2012

40KW Solar System for Apple Sauce Co

Document Created for
The Apple Sauce Co
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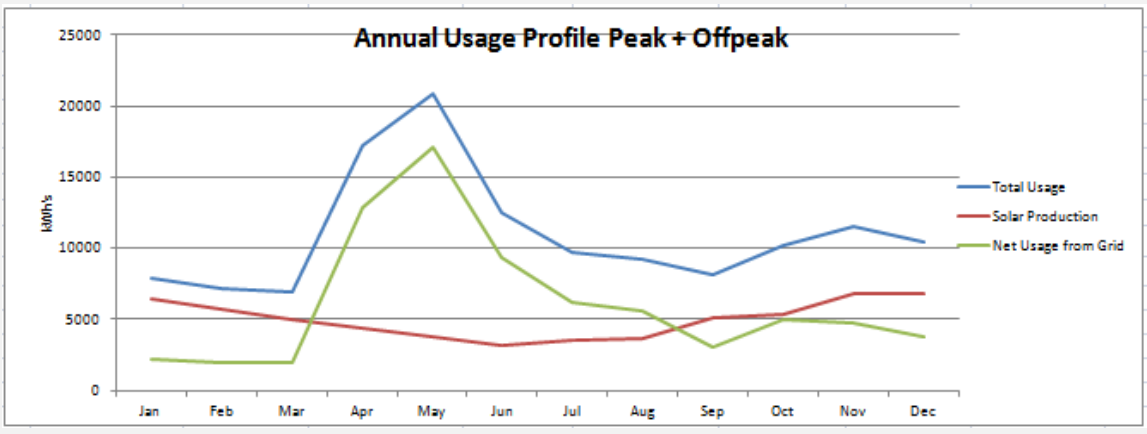
Key Points for a 40KW Solar PV System at Apple Sauce Co, Applethorpe Qld

Prepared for:- Andrew Georgio, Apple Sauce Co,. Crn. Fred Street and the New England Highway, Applethorpe.

Highlights

- Control and stability of electricity prices over the next 25 years.
- Replacement of up to 46% of power usage (your usage profile)
- Apple Sauce Co may be eligible to apply for a grant under the Clean Technology Program (CTP) food & foundries program.
- Payback 1.9 years with grant and 5.7 years without the grant
- Net cost $21,038 - Gross cost $90,200 less Grant + STC's -$69,000 (Est)
- Estimated Internal rate of return in excess of 111.5% (with grant)
- Reduces annual bill from $27,207 to approximately $14,525.43 (inc GST)
- Multiple self funding finance options
- Estimated CO2-e/kWh Savings of 52.9 tonnes PA (.89 kg CO2-e/kWh, Qld)
- Sustainable future power supply
- Technologically mature and sustainable green generation method
- The PV System is expandable for future site growth
- Assumptions used are very conservative
- Rapid deployment under 3 months for complete installation (roof array)
- Annual maintenance and technical support included in the assumptions

Figure 1 Future New Annual Usage profile



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Case Study for a PV Solar 40KW System for at Apple Sauce Co, Applethorpe Qld. Apple Packing Shed & Cool rooms Application

Problem

Electricity is a significant component part of input costs of production and storage of apples for Apple Sauce Co, Applethorpe Qld. Power is used for lighting, fans for cooling, refrigeration for apples, as well as pumps, etc. We were provided with data in the form of a July 2011 – Jun 2012 bills showing peak & off peak usage. This enabled us to analyse the data to provide the information displayed below.

It is estimated that the annual site usage will be approximately 133 MWH in year 12- 2013 at an average price of $19.17 Cents per kWh hour based on the 12 months data supplied. A total of $25,286 net GST. Installing Solar will reduce this to between $13,000 – $14,000 PA. In an all debt scenario, less the STC's & Grant is cash flow positive during the loan period of 3 years @ 7% Interest.

The cool room roofs are an ideal location to mount solar panels, and do not require a DA from the council. By installing a solar system, it will allow Apple Sauce Co to control their power costs over the next 25 years.

