Teraina

#### Taimanin Teraina Junior Secondary

NAME	Sex	CONTACT	YEAR	SUBJECT TEACHES
Ruita Merang	F	Ruitam11@gmail.com	Year 7	
Erena Kaobunang	F		Year 7,8,9	Kiribati Studies and Home Economics
Ueanimatang Kimaere	M		Year 7,8	English, Social Studies
Beneti Koubwere	F	roumaeman@gmail.com	Year 7,9	English, Social Studies
Tabuaka Kiaiai	M	Tabkia77@gmail.com	Year 7,8,9	Accounting,
Tongaa Tokooa	F	tongaaran@gmail.com	Year 7,8,9	IA/KI/KCS
Anna Teikarawa	F	emmewmarat@gmail.com	Year 9	Maths, Science
Ruute Reota	F		Year 7,8	Moral Education/Science
Kaburoro Tooma	M		Year 7,8	Math

#### Teraina Sunlight Primary

Name	Sex	Contact/Email	Subject Teaches
Kekaia Toki	F	tkenang@gmail.com	Year 6
Bwati Nenebwai	F	Bwatinteraoi6@gmail.com	Year 2
Euoria Teeitei	F	bwaanmwatiemeuoria@gmail.com	Year 3
Teriribwe Anterea	F		Year 3
Tearanuea Matua	F		Year 3
Ruiti Ioteba	F	Riotebwa67@gmail.com	Headmistress
Tiiren Eeri	F		Year 4
Teeta Teraraa	F		Year 5
Terikano Auriaria	F	Kiribati2018@gmail73014896	Year 1
Kitiana Temai	F	kiritanatemai@gmail.com	Year 2

#### Teraina Island Council

Name	Sex	Organisation	Contact
Tiirenga Riannaba	F	Clerk	<a href="mailto:Kofereti0677@gmail.com">Kofereti0677@gmail.com</a>
Tatai Marewe	M	Officer Commanding Station	
Ioanna Kaobunang	F	Assistant Treasurer	idwellinme@gmail.com
Bwebwe Toromon	F	Assistant Clerk	
Kanofou Kieni	M	Mayor	
Taii Onorio	F	Guest House Keeper	
Kieura Taunaia	M	Water Technician	
Atanimango Botioa	F	Island Development Officer	
Samuelu Ioane	M	Fisheries Assistant	ane555@gmail.com
Tereitabuki Tarangutu	F	Nursing Officer	

### Annex 2. People consulted on Tabuaeran

Name	Sex	Job title	Contact
Meere Kaueata	F	Clerk	mktvak@gmail.com
Teinai Taniera	M	Major	



Fetu Ale	F	Island Development Officer	
Terengantaake Ruka	F	Island Community Worker	
Willie	M	Water Technician	
		Carpenter	
Nei Taam Nawaia	F	Ice maker Caretaker	taamnawaia@gmail.com
Etau Raakoroa	M	IT Island Council Officer	
Tearei Taake	F	Island Education Coordinator	trianimarewe@moe.gov.ki
Touakin Bwebwentarawa	M	JSS Principal	rkakine@gmail.com
Miriam Betitoa	F	Medical Assistant	

