8020Green Pty Ltd
2/26 George Street
Frankston, Vic., 3199, Australia
E: bruce@8020green.com
T: +61 438 878 311

Energy Saving Case Study

Muaiwalu House, Suva, Fiji

Fiji Ports Corporation

Bruce Rowse, 8020Green Pty Ltd.

Organisation and Building Description

Fiji Ports Corporation Limited (FPCL) manages the two major ports of Suva and Lautoka and the secondary ports of Levuka, Vuda, Malau, Rotuma and Wairiki.

Muaiwalu House is its headquarters. Built in the 1980s, Muaiwalu House is a 6 level office building, occupied by around 50 staff. One floor is a conference room, only used occasionally. The approximate total floor area of the building is 2,100m2.

Figure 1 - Muaiwalu House

Energy Audit

An energy audit of Suva Port was undertaken in August 2016, funded by the Pacific Community (SPC), on request by FPCL.

Suva Port has 3 wharfs, a dry dock, a terminal operations building, workshop, passenger areas, and warehouses in addition to Muaiwalu House.

Around one day of the audit was specifically allocated to Muaiwalu House, and the audit could be classified as a walk-through audit, focussed on identifying major opportunities for energy savings.

The audit was undertaken as follows:

- Pre-visit teleconference with FPCL's CEO, Mr. Vajira Piyasena, and Mr. Sitalingi Payne, the project officer from SPC, to discuss and agree upon the scope of works for the audit. Mr. Piyasena saw the audit as being an important step in reducing Fiji Ports energy usage, and was grateful for the support offered by SPC.
- A half day workshop with senior management, including the CEO and port engineer, Mr. Ronald Sue, to discuss energy management, look at the alignment with FPCLs goals, the need to "spend in order to save", and the audit scope of works and program. Mr. Sitalingi Payne also attended this workshop, and participated and assisted throughout the entire audit.
- Site inspection and report preparation, much of this accompanied by the port authority's senior electrician, and an inspection of the air conditioning system at Muaiwalu House accompanied by the port engineer.
- A half day concluding workshop, with senior management, to present the findings and recommended actions.

Two main opportunities at Muaiwalu house were identified, upgrading the internal lighting to LED, and replacing the 30 year old air conditioning system, with the table below showing the estimated savings and cost.

Recommendation	Annual Electricity Savings (kWh)	Annual Fuel Savings (litres) (MJ)	Annual Cost Savings ($)*	Annual GHG Emissions Reduction (tonnes CO2-e) (tonnes CO2-e)	Estimated Implementation Cost ($)*	Est simple payback (years)
Upgrade internal lighting to LED	78,000	0	$ 32,000	30	$ 124,000	4
Replace office air conditioning system	47,000	0	$ 19,000	20	$ 200,000	10
Totals	125,000		$ 51,000	50	$ 324,000	6

*Fiji Dollars

Figure 2 Part of the old air conditioning system.

Implementation

Fiji Ports had an environmental policy in place stating its commitment to reduce its greenhouse gas emissions, and the CEO is strongly committed to reducing energy use. The port engineer was also supportive, and commenced with the lighting upgrade.

Lighting upgrade

The lighting upgrade was undertaken as follows:

- The port engineer confirmed with the energy auditor the type of upgrade and recommended quality of LED tube to use.
- The port electrician double checked the count of lights to be upgraded. The audit had identified 687 fluorescent lamps, the electrician's count was 666. A floor by floor lighting schedule was prepared.
- The type of upgrade specified in the audit: replacement of the tube, with the fitting rewired, was adopted.
- Quotes were sought from 5 suppliers.
- A preferred supplier (with the 2nd highest cost) was chosen, based on the quality of LED's offered (reputable brand, long tube lifetime).
- A memo was prepared, requesting budgetary approval, and summarising all the quotations, and putting forward the case for the preferred supplier. Funding for the upgrade was sought from the "general upgrade" budget.
- The CEO and senior management team approved the request
- The port electrician was tasked with upgrading the lights, which was done over January and February 2017.

It was decided to use FPCL's electricians to undertake the upgrade, and to do the project management in house, in order to reduce the outlay required.

The cost of the upgrade was $22,615[1].

[1] All monetary figures are shown in Fiji Dollars

Air conditioning upgrade

The air conditioning upgrade was implemented around two years after the energy audit. The port engineer had resigned shortly after the lighting upgrade was complete, and the remaining junior engineering staff were focussed on other activities.

Eventually a senior maintenance engineer, Mr Akila Abeyrathne was employed, who had previously worked in an engineering and sustainability role.

In the meantime, the centralized air conditioning in Muaiwalu House had becoming increasingly unreliable.

The air conditioning upgrade recommended in the energy audit had been agreed upon with Ronald Sue, the then port engineer, and was based on FPCLs existing approach of installing split system air conditioners. In actual fact, before the energy audit upgrades to split systems had already commenced, including on the top two floors of the building and in meeting rooms.

The audit had recommended that split system air conditioning units with greater than standard energy efficiency be installed, and that the existing air conditioning system be totally decommissioned.

The air conditioning upgrade was undertaken as follows:

- A design and specification was not prepared, instead a “design and supply” purchasing arrangement was adopted.
- Contractors were invited to quote on the upgrade, each contractor essentially deciding, for each area upgraded, on the location of each split system and its cooling capacity.
- A preferred contractor was selected and appointed, following the same process as for the lighting upgrade.

