



The French Pacific Fund Project Status Report

Project Title: Sustainable Energy for Sustainable Development

Principal Investigator: Dr. Atul Raturi

The project envisages sustainable development of remote fishing communities through the provision of renewable energy based refrigeration systems. Most of these communities are away from town centres and have no means to store their catch for long times. This results in their fish not reaching markets on time and being discarded. They use smoking as one of the ways to preserve fish but it has its limitations and of course the fish is not fresh when taken to be sold. Bringing ice to the villages is expensive and inefficient. A solar PV + Battery + backup generator can help power freezers using solar energy. A techno-economic analysis shows the win-win situation for all stakeholders from fisherperson to consumers created on implementation of these systems.

This project is being coordinated by Dr. Atul Raturi, School of Engineering and Physics. Under the current funding three systems are being installed that include Wainika in Vanua levu, Yanuca Island in Viti Levu and Tavuki in Kadavu. The Wainika system has been completed and other two are under establishment.

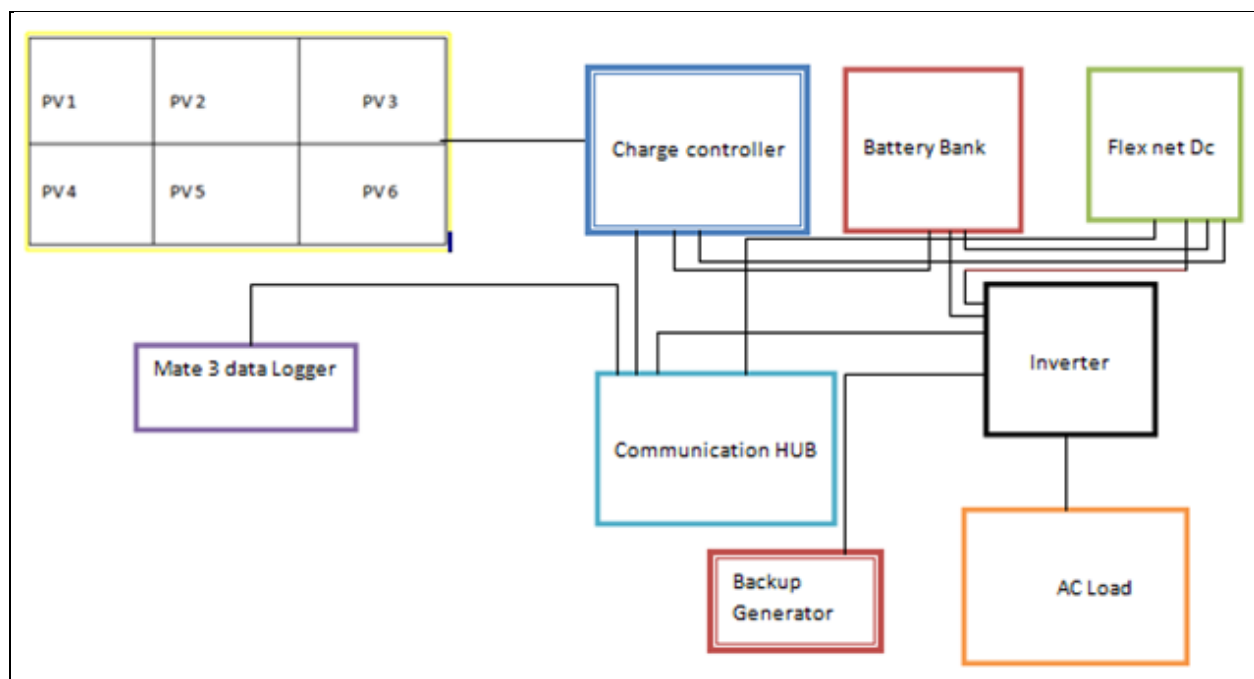
The following report describes technical aspects of the installation and describes the impact of this intervention on the livelihood of the community. A simple payback time of about one year makes this system highly economical and serves an example of Renewable Energy for Productive Use..

Following is a report on the completed Wainika installation.

Technical performance

A 1.44 kW solar PV system was established at Wainika village in November 2015 Figure below shows the schematic of the installed system along with the monitoring system.

Fig. 1 The Solar PV System at Wainika In Udu Point



The solar PV system set up at Wainika in Udu point is a standalone system that has been designed to power regular three AC freezers. The following table shows the details of the system components;

Table 1: Wainika system details

Component	Details
Solar panel	6 x 240 W Trina solar panels connected as 3 in series and in 2 parallel to meet the design array for a 1.44 Kw system
Charge controller	An Outback FX 80 charge controller receives the DC power generated by the panels and uses it to charge the battery bank
Battery Bank	Comprises of 12 x 2V Everxceede batteries @ 600AH. The 12 batteries are connected in series to make up for a 24 V battery bank.
Inverter	Outback inverter of 3Kw rating is being used in the system for the conversion of DC supply form the battery bank to an AC output of 240 V to the load.
AC load	3 x 200L deep Freezers are the main load component for the system. Each freezer has a power consumption of 360Kwh per year. The power rating of each freezer is 100w.

