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Little Academy Day-Care Centre

Type 2 Energy Audit

3 September, 2015

Executive Summary

This is the report of a Type 2 energy audit undertaken for Little Academy Day-Care Centre. The audit was completed by Ecoprofit Management Pty Ltd on behalf of United Voice as part of the Power Champions Program.

The objective of the audit was to:

1. Analyse the energy consumption of Little Academy Day-Care Centre.
2. Identify energy consumption and energy cost reduction opportunities.

Beyond this audit the aim is to develop:

- A template that incorporates energy consumption analysis and energy reduction opportunities for day-care centres generally.
- An energy management plan template for day-care centres generally based on the provisions of ISO 50001 Energy Management Systems – Requirements with guidance for use.
- A water, waste, energy & carbon initiative ("WECC") that includes reduction targets.

Key findings, developments and recommendations of this report are:

- The total energy consumption of the Centre for the 2015 financial year ("baseline year") was 16,040 MJ.
- Fifty seven percent of energy consumption at the Centre is devoted to meeting heating & cooling requirements. Of this percentage, approximately three quarters is devoted to cooling.
- The upgrade of the current ducted air conditioning system is crucial to significant energy reduction.
- The upgrade of the Centre's lights to LED technology has reduced electricity consumption by approximately 5,800 kWh over the last two years.
- The proposed energy performance indicator for the Centre is the ratio of total baseline energy consumption to the number of children enrolled and is 422 MJ.
- The projected return on investment of an 8 kW photovoltaic system is 15.9% with a payback of 6.3 years (calculations based on finance via an electricity supply agreement).
- The carbon footprint of the Centre for the baseline year was 36.95 $tCO_{2\text{-}e}$ with a ratio of carbon emissions to children enrolled of 0.97 $tCO_{2\text{-}e}$.

Contents

1 Table of figures

3 List of tables

3 Abbreviations & definitions

Abbreviation	Definition
kWh	kilowatthour
MJ	megajoule
PV	Photovoltaic system
ROI	Return on investment
tCO_{2-e}	Tonnes of carbon dioxide equivalent

4 Audit engagement overview

4.1 Introduction

Ecoprofit Management Pty Ltd ("EPM") has been commissioned by United Voice to complete a Type 2 energy audit of Little Academy Day-Care Centre ("LA" or the "Centre") at 234 Homebush Road, Strathfield South, NSW, 2135. The analysis is made as part of the Power Champions Program.

The objective of the audit is to:

- Analyse the energy consumption of Little Academy Day-Care Centre.
- Identify energy consumption and energy cost reduction opportunities.

The requirements of a Type 2 audit are specified in the standard AS/NZS 3598.2:2014 Energy audits Part 2: Industrial and related activities which defines *a detailed level of audit involving a comprehensive review and analysis of equipment, systems, and operational characteristics of the whole site to enable quantified energy savings recommendations.*

Incorporated in the audit is a review of:

- Water consumption
- Waste content and quantity
- Carbon emissions

Beyond this audit the aim is to develop:

- A template that incorporates energy consumption analysis and energy reduction opportunities for day-care centres generally.
- An energy management plan template for two day-care centres based on the provisions of ISO 50001 Energy Management Systems – Requirements with guidance for use.
- A water, waste, energy & carbon initiative ("WECC") that includes reduction targets.

This report is prepared to:

- Gain a better understanding of energy consumption at the Centre.
- Establish a baseline of energy consumption for the Centre.
- Analyse electrical and gas energy with review of current practices.
- Identify and evaluate opportunities for improving LA's energy efficiency and reducing energy costs.
- Identify LA's carbon footprint.
- Outline initiatives that would support energy efficiency.
- Analyse the business case for acquisition of a photovoltaic system.
- Final recommendations

LA may be expanded with the addition of an extra storey in the next couple of years. The impact on the thermal dynamics of the building has been incorporated into the energy reduction opportunities assessment.

EPM acknowledges the valuable assistance of Mary Brennan providing key information to complete the report.

4.2 Energy auditor

EPM provides specialist consulting services to Australian commercial and industrial organisations. The mission of EPM is to:

- Make clients aware of their energy consumption and carbon emissions processes.
- Identify energy options that can be converted to affordable solutions to improve the organizational bottom line.
- Assist with funding applications to support the business case of identified opportunities.
- Make clients aware of the adaptive and emerging energy technology opportunities available to them**.**
- Assist clients in their energy procurement to minimize energy costs.

EPM has developed a network of selected and trusted experts to be consulted as and when appropriate to achieve its mission's goals. This includes electrical engineers, equipment specialists and other field experts.

The principals of EPM are active in the pursuit of achieving their mission objectives.

4.3 Energy audit method

The audit process has included the following steps:

- Initial and subsequent discussions with LA's managing director, Mary Brennan about operational procedures and data procurement.
- Collection of primary data such as electricity and gas bills.
- Collection of electrical load profile data from the energy retailer for the baseline year.
- Listing of energy consuming equipment list.
- Extension of the equipment list to include average daily energy consumption calculations.
- Compilation of collected data for analysis to identify where, when and for what purposes energy is being consumed.
- From the analysis, evaluation of opportunities for reducing energy consumption.

As part of the audit the concept of the implementation of the WECC Initiative was discussed and includes development of performance indicators for:

- **W**ater consumption
- **W**aste disposal amounts
- **E**nergy consumption
- **C**arbon emissions

5 Baseline energy analysis

5.1. Total energy consumption

The two sources of energy used at the facility are:

- Electricity
- Natural gas

Baseline energy consumption for the Centre has been aligned as closely as possible to the 2014/15 financial year. The total kWh energy consumption for the period was 16,040 kWh being 12,939 kWh of electricity and 3,101 kWh of gas. Figure 1 shows energy consumption for that period by percentage.

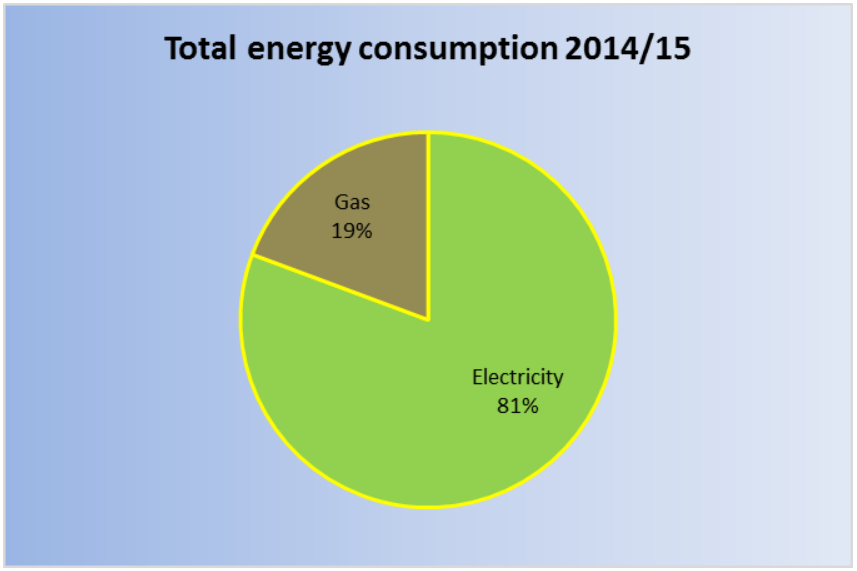


Figure 1 Total energy consumption 2014/15

5.2 Electricity

Figure 2 shows LA's pattern of electricity consumption for the 2014/15 financial year.

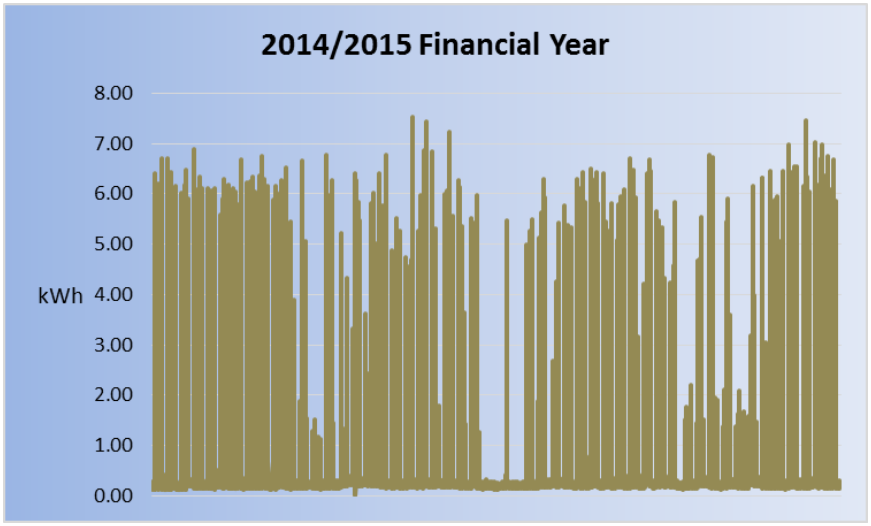


Figure 2 Load profile for the 2014/15 financial year

Figure 2 shows kWh consumption every half hour of each day for the year. It reflects the Centre is open 48 weeks per year on weekdays only. It is closed on weekends, public holidays and four weeks over Christmas.