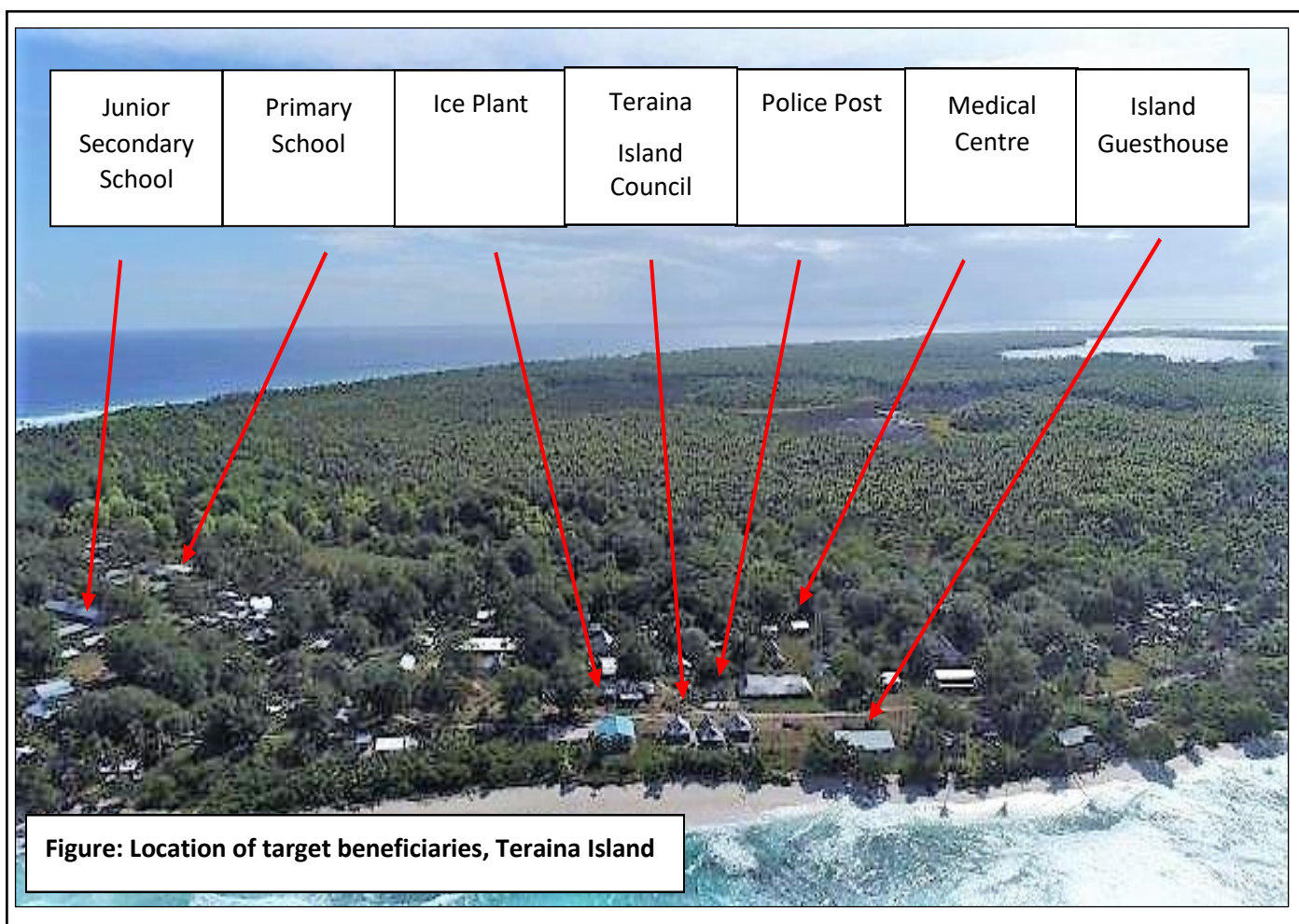
### Annex 3.A. Teraina Lighting Island

Prepared by Craig Bohm , GIZ Technical Adviser

#### Teraina Island Orientation

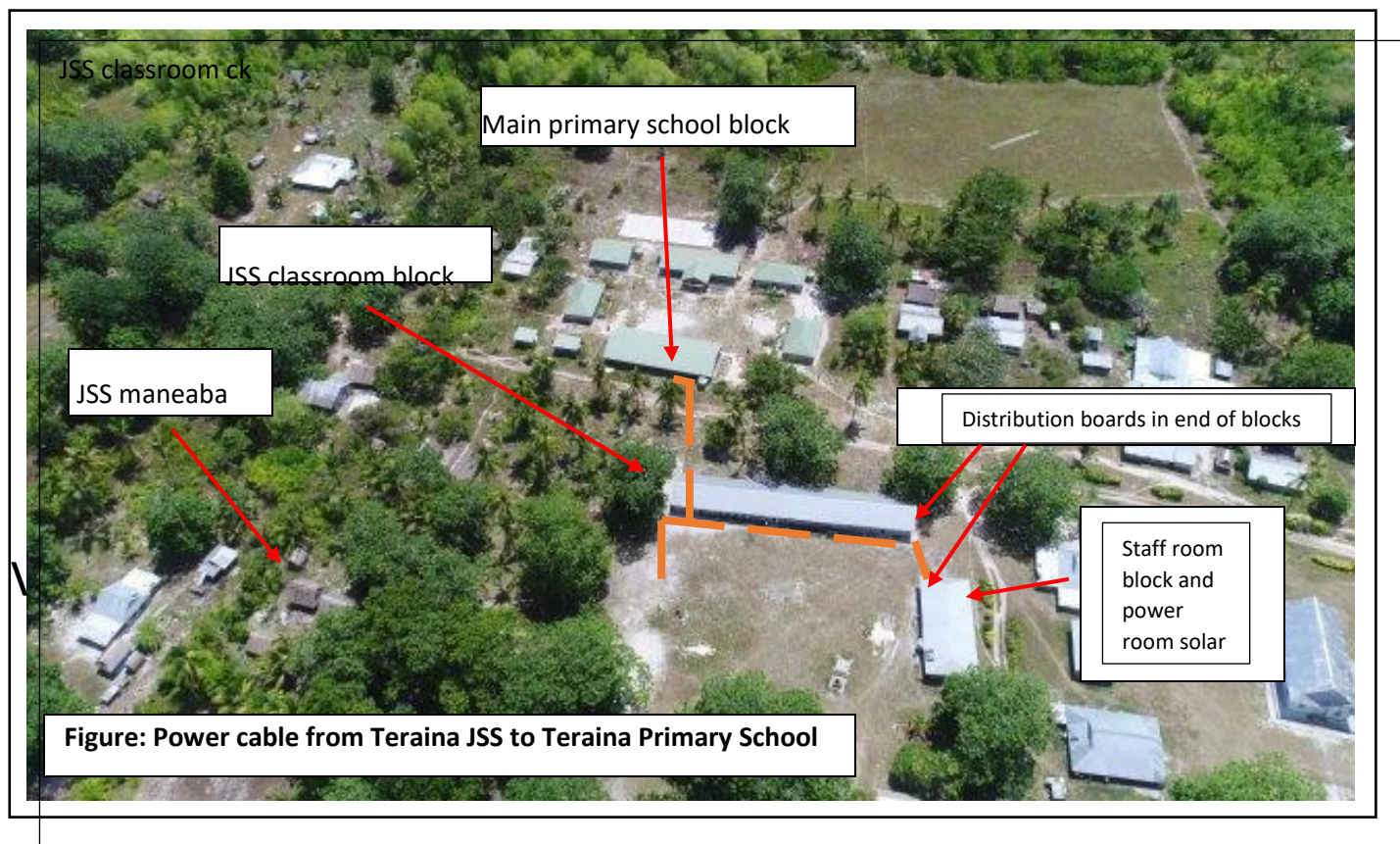