The cost of the air-conditioning units installed after the audit was $54,222. The audit had identified 23 units to be installed, 14 units were actually installed.

Savings

The graph below shows monthly electricity consumption over the years 2016 to 2019, with key interventions highlighted. Note the seasonal drop in usage in the middle of the year, when the weather is cooler, with usage remaining at winter levels through to December (when there is a Christmas shut down).

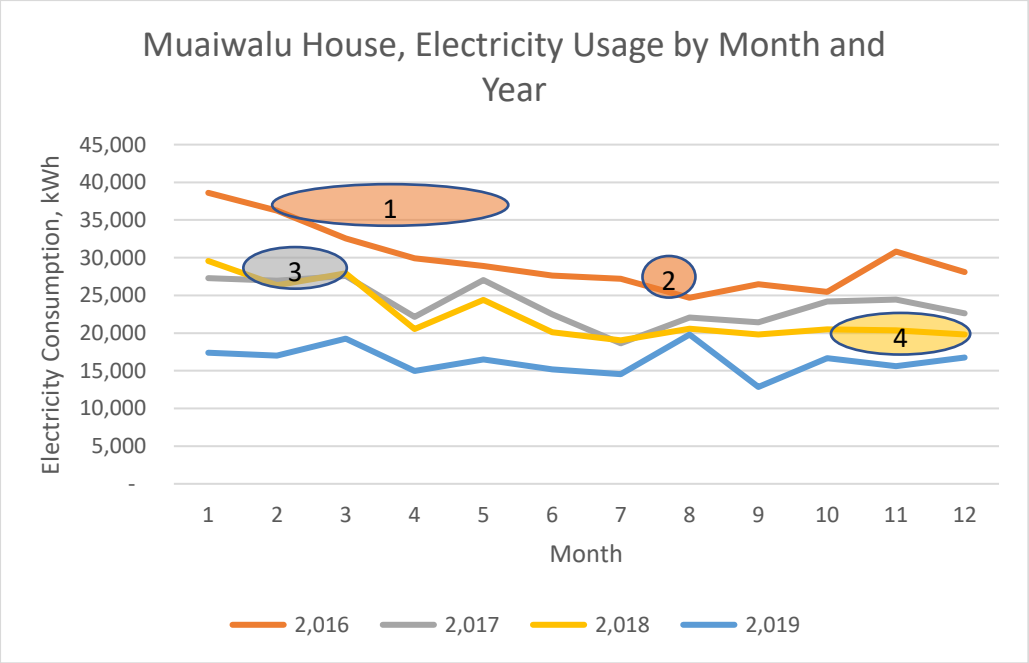

Figure 3 Monthly electricity usage 2016 to 2019

Activities marked on chart:

1. Partial air conditioning upgrade
2. Energy audit
3. Lighting upgrade
4. Air conditioning upgrade completed

Comparing 2019 with 2016, electricity consumption was 160,012 kWh (45%) lower, and energy costs were $62,917 lower, noting that electricity tariffs were largely unchanged.

Savings and costs compared with the energy audit estimates

Savings were roughly as predicted by the energy audit, taking into account the pre-audit savings achieved by the initial air conditioning upgrades in early 2016.

The costs of the upgrades were substantially lower than estimated by the audit.

For the **lighting upgrade**, the audit cost work up had allocated slightly more than $40,000 for labour and project management costs, however these costs were absorbed by FPCL, who managed the

project and used its own electricians. The cost of the LED tubes was much lower than estimated by the audit, and the number of tubes installed slightly lower.

For the **air-conditioning upgrade**, similarly FPCL absorbed the project management costs, estimated to be $46,000 in the audit. The audit had specified that the air conditioning upgrade be accompanied with the installation of a ventilation system - at a value of $60,000 - this, however, was not installed.

The audit had identified that 23 units would be required, 15 of which were the more expensive ceiling mounted cassette types, vs the standard wall mounted in unit. It stated that this should be verified.

What was actually installed was 4 cassette units and 10 split systems. The per unit installed cost was roughly the same as identified in the audit.

The auditor had not undertaken an air-conditioning design, and had clearly over-estimated the cooling requirements. Installing fewer units further reduced the cost of the upgrade.

Lessons learnt

Top level organisational commitment to implementing audit measures is essential

The CEO initiated the energy audit, and followed through by approving budgetary requests for energy efficiency upgrades.

Take action and spend in order to save

Only by taking action on the audit recommendations were savings achieved.

In 2016 electricity charges for Muaiwalu house were $142,000. The upgrades cost $77,000. An amount equivalent to over half the total annual energy costs had to be invested in order to achieve the savings.

Those whose decisions impact on energy use are very important, an audit is a team effort

The port engineer, and later the senior maintenance engineer, responsible for making decisions about building upgrades, were ultimately the ones who initiated and followed through with the upgrades. By directly project managing the upgrades they also reduced the capital outlay required.

The consultation between the port engineer and the auditor resulted in agreement on the lighting and air conditioning upgrades to be implemented. Without this agreement the lights may have not been upgraded, and less efficient units would have been installed for the air conditioning upgrades.

An audit is not a works specification or design

As shown with the air conditioning upgrade, where the number of units installed was 2/3rds of that identified by the auditor, the audit is not a specification or design

The audit provides estimates of savings and costs, actual figures may be different

The intent of the audit is to provide a business case for energy efficiency upgrades. In this case the estimate of savings was roughly as expected, however the costs were significantly over-estimated.