5.3 Gas

Table 1 summarises gas consumption for the Centre for the baseline period. The total consumption is 11,162 MJ. This equates to 3,101 kWh of energy.

Period of consumption	MJ
26/07/14 - 24/10/14	3276
25/10/14 - 06/02/15	2232
07/02/15 - 24/04/15	2385
25/04/15 - 23/07/15	3269
Total	**11162**

Table 1 Gas consumption 1 May, 2014 to 24 April, 2015

The Centre uses a Rinnai instantaneous gas heater for its hotwater and gas stove top requirements.

6 Energy supply agreements

6.1 Electricity

The centre's electricity retailer is Origin Energy. Figure 3 is a snapshot of the second page of LA's electricity bill for the period 1 April to 28 June, 2015 (89 days). It shows total consumption for the period of 2,416 kWh.

Charges:	Usage (kWh)	Charge	Amount
Peak Usage			
Energy Use	505.377	46.48 c/kWh	$234.90
Off-Peak Usage			
Energy Use	325.016	10.09 c/kWh	$32.79
Shoulder Usage			
Energy Use	1585.981	18.04 c/kWh	$286.11
Supply Charge		80.53 c/Day	$71.67
Total*			**$625.47**

*Peak periods apply from 2pm - 8pm on working weekdays. Shoulder periods apply from 7am - 2pm, 8pm - 10pm working weekdays and 7am - 10pm on weekends and public holidays. Off Peak periods apply all other times. Times displayed are Australian Eastern Standard Time, unless you have an interval meter, in which case day light savings will apply if relevant.

Figure 3 Snapshot of LA's electricity bill

Figure 3 shows Origin's time-of-use (TOU) periods for a week day and for the weekend. Table 2 below summarises the week day TOU periods and tariff rates. Table 3 summarises the weekend and public holiday TOU periods.

Tariff periods	Tariff title	Tariff rate cents/kWh (ex GST)
12 midnight to 7 am	Off peak	10.09
7 am to 2 pm	Shoulder	18.04
2 pm to 8 pm	Peak	46.48
8 pm to 10 pm	Shoulder	18.04
10 pm to 12 midnight	Off peak	10.09

Table 2 Origin week day tariff periods and rates

Tariff periods	Tariff title	Tariff rate cents/kWh (ex GST)
12 midnight to 7 am	Off peak	10.09
7 am to 10 pm	Shoulder	18.04
10 pm to 12 midnight	Off peak	10.09

Table 3 Origin weekend & public holiday tariff periods & rates

EPM has noticed that the TOU periods nominated by Ausgrid (the local network provider) are different to the TOU periods of Origin Energy. Table 4 shows the Ausgrid network tariff periods for a week day (identified by EPM from the half hour load profile data).

Tariff periods	Tariff title
12 midnight to 7 am	Off peak
7 am to 9 am	Peak
9 am to 5 pm	Shoulder
5 pm to 8 pm	Peak
8 pm to 10 pm	Shoulder
10 pm to 12 midnight	Off peak

Table 4 Electricity network tariff periods for a week day

Ausgrid's weekend and public holiday tariff from 12 midnight Friday to 12 midnight on Sunday is all off peak.

Table 5 contrasts the difference in TOU kWh allocation between Ausgrid and Origin for the bill shown in Figure 3. It also shows the financial impact on the amount of the bill for that period. It shows that if Origin's TOU periods were aligned to Ausgrid's TOU periods the energy usage charge would be $29.84 less.

Tariff periods	No. of kWh as per Ausgrid data	Tariff rates $/kWh	Cost if network tariffs applied ($)	No. of kWh Origin bill	Cost as per Origin bill	Difference
Off peak	527.959	0.1009	53.27	325.016	32.79	20.48
Shoulder	1221.093	0.1804	220.29	1585.981	286.11	-65.82
Peak	667.139	0.4648	310.09	505.377	234.90	75.19
Total			$ 583.64		$ 553.80	$ 29.84

Table 5 Financial implication of unmatched tariff times

EPM notes that LA is not receiving any discount from either its energy usage or supply charges. EPM proposes that other electricity retailers be contacted to establish tariff, supply charge &

energy use discount rates available. EPM recommends that after that investigation has been finalised, the current retailer be contacted to discuss better rates. Possibly the outcome of those actions will be to consider changing retailers.

Also EPM notes that given the Centre is open between 7.30 am and 6 pm, any energy consuming activity that can be moved outside peak tariff times will reduce per kWh cost by between 28 and 36 cents per kWh. The Centre's energy consumption patterns are discussed later in this report.

6.2 Gas

Figure 4 shows an extract of LA's gas bill for the period 25 April to 23 July, 2015 (90 days).

Charges:	Bill Days	Usage (MJ)	Charge	Amount
25 Apr 15 to 30 Jun 15 (67 Days)				
Usage				
First 0-2753	67	2402.48	3.933 c/MJ	$94.49
Supply Charge			59.11 c/Day	$39.60
01 Jul 15 to 23 Jul 15 (23 Days)				
Usage				
First 0-476	23	476	3.685 c/MJ	$17.54
Next 477-945	23	390.46	2.516 c/MJ	$9.82
Supply Charge			63.65 c/Day	$14.64
Total				**$176.09**
Total Natural Gas Charges				
Charges less discounts and rebates				$176.09
GST				$17.61
Your total natural gas charges (incl. GST)				**$193.70**

Figure 4 Snapshot of LA's gas bill

The bill indicates the tariff is stepped, dropping from a high 3.685 cents/MJ to 2.516 cents/MJ. EPM notes there are no percentage discounts offered to LA. Accordingly EPM recommends a better gas contract be sought.

7 Electricity consumption processes

7.1 Summary of consumption patterns

7.1.1 Winter time

Figure 5 shows the load profile for a normal operating week in the colder months. It shows maximum week day half hour kWh consumption of around 6 kWh. The total consumption for the week was 252.61 kWh. Consumption from Monday to Friday of that week was 235.77 kWh.

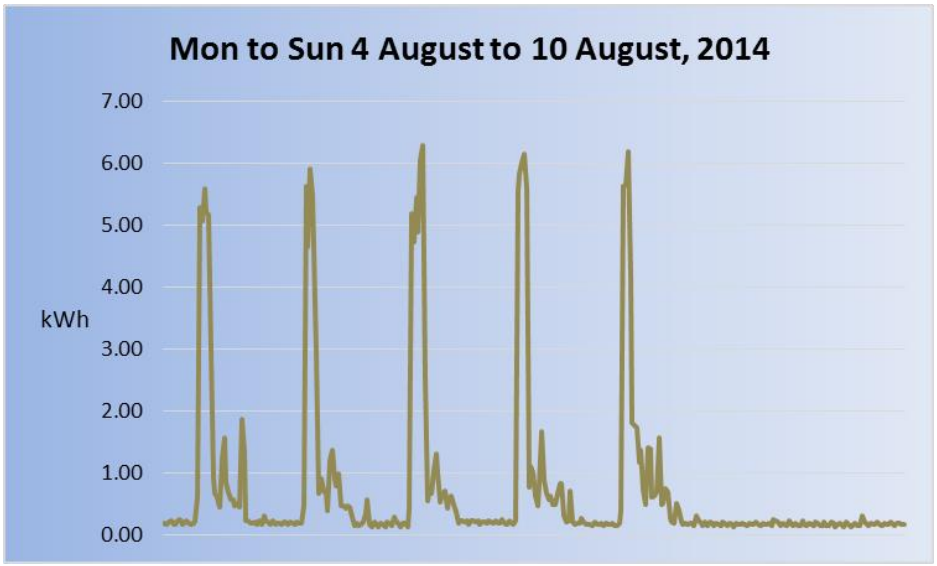


Figure 5 kWh consumption Monday 4 August to Sunday 10 August, 2015

To check whether the week commencing the 4 August, 2014 had typical temperatures for the 2014 winter, EPM checked with the local weather station for the number of heating degree days - HDD - for that week (one heating degree day is equal to being one degree below the base temperature for one day). Figure 6 shows an extract of the report from the Sydney Olympic weather station. It shows the HDD for that week were 34 and indicates that the week experienced average winter temperatures.

