Food Processing and Packaging Facility at Part lot 2304, Templar Road, Erskine Park

Greenhouse Gases & Energy Efficiency Report

Report No S.CIP-0103-R001
Date 30 July 2013

engineering sustainable environments

REPORT AUTHORISATION

PROJECT: **FOOD PROCESSING AND PACKAGING FACILITY AT PART LOT 2304, TEMPLAR ROAD, ERSKINE PARK**
GREEN HOUSE GASES AND ENERGY EFFICIENCY REPORT

REPORT NO: **S.CIP-0103-R01**

Date	Rev	Comment	Prepared by	Checked by	Authorised by
16-06-2013	A	Preliminary	MCC	AGG	AM
25-07-2013	B	Revised preliminary	AGG	JTK	AM
30-07-2013	C	Issue for EIS Submission	MCC	PJ	AM

Sydney Office
L7, 657 Pacific Highway
St Leonards NSW 2065
Australia
Tel: +61 2 9431 9431
Fax: +61 2 9437 3120
Email: ulsyd@umowlai.com.au
Web: www.umowlai.com.au
ABN: 99 150 174 782

Melbourne Office
10 Yarra Street
South Yarra VIC 3141
Australia
Tel: +61 3 9249 0288
Fax: + 61 3 9249 0299
Email: ulmelb@umowlai.com.au
Web: www.umowlai.com.au
ABN: 29 143 564 738

Brisbane Office
123 Charlotte Street
Brisbane QLD 4000
Australia
Tel: +61 7 3210 1800
Fax: +61 7 3210 1799
Email: ulbris@umowlai.com.au
Web: www.umowlai.com.au
ABN: 91 142 668 773

EXECUTIVE SUMMARY

The intent of this report is to highlight energy efficiency initiatives that will be incorporated in the proposed Food Processing and Packaging Facility at part Lot 2304, Templar Road, Erskine Park, NSW.

The facility has been assessed against the following standards:

- Design brief documentation package;
- Industry standard operational patterns; and
- Building Code of Australia (BCA) section J.

The proposed facility is to be designed to operate 24 hours per day, 7 days per week. Due to the nature of activities in the development, the facility is considered a high intensity energy using site. Hence, it is required to report its energy efficiency, as well as green house gas emissions, as part of meeting the Director General's reporting requirements.

The development is predicted to have a total annual energy consumption of 34.2 Giga Watt Hours (GWhrs). This compares to a predicted benchmark energy consumption of 36.9 GWhrs for an equivalent benchmark facility that is Designed to Satisfy (DTS) the Building Code of Australia (BCA) Section J requirements.

The facility is predicted to have total green house gases emissions of 24,008 tonnes of CO2-e per annum.

The tenant will commit to submitting an Energy Savings Action Plan and annual report detailing the progress of the Plan. The annual report will outline energy consumption for a defined 12 month period and reports the status of actions and measures identified in the plan. These plans have been developed as per the guidelines issued by Department of Energy, Utilities and Sustainability.

The energy management action plan will comprise the following sections;

- Template 1 – Baseline Energy use
- Template 2 – Management Review
- Template 3 – Energy Management Actions; and
- Template 4 – Energy Savings Measures

CONTENTS

1.0 INTRODUCTION

The intent of this report is to highlight proposed energy efficiency initiatives to be incorporated in the proposed Food Processing and Packaging Facility at part Lot 2304, Templar Road, Erskine Park, NSW.

In addition to initiatives contributing to the facility's energy efficiency, the report also includes a holistic energy efficiency strategy for the site, as well as reporting the predicted greenhouse gases emissions in line with the Director General's Requirements.

1.1 PROJECT DESCRIPTION

The project scope includes the design and construction of a multi species food processing and packaging facility and forms part of the strategic plan to develop best practice facilities to deliver a transformed meat offer to its customers.

The facility will comprise of the following areas;

- Red meat packaging areas;
- Chicken packaging areas;
- Mince packaging areas;
- Product sorting and dispatch areas;
- Supporting services areas; and
- Office and amenities areas.

1.2 REPORT LIMITATIONS

Due care and skill has been exercised in the preparation of this report.

This report is intended as a guide to illustrate the energy efficiency features to be considered in the development. It should be read in conjunction with the other design documentation and specific applications may vary during the development of the project.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Umow Lai for detailed advice which will take into account that party's particular requirements.

2.0 GENERAL OVERVIEW

The meat packaging industry is one of the largest sectors within Australia's food and beverages industry.