Figure: Teraina (Washington) Island, Line Island Group, Kiribati

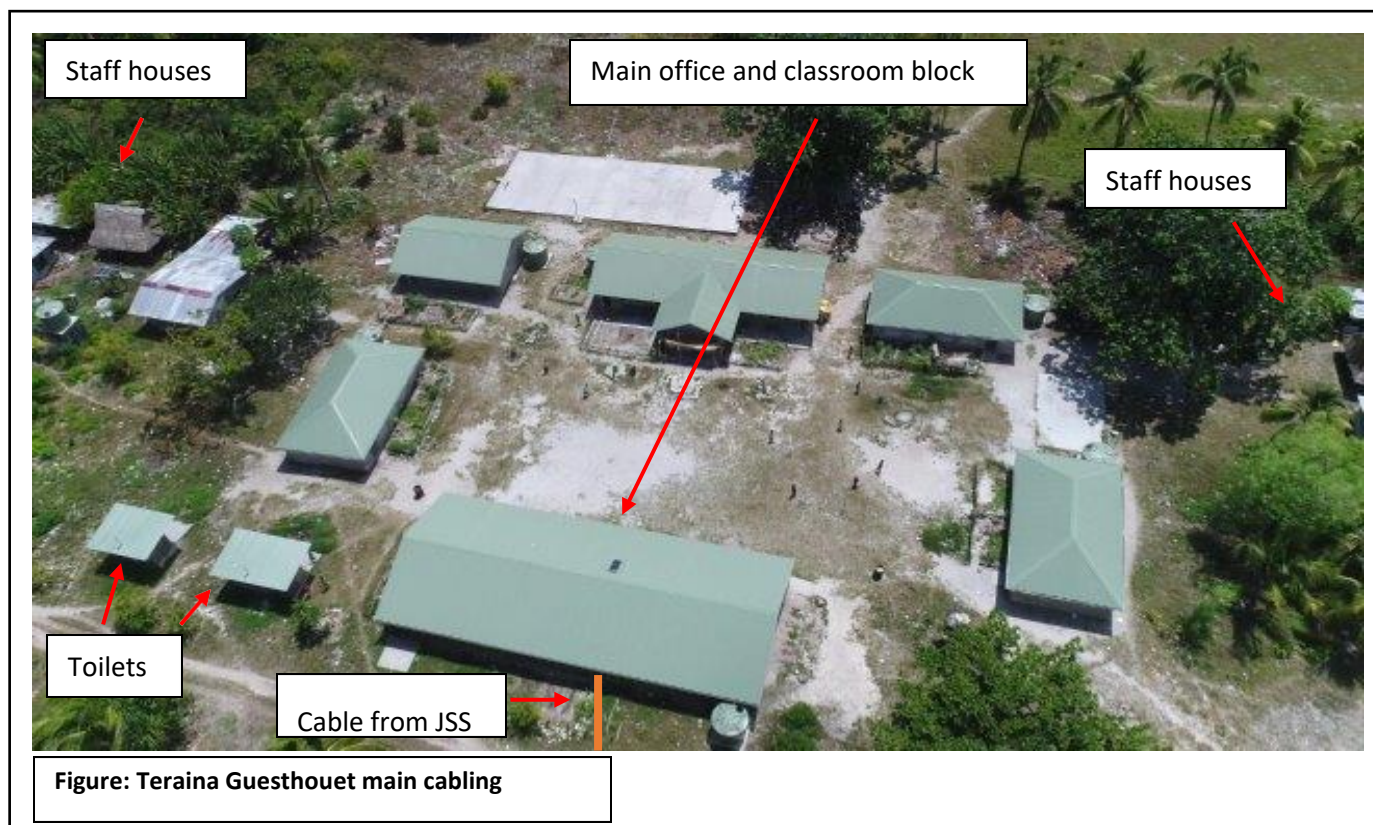


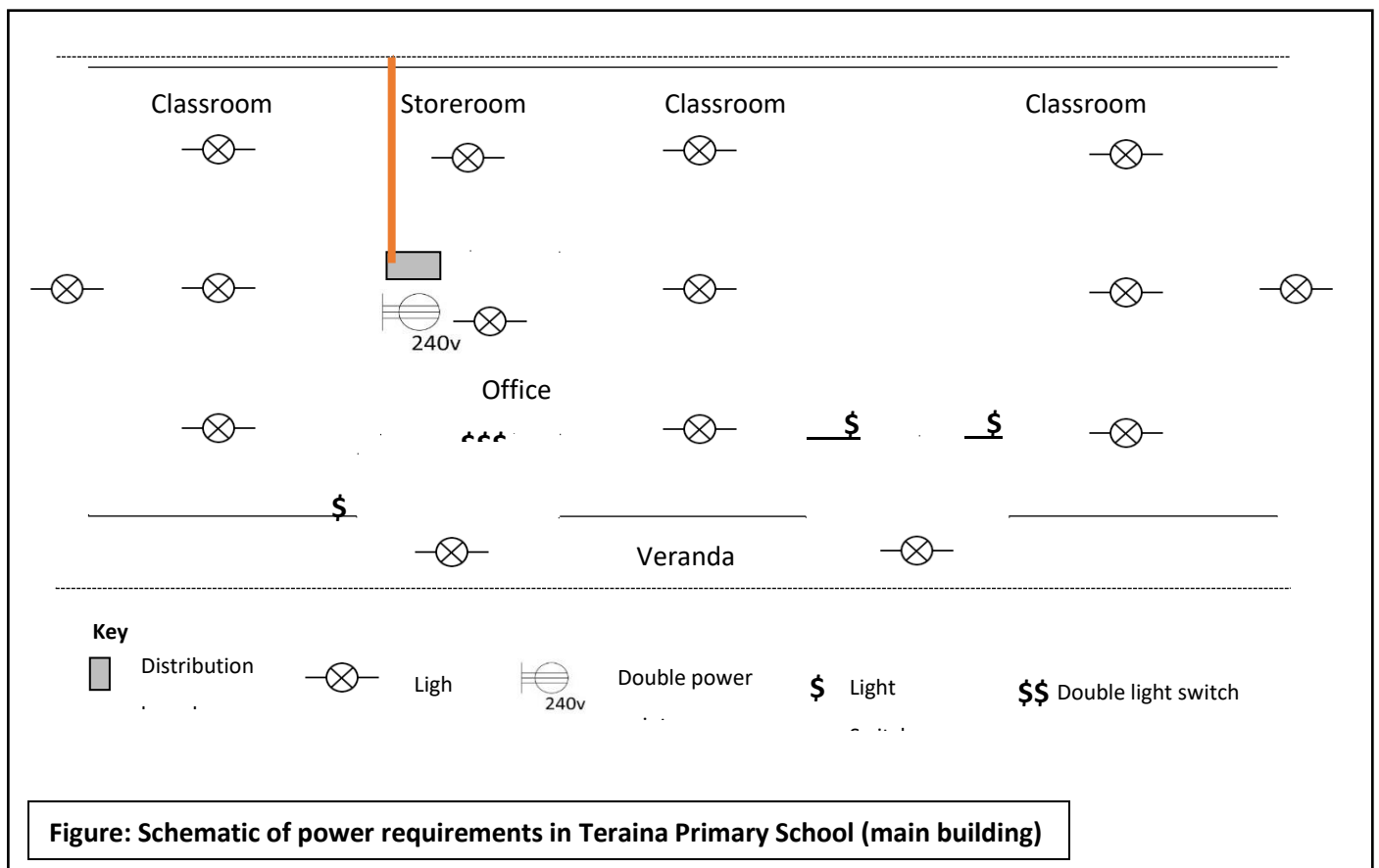
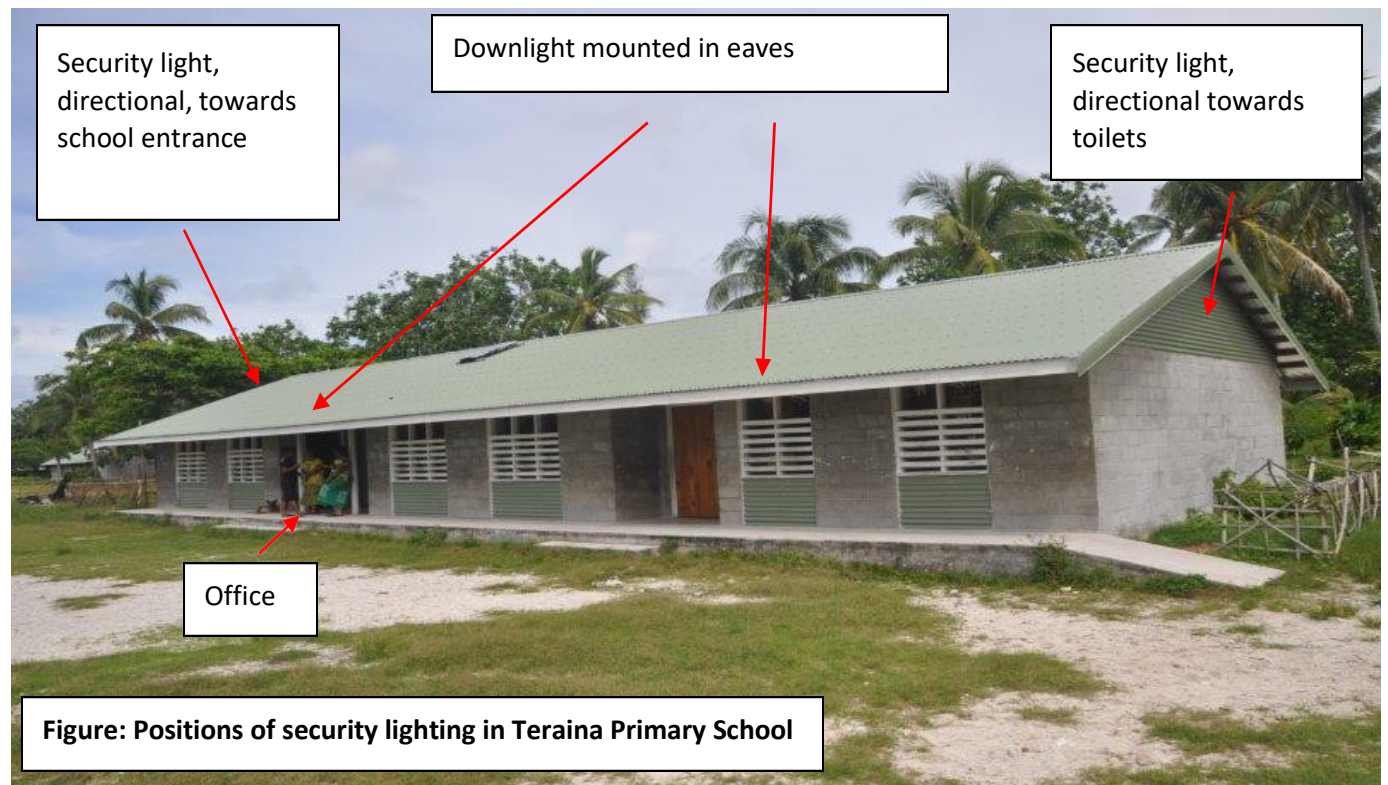