Description:	Celsius-based heating degree days for a base temperature of 15.5C	
Source:	www.degreedays.net (using temperature data from www.wunderground.com)	
Accuracy:	Estimates were made to account for missing data: the "% Estimated" column shows how much each figure was affected (0% is best, 100% is worst)	
Station:	Sydney Olympic Park Aws (archery Centre), NS, AU (151.06E,33.85S)	
Station ID:	95765	
Week starting	HDD	% Estimated
5/05/2014	14	4
12/05/2014	12	3
19/05/2014	8	3
26/05/2014	6	3
2/06/2014	15	3
9/06/2014	21	3
16/06/2014	23	3
23/06/2014	21	3
30/06/2014	39	3
7/07/2014	36	2
14/07/2014	31	2
21/07/2014	30	2
28/07/2014	22	2
4/08/2014	34	2
11/08/2014	34	2
18/08/2014	19	2
25/08/2014	15	2

Figure 6 HDD for weeks in winter

Figure 7 shows the half hour kWh consumption for Monday 4 August, 2014 to highlight the

consumption profile on an operating day in winter. Total consumption for the day was 47.87 kWh.

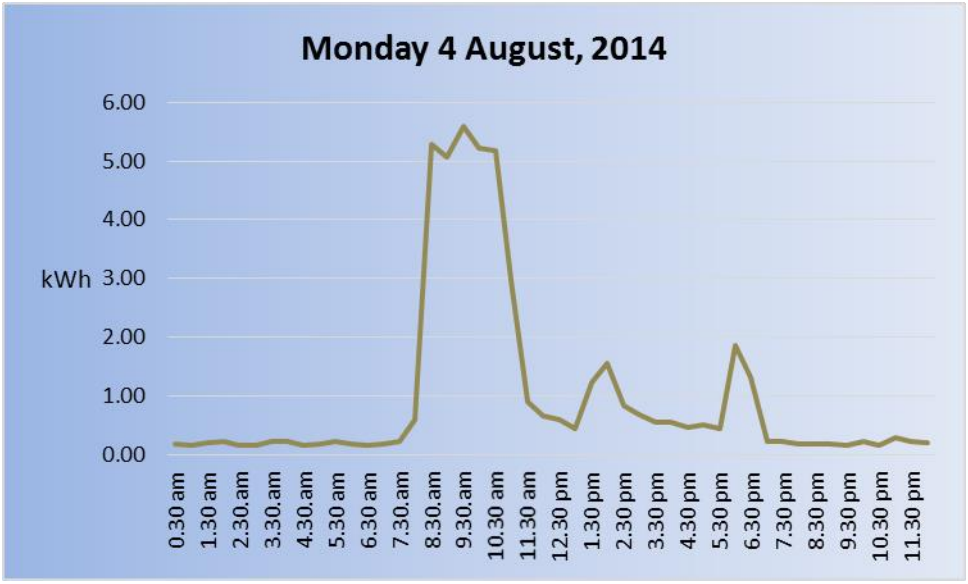


Figure 7 kWh consumption Monday 4 August, 2014

Figure 3 highlighted the similarity of the load profile for each operating day in that week. It also revealed the main power consumption on a week day occurs between 7.30 am and 11.00 am. EPM sought to reconcile power consuming equipment to total kWh consumption for a week day. Table 6 summarises the power consumption of equipment on an operating day in winter (such as 4 August).

Equipment items	Equipment power draw (kW)	Daily operating hours of equipment	Total power consumption per day (kWh)
Kitchen			
Microwave	1.50	1.00	1.50
Refrigerator	0.09	24.00	2.16
Oven	3.00	1.75	5.25
Jug	2.20	1.00	2.20
Dishwasher	1.00	3.00	3.00
Washing machine	0.80	2.00	1.60
Playroom			
DVD	0.03	2.00	0.06
Staff room			
Refrigerator	0.05	24.00	1.20
Photocopier	0.12	10.00	1.20
Laptops (two)	0.03	10.00	0.30
Security system	0.01	24.00	0.24
Lights			4.07
Sub-Total			18.71
Air conditioner	10.10	3.00	30.30
Total kWh			49.01

Table 6 Power consumption of equipment on a winter's day

Table 6 shows the amount of power drawn by be each piece of equipment (in kWh) and the amount of time the equipment is used per day. By extension total kWh consumption could be estimated for the day. The total of all equipment power consumption excluding the air conditioner is estimated as 18.71 kWh.

Figure 8 shows the load profile for the Centre for the weekend 9 & 10 August, 2014 indicating an average hourly kWh consumption of 0.35 kWh. The spikes are probably due to the activities of the cleaner.

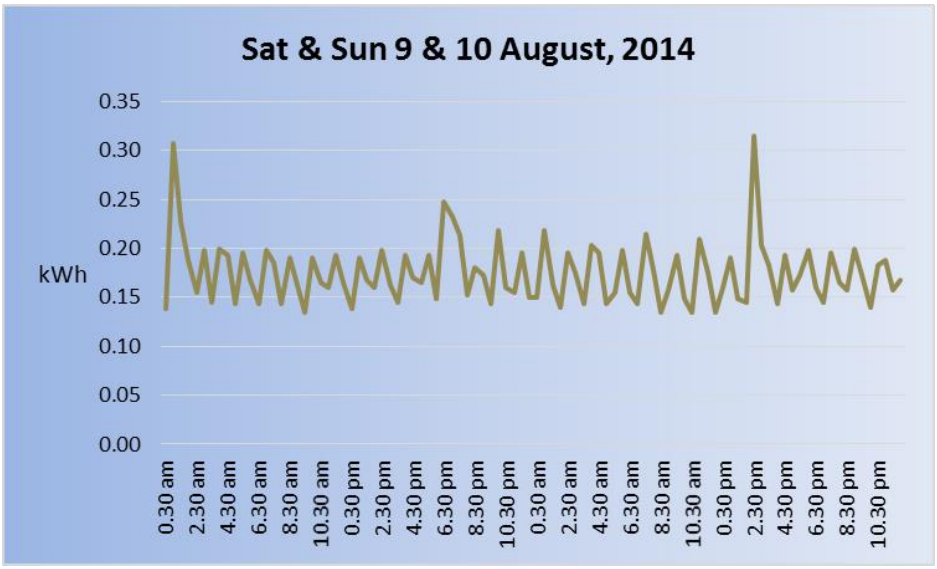


Figure 8 kWh consumption 9 & 10 August, 2014

The total kWh consumption for the weekend of 9 & 10 August was 16.84 kWh. This rate of consumption is representative of weekends and other non-operating periods.

7.1.2 Summer time

Figure 9 shows the profile of kWh consumption for the summer week commencing on 16 February, 2015. The profile of consumption is very similar to the winter week discussed above, but the peaks are higher and wider.

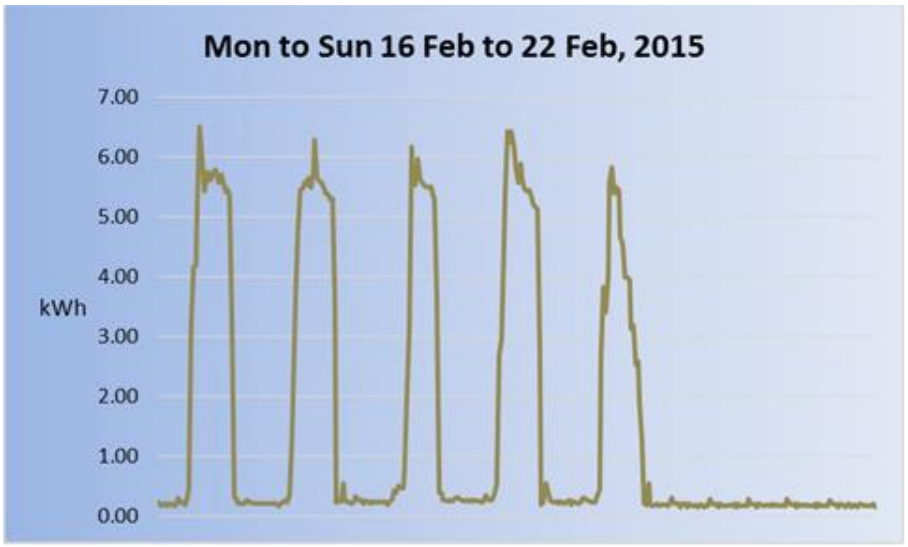


Figure 9 kWh consumption Monday 16 February to Sunday 22 February, 2015

The total consumption for the week 16 to 22 February, 2015 was 521.07 kWh. Consumption from Monday to Friday of that week was 503.34 kWh. This is over twice much as a comparable period of trading in winter. EPM checked the *cooling degree days* (CDD) data for summer. For the week ended 22 February, 2015 there were 56 CDD which was average for that summer.