Energy efficiency is being adopted by industries world-wide as a means of improving environmental performance and reducing costs. Meat packaging facilities consume energy in: product processing; monitoring and testing; cleaning; and packing.

Process equipment and refrigeration are generally the most energy intensive activities in meat processing facilities. Other areas with scope to save energy include air conditioning systems, hot water/ water heater systems and lighting.

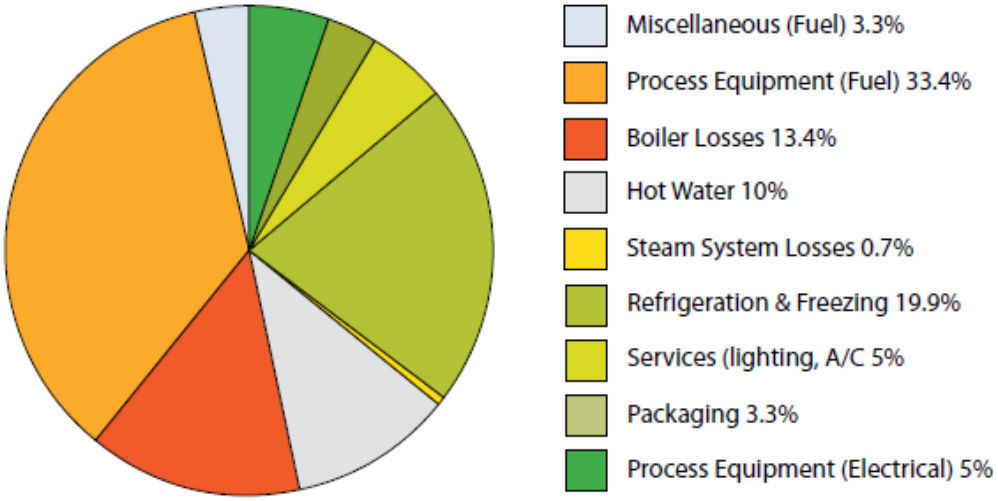
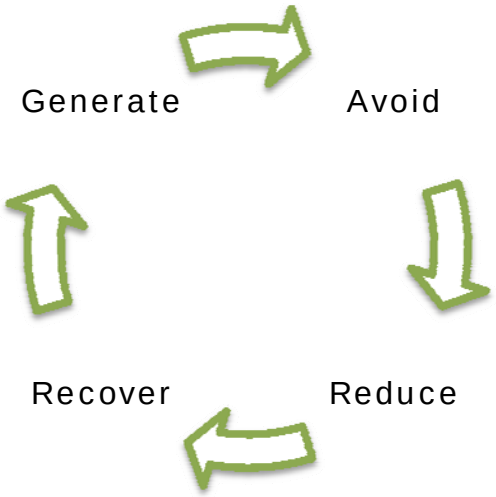


Figure 1 *Energy consumption in meat products manufacturing industry*

The figure below provides a general energy management strategy that will form a key factor in the design and operation of the facility;



3.0 BENCHMARK DEVELOPMENT FOR ASSESSMENT

3.1.1 Building Code of Australia (BCA Section J)

The facility is of BCA Class 8 - A laboratory, or a building in which a handicraft or process for the production, assembling, altering, repairing, packing, finishing, or cleaning of goods or produce is carried on for trade, sale or gain and is in Climate Zone 6.