Generator	A 3 KVA generator is also installed with the system as a backup supply in times of shortage of energy from the PV system.
Monitoring Devices	Outback Mate 3 data logger, flexnet DC are connected to the system components through a Hub 4 communication manager to allow for the recording of data for monitoring the system characteristics

Wainika System Photos

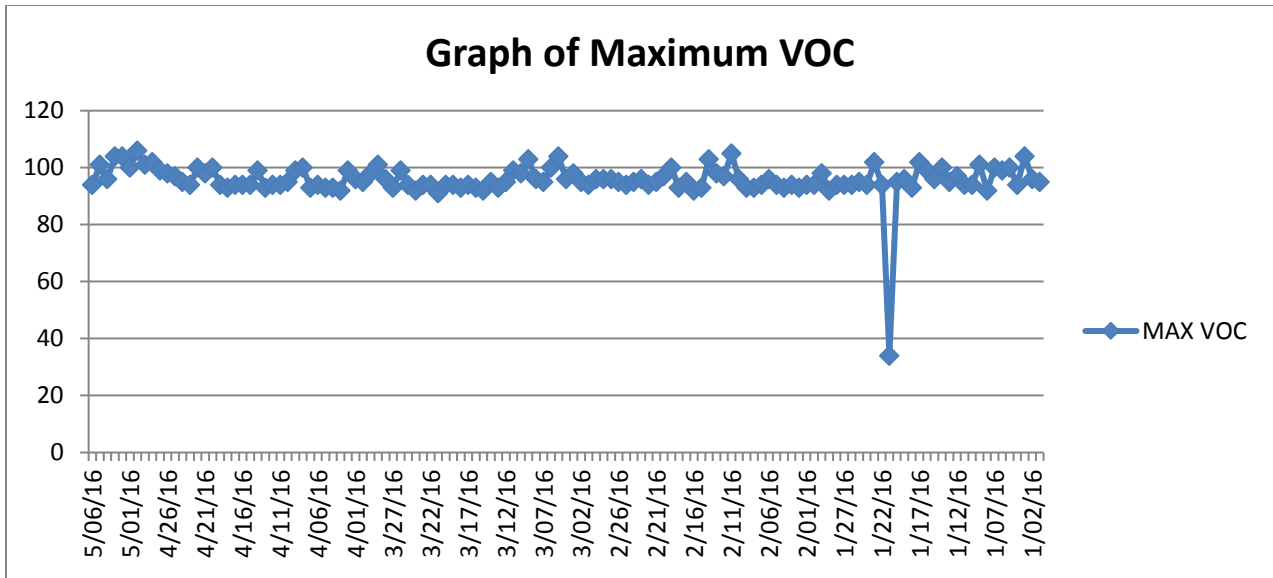


1. Solar Panels
2. Inverter and monitoring system
3. Batteries
4. Freezers.

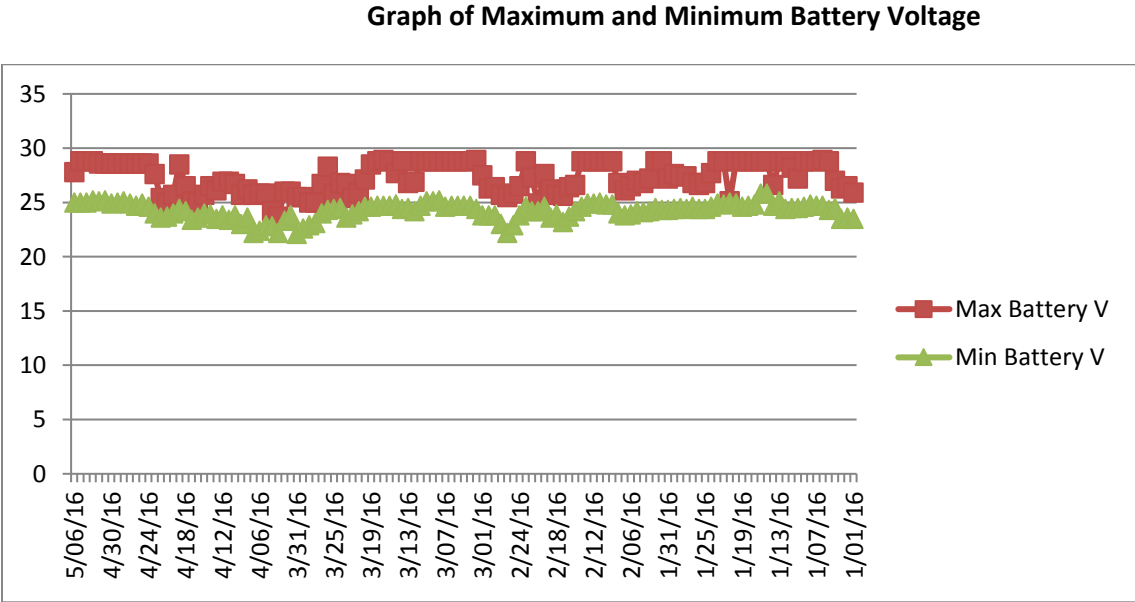


System Performance :

The maximum Open Circuit Voltage V_{oc} provides the information for the PV panel performance during the day by indicating the maximum voltage produced by the array. Fig. show the V_{oc} for the period 1/2/16 to 5/6 16.

