



## Wainimakutu School Solar Project

*One of the largest and highest quality school solar systems in Fiji.  
A strategy to supply power for computer education and establish on-going cash flow for the purchase of those education resources.*



FIJI®  
WATER  
FOUNDATION





## **Wainimakutu High School and Primary School**

Location: Viti Levu.

Google Maps search: Wainimakatu, Central Division, Fiji

The high school has 15 teachers providing classes for 122 students. The primary school has 5 teachers providing classes for 80 students. 30 students board at the two hostels. There is a total of 18 teachers' quarters in the school precinct (including the three teachers' quarters currently under construction).

Prior to the installation of the solar system, the schools could only afford to run the generator for three to four hours per week during the daytime (i.e. average less than one hour per day) and four hours in the evenings to supply the teachers' quarters and the school buildings for night study and out of hours work by the teachers.

In 2012 the school installed five computers and commenced computer classes for senior years. Whilst a major milestone in the schools' development, these classes were limited to daytime generator availability and evenings.

[Please note the generator usage described above is different to the original proposal to FIJI Water Foundation – the school had altered usage patterns since the original research]

### **Link for project photos**

<http://www.flickr.com/photos/itstimefoundation/sets/72157636106945175/>

### **Link for project videos**

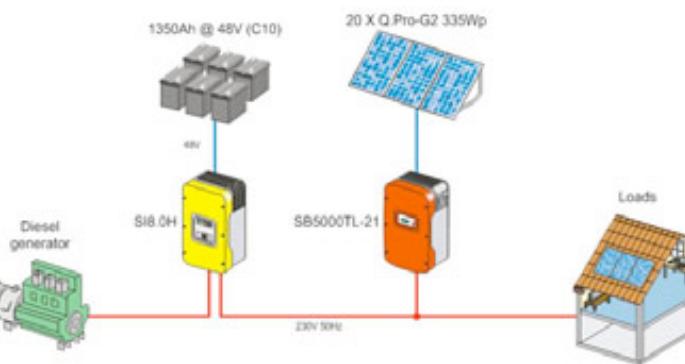
<http://www.youtube.com/channel/UCiUpk54Iz4utxoxRVQzev6g>





## Project Details

It is not uncommon in the islands, including schools, that poor quality and/or underpowered solar systems are installed, resulting in underperforming and short lasting installations. The 4700W solar system supplying Wainimakutu High School and Primary School includes premium components to withstand island conditions and deliver the objectives of the project for decades<sup>1</sup>. The design of these systems (AC Coupled<sup>2</sup>) means, whilst initially more expensive, it is a better performing system and allows for lower cost expansion (solar, wind, mini hydro) in the future if required.



The system exceeds current daytime demand, therefore giving the school capacity to increase its power consumption when the use of computers at the school increases, as is expected.

The system was installed between 22 and 27<sup>th</sup> September 2013 and is performing as expected. Key system components include:

- 20 x Hanwah Q.Cells Q.PRO 235 G2 panels<sup>3</sup>
- 1 x SMA SB 5000TL-21 grid inverter<sup>4</sup>
- 1 x SMA SI8.0H remote inverter<sup>5</sup>
- 4 x SB1802 PowerStack 12V 1350Ah battery banks<sup>6</sup>

- 1 x Clenergy PV-ezRack SolarTerrace II ground mounting system<sup>7</sup>
- LED light replacement



<sup>1</sup> With the current system settings and power efficiency strategies target battery life is well in excess of 10 years (we hope up to 20 years) before needing replacement. It is expected the other components will last decades.

<sup>2</sup> <http://www.iitime.org/new/accoupling.pdf>

<sup>3</sup> [http://www.q-cells.com/uploads/tx\\_abdownloads/files/Q-Cells\\_QBASE-G2\\_Data\\_sheet\\_2011-06\\_Rev02.pdf](http://www.q-cells.com/uploads/tx_abdownloads/files/Q-Cells_QBASE-G2_Data_sheet_2011-06_Rev02.pdf)

<sup>4</sup> [http://www.sma-australia.com.au/en\\_AU/products/solar-inverters/sunny-boy/sunny-boy-3000tl-4000tl-5000tl-with-reactive-power-control.html](http://www.sma-australia.com.au/en_AU/products/solar-inverters/sunny-boy/sunny-boy-3000tl-4000tl-5000tl-with-reactive-power-control.html)

<sup>5</sup> [http://www.sma-australia.com.au/en\\_AU/products/off-grid-inverters/sunny-island-60h-80h.html](http://www.sma-australia.com.au/en_AU/products/off-grid-inverters/sunny-island-60h-80h.html)

<sup>6</sup>

<http://www.electusdistribution.com.au/productView.asp?ID=11896&CATID=Search%20all%20Categories&keywords=sb1802&SPECIAL=&form=KEYWORD&SUBCATID=>

<sup>7</sup>

<http://www.clenergy.com.au/mounting-system.php>



## LED lighting

In the school and teachers' quarters 70 standard 600 mm and 1200 mm tube light holders were removed and replaced by standard batten holders and LED globes. 18 standard 600mm tubes were replaced with LED tubes and 15 standard light globes were replaced by LED globes. This includes provision for three new teachers' quarters currently under construction. Several unnecessary and/or dangerous light fittings were removed. Several classrooms that are not used in the evenings retained conventional lighting.