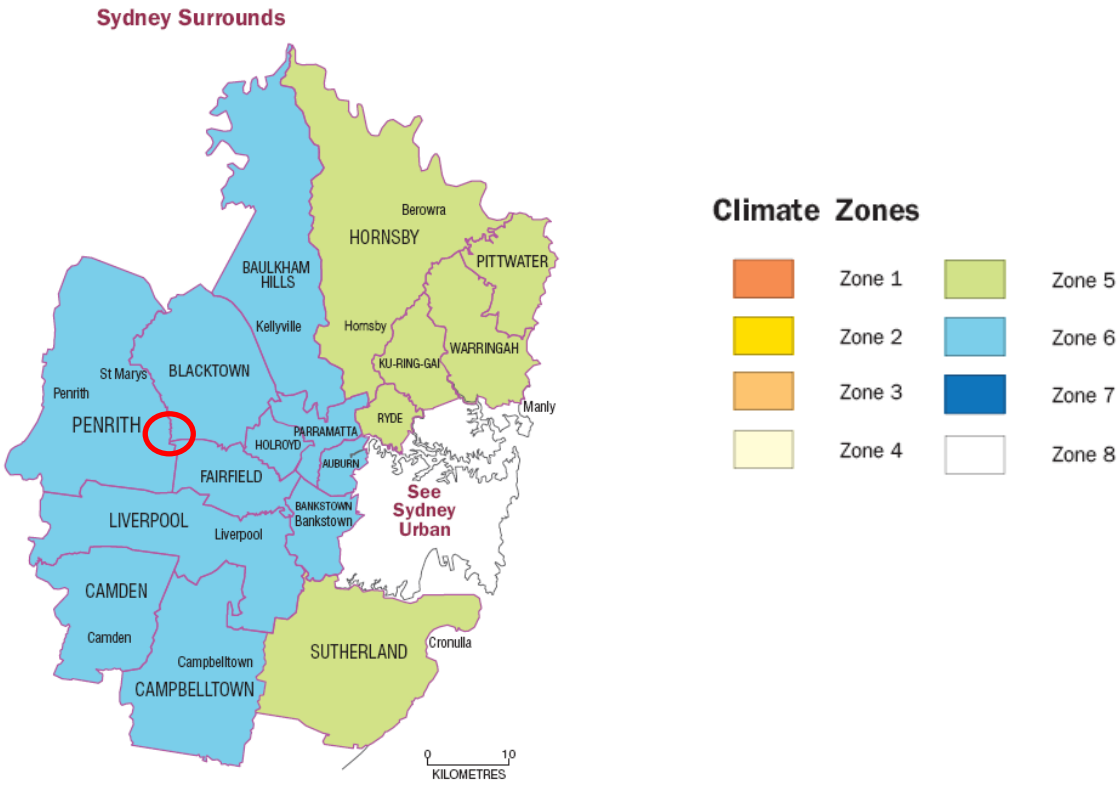


Figure 2 *Map of BCA Climate Zones for NSW.*

As Section J of the Building Code of Australia is a mandatory compliance criteria for the design of new facilities, it introduces a minimum level of energy efficient performance in the facility. This specifically relates to:

Part J1	**Building Fabric** The building envelope must meet minimum total R-Value requirements
Part J2	**Glazing** Aggregate air-conditioning value attributable to glazing must not exceed nominated allowances
Part J3	**Building Sealing** Sealing requirements for chimneys, flues, exhaust fans, building elements, windows and doors
Part J4	**Not applicable**
Part J5	**Air-conditioning and Ventilation Systems** Requirements for air-conditioning and ventilation systems
Part J6	**Artificial Lighting and Power** Requirements for lighting and power energy consumption
Part J7	**Hot Water Supply and Swimming Pool and Spa Pool Plant** Minimum requirements for hot water systems, swimming pools and spas
Part J8	**Access for Maintenance and Facilities for Monitoring** Maintenance requirements and monitoring of energy consumption for larger buildings

Table 1 *BCA Section J Energy Efficiency*

All of the above parts have been considered in the design. The proposed facility meets the minimum requirements of the BCA.

4.0 ENERGY EFFICIENCY MEASURES

4.1 PROPOSED EFFICIENCY FEATURES

The following efficiency initiatives will be included in the development of the proposed food processing and packaging facility.

4.1.1 Solar boost for Non Process Hot Water Generation

Solar boosted hot water generation is proposed for the generation of Hot Water for non process uses such as the staff kitchen and staff ablutions. Solar hot water generation is well suited to this development due to ample roof space and access to sunlight.

Figure 3 *Solar Hot Water Roof Mounted Collectors*

4.1.2 Heat Reclaim from Refrigeration and Compressed Air Plants

Heat rejection systems drawing waste heat from Refrigeration and Compressed Air plants will be incorporated, providing a significant contribution to the hot water required for regular washdown of process areas.

4.1.3 High-efficiency Refrigeration and Air Compressors

High-efficiency refrigeration and compressed air plant equipment systems will be specified incorporating variable speed drives and automatic timing systems. Plant will be sized to ensure that sufficient condenser capacity is available to operate efficiently.

Further consideration to the detailed layout of services includes positioning equipment and heat exchangers for refrigeration systems away from heat sources, where cool fresh air is available will maximise efficiency.

4.1.4 Water Boiler Efficiency

Water Boilers shall be specified to achieve operating efficiency over 80%.

4.1.5 Insulate water heaters, hot water heaters, steam condensate and other pipe work

All hot water plant and pipework will be insulated to minimise heat loss.