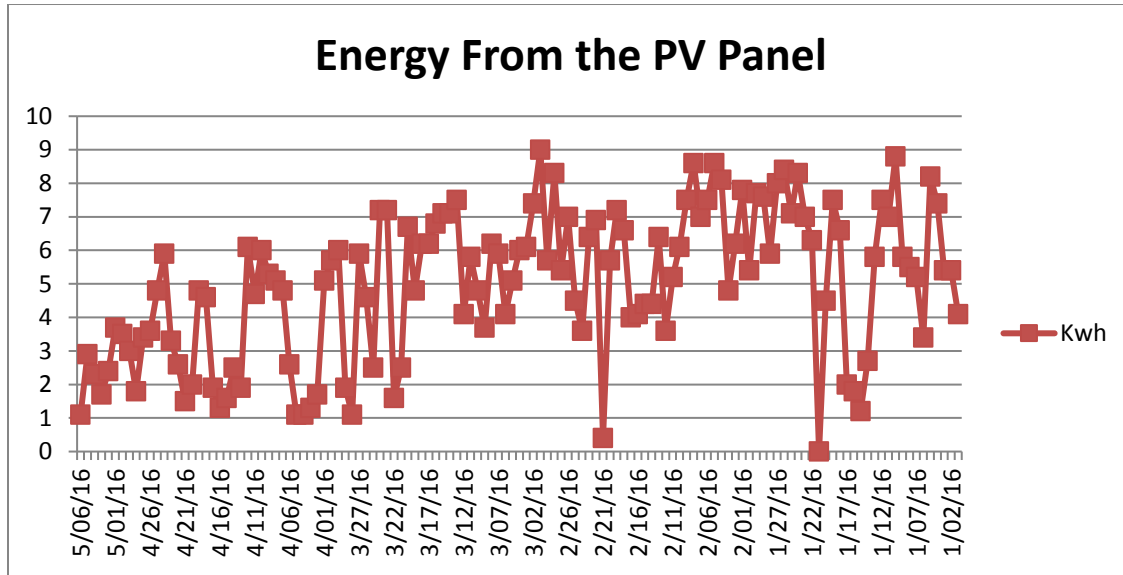


The battery voltage gives an idea of the state of charge as the battery is being discharged by the freezers and charged by solar energy. It can be seen that during the reported period the max. and minimum voltages are fairly constant. The cut off voltage set for the battery bank to power the three freezers is around 20.9 V and below which an indication light goes on the switch board goes on indicating the backup generator needs to be operational. This usually happens during consecutive cloudy days.



The graph indicates the total ampere hour accumulated during the days operation to the battery bank.

Fig. shows the energy production from the solar PV system installed. It is variable due to the amount of solar radiation available on various days. A maximum of 8-9 kWh/day is seen.



Socio- Economic Impact

The inhabitants of Wainika village depend on subsistence farming and fishing. The region is home to some great fishing locations, but the catch has to be transported to the nearest market in Labasa for sale, which requires a two hour drive in addition to the 45 minute boat trip.

Since there was no storage facility in the villages, ice had to be brought in from Labasa first and then the catch was carried back. The whole process is highly inefficient, unsustainable and uneconomical. A significant amount of fish never reached the market and had to be discarded.

Installation of the refrigeration system “marked a new beginning for the 23 households living in Wainika” according to the Chief Epironi Ravasua. According to Mr Ravasua, villagers in Wainika and the neighboring village, Vatu now use the facilities and pay for phone charges and storing of food and fish in the freezers. Currently, four villages are utilising the freezer services.

From January to March 2016, the freezers helped store approximately 2,000 kilograms of fish with a total value of \$6,000 of income for the community. They have also earned substantial amount of money through providing phone/laptop charging facilities to nearby population.

Some photos showing system utilization:



This project was officially commissioned on July 5th 2016 in the presence of French Embassy and USP representatives.



Next phase

The second installation at Yanuca is being carried out currently. The system consists of 940 PV modules coupled with 2 kW inverter that would power two energy efficient freezers. The system is expected to be in place by end November. The third and final system under this funding will be installed at Tavuki , Kadavu island. We expect to complete all installations before December 2016.

