Facility Not Disclosed

Lighting

Energy Efficiency Review

Presented September 2007

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1 Introduction

Energyfocus was engaged to assess the lighting energy efficiency at Xxxxxxx Xxxxxxx.

The focus of the investigation was on options for increasing the energy efficiency of fluorescent lighting in the selling area and Undercroft car park.

2 Total Electricity Consumption

2006/07 annual electricity consumption and outlay, as invoiced by retailer AGL, is listed in Table 1.

For comparison, consumption and cost for Xxxxxxx Xxxxxxx is included. Xxxxxxx is a larger, newer supermarket. A number of lighting energy efficiency measures have previously been undertaken at Xxxxxxx.

In terms of electricity consumption relative to total selling area, Xxxxxxx is more efficient than Xxxxxxx.

Table 1

Xxxxxxx Store	**Selling Area**	**Annual Electricity Consumption 2006/07**	**kWh/m^2**	**Outlay (Inc GST)**
Xxxxxxx	2,600 m^2	4,405,946 kWh p.a.	1,694.6	$304,825
Xxxxxxx	3,500 m^2 [total area: approx. 7,000 m^2]	4,253,217 kWh p.a.	1,215.2	$398,783

3 Tariff Rates

Below is a schedule of the various electricity tariff rates currently applicable to Xxxxxxx Xxxxxxx.

Table 2

Retailer Component (AGL)	**Charge (Excl GST)**	**Comments**
Peak (including loss factors)	$0.073688 per kWh	Peak period: 0700 hrs to 2100 hrs working days
Off peak (including loss factors)	$0.038641 per kWh	All other times
Network Charges (ETSA Utilities)		
Agreed Maximum Demand	$5.381381 per kVA/month	Average charge based on 707 kVA
Peak kWh	$0.023609 per kWh	0700 to 2100 hrs, week days
Off peak kWh	$0.018913 per kWh	All other times
Supply charge	$0 per day	
Other Charges		
NEMMCO (National Electricity Market Manager) Pool fees	$0.0004159 per kWh	Varies marginally each month
NEMMCO Ancillary Services	$0.0006325 per kWh	Varies marginally each month
Mandatory Renewable Energy Certificates	$0.001419 per kWh	

The aggregate energy charges are listed in Table 3. These are the rates used in the cost savings determinations considered in Section 8.

Table 3

Aggregated Energy Charges	**Excl. GST**
Peak	$0.0997644 per kWh
Off peak	$0.0600214 per kWh

4 Lighting Description

Lighting in the Supermarket consists predominantly of fluorescent lamp fittings. 36 Watt fittings are in use above the checkouts, with twin 58 Watt T8[1] batten fittings serving the selling area.

The majority of fluorescent lamps in use are long life triphosphor "cool whites".

50 Watt, low voltage halogen lamps are used in the speciality areas and the fruit and vegetable gondolas.

All store lighting is manually switched by staff members. The care park lighting is controlled by a seven-day time switch.

The following Table provides a lamp schedule.

Table 4

	Single 36 Watt	**Double 36 Watt**	**Twin 58 Watt**	**50 Watt halogen down-light**	**13 Watt PL down-light**	**100 Watt Down-light**
Car Park	273					
Entrance from car park	14				16	
Main entrance area						39
Checkouts		44				
Confectionery						7
Specialty area				108 (including failed lamps)		
Selling area			333			
Fruit and vegetable gondolas				24		
Bakery area						25

[1] Fluorescent lamps are categorized by tube diameter size. A T12 lamp is 12/8"=1.5";T8=8/8" = 1"; T5=5/8". T12 lamps were superseded about 20 years ago.

5 Results of Lighting Electrical Monitoring

Store lighting is fed from Sub-Board 1, located in the main store. Results of spot electrical load measurements taken on this Board are listed Table 5.

A number of halogen down-lights were noted as failed at the time of measurement.