Site Analysis (Solar only)

Further analysis would be required to determine the optimum size of installation and any available grant for this site - taking into consideration:

a. Roof area & roof loading limits survey, etc. on roofs.
b. (All the power in this instance from the production from the solar panels would be consumed at the site. This installation would be a "behind the meter installation", with no feed in tariff or power purchase agreement (PPA) negotiations required. No permission is required from Ergon or the network provider).

Figure 2 Apple Sauce Co New England Highway

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Available Grants

Apple Sauce Co may be eligible to apply for a grant under the Clean Technology Program (CTP) food & foundries program, as a manufacturing business is classified under ANZSIC code 1199, covered by the program. The grant applied for can be for up to 1/2 approximately of the cost of the installation. *(This grant is also available for other energy saving devices like LED lights, variable speed device's (VSD's), for pumps, augurs etc. It is recommended that a complete energy audit be conducted for all other items as well, as a % of the capital cost is eligible under the grant.)* We have modelled the installation with and without a grant for solar only in this instance.

Solution

In this example the optimum size for the roof space available was determined to be forty Kilowatts (40KW) installation, based on the current usage and load profile. It is projected that Apple Sauce Co would save circa 59,555 kWh PA, and produce an electricity saving of approximately $11,675, in the first year, replacing 46% of current grid usage. As the system is less than 100KW it will also attract a rebate from the government of 829 STC credits @$29 each (market price varies each day) or $24,041. The payback period is approximately 1.9 years (with grant) and 5.7 years (without) using the Federal Governments "return on investment calculator". It is also assumed that all the panels would fit on the roofs as indicated. (Subject to survey, see suggested locations appendix A)

Finance Options

Loan Type	Conditions	CTP Grant	Financier
Traditional corporate loan	Standard Guarantees	Yes	Major Bank
Operating lease	Standard Guarantees	Yes	Major Bank

Assumptions

It is assumed for the purposes of this exercise that there are no planning issues, and the roofs are able to sustain the required load. Electricity pricing and usage profile have been taken from the data provided. The installation has been costed using industry standard components at a price of $2.25 per watt or a total of $90,079 + GST. The assumed grant, debt and equity used are shown in the table below. In calculating the average cost of electricity generated by the solar, we have assumed that the project was financed, using the capital cost less grant equalling the debt, at the same WACC cost of 7% as used by the Government.

The economic analysis Payback, ROI, NPV & IRR was generated using extrapolated data over a year derived from an average of the 12 months data we were given. The sun hours used; Average for the whole 12 months, 5.43 hours at Apple Sauce Co, Applethorpe(ref Bureau of Meteorology).

Capital Structure	Amounts
Grant	$45,000
Debt	$21,038
STC's Government Rebate @29 ea	$24,041
Totals	**$90,078**

For the purpose of this exercise we have shown the payback with and without the grant but the cost of solar generation with the grant only.

Financial Analysis

1. Before Solar Install

Assumptions	Values
Usage profile throughout the Week	Client Usage Profile Provided
Current Usage PA	133 MWh PA
Current Usage Peak	Unknown kW
Nominal Average Electricity Price	0.1917 Cents per kWh
Annual Electricity Bill Projected	$25,268 + GST
Usage Assumption ("behind the meter")	All power consumed by site (No feed in tariff required)

2. Current Usage Profile - Peak / Off Peak Periods

Current Usage Profile	Start	End	Annual kWh	%
Peak Energy	700 Hrs	2100 Hrs	65,937	49.957%
Shoulder Energy	0 Hrs	0 Hrs	0	0.000%
Off Peak energy	2100 Hrs	700 Hrs	66,050	50.043%
**Weekends all off peak		Totals	131,987	100.000%

3. After Solar Installation of 40KW System

Assumptions	Values
Average Sun hours per day Apple Sauce Co, Applethorpe Qld (Ref Bureau of Meteorology)	5.44 per day
Usage profile throughout the year	Usage Profile
Revised Usage From Grid PA	73.7 MWh PA
Revised Current Demand Peak kWh Estimated	120.08 kW
Nominal Average Electricity Price	0.191 Cents per kWh

