AUSTRALIAN MEAT PROCESSOR CORPORATION

AN ENERGY MANAGEMENT PLAN FOR RED MEAT PROCESSING FACILITIES

Project code:	AM12-5066 Domestic Processors Energy Effic Program
Prepared by:	Phuong Tang and Mike Jones Energetics Pty Ltd
Date Submitted:	April 2013
Date Published:	October 2013
Published by:	Australian Meat Processor Corporation Ltd

AUSTRALIAN MEAT PROCESSOR CORPORATION
T (02) 9436 0042 F (02) 9436 0343 E AMPC@AMPC.COM.AU WWW.AMPC.COM.AU
Suite 205, Level 2, 460 Pacific Highway, St Leonards, NSW 2065 | PO Box 11, St Leonards, NSW 1590.

AMPC

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Suite 205, Level 2,
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TABLE OF CONTENTS

T (02) 9436 0042 F (02) 9436 0343 E AMPC@AMPC.COM.AU WWW.AMPC.COM.AU

INTRODUCTION

This document describes how to develop an Energy Management Plan (EMP) and is tailored for small to medium scale red meat processing facilities, which are defined as having a processing capacity of between 400 and 1,500 head per day. The document describes why an EMP is important, the steps to developing and EMP, and how to compare the energy performance of a facility against energy management best practice benchmarks and principles. A template EMP is also included in the Appendix and can be adapted to use at small to medium scale red meat processing facilities.

In addition to this EMP, two documents have been developed by Energetics on behalf of the Australian Meat Processor Corporation (AMPC) under the program entitled 'Domestic Processors Energy Efficiency Program (DPEEP)'. These documents include the 'Energy Consumption Guide for Small to Medium Scale Red Meat Processing Facilities' (Energetics, 2013) and the 'Literature review of Energy Efficiency Benchmarks and Technologies' (Energetics, 2013). These documents underpin the management concepts contained in the EMP by elaborating on the benchmarks developed through analysis of energy consumption patterns at the facilities surveyed under the DPEEP, in addition to the energy efficiency and renewable energy initiatives identified at these facilities.

WHY AN ENERGY MANAGEMENT PLAN IS GOOD FOR BUSINESS

An Energy Management Plan (EMP) contains management techniques to help managers to mitigate the risks associated with increasing energy costs, greenhouse gas emissions resulting from energy use, and consumer and community expectations relating to environmental performance of the business. When implemented successfully, an EMP can unlock significant opportunities to reduce energy costs, improve plant operation, maximize the operating life of energy consuming plant and equipment, reduce the environmental impact of business operation, empower employees to actively engage in energy efficiency, and improve brand image within the marketplace.

STEPS TO DEVELOPING AN ENERGY MANAGEMENT PLAN

An effective energy management plan can be developed by following five simple steps, including:

1. **Understanding your energy usage and cost**
   - Determine the site's baseline energy use by either:
     - adding up energy bills; or/and
     - undertaking engineering calculations of energy consuming equipment or processes (if you possess the skills and know-how to do this) utilising mains metering and sub-metering equipment; or/and
     - referring to output from the site's energy management software (if installed and accounts for all energy consuming end-uses).
2. **Review your energy management systems**
   - The energy management review is a structured assessment of the systems which are in place for managing energy.

- Involve all levels of management, including financial, operations, maintenance and health, safety and environment.
- Key areas to include in the review are:
  - Who is accountable for energy management at the facility?
  - Are any senior managers involved in energy management?
  - Has an energy assessment been done?
  - Is there any energy monitoring or reporting done?
  - Are there any energy training and awareness procedures for staff?

3. Develop an energy management improvement plan

- Based on the energy management review, identify and assess actions needed to improve the management systems that are currently in place for managing energy.
- Include in the improvement plan:
  - The specific energy management action;
  - Manager responsible for implementing the action;
  - Timeframe for implementing the action;
  - The planned evidence for the energy management action on completion.