4.1.6 Minimise air flow into cool rooms

The design of the facility will consider minimising air flow into cool rooms by maintaining seals around cool room doors and installing rapid roller doors or air locks with inter-locked doors.

4.2 ENERGY CONSUMPTION - BENCHMARK VS. PROPOSED

Energy consumption for the various facility components has been projected for both a benchmark and the proposed facility.

The development is predicted to have a total annual energy consumption of **34.2 Giga Watt Hours** (GWhrs). The table below provides a breakdown of the predicted energy consumption.

Description	Benchmark Facility; Energy Consumption DTS compliant Facility (kWhrs) / Annum	Proposed Facility; Energy consumption including efficiency measures (kWhrs) / Annum
Processing Equipment – Based on the sum of processing equipment loads with variant motor diversities operating	11,951,465 kWhrs	11,951,465 kWhrs
Processing Hot Water – **Benchmark:** Based on a daily demand of 426 kL/day, and water heaters with total heating capacity of 2,400 kWs serving a 75kL hot water storage tank, 90% efficiency and a diversity factor of 50% **Proposed facility:** Energy saving met via heat recovery from refrigeration and compressed air plants.	11,680,000 kWhrs	9,110,400 kWhrs
Refrigeration – Based on the sum of refrigeration load for the facility, standard energy efficiency rating of 3.5 for compressors, diversity factor of 65%	7,688,852 kWhrs	7,688,852 kWhrs
Heating Ventilation & Air Conditioning (HVAC) – Based on 120 W/m^2 of air conditioning for offices and amenities, efficiency as per BCA Section J requirements, A sum of ventilation loads for the facility with fan motor power consumption of 0.5W/m^2	2,215,486 kWhrs	2,215,486 kWhrs
Lighting – Based on BCA Section J lighting illumination power densities	1,483,992 kWhrs	1,483,992 kWhrs

Description	Benchmark Facility; Energy Consumption DTS compliant Facility (kWhrs) / Annum	Proposed Facility; Energy consumption including efficiency measures (kWhrs) / Annum
Domestic Hot Water – **Benchmark:** Based on Domestic Hot water heating requirements for a total daily demand of 1,454 L/Day **Proposed facility:** Energy saving met via solar boost	296,490 kWhrs	177,894 kWhrs
Miscellaneous – Based on a miscellaneous load of 10W/m2 for the entire facility	1,576,800 kWhrs	1,576,800 kWhrs
Total Energy Consumption	**36.9 GWhrs** 24.91 GWhrs (Electricity) 11.98 GWhrs (Gas)	**34.2 GWhrs** 24.91 GWhrs (Electricity) 9.29 GWhrs (Gas)

Table 2 *Current design and energy efficiency measures*

The figure below provides a breakdown of the predicted energy consumption;