Table 5

Sub- board 1		
Circuit	**Description**	**kW**
R1	lighting entrance	0.56
W1	lighting entrance	0.58
B1	lighting entrance	0.58
R3	lighting entrance	0.67
W3	lighting entrance	0.68
B3	lighting entrance	0.68
R5	lighting checkout area	1.2
W5	lighting checkout area	1.12
B5	lighting checkout area	1.52
R7	controls	0
W7	GP entrance	0
R9	exit signs	0.04
R11	teller machine	0
W11	GPO	0
B11	car park lights	Fed from upstairs distribution
W13	car park lights	As above
B27	lighting meat prep	0.86
R2	no description	0.8
W2	no description	0.19
B2	canopy lights	0.01
R4	selling area lights row 1	1.45
W4	selling area lights row 2	2.01
B4	selling area lights row 3	1.97
R6	selling area lights row 4	2.01
W6	selling area lights row 5	1.93
B6	selling area lights row 6	2.09
R8	selling area lights row 7	1.89
W8	selling area lights row 8	2.09
B8	selling area lights row 9	2.91
R10	s/w corner (bakery)	1.5
W10	bulkhead down-lights - meat	0.89
B10	bulkhead down-lights - seafood	0.74
R12	bulkhead down-lights - deli	0.82
W12	bulkhead down-lights - bakery	0.75
B12	Fruit & Vegetable gondola 6	0.35
R14	Fruit & Vegetable gondola 5	0.26
W14	Fruit & Vegetable gondola 4	0.46
B14	Fruit & Vegetable gondola 3	0.47
R16	Fruit & Vegetable gondola 2	0.36
W16	Fruit & Vegetable gondola 1	0.36

Table 5 (Continued)

B16	metal halide above meat fridge	0.27
R18	fluorescent lights above meat fridges	1.34
sub- board 2		
R30	selling area lights row 1	3.59
W30	selling area lights row 2	1.91
B30	selling area lights row 3	2.04
R32	selling area lights row 4	1.93
W32	selling area lights row 5	2.02
B32	selling area lights row 6	1.88
R34	selling area lights row 7	2.06
W34	selling area lights row 8	1.92
B34	selling area lights row 9	3.52
R36	Bakery corner	1.16
W36	Fruit & Vegetable down-lights gondolas	0.04
B36	above meat fridges - lights	1.46
Total selling area load		**59.94 kW**

Table 6 lists the spot load measurements taken on the car park lighting circuits.

Table 6

DB A (upstairs in office)		**kW**	**kVA**
B11	car park lighting - south	3.31	4.97
R12	car park lighting - middle	5.27	7.18
W12	car park lighting - north	3.25	4.39
total		**11.83**	**16.54**

5.1 Selling Area Lighting Load Monitoring

A power analyser was installed on three selling area lighting circuits. Load was logged for a period of two week. The purpose of the logging was to sample the daily lighting duration within the selling area.

The results of the monitoring are summarised in Figure 1 and Table 7.