Figure 10 shows the kWh consumption on Monday, 16 February. The total consumption for the day was 111.58 kWh (Monday, 4 August, 2014 was 47.87 kWh).

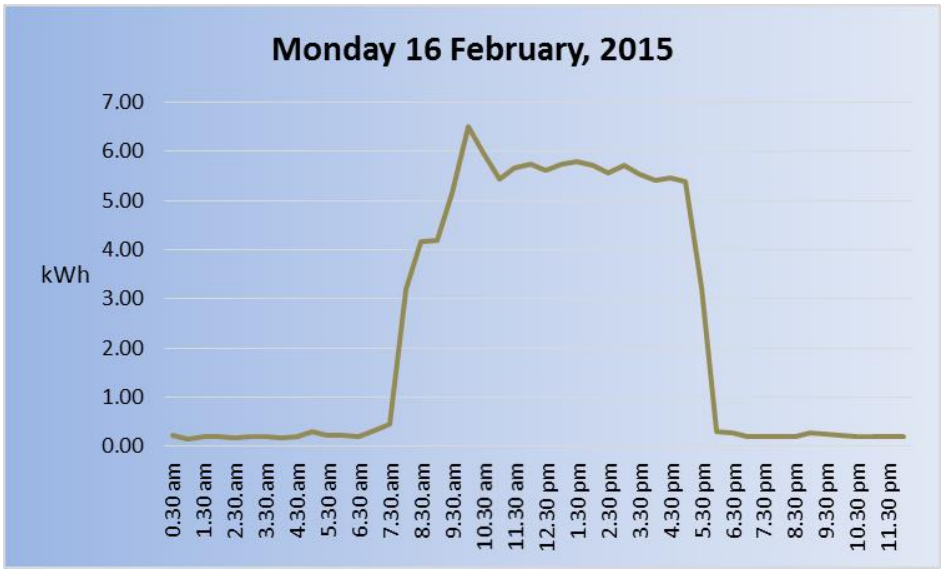


Figure 10 kWh consumption Monday 16 February, 2015

EPM is aware that the activities and activity times for children at LA are consistent year round. Further the number of children attending the Centre remains relatively constant. Therefore kWh consumption of equipment that is not affected by outside weather conditions will be relatively consistent throughout the year. This includes appliances, office equipment and lights as listed in Table 6.

Table 7 summarises kWh consumption taking up appliances, office equipment and lights as a total figure i.e. 18.71 kWh.

Electric items	Power draw (kW)	Daily operating hours of equipment	Total power consumption per day (kWh)
Appliance, office equipment & lights			18.71
Air conditioner	10.10	9.00	90.90
Total kWh			109.61

Table 7 power consumption of equipment on a summer's day

Figure 11 shows the load profile for the Centre for the weekend 21 & 22 February, 2014. The total kWh consumption for the period was 17.74 kWh, slightly more than the winter weekend discussed earlier in the report. The spikes in consumption are more frequent than the winter weekend, probably due to greater cooling requirements for the two refrigerators in the Centre.

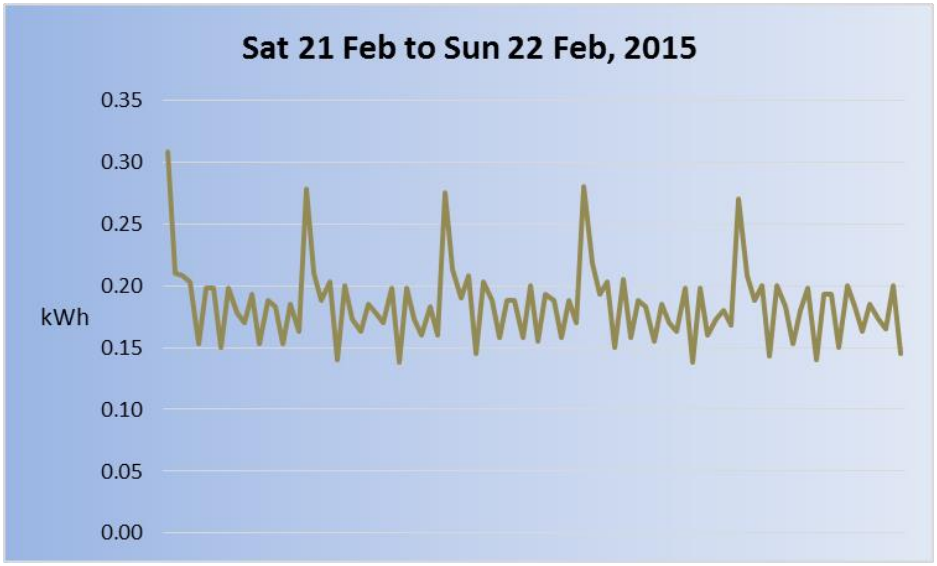


Figure 11 kWh consumption 21 & 22 February, 2015

7.1.3 A summary of findings

The average hourly kWh consumption in non-operational hours is approximately 0.354 kWh. In a year it is estimated there are 3072 non-operational hours. Therefore the total kWh consumption in non-operational hours was approximately 1,088 kWh of the total of 12,939 kWh (8.4% of total).

The estimated kWh consumption of appliances, office equipment and lights was 18.71 kWh on each operational day (a total of 4,434 kWh for the year or 34.3%).

Given the total kWh of the Centre was 12,939 kWh for the year, then by deduction the air conditioner consumed approximately 7,417 kWh for the year which is over 57.3% of the Centre's total electricity consumption as illustrated in Figure 12.

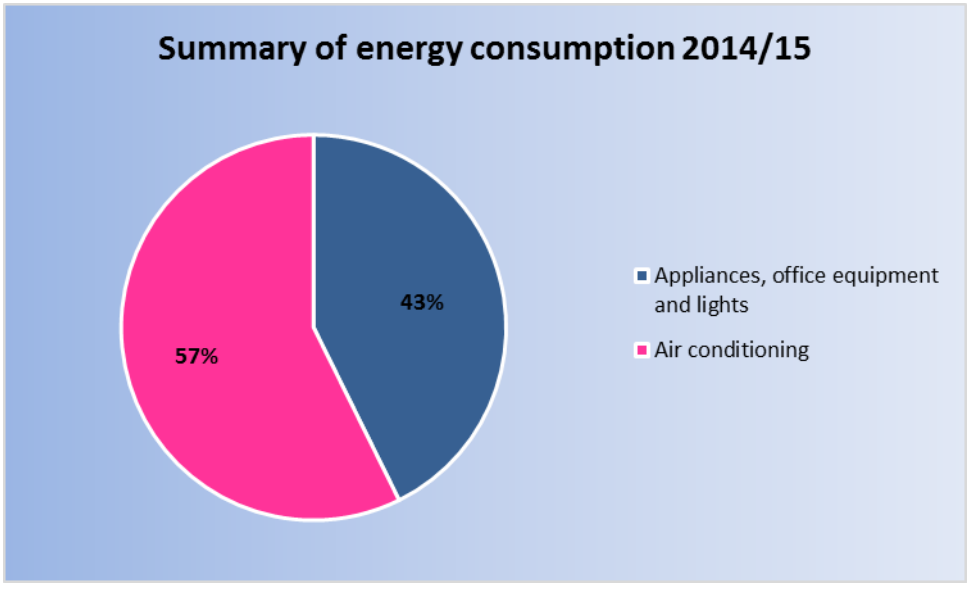


Figure 12 Summary of baseline energy consumption

The load profile shown in Figure 10 for Monday, 16 February indicates that the air conditioner is working a lot longer in the summer months. Accordingly it can be surmised that over 40% of the Centre's per annum electricity consumption is devoted to cooling.