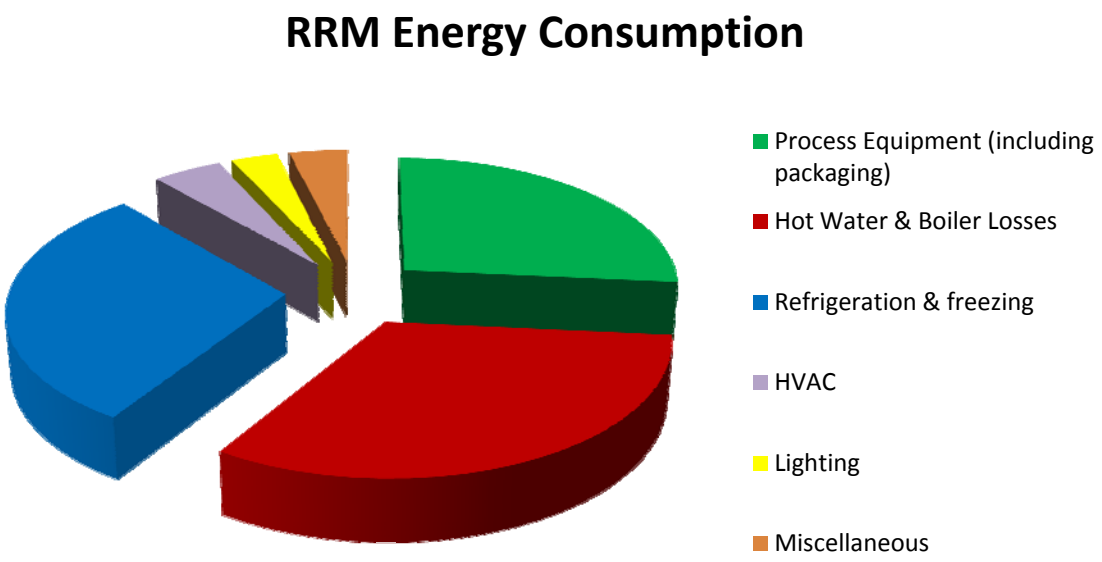


Figure 3 *Predicted Energy consumption in the RRM facility*

5.0 GREENHOUSE GASES – CURRENT FACILITY DESIGN

5.1 OVERVIEW

As part of meeting the Director General's Requirements, an assessment of greenhouse gases associated with the operation of the building's operation was undertaken. This assessment has been undertaken as per the requirements of the Australian Greenhouse Office Factors and Methods Workbook (December 2006).

5.2 DEFINITIONS & METHODOLOGY

The Green House Gas (GHG) Protocol defines three 'scopes' of emission categories:

- **Scope 1** – covers direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes;
- **Scope 2** – covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope; and
- **Scope 3** – includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation.

In accordance with the Australian Greenhouse Office Factors and Methods Workbook (December 2006), the assessment has covered scopes 1 & 2 greenhouse gas emissions of the development.

5.3 GREENHOUSE GASES CALCULATIONS

5.3.1 Fuel combustion emissions (Electricity)

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in kWh, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 2, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 2.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = 24,916,595 kWhrs x 0.893 / 1000

= **22,250 tonnes of CO2-e per annum**

5.3.2 Fuel combustion emissions (Gas)

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in GJ, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 1, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 1.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = (9,290,000 kWhrs x 3.6 / 1000) x 51.7 / 1000

= 1,729 tonnes of CO2-e per annum

5.3.3 Synthetic Gases (refrigerants)

The following formula can be used to estimate greenhouse gas emissions from the use of synthetic gases:

GHG emissions = Q x GWP / 1000

Where;

Q = total amount of refrigerant used x annual loss rate (to estimate annual refrigerant charge)

GWP = Global warming potential

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = (200 kg of R410a x 8.5% loss rate) x 1725 / 1000

= **29 tonnes of CO2-e per annum**

5.4 TOTAL GREEN HOUSE GASES

Based on the above, the facility will have total greenhouse gases emissions of **24,008 tonnes of CO2-e per annum.**

6.0 GREENHOUSE GASES – DESIGN WITH EFFICIENCY MEASURES

6.1.1 Fuel combustion emissions (Electricity)

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in kWh, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 2, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 2.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = 24,916,595 kWhrs x 0.893 / 1000

= **22,250 tonnes of CO2-e per annum**

6.1.2 Fuel combustion emissions (Gas)

The following formula can be used to estimate greenhouse gas emissions from the combustion of each of fuel:

GHG emissions (t CO2-e) = Q x EF / 1000

Where:

Q (Activity) is the electricity consumed by the reporting organisation expressed in GJ, and

EF is the emission factor (CO2-e) obtained from the AGO workbook

Emission factors are reported for scope 1, scope 3 and the full fuel cycle. As scopes 1 and 2 only are required, the GHG have only been calculated for scope 1.

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = (9,288,294 kWhrs x 3.6 / 1000) x 51.7 / 1000

= **1,728 tonnes of CO2-e per annum**

6.1.3 Synthetic Gases (refrigerants)

The following formula can be used to estimate greenhouse gas emissions from the use of synthetic gases:

GHG emissions = Q x GWP / 1000

Where;

Q = total amount of refrigerant used x annual loss rate (to estimate annual refrigerant charge)

GWP = Global warming potential

Based on the above formula, the GHG are estimated to be the following;

GHG Emissions (**t CO2-e)** = (200 kg of R410a x 8.5% loss rate) x 1725 / 1000

= **29.3 tonnes of CO2-e per annum**

6.2 TOTAL GREEN HOUSE GASES

Based on the above, by including energy efficiency measures the facility will have total greenhouse gases emissions of **24,008 tonnes of CO2-e per annum.**

Therefore, the facility will reduce its emission of greenhouse gases into the atmosphere by 501 **tonnes of CO2-e per annum.**

The harmful effects of presence of greenhouse gasses in atmosphere are global warming, climate change, ozone depletion, sea level rise, adverse effects on biodiversity etc. One way or another these adverse impacts are all directly or indirectly related to the presence of greenhouse gases in the atmosphere. A number of human activities, processes and consumptions produce waste gasses or greenhouse gasses that are harmful to the environment. The reduction in energy consumption from energy efficiency measures will reduce the emission of greenhouse gases into the atmosphere.