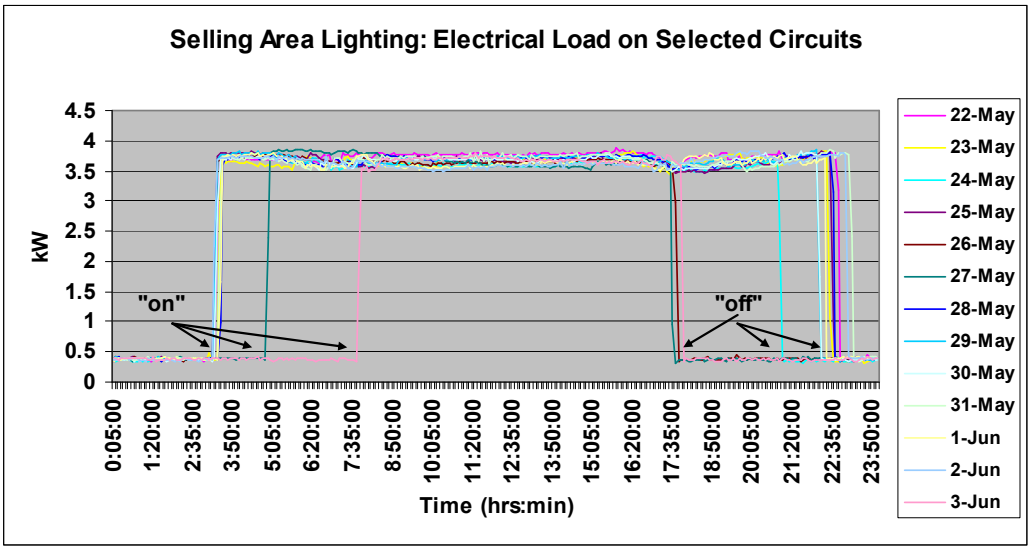


Figure 1

Table 7

	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May	31-May
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**	**Mon**	**Tue**	**Wed**	**Thu**
"On" time		3:20	3:25	3:15	3:15	3:20	4:55	3:25	3:15	3:20	3:25
"Off" time	21:10	22:50	22:30	20:55	22:35	17:40	17:35	22:35	22:10	22:10	23:10
Lighting hours		19.5	19.1	17.7	19.3	14.3	12.7	19.2	18.9	18.8	19.8

	1-Jun	2-Jun	3-Jun	4-Jun
	Fri	**Sat**	**Sun**	**Mon**
"On" time	3:25	3:15	7:45	3:25
"Off" time	22:20	23:00	17:50	
Lighting hours	18.9	19.8	10.1	

It can be seen that the selling area lighting circuits were generally switched "on" between 3:15 am and 3:25 am on all days, and switched "off" between 22:30 and 23:00 hrs on weekdays. Lighting duration was generally less on weekends, reflective of shorter trading hours.

Average weekday and weekend lighting duration during the monitoring period is determined as:

Selling Area: average weekday lighting duration	19.0 hours per day
Selling Area: average weekend lighting duration	14.2 hours per day

It is understood that there is no 33% or 67% switching of Selling Area lighting outside trading hours for shelf packing.

5.2 Car Park Lighting Load Monitoring

The car park circuits were also logged for a period of two weeks. The outcome of this monitoring is given in Figure 2 and Table 8.