## Power Sharing - Teraina Primary School and Junior Secondary School (JSS)



## Power Distribution - Teraina Junior Secondary School (JSS)







## Power Distribution - Teraina Junior Secondary School (JSS)

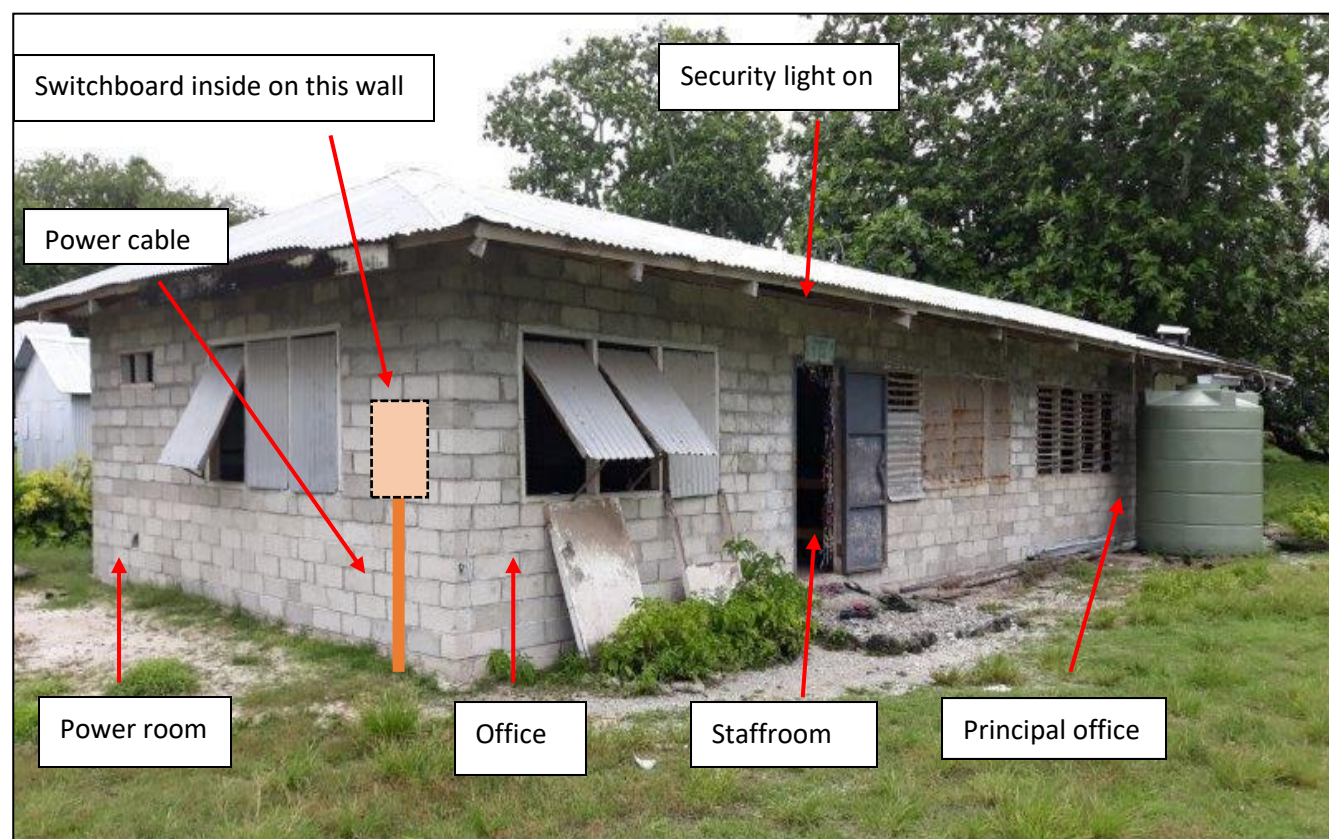


Figure: Power supply and security light – staff block at Teraina JSS

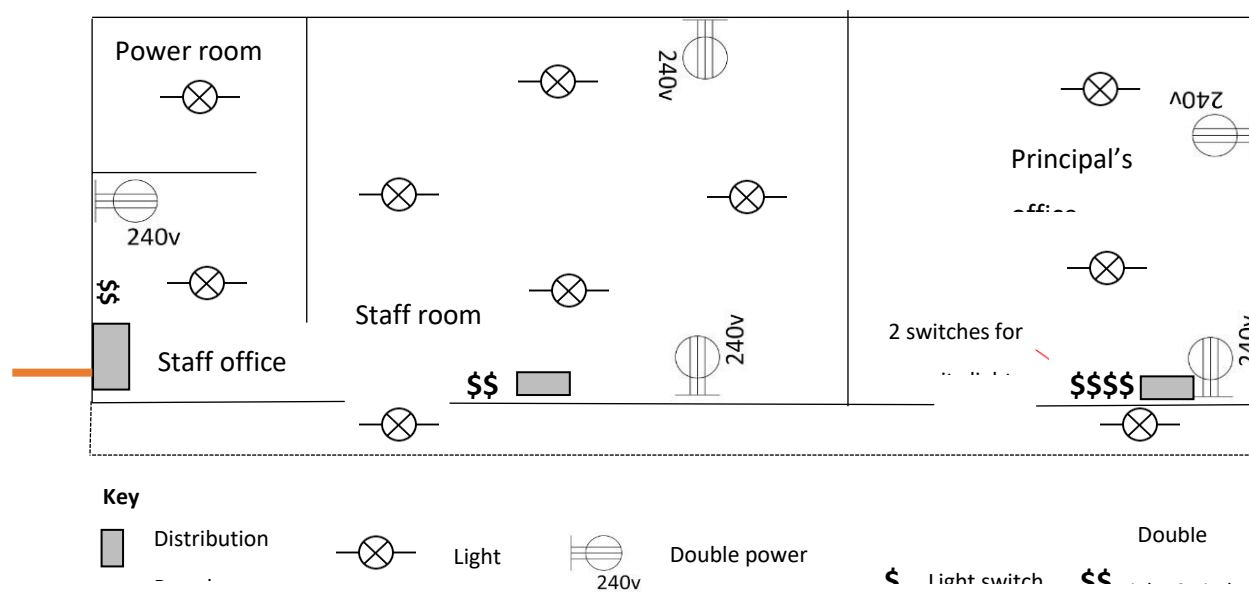
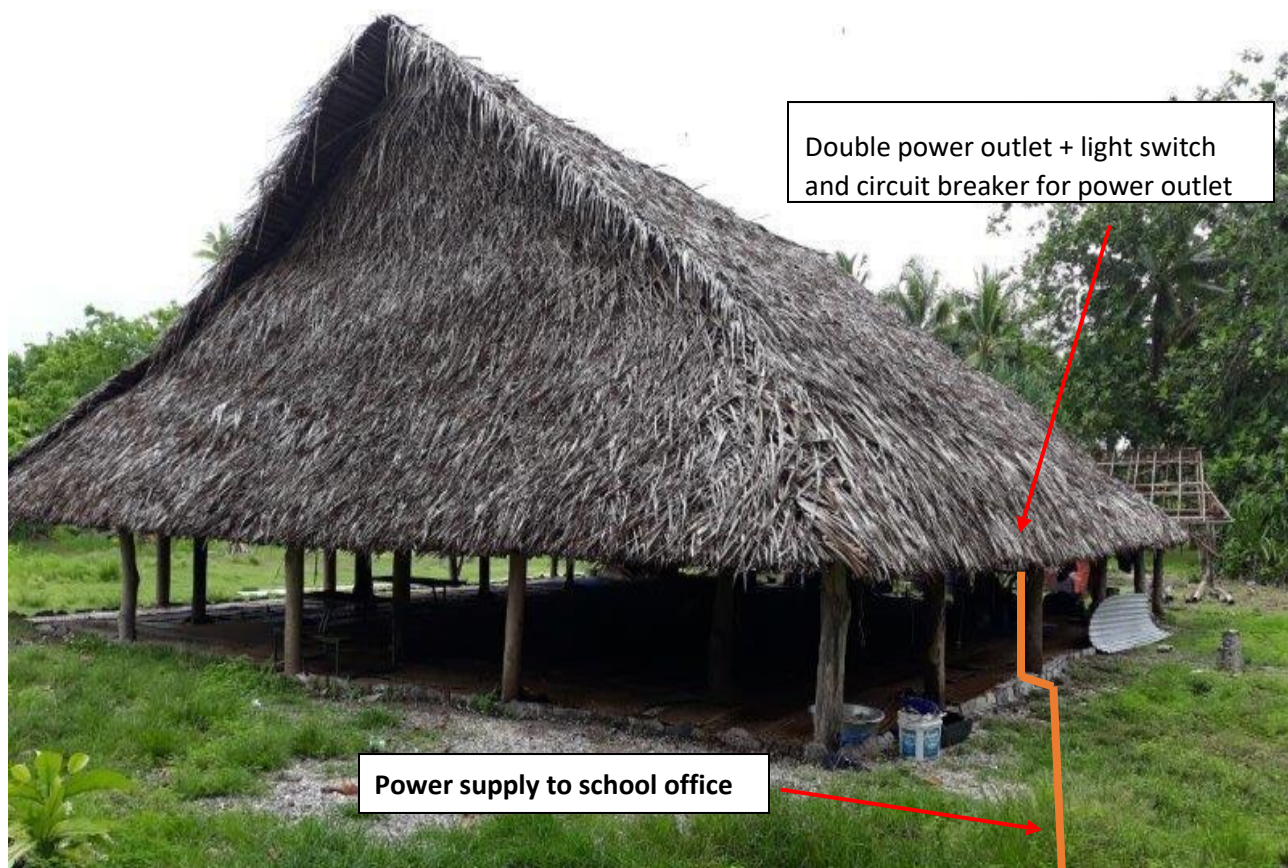
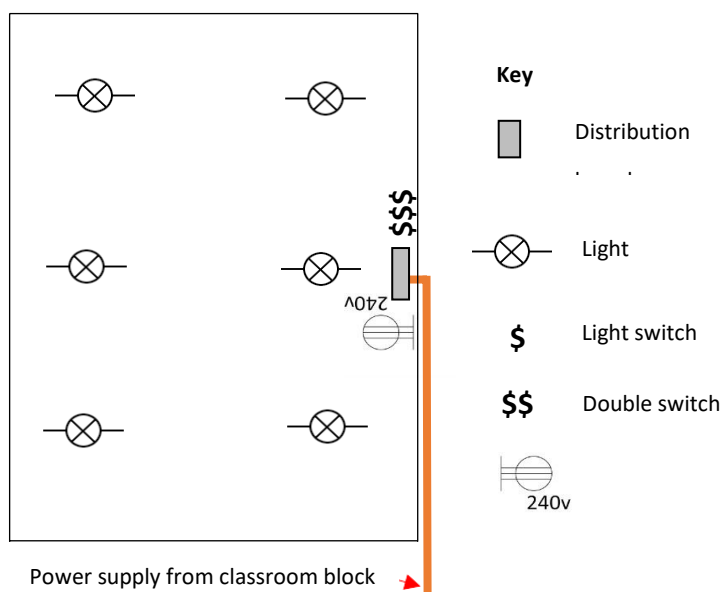


Figure: Schematic of power requirements - Staff block, Teraina JSS



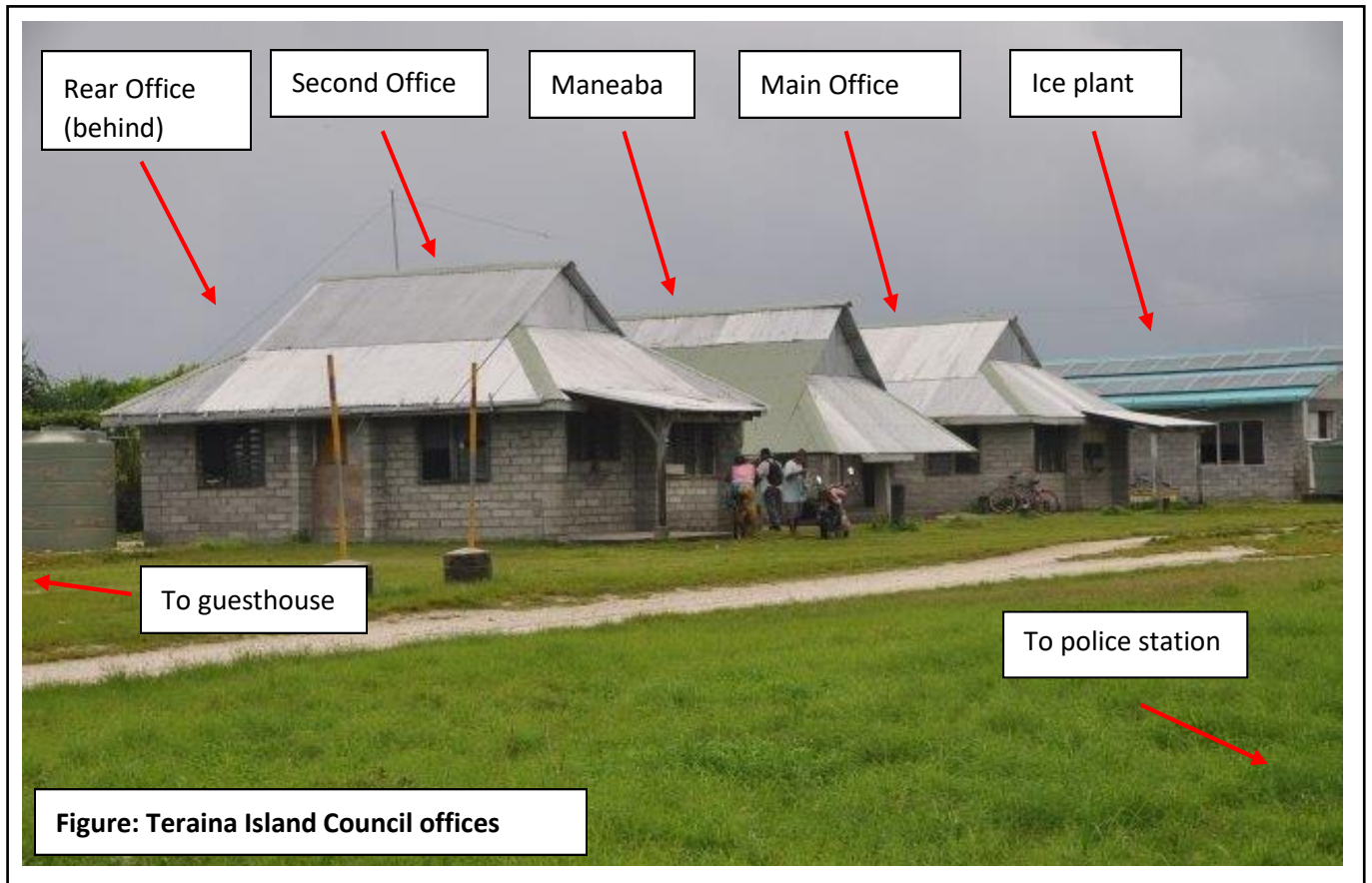
**Figure: Power supply to maneaba – Teraina JSS**