4. Revised Annual Usage Peak / Off Peak Periods

Annual Usage	Start	End	Annual kWh	%
Peak Energy	700 Hrs	2100 Hrs	24704.83	33.50%
Shoulder Energy	0 Hrs	0 Hrs	0.00	0.00%
Off Peak energy	2100 Hrs	700 Hrs	49034.17	66.50%
**Weekends all off peak		Totals	73739.00	100.00%

5. Power Production Profile from a 40KW Solar System

kWh Generated From Solar	Annual kWh	%
Peak Energy	42,539.57	71.4%
Shoulder Energy	0.00	0.0%
Off Peak Energy	17,015.83	28.6%
Total	59,555.40	100.0%

6. Replacement Revenue from Solar

Revenue from Solar	Yearly kWh	Cost per kWh	Annual production in $
Total Generated from Solar	59,555.40	0.191	$11,375
		Total deemed Revenue or Savings	$11,375

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7. Power Usage Split Grid & Solar

Total Power MWh %	Solar Production	Net Grid Purchase	Total Power Used
kWh	59,484	73,739	133,223
% Usage	45.12%	54.88%	100.0%

8. Capital Cost Example for 1 MW Solar System

A. Example cost Installed @2.25 per watt
B. Project Life 25 Years
C. With 50% Grant under the Current Government Clean Technology Program
D. Payback ,ROI, & IRR generated using the Govt "Return On Investment Calculator"*

Capital Structure	Amounts	Inc Grant	Ex Grant
STC's	$24,045	Payback yrs	Payback yrs
Grant	$45,000	1.9	5.71
Debt	$24,041	IRR	IRR
Totals	$90,078	111.53%	22.91%
Loan Years	3	ROI	ROI
Loan Interest Rate	7.00%	417%	367%

9. Price stability per KWh is assured with generating your own power, with or without the grant.

a. Raw Cost of power production with the grant.

Year	Year 1	Year 3	Year 5	Year 7	Year 10	Year 15	Year 20
Grid + 2.88% PA	$0.192	$0.203	$0.215	$0.227	$0.247	$0.285	$0.329
Solar Cost Power	$0.131	$0.131					
Aggregate Cost Per kWh	-$0.013	$0.175	$0.122	$0.129	$0.140	$0.160	$0.184