7.2 Passive cooling & heating

LA's building is well orientated with a large playroom positioned on the north side of the building.

LA's building is double brick construction which helps its insulation qualities. EPM notes however there is no insulation in the roof.

Wide awnings and shade cloth are well positioned on the north and west sides of the building to protect against the summer sun.

Figure 13 View of LA from north-west perspective

Figure 13 shows the north facing awning and west facing shade cloths.

7.3 Air conditioning

The Centre uses a Fujitsu ducted air conditioning system for its cooling and heating needs (model no. AOT90TPC3L). EPM estimates it is over 15 years old.

Figure 14 Fujitsu outdoor unit

The input capacity of the three phase unit is 10.1 kW (19.5 amps) with a cooling capacity of 26.4 kW and heating capacity of 29.5 kW, giving an energy efficiency ratio of only 2.6 (cooling) and coefficient of performance of 2.9 (heating). These ratios are very low in comparison to modern air conditioning systems and explain largely why heating and cooling costs are so high for the Centre.

EPM understands the air conditioning system is manually controlled by being turned on and off judiciously with the aim of minimising its hours of operation. Further, the filters are cleaned by outside contractors each six months.

However the controls on the system are not utilized for night purging. Further there is no facility for zoning areas of the Centre. Figure 15 shows a north facing plan view of the Centre.

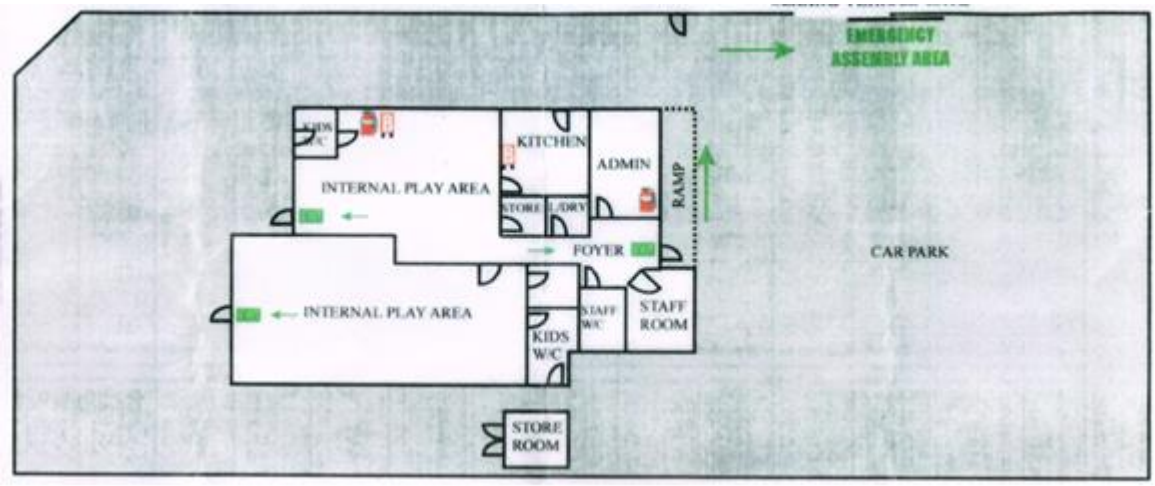


Figure 15 Plan view of the Centre

EPM arranged for Daniel Richards from Toshiba Air Conditioning to attend at the Centre to give his opinion of optimum air conditioning system upgrade for the site, taking into consideration the:

- Potential for zoning.
- Opportunities for night purging and load shifting (using the equipment in low electricity tariff periods).
- Contingency for the expansion of the Centre.

Daniel Richards' report states:

"Please find attached an engineering data sheet for the model of the outdoor unit I recommend for the Strathfield St Child Care Centre.

This is a VRF outdoor unit which can have multiple indoor units attached to it.

The second attachment shows the indoor unit I propose to attach to this system.

From the outdoor unit on this drawing the first unit is a 2.2kW wall mounted unit for Mary's office, the second unit is a 2.8kW wall mounted unit for the staff room, the third unit is a 14kW high static ducted system for the TR Room, the fourth unit is a 8kW ducted system for the Rainbow Room and the last unit is a 3.6kW wall mounted unit for the kitchen.

With this system you can turn as many or as little of these indoor units on as you require, and the outdoor unit will adjust its capacity output accordingly.

Just a quick note to let you know, when I got into the roof the existing duct work is very old and has very poor insulation around it. It would be highly advisable that this duct work be replaced. At the moment when it is a hot day and it is extremely hot in the roof, the AC unit will be cooling the air down to the best of its ability, but due the poor insulation on the duct work, the cool air will be heated up through the ducting before it is delivered into the desired space. This means the air being delivered is higher, hence the unit having to work harder, and for longer to reach the desired temperature set point.

For the Rainbow Room and TR Room we could use the existing outlets, but would be much better served by changing the duct work.

In regards to the upstairs extension, I have not allowed for this in my unit selection, firstly because I don't know how much extra capacity would be required to cater for the extension, and it would dramatically increase the cost to do the upgrade.

Secondly, as the upstairs unit will get hotter in summer, and probably require less heating in winter as it will receive the majority of the solar load, it would most likely be more efficient for the top level to have its own unit."

The attachments to that report are attached at Appendices 12.1 & 12.2.

EPM estimates that heating and cooling costs could be significantly reduced with the introduction of a new air conditioning system with inverter and electronic valve technology. Accordingly. EPM recommends further investigation into possible air conditioner options be undertaken to ensure the best replacement opportunity is realised. This would include quantification of projected operating costs to ensure maximum cost savings.

7.4 Lighting

All the lights in the Centre were replaced with LED lamps in August, 2013. Table 8 summarises the lamp types in the Centre and their estimated daily kWh consumption on an operational day.

Lamp types	No. of lamps	kW draw for each lamp	No. hours on per day	Estimated kWh consumption per day
LED downlights	33	0.01	10.50	3.47
Oyster lights	5	0.01	10.50	0.53
Spotlights	2	0.02	2.00	0.08
Total kWh				4.07

Table 8 Lamps - estimated daily kWh consumption

EPM estimates that prior to the LED lamp upgrade the daily kWh consumption of the lights during operational hours would have been 16 kWh. Therefore the Centre has saved 12 kWh for each operational day for the last two years totalling 5,800 kWh. This is a saving of approximately $850 and nearly three tonnes of carbon emissions per annum.

Apart from operational trading hours the Centre's lights are on briefly for the cleaner 3 nights per week and once on the weekend. The outside spotlights have sensors.

8 Energy performance indicator

An energy performance indicator (“EnPI”) should be established for site operations under the provisions of the standard AS/NZS 3598.1.2014 Energy audits. It is an indication of energy performance over time. Establishing an EnPI for LA is particularly appropriate for LA in light of its plans to expand the Centre.

EPM suggests that the EnPI be allocated as a ratio of baseline megajoules of energy consumption per child. The baseline energy consumption is 16,040 MJ. The total number of children attending the Centre is 38. Therefore the current EnPI is 422 MJ.

8 PV system analysis

EPM has a completed a preliminary PV analysis for the Centre to evaluate the business case for same. The analysis is made assuming a 20% reduction in consumption after upgrade of the air conditioning system. EPM is aware however that the analysis may need to be amended to reflect:

- Actual savings from an air conditioning system upgrade.
- The impact on consumption when the number of children enrolled at the Centre is increased with the extra storey addition.

EPM used PV Sell software for the analysis. Pertinent data such as the half hour interval data for the financial year 1 July, 2014 to 30 June, 2015, tariff rates and roof orientation & tilt was uploaded into the software. EPM was then able to calculate the optimum system size to maximise the return on investment. The result was an 8 kW system. Figure 16 shows average generated and exported kWh/day with 81% of solar generated electricity consumed on site.

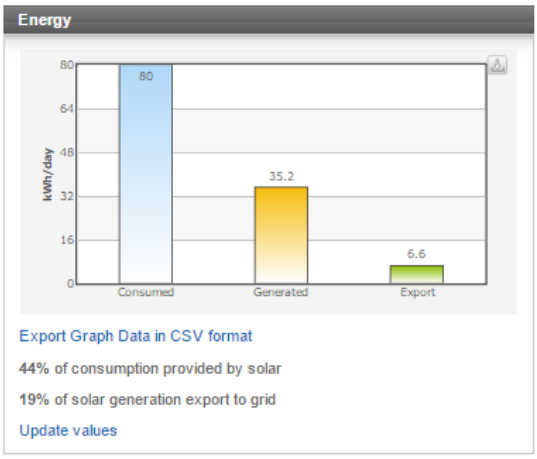


Figure 16 Consumption/generated/exported kWh

Figure 17 shows the net system price after STC discounts at $15,056. This assumes a gross cost of the system of $2.62 per kW which includes finance charges for the acquisition of the system.