7.0 ENERGY SAVINGS ACTION PLAN

The proposed facility is designed to operate 24 hours per day, 7 days per week. Due to the nature of activities in the development, the facility is considered a high intensity energy using site. As a result, energy savings action plans are required to be submitted on an annual basis, as required by the Director General's Requirements. These plans have been developed as per the guidelines issued by DEUS.

The tenant is committing to carrying out a review of the environmental performance of the facility. This review is to identify opportunities for improvement in environmental performance, in relation to energy savings and greenhouse gas reduction opportunities, and provide an energy management action plan to be utilised in the operation of the facility.

The tenant will also commit to submitting an energy savings action plan and annual report detailing the progress of the Plan. The annual report will outline energy consumption for a defined 12 month period and report the status of actions and measures identified in the plan.

This review will be based on the 'Guidelines for Energy Savings Action Plans'. There are a number of tasks identified in these Guidelines:

- Gather 12 months of energy usage data to identify existing baseline energy use;
- Involve senior management levels at the outset to gain commitment to, and understanding of, the requirements for Energy Savings Action Plans;
- Determine how energy is used. It will help assess what appliances and processes are consuming energy, and will facilitate the assessment of energy utilisation and opportunities for improvement;
- Put the Energy Savings Action Plan Together; and
- Implement and Review Energy Savings Action Plans.

The energy management action plan will comprise the following sections:

- Template 1 – Baseline Energy Use;
- Template 2 – Management Review;
- Template 3 – Energy Management Actions; and
- Template 4 – Energy Savings Measures.

The following sections provide sample templates based on the plans.

TEMPLATE 1 – BASELINE ENERGY USE

Organisation name	
Address	
Baseline start date	
Baseline end date	
A = baseline energy use per annum (kWh)	
Greenhouse emissions	
Is baseline representative of normal energy use YES/ NO	
B = Impact of variation on energy use (i.e. variation from normal) kWh p.a.	
C = A-B baseline energy use corrected for variation (kWh)	
Business Activity Indicator	
D = Quantity of Site Business Activity Indicator p.a. (corrected for variations)	
E = C/D baseline energy use key performance indicator (KPI)	
Baseline KPI units	
Baseline summer peak electrical use (KVa)	
Baseline winter peak electrical use (KVa)	

TEMPLATE 2 – SAMPLE MANAGEMENT REVIEW

Area	**Review Area**	**Rating**				
		Low	**Moderate**	**Minimum Sustainable**	**Industry Leader**	**Best Practice**
A	Senior management commitment					
B	Understanding of energy savings potential					
C	Energy targets and key performance indicators					
D	Energy metering and monitoring					
E	Energy management reporting					
F	Energy supply management					
G	Operating and maintenance procedures					
H	Accountabilities for energy management					
I	Training and awareness procedures					
J	Compliance with legal and/or regulatory requirements					

TEMPLATE 3 – ENERGY MANAGEMENT ACTIONS

Proj No.	Energy Management Action	Planned Responsibility	Planned Completion Date	Actual Completion Date
1	Incorporate energy efficiency into the site environmental policies.	TBC	TBC	TBC
	Step 1. Review existing policy and prepare updated draft.	TBC	TBC	TBC
	Step 2. Gain approval and sign off by CEO.	TBC	TBC	TBC
	Step 3. Communicate changes to all staff	TBC	TBC	TBC
2	Implement an energy savings awareness program	TBC	TBC	TBC
	Step 1. Prepare tenancy information brochure	TBC	TBC	TBC
	Step 2. Staff meeting to advise energy savings awareness	TBC	TBC	TBC
	Step 3. Prepare awareness for service areas and plantrooms encouraging energy savings	TBC	TBC	TBC
3	Assign specific responsibility for energy efficiency to operation managers, including targets.	TBC	TBC	TBC
4	Prepare energy usage balance and Inventory	TBC	TBC	TBC
5	Calculate energy usage across site	TBC	TBC	TBC
6	Investigation of energy consumption at each metered point	TBC	TBC	TBC
7	Investigation of usage trends	TBC	TBC	TBC
8	Investigation of out of hours energy consumption	TBC	TBC	TBC
9	Implement action plan	TBC	TBC	TBC

TEMPLATE 4 - ENERGY SAVINGS MEASURES

Initiatives	Cost	Energy saving	Payback period