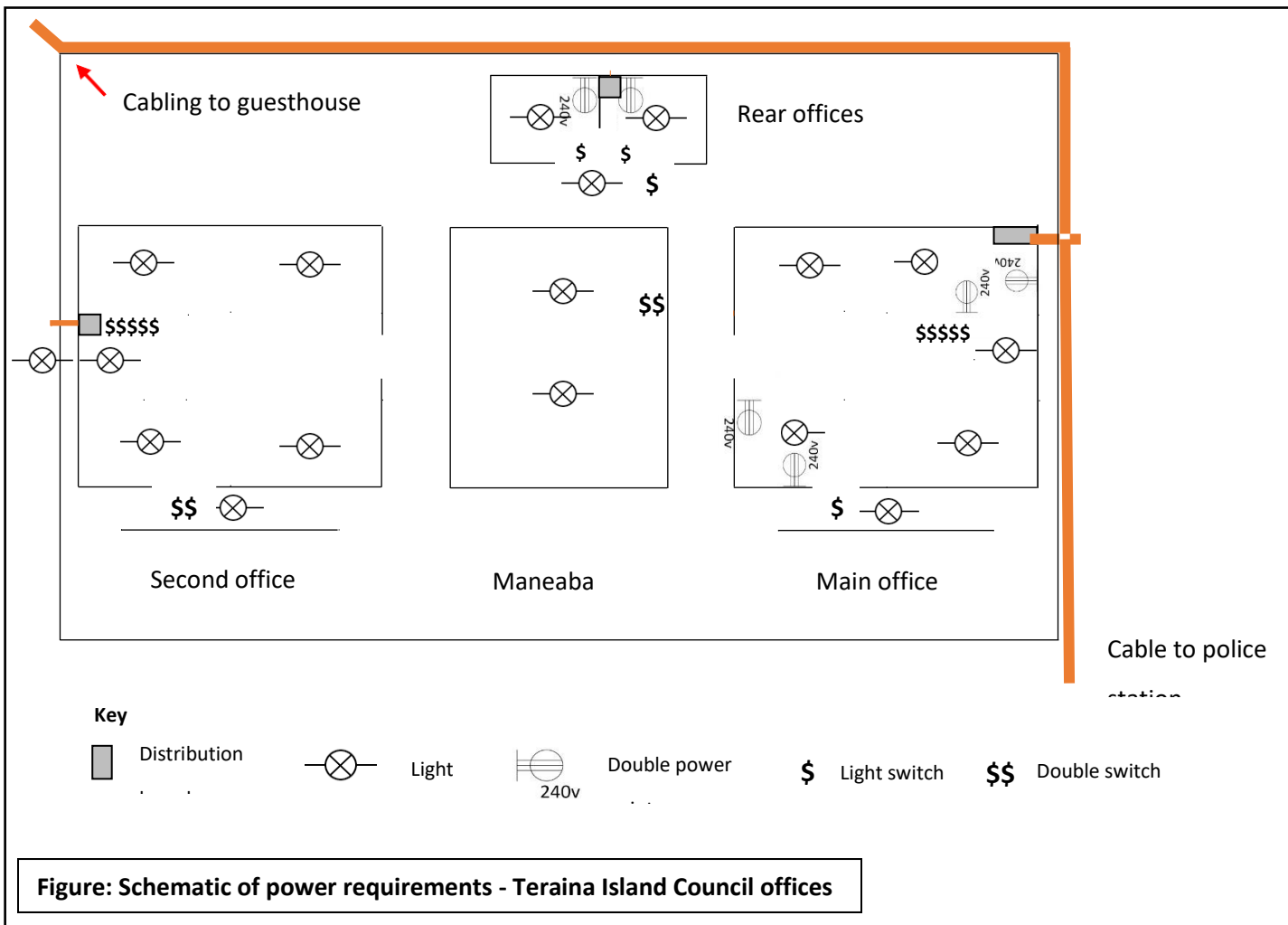


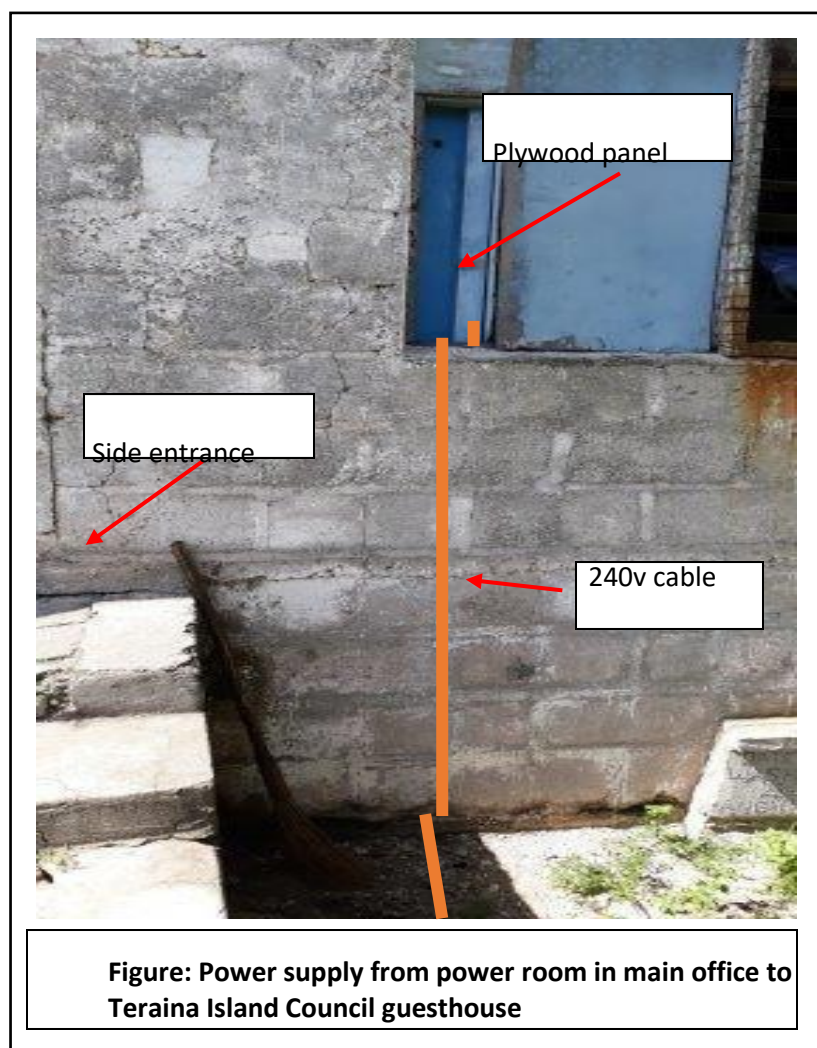
**Figure: Schematic of power requirements - Teraina JSS maneaba**







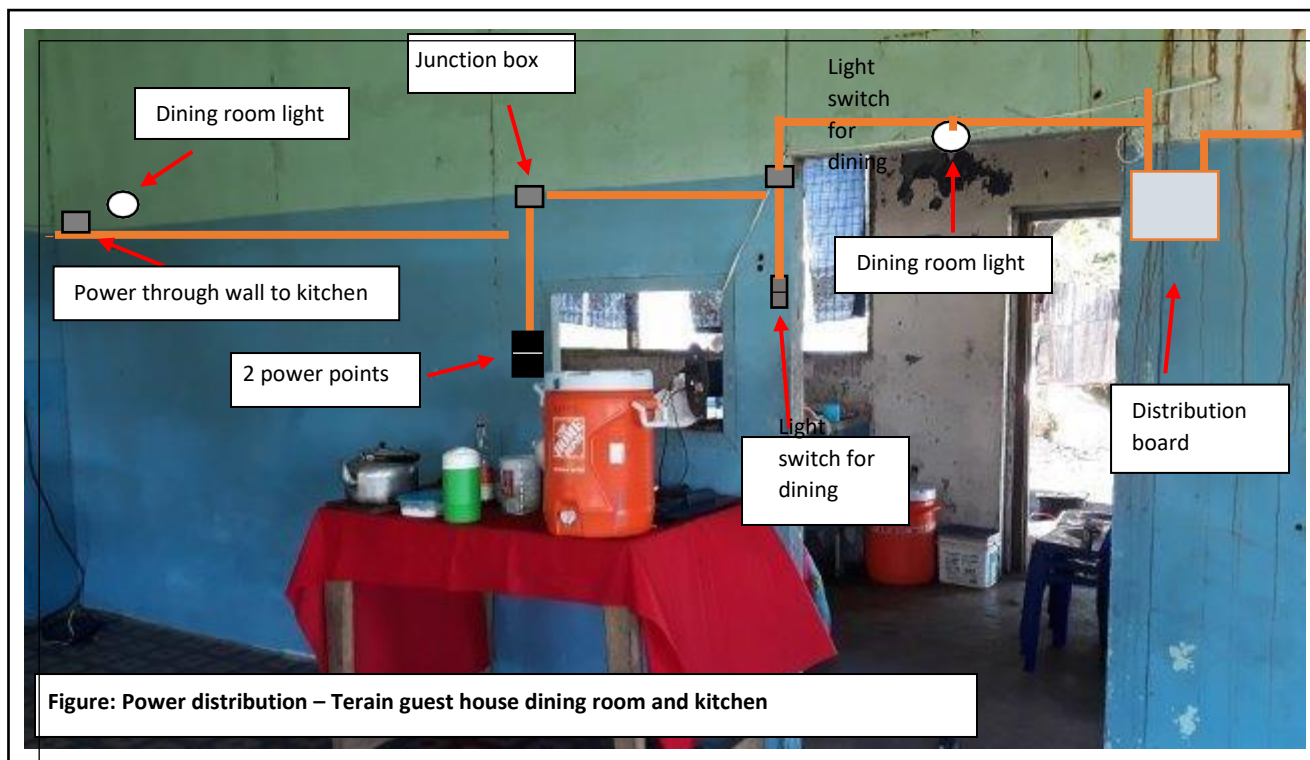
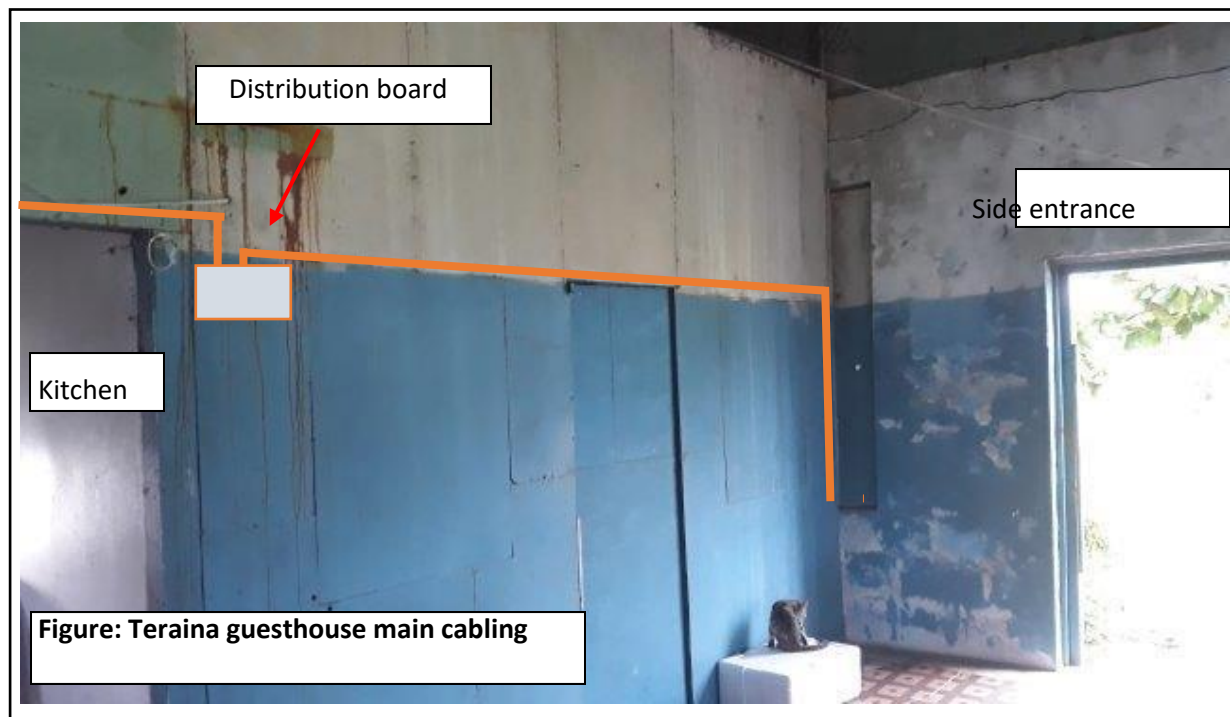