4. Understand energy use and key opportunities

- Understand the key drivers of energy use by analyzing the facilities' energy use against factors such as: production level, electrical demand, operating hours, seasonal changes.
- Identify opportunities to reduce energy use by surveying the facility's energy using equipment and conducting a brainstorming session with key technical staff.
- Calculate the costs and benefits of the energy efficiency opportunity, including details on:
  - Opportunity description;
  - Estimate of savings in energy use (in kWh and/or GJ), operating costs;
  - Capital cost estimate;
  - Payback period.
- Prioritise the opportunities.

5. Implement and track energy improvements

- Create an energy savings action plan, assign responsibilities and set energy performance targets.
- Implement and review the energy savings action plan.
- Continuously integrate energy management into your business through behavior and organisational changes.

Achieving best practice in energy management is a continuous process and some businesses are more advanced than others. A graphical representation of the various energy management adoption levels is shown in Figure 1.

Traditionally, businesses with limited available skills and resources focused on cost-cutting and compromised energy efficiency for other core or critical business functions. However, the emergence of some influential drivers such as the Carbon Pricing Mechanism, fluctuating energy prices and increasing consumer awareness and expectations for environmental performance of the red meat supply chain, red meat processing businesses of all sizes are making a concerted effort to improve energy efficiency and reduce the overall environmental impact of their operations.