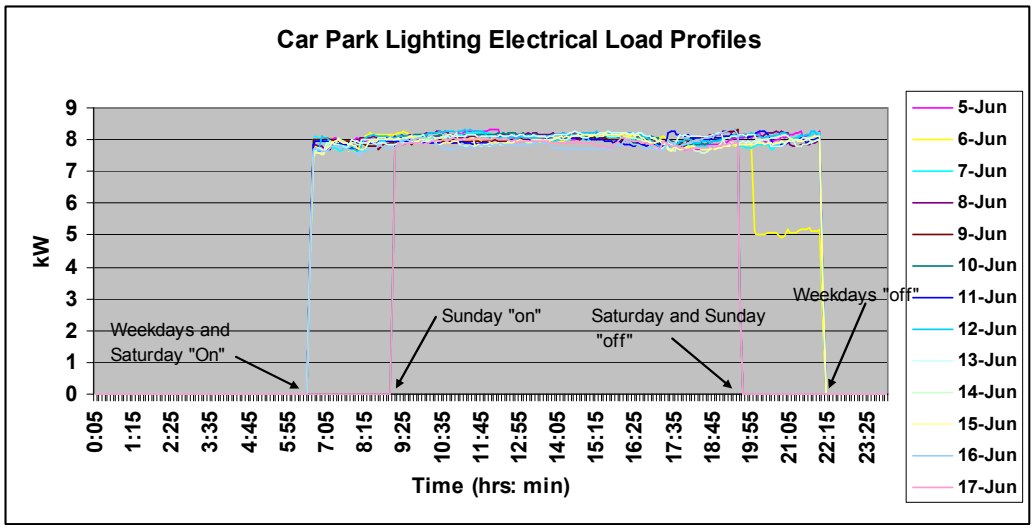


Figure 2

Table 8

Total	5-Jun	6-Jun	7-Jun	8-Jun	9-Jun	10-Jun	11-Jun	12-Jun	13-Jun	14-Jun	15-Jun	16-Jun	17-Jun
	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
"On" time	6:30	6:30	6:30	6:30	6:30	9:00	6:30	6:30	9:00	6:30	6:30	6:30	9:00
"Off" time	22:05	22:05	22:05	22:05	19:35	19:35	22:05	22:05	22:05	22:05	19:35	19:35	19:35
Duration (hours)	15.6	15.6	15.6	15.6	13.1	10.58	15.6	15.6	15.6	15.6	15.6	13.1	10.58

(Note: 11th June was a public holiday)

It can be seen that on Monday to Friday, the car park lighting is time scheduled from 06:30 am to 22:05 pm, on Saturday from 06:30 am to 19:35 pm, and on Sunday from 09:00 am to 19:35 pm.

Car park lighting duration is as follows:

Weekday lighting hours (including public holidays)	15.6 hours per day
Saturday lighting hours	13.1 hours per day
Sunday lighting hours	10.58 hours per day

6 Annual Lighting Electricity Consumption

Based on the results of spot electrical load measurements and load monitoring, the calculated contribution of lighting in the areas surveyed to the total site electricity consumption is summarised in Table 9. The percentage contribution of lighting on an annual basis is estimated at 8%. Note that this figure excludes lighting in the Administration area and stores.

Table 9

Energy split	kWh	%
Store lighting	302,640	7%
Car park lighting	62,490	1%
Whole Site: Total annual electricity consumption	4,405,946	100%

7 Lux Levels

Table 10 lists the lighting levels taken in the car-park and Selling area. Spot readings were taken during daylight hours, resulting in the car park levels being influenced by ambient lighting levels.

Lighting levels in the Selling Area are considered adequate and comparable to levels previously measured at Xxxxxxx.

Table 10

Area	Lighting Levels (Lux) on horizontal surface
Car-park (middle):	158.8, 179.2, 98.4, 156, 150
Selling area:	
Vegetables	708, 728
Row 1	952
Row 2	831
Row 3	968
Row 4	989
Row 5	898
Row 6 (refrigeration cabinets)	1343
Row 7	1301
Row 8	916
Row 9	868
Row 10	908
Row 11	974
Row 12	722
Row 13	629

8 Lighting Energy Efficiency Measures

Three lighting energy efficiency measures have been considered. These involve the installation of auto-transformers on the Selling Area and Car park fluorescent lighting, and the re-lamping of the halogen down-lights with lower Wattage IRC lamps. The same technology has been implemented at Xxxxxxx Xxxxxxx.

Other lighting measures are available, for example replacing all existing tubular fluorescent lamps with electronic T5 Lamps. However, this would involve significant capital investment (greater than $100,000 for the Selling area alone) and present some disruption to customers and staff during the implementation phase.

Time scheduling of Selling Area lighting was considered. However this measure was determined to be unviable financially and impractical without the re-wiring of the lighting fittings to provide separate 33% and 67% circuits.

8.1 Auto-Transformer Installation

Auto-transformers are energy saving devices which are retrofitted to fluorescent lighting circuits. The device is designed to reduce the voltage to each circuit after allowing sufficient time for the lamps to "warm-up" after initially switching. Auto transformers, used in applications such as supermarket lighting, have achieved savings approaching 30% with only a small impact on lighting levels.

Figure 3 provides an outline of a typical auto-transformer model, available from Energy Conservation Systems (ECS).

An analysis of the financial viability of installing auto-transformers on the Selling Area and car park lighting is given in Table 11. The implementation budget is based on a quotation provided by ECS (refer Figure 4). This quotation allows for all works to be done during normal working hours.