This strategy has reduced the lighting load by in approximately 75%. Along with behaviour change we expect power demand from lighting (the largest load category) to drop by as much as 90%. Therefore significantly enhancing the effectiveness of the solar system, the amount of fuel saved and battery life.

## Energy efficiency education

Energy usage behaviours by students, staff and their families will influence the effectiveness of the solar system. At the time of installation everyone in the school community was educated about the efficient use of electricity. Posters (see Appendix 2) are installed in all teachers' quarters, dormitories, the office and relevant classrooms. Also, night study is consolidated into one classroom in the primary school and three in the high school (rooms with LEDs)

The school has signed an agreement committing to an energy efficiency strategy at the school (see Appendix 1).

## Power rationing strategy

The system size is selected to give maximum benefit to the school within a reasonable budget. Central to achieving this objective is rationing power periods to the teachers' quarters. They now receive much longer periods of power access than before the solar system was installed.

Power stored in the batteries during the day is supplied at night until the batteries are 40% drawn down, at which point the solar system shuts down. If further power is required that evening the generator is used. This strategy is an effective balance between supplying evening power and extending battery life. Please note is now very rare that the generator is switched on.

Hardwired timers were installed to supply power to the teachers' quarters and dormitories from 5.30 to midnight every day and additionally daytime power on the weekends. Whether or not the batteries supply power for that full evening period largely depends on 1. the community's compliance with energy efficiency strategies 2. Weather conditions -- extended cloudy periods may require limited generator use.

## Maintenance

The school made an AUD2000 contribution to a maintenance fund held by Its Time Foundation. These funds are held for future needs of the project. The school also contributes FJD60 per month into their own maintenance fund. See Appendix 1 for conditions.

## Reporting

The school is required to report to Its Time Foundation each school term. See Appendix 3 for report content.



## Benefits

The estimated savings are approximated based on current fuel prices and with the assumption that the solar system is supplying 90% of the school's power needs.

- The schools now have all day power (instead of a few hours per week). This provides for a significant expansion of computer education. Prior to the solar installation senior students had a small amount of access to computer education; most students had no access.
- Due to reduced fuel consumption the school will save up to FJD5000 per year. The school has agreed that these savings will be directed to student education resources with a preference for increasing the school's stock of computers and other electronic education resources.

Included in the above calculation is that teachers will contribute \$10 per month (less than their previous fuel contribution) to the school's new Electronic Education Fund that will be used exclusively to build the school's stock of computers and related resources.

The school is now shielded from expected increases in fuel prices. Therefore the real financial benefit will increase with time.

- The reduced generator usage will reduce future generator maintenance costs.
- Less use of kerosene lanterns in teachers' quarters reduces fire and health risks. Also additional fuel savings for those individuals.
- Generators often supply 'dirty' power that damages equipment such as computers. Of the five computers purchased by the school three required new internal power supplies within 18 months. The solar system delivers high quality power therefore extending the life of computers and other electronic equipment -- and indirectly saving money.
- Prior to the solar system teachers did their report writing, photocopying etc. in the evenings when the generator was running. They now have the flexibility to do that work as part of their daytime routine.
- The extended power supply to the teachers' quarters (more in the nights and daytime power on the weekends) enhances the quality of life for teachers and their families.
- As the schools now have the capacity for electronic education this may create a greater attraction for quality teachers to stay at the school.
- Approximately 5000kgs of carbon dioxide emissions will be abated annually due the replacement of diesel with renewable power.
- We encourage the school to engage students in learning about renewable energy and climate change. With the hope that the presence of the solar system will result in more environmentally aware and proactive school leavers.



## Funding

FIJI Water Foundation

## Project partners

The generous support of our equipment and service sponsors allowed donated funds to be spent approximately twice over. Estimated retail value of the project is in excess of FJD85,000. Direct supporters who supply equipment or services at favourable pricing (some free of charge) include:

Solar panels:	Hanwah Q.Cells
Mountings:	Clenergy
Batteries:	Tech Brands
LED Lighting:	VIRIBRIGHT
International freight:	Mainfreight
Installation:	CBS Power Solutions (provided labour free of charge)

For other general supporters of Its Time Foundation: <http://iitime.org/supporters/>

See Appendix 4 for general information about Its Time Foundation

Thank you FIJI Water Foundation for enhancing the lives of a generation of children at Wainamikutu.



Rob Edwards  
Founder  
Its Time Foundation  
+61 413 734 916  
+61 2 8003 4143  
[rob.e@iitime.org](mailto:rob.e@iitime.org)



Changing kids  
lives with these.....