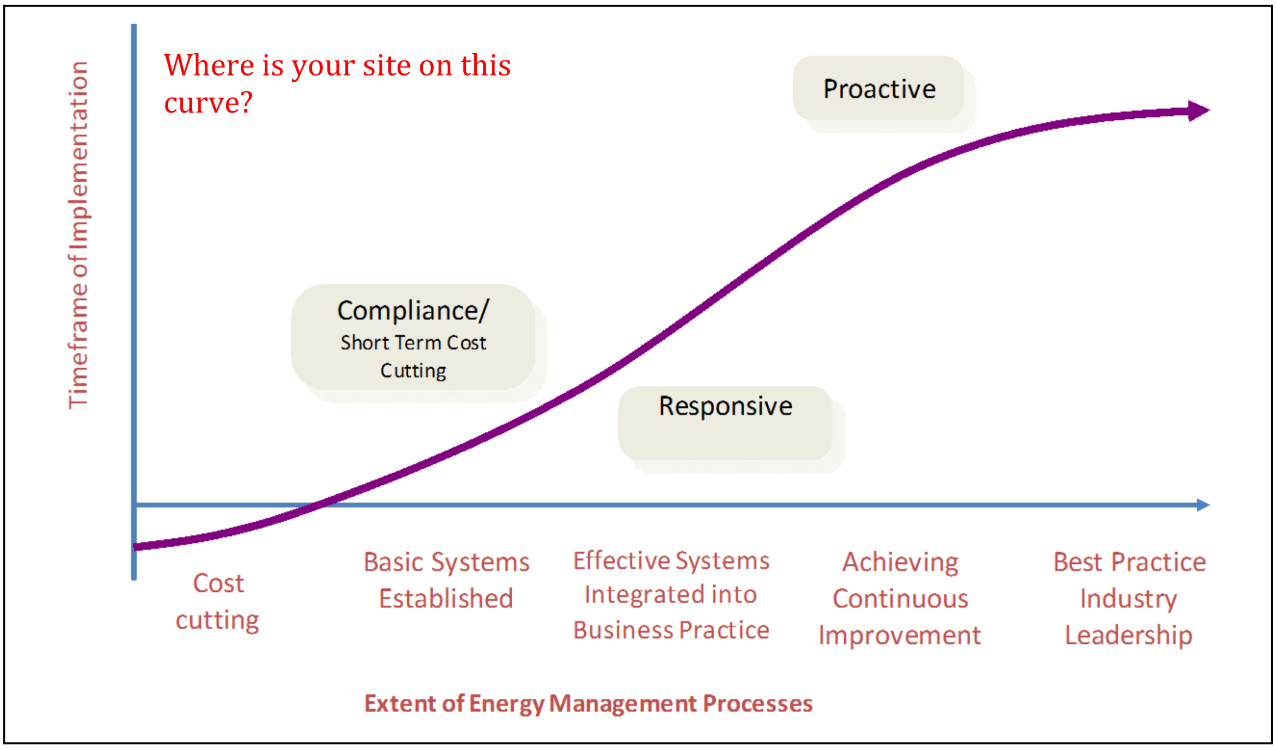


Figure 1: Energy management adoption curve

HOW TO CALCULATE YOUR ANNUAL ENERGY CONSUMPTION

CALCULATE ENERGY USAGE

The first step in managing your energy consumption is to calculate the monthly and annual energy used on site. The information required includes:

- Monthly gas bills (amount in GJ) and/or metered consumption.
- Electricity bills (total electricity use in kilowatt hours) and/or metered consumption.
- Other Fuel invoicing or metering.

UNDERSTAND THE ENERGY USE BREAKDOWN BY PROCESS OR EQUIPMENT

The information required to calculate the energy breakdown by equipment or processes includes:

Stationary heating fuel use (for example, gas, coal and oil):

- Type, age and heating capacity/rating of the stationary heating equipment to allow estimate of efficiency.
- Major hot water and steam process device ratings (GJ).
- Operating hours for each stationary heating device.

Electricity use:

- Equipment (motors and other devices) kW rating (apply a factor to estimate load) or kW load.
- Typical running load (%). This is an estimate of how heavily loaded the equipment is. For instance a pump may not be pumping at its full capacity or a fan maybe not running at full speed.
- Typical utilisation factor (%) or Equipment operating hours per year. This is an estimate of how much the equipment is operating. For instance a pump may run only 50% of the day.

Example A: Calculating the refrigeration load

A red meat processing facility has a large cold store which draws significant electricity, even when the load is low. The site plans to install variable evaporator fans, so that the fan speed will now suit the load and therefore reduce the overall power consumption.

Energy consumption of existing system is 370,000 kWh/year

Energy consumption of improved system with variable evaporator fans is 80,000 kWh/year

Energy savings 370,000- 80,000 = 290,000 kWh/year

Assuming electricity costs of $0.2/kWh, the energy cost savings = 290,000 x 0.2 = $58,000 per annum

Example B: Calculating the lighting load

There are 70 x 400W high bay lights installed throughout the meat processing site. The measured (or estimated based on the lighting spec sheet) load on each light is 452W and the typical utilisation is 95%. The site operates 12 hours a day, 5 days week and 50 weeks of the year.

The site operates = 12 x 5 x 50 = 3,000 hours per year

The lighting load = 70 x 452 x 0.95 x 3,000 = 90,174,000 watt hours (Wh) per year, or 90,174 kilowatt hours (kWh) per year

The lighting load in GJ = 90,174 x 3.6 / 1000 = 325 GJ per year

The site pays an average electricity price of 16 c/kWh and the cost of running the lights is

90,174 kWh x 16 c/kWh = 1442784 c = $14,428 p.a.

If the site's total electricity use is 4,000,000 kWh, the lighting load is ~ 2%.

ASSESSING YOUR LEVEL OF ENERGY MANAGEMENT

Use the checklist below to assess your level of energy management.

1. COST CUTTING

- ☐ There is a combination of old and new equipment and technologies
- ☐ Operations have grown in size to meet increased production levels
- ☐ Staff have little experience and knowledge in energy management
- ☐ There is no coordinated approach to reducing energy costs

Example

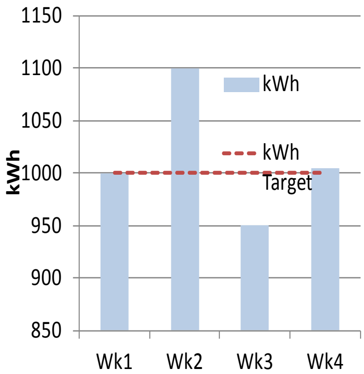
The refrigeration system and the air compressor on site are over 30 years old. The equipment is regularly maintained. When the equipment fails, it is usually replaced on a '*like for like*' basis. An assessment of the cost and benefits of an upgrade has not been done. There are no energy reduction targets and energy costs are rarely discussed at production meetings.