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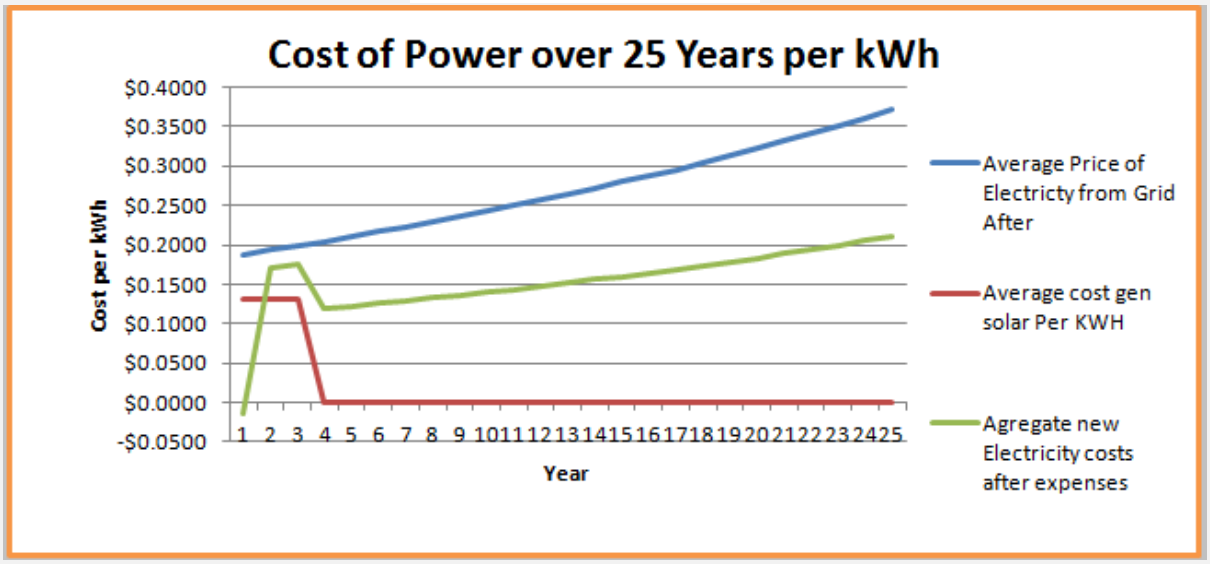
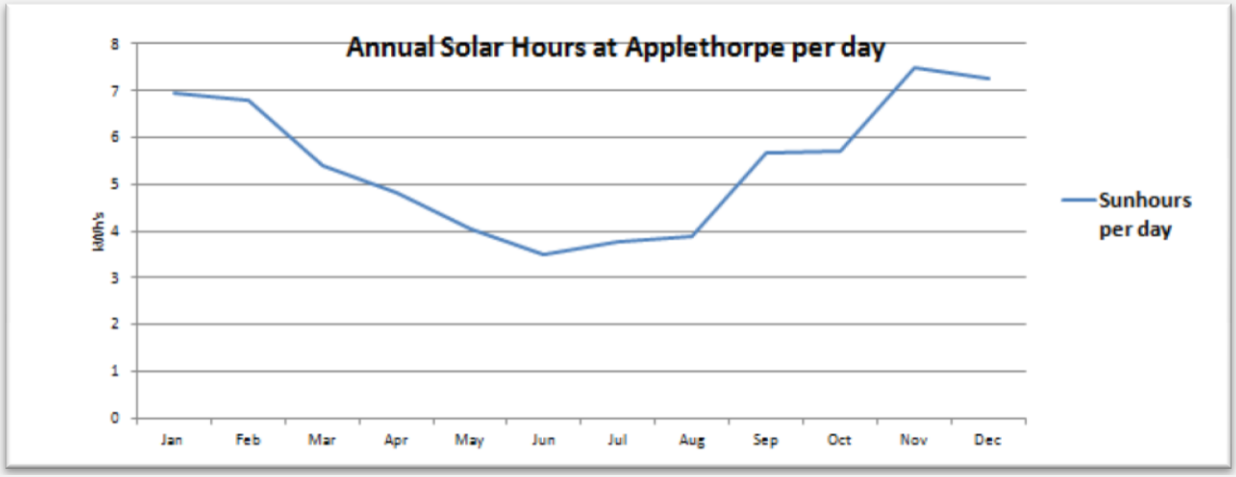
The real story is that Apple Sauce Co has pegged the rise in the price of electricity to 1.74% in year 1 and 1.8% in year 1-3, based on the grid price rising by 2.88% PA. Then having a large reduction in Year 4, slowly increasing over time.

Figure 3 with Grant



The graph below shows the average sunhours per day from Jul 11 – Jun 2012.



10. Solar System Specification for a 40KW System

Solar Panels

1. 157 x Monocrystalline 255 Watt panels
2. 3 x SMA Inverters up to 17 KW
3. Standard or Custom made roof mounting arrangement (BCA2006, AS4100 and AS1170)
4. All installations compliant to current Australian Standards.

11. Warranty

1. Solar Panels Warranty 25 years
    a. 10 year limited warranty of materials and workmanship
    b. 10 year limited warranty of 90% of power output
    c. 25 year limited warranty of 80% of power output
    d. Warranty backed by China Export & Credit Insurance Corporation (SINOSURE) is a state-funded policy-oriented insurance company (or similar).
2. Inverters Variable
    a. Warranty – 5 – 25 years (optional – Cost dependent)
    b. Usually excess inverters are purchased at the outset to swap out defective units as well as a warranty.

12. Maintenance Contract for a 40MW System

3. A long term maintenance contract can be established to clean and maintain the solar panels in a roof array, and replace and repair any panels that became defective as well as maintain the electrical installation and inverters. (this is allowed for in the economic analysis)
4. If a ground array, then maintenance would be quoted separately as mowing and other services are required in addition to standard maintenance services.