Appendix 1: Agreement text (the signed agreement is laminated and displayed in the school office)

### **Agreement for the acceptance a school solar system by Wainimakutu High School**

These guidelines insure that the solar system provides the greatest possible benefit for the longest possible time. In accepting the solar system the school management committee agrees to comply with the following.

1. This agreement will be a recurring agenda item at school management committee meetings where compliance to the below points is confirmed.
2. The school accepts that, while Fiji Water is generously funding the project, Fiji Water has no ongoing or other obligations to the school.
3. In advance of the system being installed the school will contribute FJD3500. Its Time Foundation will retain this for future maintenance of the system.
4. The school will create a new "Maintenance Account" (held by the school) and deposit FJD60 per month from the money saved on fuel. That will gain interest and be available for future maintenance needs of the solar system. Please note the funds referred to in item 3 will not be released unless the school is up to date with their maintenance savings. The major maintenance cost to be aware of is replacement of batteries (used correctly the target life will exceed nine years).
5. Other than the maintenance provision, all money the school saves due to reduced need for generator fuel will be spent only on education resources for the use of students. We encourage expenditure on computers and other resources to advance electronic education. These savings are not for expenditure on administrative items or equipment for teachers' personal use.
6. In addition to the above saving the teachers (and two private houses supplied) will pay \$10 per month to the Electronic Education Fund. The committee will discuss each month how this fund will be used to advance computer education at the school.
7. Instructions and a card reader will be provided to download a file from the solar inverter once every term with the term report. The file is emailed to Its Time Foundation. This provides a summary of the system's performance.
8. The school and teachers quarters will adopt a strong energy efficiency policy to minimise the amount of electricity used. This will reduce the need to use the generator to supplement the solar system. Remember: the solar system only provides a limited amount of power! The committee will assign a responsible person to report to each committee meeting about how well the energy efficiency policy is being applied in the school and the teacher's quarters.

The energy efficiency policy will include all points listed on the posters.

The large chest freezer will be replaced by a small high energy-rating refrigerator.

9. Any new teacher's quarters or school buildings built in the future will be fitted with LED globes.
10. Where appropriate take opportunities to teach students about climate change and renewable energy.
11. Where possible support attempts by Its Time Foundation to establish communication between an Australian school and Wainimakutu High School to gain mutual benefits from sharing learning experiences.
12. Report to the Its Time Foundation, by email, once per term the following:
  - The maintenance and security of the solar system and any other donated equipment.
  - How the fuel savings are being spent or expected to be spent.
  - The functioning of the energy efficiency policy.
  - Supply bank statement for the maintenance account as per item 4.

Signed:

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
On behalf of the WHS school management committee

Rob Edwards  
Its Time Foundation



Appendix 2. Posters in classrooms, office and teachers' quarters



## **Saving electricity saves money. It is everyone's responsibility**

Turn lights off **every time** you leave the room

Turn all power devices and switches off when not in use

Set computer preferences to maximum power saving

School night study: use as few rooms as is necessary

Use as few corridor and outside lights as is necessary

When replacing lights use only LEDs

Where convenient do electrical activity in the daytime, such as photocopying, printing, scanning, power tools and washing machines

If possible purchase laptops rather than desktop computers as they draw less power

Do not use electric cook tops, air conditioners and other high load appliances. The solar system can not support them and deliver the school's needs.





Appendix 4

## Its Time Foundation

### What we do

Most remote Pacific Island schools depend on diesel generators for their electricity. We install solar power so, instead of spending their very limited money on fuel, they can buy computers, books and other desperately needed education resources. That means decades of new education opportunities and less carbon dioxide entering the atmosphere.

### More education



### General benefits we strive for

- These projects can increase school resources budgets by more than 20%.
- We encourage schools to invest in computer education and for some schools that creates their first opportunity to have computer classes.
- In most schools the high cost of fuel limits electricity supply to only a couple of hours each day. They can now enjoy reliable all-day power and no cost night study is a bonus!
- Less noisy generators running near classrooms.
- Usually teacher's quarters are located on the school property and receive generator power a couple/few hours each night. The improved power supply enhances their quality of life.
- Remote schools are better able to attract quality teachers.
- Less use of kerosene lanterns in boarding houses and teachers' quarters reduces fire and health risks.
- To a small degree these systems contribute to poverty proofing the communities by partly shielding villages from rising oil prices.
- Hundreds of tonnes less carbon dioxide will enter the atmosphere.

**"Inreach".** For those of you who join us on this journey we hope you'll see we can create a better educated and more sustainable world. You are making a real difference.

### Less carbon emissions



### An investment in the future



### Who we are

Its Time Foundation is a privately established Australian charity registered with the Australian Department of the Environment and is bound by item 6.1.1 of the Australian Income Tax Assessment Act. Constitution:  
<http://www.iitime.org/documents/Constitution.pdf>

*"Kids are 20% of our world, but 100% of our future"*

*(A. Wood)*