Investment

STC quantity and price: 165 x $36.00

Customer IS Registered for GST:

Calculations and results shown GST inclusive [CHANGE]

	ex GST	incl GST
Gross System Price:	$20,995	$23,094
Plus Additional Costs:	-	-
Less Additional Discounts:	-	-
Total System Price:	$20,995	$23,094
Less 165 STCs @ $36.00 each:	$5,940	$6,534
Net System Price after STC Discount:	$15,055	$16,560
Includes GST of:		$1,505
Gross $/W:	$2.62	$2.89
Net $/W:	$1.88	$2.07

Figure 17 Net PV system price summary

Figure 18 shows the payback period at 6.3 years with a net present value of $24,443 at 7% discount rate. Appendix 12.3 below shows the project cashflow.

Return

Simple payback:	6.3 years
True payback:	0 years
Simple ROI:	15.9%
Internal Rate of Return:	>100%
NPV (at discount rate 7%):	$24,443

Figure 18 Payback and NPV

For the purposes of the analysis EPM assumed the mode of financing to be an electricity supply agreement (“ELS”). Under an ELS the Centre would pay a rental equal to the supplier equal to the number of kWh generated by the system charged at a lower rate than the electricity retailers (usually 10 cents per kWh). After 15 years LA would become the owner of the system. In the meantime the supplier is responsible for the operational maintenance and any repairs needed.

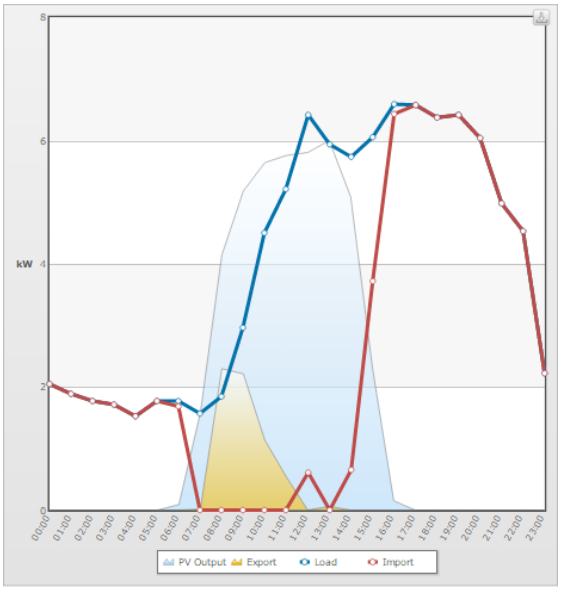


Figure 19 PV generation 4 August

Figure 19 shows the anticipated generation of electricity from the PV system on Monday 4 August. It also shows the actual consumption reduced by 20% to cater for heating reduction requirements.

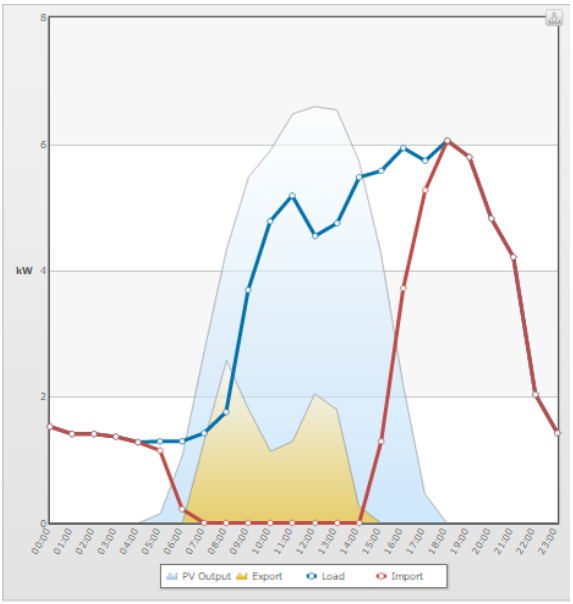


Figure 20 PV generation 16 February

Figure 20 shows the anticipated generation of electricity from the PV system on Monday 16 February. It also shows the actual consumption reduced by 20% to cater for cooling reduction requirements.

9 Sustainability policy & WWEC Initiative

EPM suggests that LA develop a sustainability policy and implement water, waste, energy and carbon reduction targets. It is recommended that these targets be intensity style targets to allow for future increased enrolee numbers.

9.1 Water

The water usage for the baseline year was 516 kL. The *water usage to enrolee* ratio was 13.58 kL.

To develop an understanding of the opportunities to reduce this ratio it would be necessary for a water audit to be conducted that:

- Review tap flow rates
- Checks tap aerators for proper functioning
- Review washing machine use to ensure full load operation.

9.2 Waste

The general waste for the baseline year was approximately 11.5 cubic metres with a weight of approximately 1.4 tonnes. Nappies represent 75% of the general waste. The *waste to enrolee* ratio for the baseline year was 36.84 kg.

The recyclable waste (mostly plastic bottles) was approximately 5 cubic metres.

9.3 Energy

As discussed above, the EnPI provides a measure for energy performance and a baseline benchmark. It is 422 MJ per enrolee. A realistic reduction target can be evaluated after assessment air conditioner upgrade electricity savings.

9.4 Carbon

Figure 21 shows the carbon footprint of LA for the baseline year of 36.95 tonnes of $CO_{2\text{-}e}$.

Emission source	Consumption	Consumption Units	CO2-e Tonnes	% of Total Emissions
Scope 1:				
Refrigerant leakage	0.10	kg	0.13	0.35%
Combustion of natural gas	11.16	MJ	0.57	1.55%
			0.70	
Scope 2:				
Electricity consumption	12939	kWh	**11.26**	30.47%
Scope 3:				
Paper use	120	kg	0.30	0.81%
Full fuel cycle - natural gas	11.16	GJ	0.15	0.41%
Full fuel cycle - electricity	12939	kWh	2.46	6.65%
Waste disposal to landfill	2.42	tonnes	22.08	59.76%
			24.99	
Total Emissions			**36.95**	100.00%

Figure 21 Carbon footprint for the baseline year

The footprint includes all scope 1 and scope 2 carbon emissions. Significant scope 3 *upstream* emissions including paper consumption and the full fuel cycle for gas and electricity. The footprint includes a scope 3 *downstream* emission of general waste which represents 60% of the total footprint. It does not include carbon emissions of processing recycled waste. The second significant emission is electricity consumption totalling 37% of the footprint (scopes 1 & 3).

Other scope 3 emissions were considered for inclusion in the footprint but were dismissed because it was too difficult to obtain accurate data or they were insignificant in amount.

Disposable nappies represent 94% of the waste emissions. EPM has been in contact with Relivit, a nappy recycling company about to start operating in 2016. Relivit claims its plant will allow 95% of the wood fibre, plastic and super absorbent polymer (SAP) contained in this nappies to be recovered and used in the manufacture of new products. It will mean waste emissions from nappies will be halved. EPM will keep LA appraised of Relivit's operational start date.

The *carbon emissions to enrolee* ratio is 0.97 $tCO_{2\text{-}e}$ applying the baseline year emissions. EPM suggests a carbon target be based on a reduced carbon emissions to enrolee ratio after assessment of air conditioner upgrade electricity savings.

10 Recommendations

Current situation/issue	Recommendations
No discount given by electricity retailer on electricity use and electricity contract currency unknown.	• Contact other electricity retailers to establish tariff, supply charge & energy use discount rates. • Contact current retailer to discuss better rates and consider changing retailers.
No discount given by gas retailer on gas use and gas contract currency unknown.	Contact current retailer to discuss better rates and consider changing retailers
No insulation in the ceiling space.	• Obtain quotes for installation of insulation. • Calculate energy cost savings with the addition of insulation. • Prepare timeline for addition of second storey and assess potential for reusing the insulation in the new ceiling.
Inefficient ducted air conditioning system.	• Explore air conditioning system upgrade options that will facilitate the benefits of zoning, night purging and load shifting. • Calculate ROI on each option. • Obtain quotes for ceiling space ventilation.
No renewable energy used.	Prepare timeline for second storey addition with ideal PV system roof design.
Absence of sustainability policy	Develop sustainability policy to incorporate the desire to reduce water, waste, energy and carbon emissions.
Absence of EnPI and energy reduction target	After assessment of air conditioning upgrade options develop a target based on an improved EnPI.
Absence of water, waste & carbon emission targets	Develop targets for each.