Table 11

1. Selling Area (58 Watt fluorescent lamps, excluding lighting above checkouts)	
Estimated electricity consumption	250,000 kWh per year
Estimated kWh savings @25%	62,500 per year
Estimated cost savings (excl GST)	**$5,600 p.a.**
Equivalent Greenhouse emission reduction	65.1 tonnes CO_2-e
Implementation budget (based on quotation received from ECS) – excl. GST	**$9,314**
Payback Period	**1.7 years (60% p.a. return)**
2. Car park (36 Watt fluorescent lamps)	
Estimated electricity consumption	62,490 kWh/year
Estimated kWh savings @25%	15,600 kWh per year
Estimated cost savings	**$1,350 p.a.**
Equivalent Greenhouse emission reduction	16.3 tonnes CO_2-e
Implementation budget (based on quotation received from ECS) – excl. GST	**$2,100 (includes $250 allowance for additional work to split one circuit)**
Payback Period	**1.6 years (64% p.a. rate of return)**

The analysis indicates that retrofitting auto-transformers provides a return on investment within 1.7 years for both the Selling Area and Car Park lighting.

LSA3000 LIGHTSAVE
STATIC FLUORESCENT DIMMER

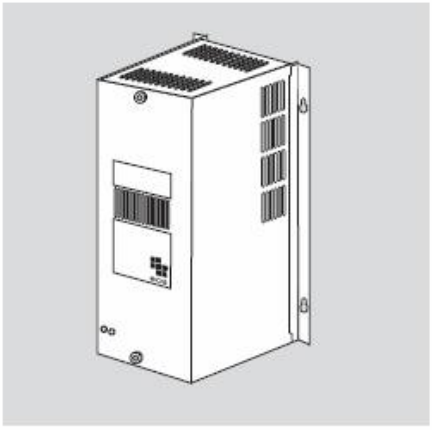
LightSave is an energy saving device which operates by reducing the voltage to a lighting load thereby reducing the power consumed. **It cuts energy bills by up to 30% with only a 15% reduction in light output** (NATA accredited laboratory test results). Lamp life is maintained by ensuring full voltage at start-up.

If it is inappropriate to reduce light output, LightSave can often be used in conjunction with widely available replacement fluorescent lamps to produce the same energy savings and no reduction in light levels. Contact ECS for further details.

The LightSave energy controller for discharge lamp lighting operates at full power for an initial startup period of 5 minutes. This facilitates striking of the lamp and stabilisation of discharge lamp light levels. Unlike other devices, LightSave is designed to be installed in the switched line of the controlled load rather than at the distribution board and is therefore unaffected by switching of adjacent loads.

The LSA LightSave with control of individual circuits has a number of significant benefits:

- extremely simple and inexpensive to install.
- no generated harmonic distortion.
- unaffected by future modifications to the distribution board.
- no system wide failure under fault conditions.
- Fail Safe' operation.
- Australian Designed and Manufactured



LightSave is designed for use in commercial, retail, educational, warehousing and hospital installations where it is impractical to switch off a load completely during working hours. It connected in series with the switched load and no commissioning is needed.

LightSave can be used in conjunction with other ECS lighting controls to further increase savings. Contact your nearest ECS office for further details.

Figure 3

energy conservation systems

Unit 8 / 81 Prospect Road, Prospect SA 5082
Telephone: (08) 8344 3488 Fax: (08) 8344 7963
Email: ecssa@ecsaustralia.com Web:www.ecsaustralia.com

QUOTATION EQA: 50702

TO: Energy Focus	DATE: July 12, 2007
	REF: Foodland Pasasena - During business hours
FAX NO: 08 8339 8357	ATTN: Bruce Dolman

ITEM	QTY	EQUIPMENT ITEMS	UNIT PRICE	TOTAL
1	2	LSA2000B - installed above existing switchboard		
2	13	LSA3000B - installed above existing switchboard		
3	3	LSA5000B - installed above existing switchboard		
		Total Store area lighting excluding car park circuits		**$9,314.00**
4	3	LSA5000B - installed above existing switchboard for carpark lights		**$1,950.00**
		Please note: This cost includes the provision of 3 LSA5000B for the car park lighting, presently the car park has one circuit that has a kW reading exceeding 7kW this will require the circuits to be split. ECS have made no allowance for the splitting of these circuits, further investigation will be required.		
		TOTAL PRICE (Excluding GST Allowance)		**$11,264.00**
		GST Allowance		**$1,126.40**
		TOTAL PRICE (Including GST Allowance)		**$12,390.40**