2. AWARE

- ☐ Energy use is monitored on a monthly basis
- ☐ The major energy using equipment and processes have been identified (e.g. refrigeration is responsible for 50% of electricity consumption)
- ☐ Energy costs are reviewed during production/management meetings
- ☐ The site engineer has undergone some energy training

Example

A red meat processing site uses 3,000 GJ of energy and spends over $100,000 on energy costs. An energy audit was conducted a few years ago.



During production meetings, monthly energy bills are reviewed against production levels. In one of the meetings, the team noticed a higher than average electricity bill. This was due to a high electrical load due to an incorrect set point on the refrigeration system. The site immediately corrected this set point.

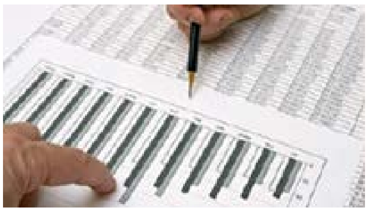
- ☐ Frequent energy reports are created for staff and management
- ☐ Major energy using equipment are sub-metered and monitored (e.g. refrigeration and boiler systems)
- ☐ All staff have received basic energy training

3. BASIC SYSTEMS ESTABLISHED

- Specialist energy and technology contractors are used where required
- There is a list of energy efficiency opportunities (under investigation and implemented) on site
- There is an equipment replacement and maintenance schedule for major energy using equipment

Example

Site A has a good awareness of energy use and has basic energy management systems in place.



The site engineer has an understanding of energy tariffs and energy efficient equipment. The engineer has received training to be able to identify energy saving opportunities in the refrigeration, boiler and compressed air systems.

The site manager maintains a list of energy efficient opportunities with calculated payback. This list is used to assess if equipment needs replacement.

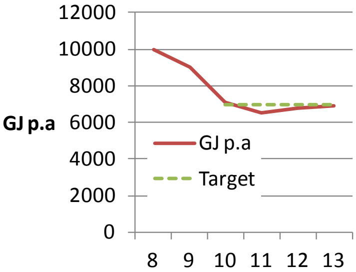
The next step for this site is to set energy targets and develop a long term energy plan.

4. EFFECTIVE SYSTEMS INTEGRATED INTO BUSINESS

- Short (less than 1 year) and long term (5 year) energy improvement targets are set
- There is an allocated budget for equipment replacement and energy efficiency projects
- All site staff are trained in energy management
- Energy reports are communicated and available to all staff

Example

Site A has been monitoring and assessing their energy use for several years. Many simple and low cost energy saving opportunities with less than 1 year payback have already been implemented (e.g. fixing compressed air leaks and upgrading to energy efficient lights).



The site has set a short term target to reduce total energy use by 15% over 2 years. An initial budget of $500,000 has been allocated to identify and implement energy efficiency projects. One of the projects involves upgrading the refrigeration system, which has a payback of 3 years and will reduce electricity costs by half.

Progress towards the energy targets are communicated in monthly energy reports to all staff.

5. ACHIEVING CONTINUOUS IMPROVEMENT

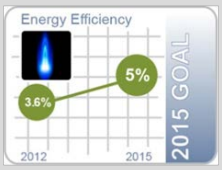
- ☐ The site is continuously looking for energy saving opportunities
- ☐ Management have energy performance targets and responsibilities
- ☐ Energy achievements and initiatives are communicated widely to customers and to other meat processing sites
- ☐ Alternative energy options are being assessed or implemented

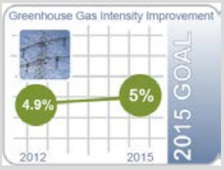
Example

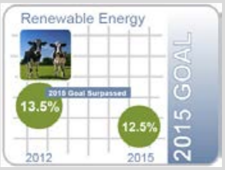
The site has achieved significant energy savings through their energy management program. All new capital projects now have energy criteria, which assesses the project against energy efficiency and takes into account increasing energy costs/tariffs.