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Appendix A – Suggested location of fixture of solar panels

Site :- Apple Sauce Co, Crn Fred Street and the New England Highway, Applethorpe Qld - Brief Desktop Analysis

The north facing roofs of the various warehouses on the site would conservatively accommodate 157 panels using custom racking. We have assumed the roofs are able to accept the required load. (Subject to survey)

**Numbers contained within the picture denote the possible location of solar panels.

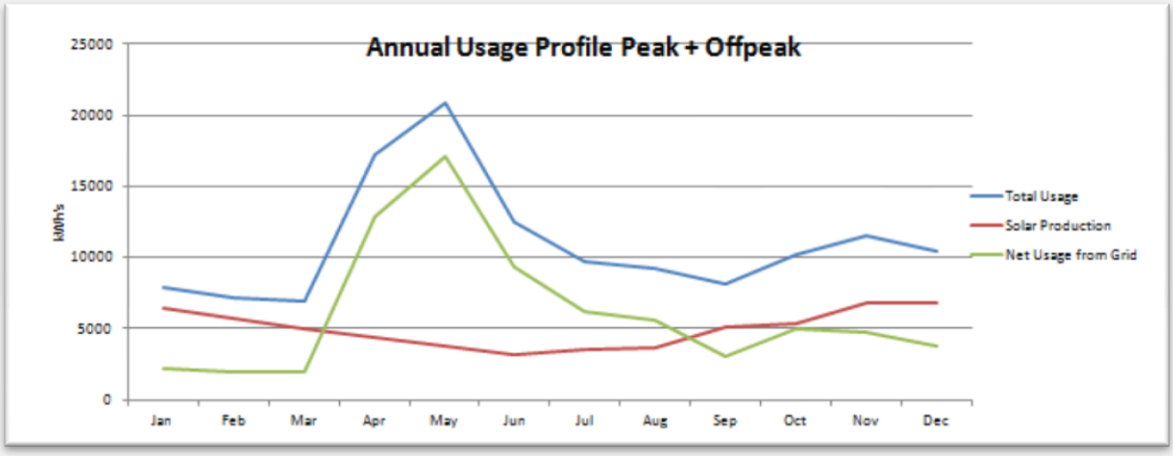
Appendix B - Site Analysis

In this analysis, a system size of 40KW was chosen as the optimum fit for both the available roof area, (see above), the amount of power consumed, and power usage profile for the site.
This was then plotted against the projected production of power from the solar panels, and the calculated net usage from the grid over a 7 day period. It shows that the system could potentially overflow onto the grid at peak times, in Oct- Feb (highest sun hours) but with a backflow shunt in place, before the meter, would stop this from happening. Most of the overflow happens on the weekend.
A data file from the Bureau of Meteorology http://www.bom.gov.au/climate/data/ was obtained to ascertain the average sun hours for Apple Sauce Co, Applethorpe in 2011. These were as follows:

Year	2011	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Sun Hours	5.44	6.94	6.81	5.42	4.81	4.06	3.50	3.78	3.89	5.67	5.69	7.50	7.28

The annual usage was taken from the bills as provided from July 11- June 12 from Apple Sauce Co. These were then plotted against the average sun hours for the month shown beside the table. The net solar line is used to define the resultant net usage pattern from the grid.

Total usage in blue and new usage plotted in green.



Appendix C – Average data used for economic analysis (Sample over 12 months)

a. Current Average grid usage over a sample average week

Data shown is the usage in kWh over 1 year, derived from bills as provided.

Total kWh Per Month	Peak	Shoulder	Offpeak	Total
Jan	3941	0	3994	7935
Feb	3591	0	3592	7183
Mar	3466	0	3404	6870
Apr	7410	0	9826	17236
May	9549	0	11279	20828
Jun	7234	0	5302	12536
Jul	4780	0	4941	9721
Aug	4780	0	4492	9272
Sep	4720	0	3441	8161
Oct	5291	0	4942	10233
Nov	5874	0	5643	11517
Dec	5301	0	5194	10495
Per Annum	65937	0	66050	131987

b. Current Average solar production over a sample average year

Data shown is the average sample solar production over 1 year, from a 40KW system with the average sun hours changing per month per the BOM results.