· Goods available for purchase from ECS on a COD basis at the above Total Price.
· ECS product information shall be treated strictly in confidence and as solely belonging to ECS.
· Acceptance of this quotation constitutes agreement to terms and conditions of sale as contained in this quotation.
· Quotation valid for 60 days.
· Warranty 12 months from Delivery.

Figure 4

8.2 Fit 35 Watt IRC lamps to Existing Low Voltage Down-lights

The existing 50 Watt halogen lamps located in the various bulkheads and fruit gondolas provide a high quality light, but are relatively inefficient and have a short lamp life.

There is the option of replacing these lamps with 35 Watt IRC lamps. The exiting lamp holders and transformers would be retained. A summary of the benefits of IRC lamp technology[2] is given in Figure 5.

An analysis of the financial viability of fitting 35 Watt IRC lamps to all down-lights (130 off) is given in Table 12. The implementation budget is based on a quotation provided by ECS.

2 http://www.osram.com/_global/pdf/Professional/General_Lighting/Halogen_lamps/101W001GB_IRC_Halogen.pdf

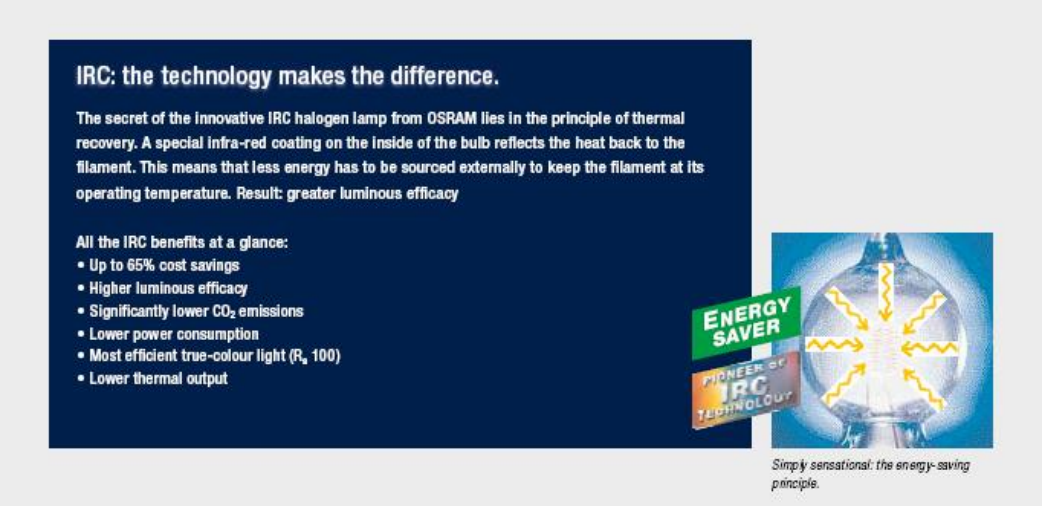


Figure 5

Table 12

Replace 50 Watt halogen lamps with 35 Watt IRC lamps in 130 down-lights	
Estimated electricity consumption	51,760 kWh per year
Estimated kWh savings (excluding air conditioning savings through reduced cooling load)	15,500 kWh per year
Estimated cost savings (excl GST)	**$1,550 p.a.**
Equivalent Greenhouse emission reduction	16.2 tonnes CO_2-e
Implementation budget (based on quotation received from ECS) – excl. GST	**$2,767.70**
Payback Period	**1.8 years (56% p.a. return)**

The analysis indicates, conservatively, a return on investment within 1.8 years would be achieved through implementation of this measure. This measure was also implemented at Xxxxxxx Xxxxxxx.