11 Conclusion

It has become clear to EPM in conducting the energy audit and preparing this report that opportunities are available to LA that will significantly reduce energy and other operational costs. However to ensure the correct equipment upgrade and infrastructure decisions are made it is imperative that LA implement timeline planning of the second storey addition.

It is also clear that with the adoption of WECC targets and processes to achieve those targets that LA can demonstrate sustainable best practice. This is highly likely to significantly enhance the Centre’s community profile and goodwill value.

12.1 Appendix Toshiba MMY-MAP1004HT8

8 Technical Specifications

MMY-MAP1004HT8, MAP1004T8 (10HP, 28kW system)

Cooling

Outdoor Unit Dry-Bulb (°C)	Outdoor Unit 100% Cooling Capacity (kW)	Compressor + Oudoor Fan Power consumption (kW)							
		100% Capacity		90% Capacity		80% Capacity		70% Capacity	
		TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)
40 °C	26.1	26.1	8.00	23.5	6.58	20.8	5.33	18.2	4.26
39 °C	26.5	26.5	7.88	23.8	6.48	21.2	5.25	18.5	4.20
37 °C	27.3	27.3	7.65	24.5	6.28	21.8	5.09	19.1	4.07
35 °C	28.0	28.0	7.41	25.2	6.09	22.4	4.93	19.6	3.95
33 °C	28.0	28.0	6.85	25.2	5.64	22.4	4.58	19.6	3.67
31 °C	28.0	28.0	6.35	25.2	5.24	22.4	4.26	19.6	3.43
30 °C	28.0	28.0	6.13	25.2	5.06	22.4	4.12	19.6	3.32
29 °C	28.0	28.0	5.91	25.2	4.88	22.4	3.98	19.6	3.21
27 °C	28.0	28.0	5.51	25.2	4.56	22.4	3.72	19.6	3.01
25 °C	28.0	28.0	5.14	25.2	4.26	22.4	3.48	19.6	2.82
23 °C	28.0	28.0	4.81	25.2	3.98	22.4	3.26	19.6	2.65
21 °C	28.0	28.0	4.71	25.2	3.90	22.4	3.20	19.6	2.60
20 °C	28.0	28.0	4.66	25.2	3.87	22.4	3.17	19.6	2.58
19 °C	28.0	28.0	4.62	25.2	3.83	22.4	3.15	19.6	2.56
17 °C	28.0	28.0	4.54	25.2	3.77	22.4	3.10	19.6	2.53
15 °C	28.0	28.0	4.48	25.2	3.72	22.4	3.06	19.6	2.50

Outdoor Unit Dry-Bulb (°C)	Outdoor Unit 100% Cooling Capacity (kW)	Compressor + Oudoor Fan Power consumption (kW)							
		60% Capacity		50% Capacity		40% Capacity		30% Capacity	
		TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)
40 °C	26.1	15.6	3.37	13.0	2.66	10.42	2.12	7.82	1.76
39 °C	26.5	15.9	3.32	13.2	2.62	10.59	2.09	7.94	1.74
37 °C	27.3	16.4	3.22	13.6	2.54	10.91	2.03	8.18	1.69
35 °C	28.0	16.8	3.12	14.0	2.46	11.20	1.96	8.40	1.63
33 °C	28.0	16.8	2.92	14.0	2.31	11.20	1.86	8.40	1.56
31 °C	28.0	16.8	2.74	14.0	2.18	11.20	1.77	8.40	1.49
30 °C	28.0	16.8	2.65	14.0	2.12	11.20	1.72	8.40	1.46
29 °C	28.0	16.8	2.57	14.0	2.06	11.20	1.68	8.40	1.43
27 °C	28.0	16.8	2.42	14.0	1.95	11.20	1.60	8.40	1.37
25 °C	28.0	16.8	2.27	14.0	1.84	11.20	1.51	8.40	1.30
23 °C	28.0	16.8	2.14	14.0	1.74	11.20	1.44	8.40	1.24
21 °C	28.0	16.8	2.11	14.0	1.72	11.20	1.43	8.40	1.24
20 °C	28.0	16.8	2.09	14.0	1.71	11.20	1.42	8.40	1.24
19 °C	28.0	16.8	2.08	14.0	1.70	11.20	1.42	8.40	1.23
17 °C	28.0	16.8	2.06	14.0	1.68	11.20	1.41	8.40	1.23
15 °C	28.0	16.8	2.04	14.0	1.67	11.20	1.40	8.40	1.23

TC : Total Capacity PI : Power Input
Indoor air temperature conditions : 27.0°C dry-bulb / 19.0°C wet bulb