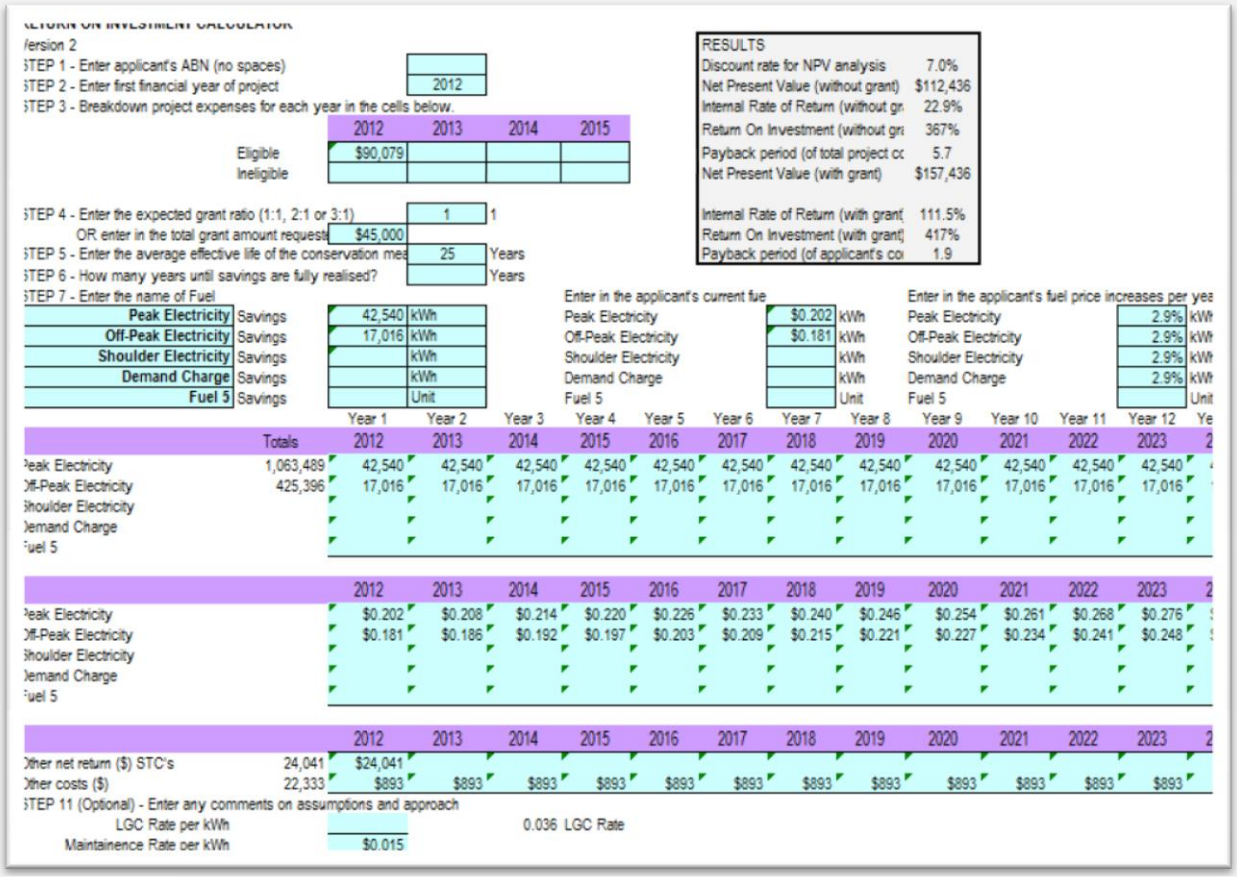
Solar Production kWh	Peak	Shoulder	Offpeak	Total
Jan	4617	0	1847	6464
Feb	4087	0	1635	5722
Mar	3601	0	1441	5042
Apr	3092	0	1237	4329
May	2696	0	1079	3775
Jun	2252	0	901	3153
Jul	2512	0	1005	3516
Aug	2586	0	1034	3620
Sep	3646	0	1458	5104
Oct	3786	0	1514	5300
Nov	4826	0	1930	6756
Dec	4839	0	1936	6774
Per Annum	42540	0	17016	59555

c. Net usage over a year based on current usage less solar production

Data shown is net grid consumption, less the production from a 40KW system .