## Power Distribution – Teraina Island Guesthouse – internal fit out







## Power Distribution – Teraina Medical Centre

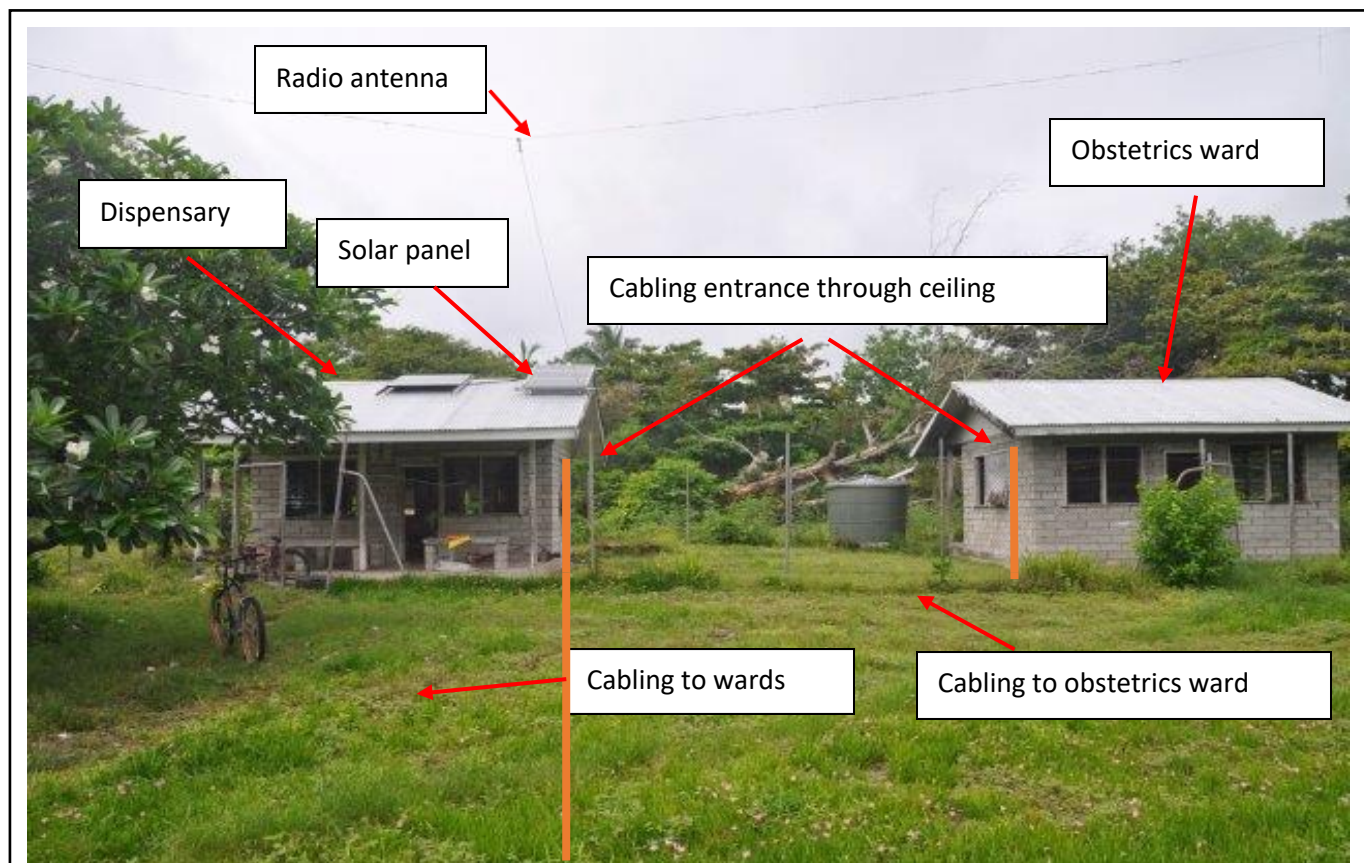


Figure: Teraina Island Medical Centre cabling

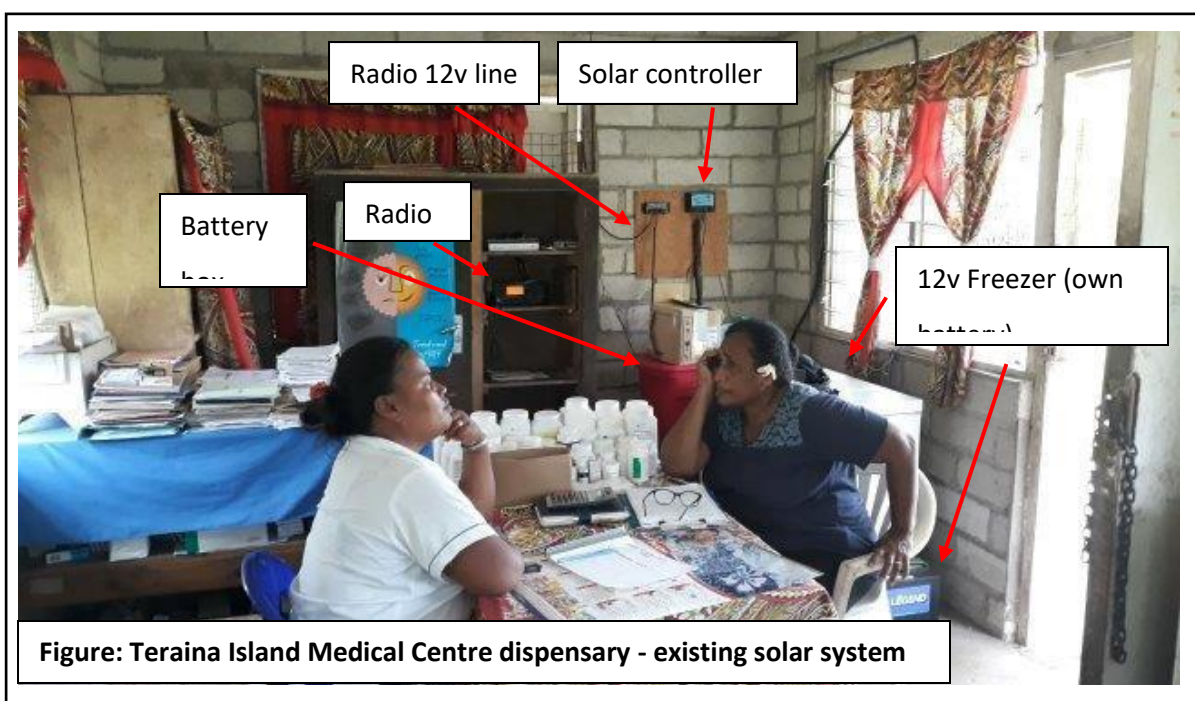
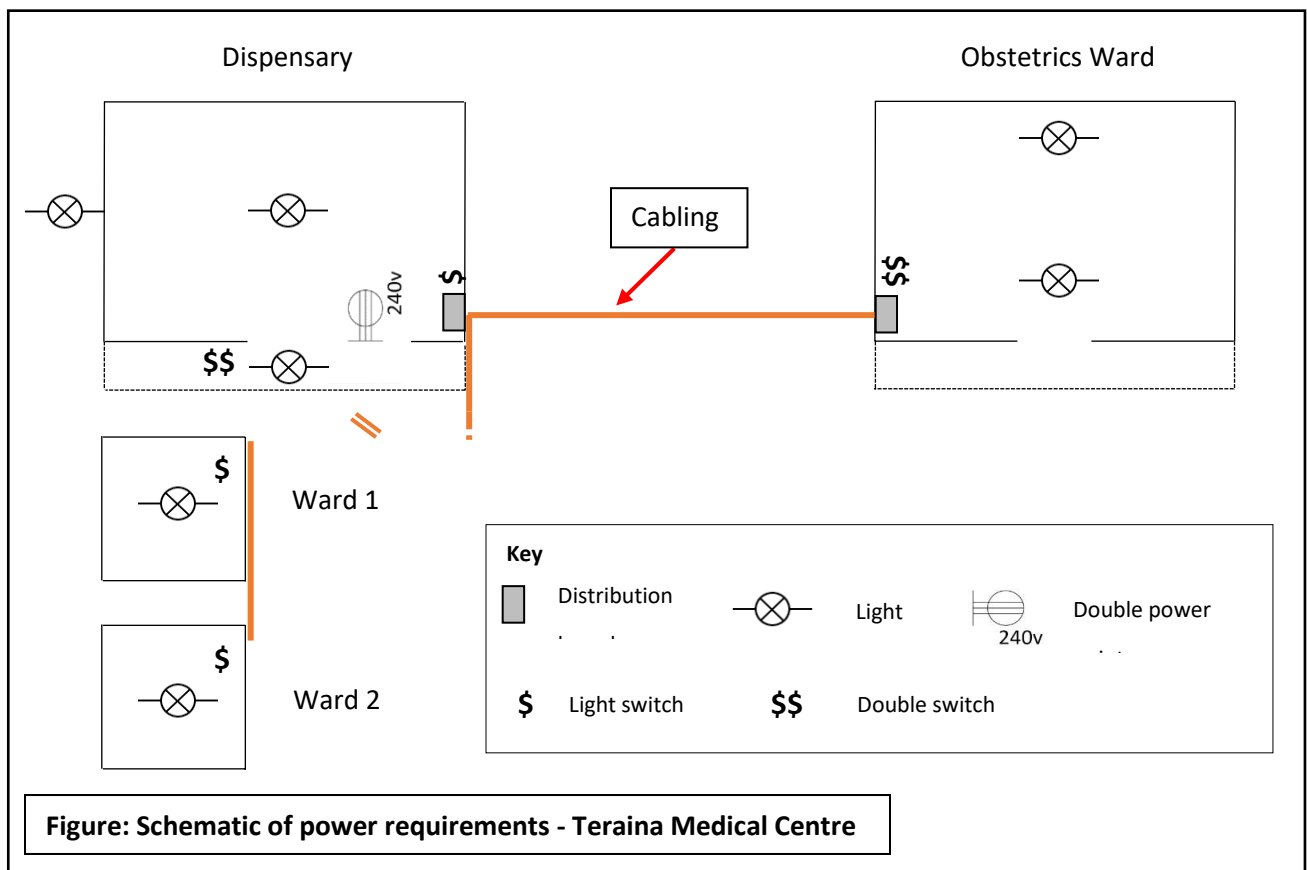
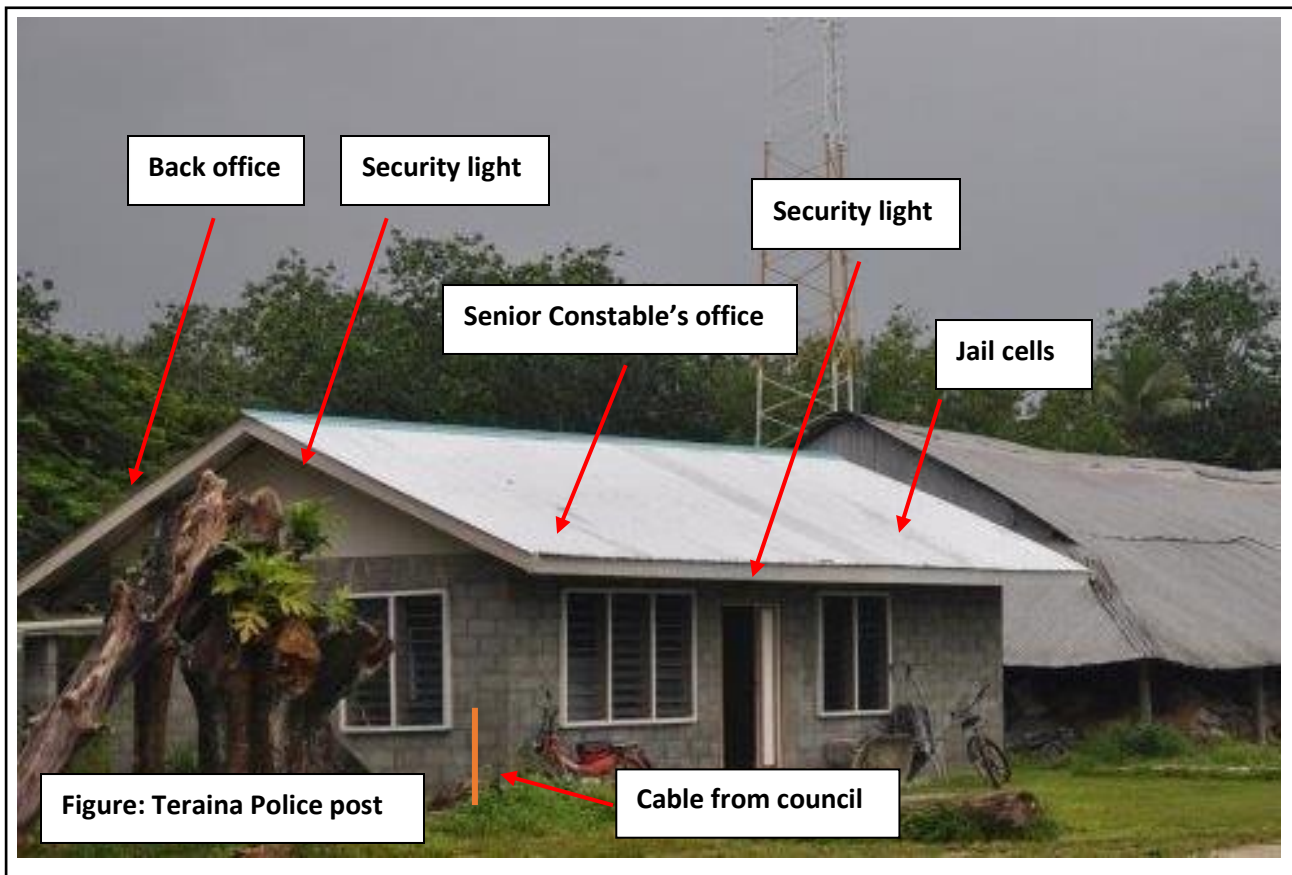
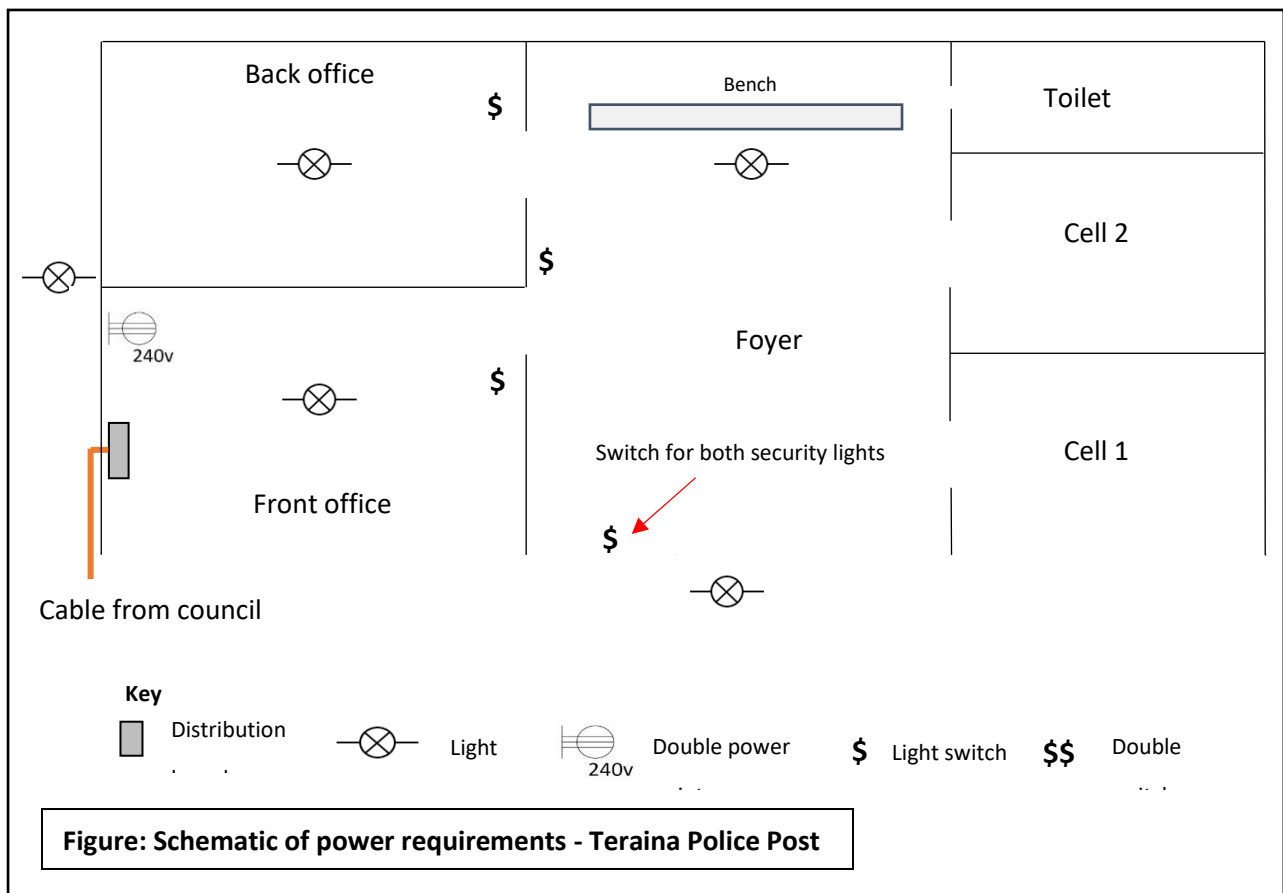


Figure: Teraina Island Medical Centre dispensary - existing solar system



## Power Distribution – Teraina Police Post





Annex 3.B. Tabuaeran Lighting Needs  
Annexes 4 to 8. Gender and Energy Needs Demand  
Annex 9. People Consulted on Kiritimati Island