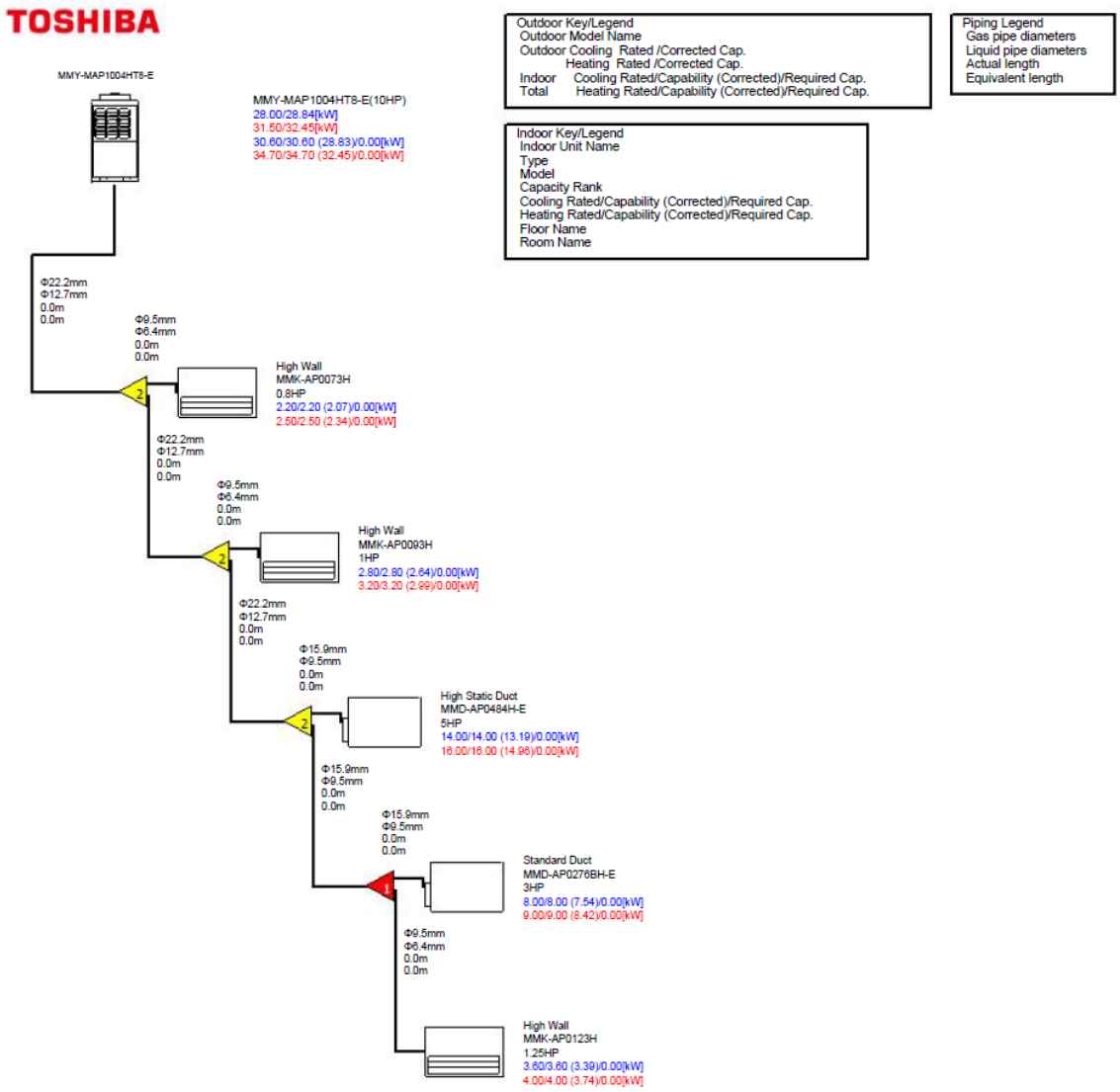
Heating

Outdoor Unit Dry-Bulb (°C)	Outdoor Unit Wet-Bulb (°C)	Outdoor Unit 100% Heating Capacity (kW)	Compressor + Oudoor Fan Power consumption (kW)							
			100% Capacity		90% Capacity		80% Capacity		70% Capacity	
			TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)
15.0	13.7	31.5	31.5	6.24	28.4	5.18	25.2	4.31	22.1	3.59
13.0	11.8	31.5	31.5	6.49	28.4	5.36	25.2	4.43	22.1	3.67
11.0	9.8	31.5	31.5	6.79	28.4	5.57	25.2	4.57	22.1	3.76
9.0	7.9	31.5	31.5	7.12	28.4	5.80	25.2	4.73	22.1	3.87
7.0	6.0	31.5	31.5	7.50	28.4	6.08	25.2	4.92	22.1	4.00
5.0	4.1	30.4	30.4	7.38	27.4	5.98	24.3	4.85	21.3	3.93
3.0	2.2	29.3	29.3	7.27	26.4	5.89	23.5	4.77	20.5	3.87
0.0	-0.7	27.6	27.6	7.10	24.9	5.75	22.1	4.66	19.3	3.78
-3.0	-3.7	25.8	25.8	6.92	23.2	5.60	20.7	4.54	18.1	3.68
-5.0	-5.6	24.6	24.6	6.80	22.2	5.51	19.7	4.47	17.3	3.62
-7.0	-7.6	23.4	23.4	6.68	21.0	5.41	18.7	4.39	16.4	3.56
-10	-10.5	21.5	21.5	6.51	19.4	5.27	17.2	4.27	15.1	3.47
-14.5	-15.0	18.5	18.5	6.24	16.7	5.05	14.8	4.10	13.0	3.32

Outdoor Unit Dry-Bulb (°C)	Outdoor Unit Wet-Bulb (°C)	Outdoor Unit 100% Heating Capacity (kW)	Compressor + Oudoor Fan Power consumption (kW)							
			60% Capacity		50% Capacity		40% Capacity		30% Capacity	
			TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)	TC (kW)	PI (kW)
15.0	13.7	31.5	18.9	2.99	15.8	2.49	12.6	2.04	9.45	1.62
13.0	11.8	31.5	18.9	3.04	15.8	2.52	12.6	2.06	9.45	1.63
11.0	9.8	31.5	18.9	3.10	15.8	2.56	12.6	2.08	9.45	1.65
9.0	7.9	31.5	18.9	3.17	15.8	2.60	12.6	2.11	9.45	1.66
7.0	6.0	31.5	18.9	3.25	15.8	2.65	12.6	2.14	9.45	1.68
5.0	4.1	30.4	18.3	3.20	15.2	2.61	12.2	2.10	9.13	1.66
3.0	2.2	29.3	17.6	3.15	14.7	2.57	11.7	2.07	8.80	1.63
0.0	-0.7	27.6	16.6	3.08	13.8	2.50	11.1	2.02	8.29	1.59
-3.0	-3.7	25.8	15.5	3.00	12.9	2.44	10.3	1.97	7.75	1.55
-5.0	-5.6	24.6	14.8	2.95	12.3	2.40	9.86	1.94	7.39	1.53
-7.0	-7.6	23.4	14.0	2.90	11.7	2.36	9.35	1.90	7.01	1.50
-10	-10.5	21.5	12.9	2.82	10.8	2.30	8.61	1.86	6.45	1.46
-14.5	-15.0	18.5	11.1	2.70	9.26	2.20	7.41	1.78	5.55	1.40

TC : Total Capacity PI : Power Input
Indoor air temperature conditions : 20.0°C dry-bulb

12.2 Appendix Toshiba air conditioner upgrade proposal



12.3 Appendix PV system cashflow analysis

Calendar Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Electricity Price (ex GST)																										
Export	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peak Periods	-	$0.47	$0.48	$0.49	$0.51	$0.52	$0.54	$0.56	$0.57	$0.59	$0.61	$0.63	$0.64	$0.66	$0.68	$0.70	$0.72	$0.75	$0.77	$0.79	$0.82	$0.84	$0.87	$0.89	$0.92	$0.95
Shoulder Periods	-	$0.18	$0.19	$0.19	$0.20	$0.20	$0.21	$0.22	$0.22	$0.23	$0.24	$0.24	$0.25	$0.26	$0.27	$0.27	$0.28	$0.29	$0.30	$0.31	$0.32	$0.33	$0.34	$0.35	$0.36	$0.37
Off-Peak Periods	-	$0.10	$0.10	$0.11	$0.11	$0.11	$0.12	$0.12	$0.12	$0.13	$0.13	$0.14	$0.14	$0.14	$0.15	$0.15	$0.16	$0.16	$0.17	$0.17	$0.18	$0.18	$0.19	$0.19	$0.20	$0.21
System Output																										
Export	-	2,409	2,395	2,380	2,366	2,352	2,338	2,324	2,310	2,296	2,282	2,269	2,255	2,241	2,228	2,215	2,201	2,188	2,175	2,162	2,149	2,136	2,123	2,110	2,098	2,085
Peak Periods	-	1,844	1,833	1,822	1,811	1,800	1,790	1,779	1,768	1,758	1,747	1,737	1,726	1,716	1,705	1,695	1,685	1,675	1,665	1,655	1,645	1,635	1,625	1,616	1,606	1,596
Shoulder Periods	-	8,332	8,282	8,233	8,183	8,134	8,085	8,037	7,988	7,941	7,893	7,846	7,798	7,752	7,705	7,659	7,613	7,567	7,522	7,477	7,432	7,387	7,343	7,299	7,255	7,212
Off-Peak Periods	-	269	268	266	265	263	261	260	258	257	255	254	252	251	249	248	246	245	243	242	240	239	237	236	235	233
Total Output	-	12,855	12,778	12,701	12,625	12,549	12,474	12,399	12,325	12,251	12,177	12,104	12,032	11,960	11,888	11,816	11,746	11,675	11,605	11,535	11,466	11,397	11,329	11,261	11,193	11,126
Revenue																										
Electricity: Export Power	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricity: Offset Consumption																										
Peak Periods	-	$943	$965	$988	$1,012	$1,036	$1,061	$1,086	$1,112	$1,138	$1,165	$1,193	$1,222	$1,251	$1,281	$1,311	$1,342	$1,374	$1,407	$1,440	$1,475	$1,510	$1,546	$1,583	$1,620	$1,659
Shoulder Periods	-	$1,653	$1,693	$1,733	$1,774	$1,817	$1,860	$1,904	$1,950	$1,996	$2,044	$2,092	$2,142	$2,193	$2,245	$2,299	$2,354	$2,410	$2,467	$2,526	$2,586	$2,648	$2,711	$2,775	$2,841	$2,909
Off-Peak Periods	-	$30	$31	$31	$32	$33	$34	$34	$35	$36	$37	$38	$39	$40	$41	$42	$43	$44	$45	$46	$47	$48	$49	$50	$51	$53
Total savings	-	$2,626	$2,689	$2,753	$2,818	$2,886	$2,954	$3,025	$3,097	$3,171	$3,246	$3,323	$3,403	$3,484	$3,567	$3,652	$3,738	$3,828	$3,919	$4,012	$4,108	$4,205	$4,306	$4,408	$4,513	$4,621
Expenses																										
Lease Deposit/Repayments	-	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	-	-	-	-	-	-	-	-	-	-
Total expenses	-	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	$1,488	-	-	-	-	-	-	-	-	-	-
Net cashflow	-	$1,138	$1,201	$1,265	$1,330	$1,398	$1,466	$1,537	$1,609	$1,683	$1,758	$1,835	$1,915	$1,996	$2,079	$2,164	$3,738	$3,828	$3,919	$4,012	$4,108	$4,205	$4,306	$4,408	$4,513	$4,621
Cumulative Cashflow	-	$1,138	$2,339	$3,604	$4,934	$6,332	$7,798	$9,335	$10,944	$12,626	$14,384	$16,220	$18,134	$20,130	$22,208	$24,372	$28,110	$31,938	$35,857	$39,869	$43,976	$48,182	$52,488	$56,896	$61,409	$66,030