Net Usage from Grid kWh	Peak	Shoulder	Offpeak	Total
Jan	0	0	2147	2147
Feb	0	0	1957	1957
Mar	0	0	1963	1963
Apr	4318	0	8589	12907
May	6853	0	10200	17053
Jun	4982	0	4401	9383
Jul	2268	0	3936	6205
Aug	2194	0	3458	5652
Sep	1074	0	1983	3057
Oct	1505	0	3428	4933
Nov	1048	0	3713	4761
Dec	462	0	3258	3721
Per Annum	24705	0	49034	73739

Appendix D – Return on Investment Calculator used for economic analysis



RETURN ON INVESTMENT CALCULATOR

Version 2

STEP 1 - Enter applicant's ABN (no spaces)

STEP 2 - Enter first financial year of project: 2012

STEP 3 - Breakdown project expenses for each year in the cells below.

	2012	2013	2014	2015
Eligible	$90,079			
Ineligible				

STEP 4 - Enter the expected grant ratio (1:1, 2:1 or 3:1): 1 (1)

OR enter in the total grant amount request: $45,000

STEP 5 - Enter the average effective life of the conservation mea: 25 Years

STEP 6 - How many years until savings are fully realised? Years

STEP 7 - Enter the name of Fuel

				Enter in the applicant's current fue			Enter in the applicant's fuel price increases per yea	
Peak Electricity	Savings	42,540	kWh	Peak Electricity	$0.202	kWh	Peak Electricity	2.9% kWh
Off-Peak Electricity	Savings	17,016	kWh	Off-Peak Electricity	$0.181	kWh	Off-Peak Electricity	2.9% kWh
Shoulder Electricity	Savings		kWh	Shoulder Electricity		kWh	Shoulder Electricity	2.9% kWh
Demand Charge	Savings		kWh	Demand Charge		kWh	Demand Charge	2.9% kWh
Fuel 5	Savings		Unit	Fuel 5		Unit	Fuel 5	Unit

RESULTS

Discount rate for NPV analysis	7.0%
Net Present Value (without grant)	$112,436
Internal Rate of Return (without gr	22.9%
Return On Investment (without gr	367%
Payback period (of total project co	5.7
Net Present Value (with grant)	$157,436
Internal Rate of Return (with grant	111.5%
Return On Investment (with grant	417%
Payback period (of applicant's co	1.9

	Totals	Year 1 2012	Year 2 2013	Year 3 2014	Year 4 2015	Year 5 2016	Year 6 2017	Year 7 2018	Year 8 2019	Year 9 2020	Year 10 2021	Year 11 2022	Year 12 2023	Ye 2
Peak Electricity	1,063,489	42,540	42,540	42,540	42,540	42,540	42,540	42,540	42,540	42,540	42,540	42,540	42,540	
Off-Peak Electricity	425,396	17,016	17,016	17,016	17,016	17,016	17,016	17,016	17,016	17,016	17,016	17,016	17,016	
Shoulder Electricity														
Demand Charge														
Fuel 5														

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2
Peak Electricity	$0.202	$0.208	$0.214	$0.220	$0.226	$0.233	$0.240	$0.246	$0.254	$0.261	$0.268	$0.276	
Off-Peak Electricity	$0.181	$0.186	$0.192	$0.197	$0.203	$0.209	$0.215	$0.221	$0.227	$0.234	$0.241	$0.248	
Shoulder Electricity													
Demand Charge													
Fuel 5													

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2
Other net return ($) STC's	24,041	$24,041												
Other costs ($)	22,333	$893	$893	$893	$893	$893	$893	$893	$893	$893	$893	$893	$893	

STEP 11 (Optional) - Enter any comments on assumptions and approach

LGC Rate per kWh: 0.036 LGC Rate

Maintainence Rate per kWh: $0.015