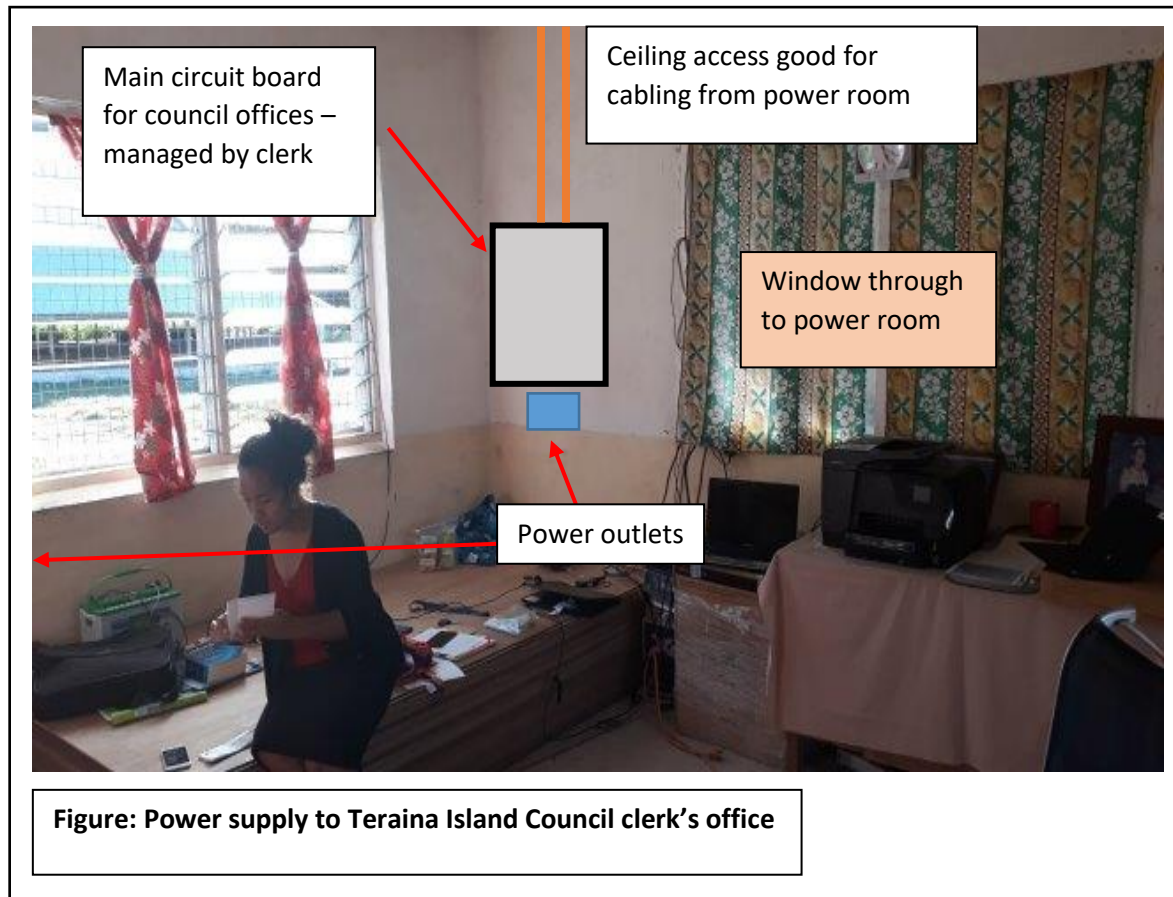


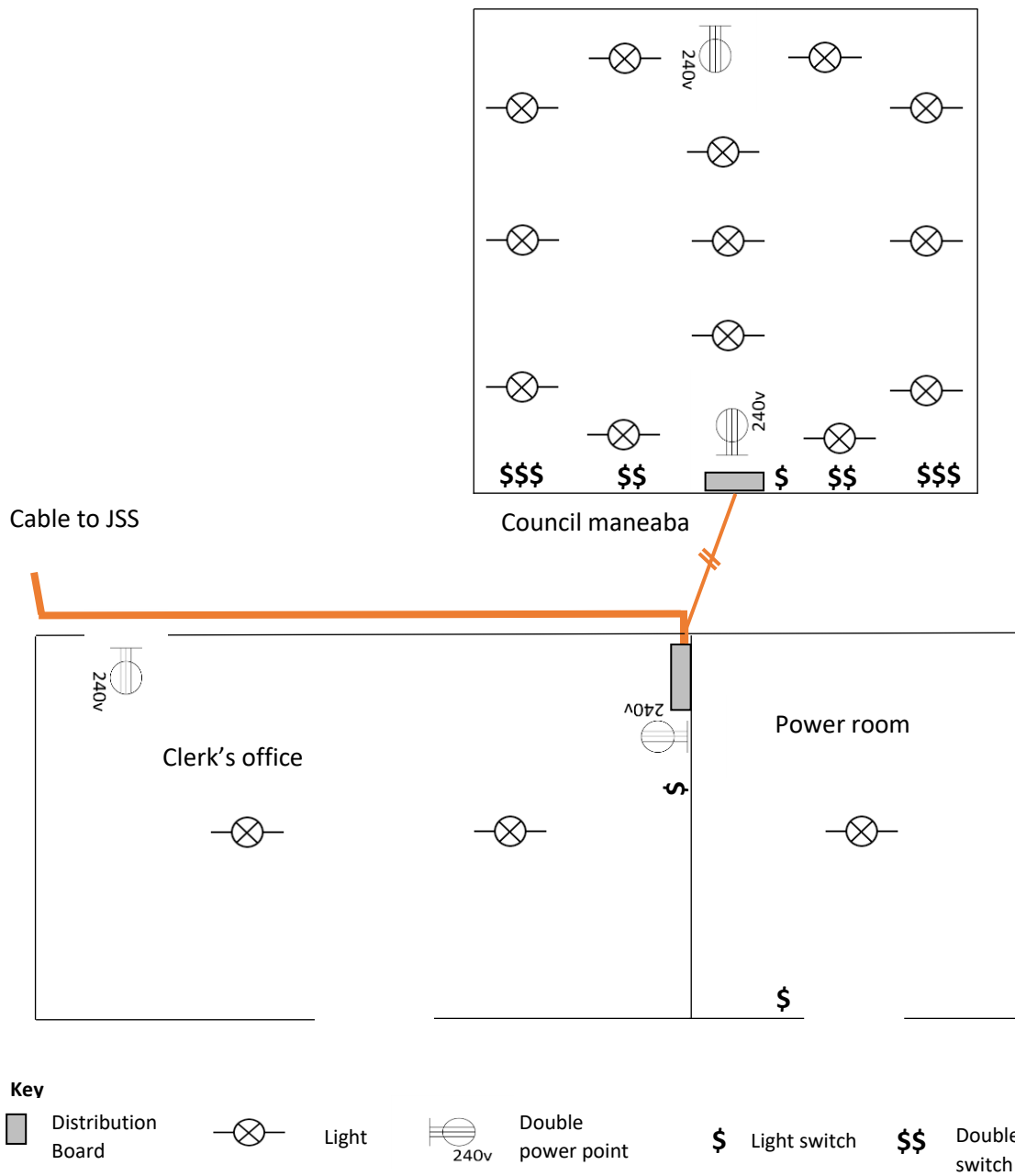
## Power Sharing – Tabuaeran Island Council and Junior Secondary School



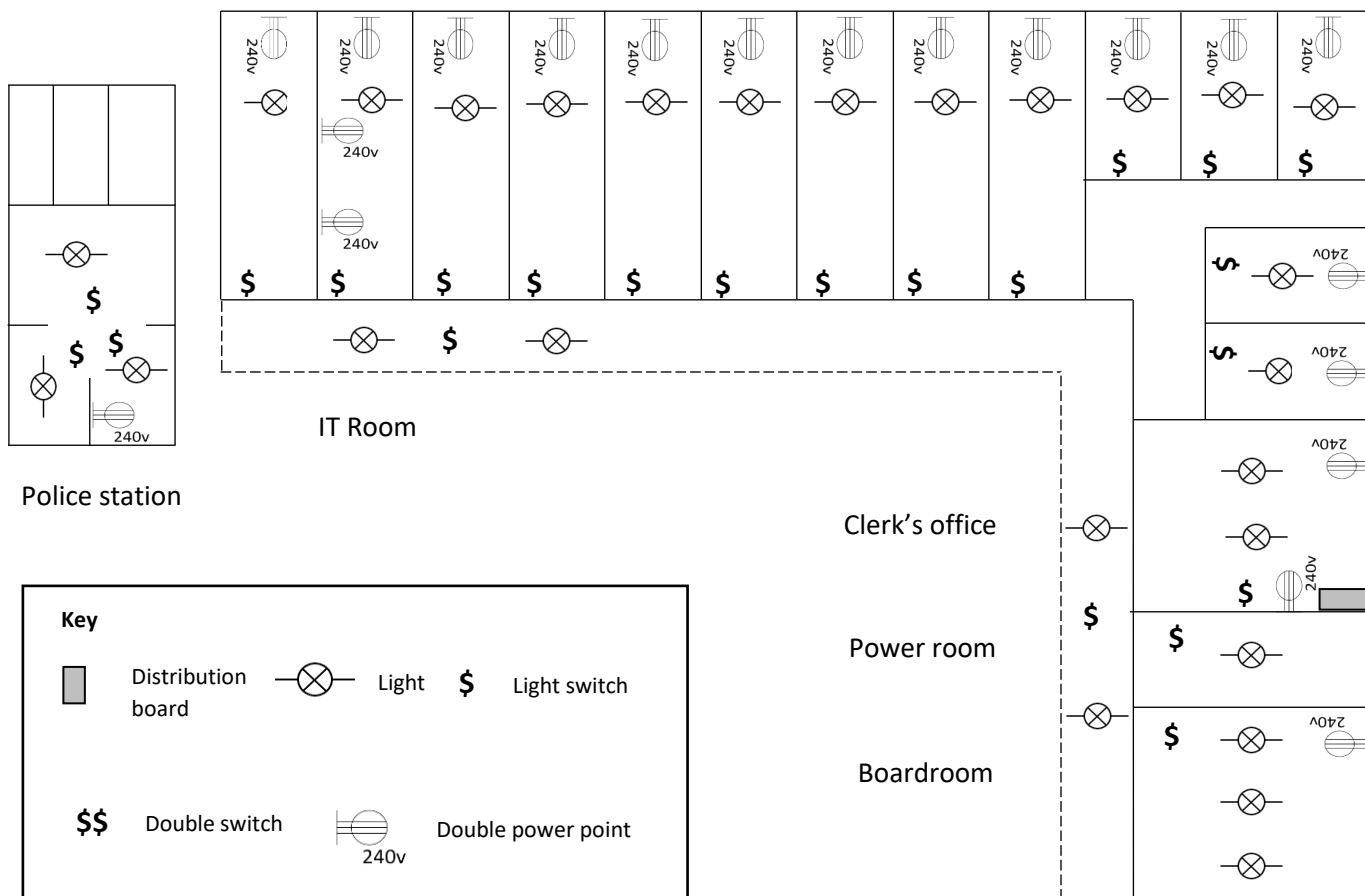


## Power Distribution – Tabuaeran Island Council





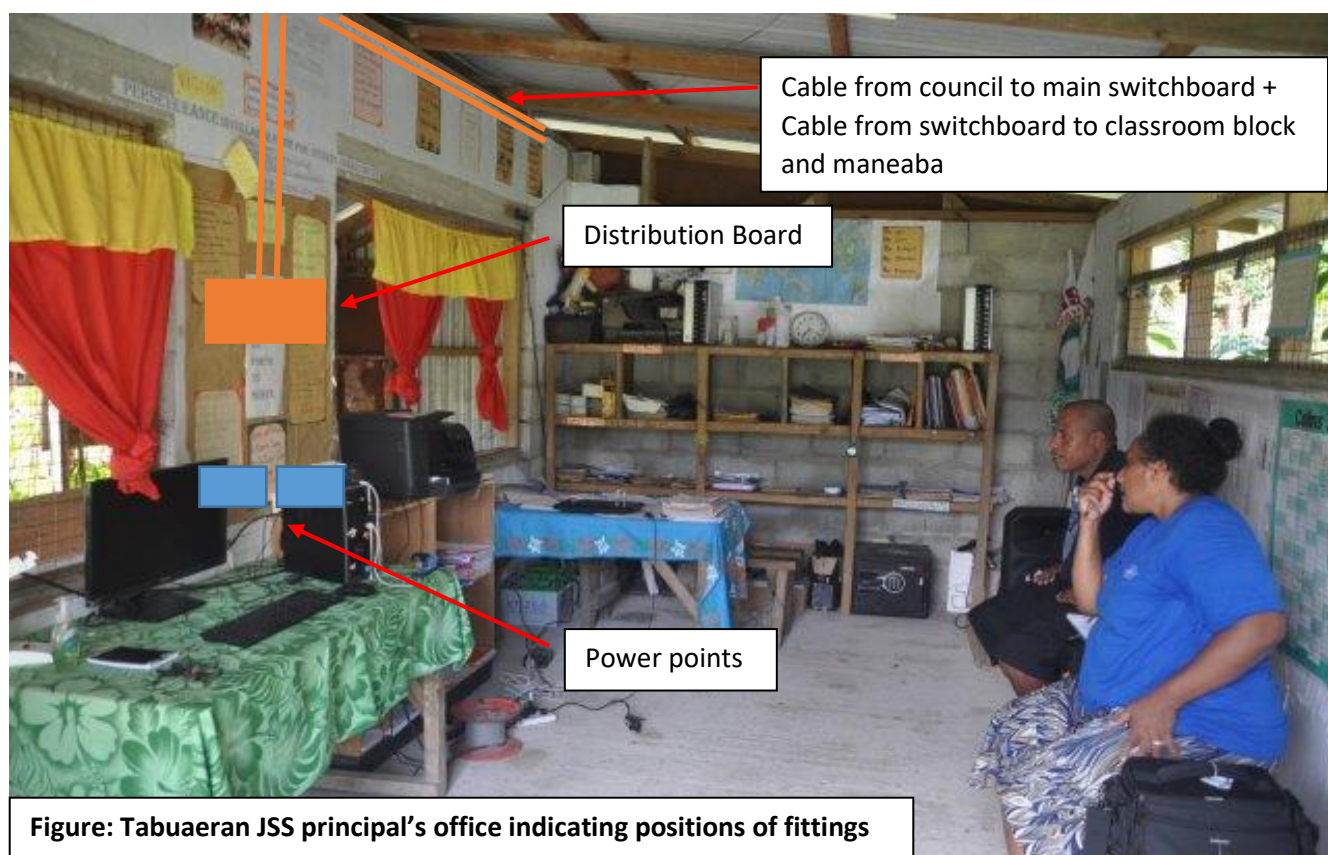
**Figure: Schematic of power requirements - Tabuaeran Island Council – clerk's office, power room, maneaba**



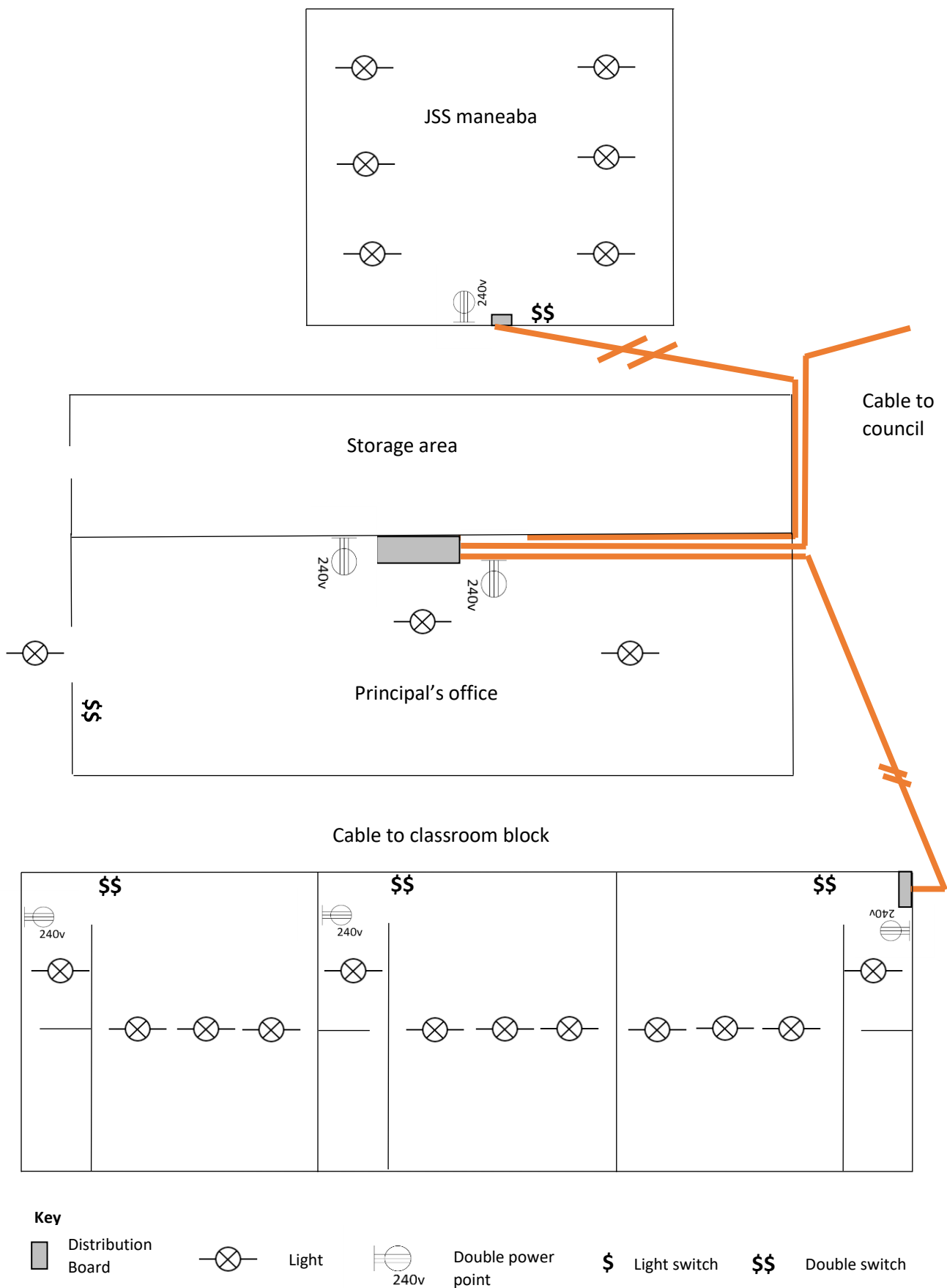
**Figure: Schematic of power requirements – Tabuaeran Island Council**



## Power Distribution – Tabuaeran Junior Secondary School (JSS)







**Figure: Schematic of power requirements - Tabuaeran JSS - maneaba, principal office, main classroom block**

Annex 4 Teraina island Council Energy Demand

	Equipment	Energy Demands	Equipment	Quantity	Hours Equipment on Load per day	Load (Watts)	Daily Load – Max (kW)	Use (kWh)	No. of days in month	Daily Demand Use (KWh)
<b>Teraina Island Council</b>										
<b>Building 1 - Main Office</b>										
Clerk Room	2 power points in clerk room	2 GPO and 1 light switch	LED light	1	2	5	0.005	0.01	20.00	0.20
	laptop	Use every day	laptop	2	8	60	0.12	0.96	20.00	19.20
	printer <sup>1</sup>		EPSON printer	1	0.25	25	0.025	0.01	20.00	0.13
	Internet use	Daily use	modem	1	24	70	0.07	1.68	30.00	50.40
			router	1	24	70	0.07	1.68	30.00	50.40
Council Financial Clerk Room		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
		laptop	laptop	1	8	60	0.06	0.48	20.00	9.60
Radio Operator room		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Storage room	storage room to store batteries and controller	light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
	2 GPO	for internet use	internet cable switch	1	24	30	0.03	0.72	30.00	21.60
	printer use for meetings and report (financial,	DELL AC 110- 127V, hertz 50/60 hZ, model no. Dell B1163W, Amps 5.0A	Dell printer	1	0.25	100	0.1	0.03	5.00	0.13

<sup>1</sup> EPSON XP- 420, 240v, Model C462N 0.5 - 0.3 Amp, 50-60 Hz, Made in Thailand

	Equipment	Energy Demands	Equipment	Quantity	Hours Equipment on Load per day	Load (Watts)	Daily Load – Max (kW)	Use (kWh)	No. of days in month	Daily Demand Use (kWh)
	project, school test paper, etc)									
		Brother MFC L575DW Model	Brother Printer	1	0.25	1280	1.28	0.32	5.00	1.60
	Laptop (4) mini laptop	HP Stream 1 PO Notebook, 19.5 Volt approx. 2.31A	mini laptop	4	1	70	0.28	0.28	5.00	1.40
Copra Coordinator		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Secondary Office - Building 2										
Island Council Assistant Clerk		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Island Fund Treasurer		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Revenue Collector		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
ICW - Island Community Worker		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Island Development Officer		light switch	LED light	1	3	5	0.005	0.02	20.00	0.30
Maneaba										
Lights		light switch	LED light	2	12	5	0.01	0.12	20.00	2.40

	Equipment	Energy Demands	Equipment	Quantity	Hours Equipment on Load per day	Load (Watts)	Daily Load – Max (kW)	Use (kWh)	No. of days in month	Daily Demand Use (KWh)
safety lights	switch for safety lights will be in the maneaba for watchman to on and off	safety lights	LED light	3	12	5	0.015	0.18	20.00	3.60
Rear Office										
1 office for IEC	1 GPO, 1 light switch	laptop	laptop	1	8	60	0.06	0.48	20.00	9.60
			LED light	1	3	5	0.005	0.02	20.00	0.30
1 office for Court Clerk	1 GPO, 1 light switch	laptop	laptop	1	8	60	0.06	0.48	20.00	9.60
			LED light	1	3	5	0.005	0.02	20.00	0.30
Quest House										
Living room		switch light	LED Light	2	3	5	0.01	0.03	30.00	0.90
rooms	3 bedrooms	switch light	LED Light	3	3	5	0.015	0.05	30.00	1.35
Bathroom		switch light	LED Light	1	3	5	0.005	0.02	30.00	0.45
kitchen light		switch light	LED light	1	3	5	0.005	0.02	30.00	0.45
Freezer	2 GPO	GPO - double	Freezer	1	1	300	0.3	0.30	30.00	9.00
Guests use	Guests staying at rest house, average 2 people at one time		laptop	2	3	60	0.12	0.36	30.00	10.80
		GPO for charging	tablet/phone	3	1	50	0.15	0.15	30.00	4.50
<b>TOTAL ISLAND COUNCIL DEMAND/NEEDS</b>										<b>206.10</b>
Police Station										
OCS Room	1 GPO		LED Light	1	3	5	0.005	0.02	20.00	0.30



[illegible]

## Annex 5. Taimanin Teraina JSS Energy Demand

[illegible]

	Energy Demands	Equipment	Quantity	Hours Equipment on Load per day	Equipment Rating load (watts)s	Daily Load Max -	Use (kWh)	No. of days in month	Daily Demand Use (KWh)
Laptop 2	laptop	Lenovo Model Name: PA-1450 - 55LL 100V - 240v approx. 1.7A 50-60HZ 20V = 2.25A	3	8	50	0.15	1.20	20.00	24.00
photocopier	laptop	MP 2501SP, MODEL D159 - 29, Serial No. E336M250184, EDP CODE 416448, 220V- 240V, 50/60Hz 52kg	1	4	1280	1.28	5.12	20.00	102.40
Projector	projector	Model : 3200 MP DLP Front Porjector, AC 100-240v approx, 50-60HZ/2aM	1	3	150	0.15	0.45	20.00	9.00
<b>TOTAL JSS DEMAND/NEEDS</b>									<b>164.00</b>

## Annex 6. Teraina Sunlight Primary School Energy Demand

[illegible]



Annex 7. Tabuaeran Island Council Energy Demand

Room	Energy Demand	Equipment	Quantity	Hours Equipment on Load per day	Equipment Ratings (watts)	Daily Load Max (kW)	Use (kwh)	No. of days in month	Daily Demand use (kWh)
<b>Tabuaeran Island Council Office</b>									
<b>Board room</b>									
	1 GPO, 1 light switch	Light	2	3	5	0.01	0.03	20.00	0.60
<b>Power Room</b>									
	1 GPO, 1 Light switch	light	1	3	5	0.005	0.02	20.00	0.30
<b>Clerk Office</b>									
		light	2	3	5	0.01	0.03	20.00	0.60
2 power points required due to the modem and laptop use and printer use	2 GPO, 1 Light switch	HP Office Jet 8715	1	1	100	0.1	0.10	20.00	2.00
20Volts at 2.25 Amps (Lenovo laptop)		Laptop	1	6	60	0.06	0.36	20.00	7.20
internet use		modem	1	24	100	0.1	2.40	20.00	48.00
		photocopier	1	0.25	1280	1.28	0.32	20.00	6.40
		solar café light	2	6	6	0.012	0.07	30.00	2.16
		mobile	1	1	6	0.006	0.01		

Room	Energy Demand	Equipment	Quantity	Hours Equipment on Load per day	Equipment Ratings (watts)	Daily Load Max (kW)	Use (kwh)	No. of days in month	Daily Demand use (kWh)
<b>Island Council workers Offices</b>									
A total of 17 rooms at the island council block. Board room, clerk room and 14 additional rooms will have light switch, light and GPO	13 GPO and light switch	light	13	3	5	0.065	0.20	20.00	3.90
		laptop	8	6	60	0.48	2.88	20.00	57.60
most officers have tablets/mobile for use		tablets/mobiles	15	1	6	0.09	0.09	20.00	1.80
there are four LED strip lights using a 12 V battery	1 switch light - out on the porch	safety lights	3	12	5	0.015	0.18	30.00	5.40
<b>IT /Internet room</b>									
	required 4 GPO, 1 Light switch	light	1	3	5	0.005	0.02	20.00	0.30
current use of power is big with 3 extension cords from 1 power point	security lighting for internet use - should be off when no one is using internet	LED Light	2	6	5	0.01	0.06		
	Printer	HP Office Jet 8715	1	0.25	12	0.012	0.00	20.00	0.06
	4 hours per use per person	modem	1	24	100	0.1	2.40	20.00	48.00
laptops	Income from internet ranges from 3,000 to 4,000 a month	router	1	24	50	0.05	1.20	20.00	24.00

[illegible]

## Annex 8. Keina Tiito JSS Energy Demand

Room	Energy Demands	Equipment	Quantity	Hours Equipment on Load per day	Equipment Ratings (load in watts)	Daily Load - Max (kW)	Use (kWh)	No. of days in month	Daily Demand Use (KWh)
<b>Junior Secondary School</b>									
Principals Office	2 GPO	light	2	3	5	0.01	0.03	20.00	0.60
	2 switch light - porch light	light	1		5	0.005	0.00	20.00	0.00
Samsung 1.79Amps	Desktop	Computer monitor	1	8	43	0.043	0.34	20.00	6.88
Dell 1.79 Amps	Computer	CPU	1	8	43	0.043	0.34	20.00	6.88
Current power is small genset hired \$50.00 for 24 houses, expenses includes hire and fuel of \$20 - \$30	Photocopier	Photocopier	1	1	1500	1.5	1.50	20.00	30.00
Lenovo		Laptop	1	8	80	0.08	0.64	20.00	12.80
Printer1600 mA	Printing	HP Office Jet 8715	1	1	12	0.012	0.01	20.00	0.24
<b>1st Block Classroom</b>									
3 classrooms	light switch	light	6	3	5	0.03	0.09	20.00	1.80
3 staff rooms	3 GPO, 3 switch lights	light	3	3	5	0.015	0.05	20.00	0.90
		Laptop	3	7	80	0.24	1.68	20.00	33.60
3 storage rooms		tablets	3	1	60	0.18	0.18	20.00	3.60
Maneaba	1 GPO	PA system	1	2	120	0.12	0.24	1.00	0.24
		Projector	1	2	80	0.08	0.16	1.00	0.16
	Light switch	light	5	3	5	0.025	0.08	1.00	0.08
	outside maneaba	safety light	3	12	5	0.015	0.18	20.00	3.60

Annex 9. People consulted on Kiritimati

<b>Name</b>	<b>Sex</b>	<b>Organisation/Supplier</b>	<b>Contact</b>
Taake	F	Kings Holdings	<a href="mailto:Nanas.taake@gmail.com">Nanas.taake@gmail.com</a> Ruataru.king@icloud.com
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