The site has set energy targets and communicates their progress to all staff and customers. Customers have welcomed the improvements and sales have increased.

The site is now looking at alternative energy options to further reduce costs and reduce greenhouse gas emissions. One option they are investigating is to reclaim methane from the covered anaerobic lagoons to fuel the plant boilers.







Cargill

Case Study A: Cargill's energy management program leads to savings

Cargill Beef, one of North America's largest beef processors (almost 3.6 Million tonnes of boxed beef and by-products each year). On the energy management adoption curve, the company is at Level 4 (effective systems integrated into the business) by employing the following principles:

Establish and communicate your energy improvement goals.

Cargill has clear goals and commitment to reducing greenhouse gas emissions and energy use. The first environmental goals were set in 2001 and new goals are established every five years. The current goal is to improve energy efficiency to 5% by 2015. Progress towards these goals is reported on the company website and public annual reports.

T (02) 9436 0042 F (02) 9436 0343 E AMPC@AMPC.COM.AU WWW.AMPC.COM.AU

All site employees are engaged and informed.

Cargill has a global behaviour-based energy management (BBEM) system which encourages employees to integrate energy into daily actions to improve performance.

There is investment in energy efficient technology.

Cargill have invested in a variety of innovating energy improvement solutions. For example, at the beef and pork plants, Cargill reclaims biogas from the covered anaerobic lagoons and turns it into methane to fuel the plant boilers. Methane from Biogas now displaces 20-25 percent of natural gas demand at all eight of their U.S. meat processing plants, while reducing greenhouse gas (GHG) emissions by more than 1.3 million metric tons in the last four years.

Case Study B: Potential improvements at a small to medium sized facility

One of the small red meat processing facilities surveyed under the DPEEP (~10,000 tHSCW p.a) with on-site rendering highlighted the significant opportunities for cost savings by adopting energy management best practices. The audit identified where energy was used with refrigeration and hot water systems representing 15% and 75% of total energy use. The refrigeration compressor system was over 25 years old and required significant maintenance.

Energy saving opportunities identified during the audit included upgrading the compressor motors, glycol system and ammonia plant. Implementing these projects was estimated to save $200,000 in energy cost and 320 GJ of energy per annum (halving the refrigeration energy use). Other opportunities included replacing the steam boiler and recovering energy from the compressed air system.

Most opportunities identified had a payback of less than 5 years. Overall, by applying energy best practice and implementing these projects, the site could reduce energy use and cost by 25%.

ASSESSING YOUR ENERGY EFFICIENCY OPPORTUNITIES

BENEFITS OF ENERGY PROJECTS

There are numerous benefits that arise from energy saving projects other than energy savings and cost reductions. In some cases, the benefits can be difficult to quantify (for example, improved safety); however, they should still be mentioned and highlighted when assessing energy efficiency opportunities.

The checklist below provides guidance for identifying all the potential benefits of an energy project.

- ✓ Has the current energy consumption and operating cost of existing equipment been determined?
- ✓ Have projections been made for energy consumption, upfront cost and operating cost of new equipment?
- ✓ Have lifetime energy and maintenance savings comparisons been made for new versus old equipment?
- ✓ Have environmental benefits from less greenhouse gases emissions and heat discharge been taken into account?
- ✓ Have Energy Saving Certificates (ESCs) been applied to the project (for businesses in NSW and Victoria only)?
- ✓ Have all internal and external funding sources been considered?
- ✓ Have Renewable Energy Certificates (RECs) been applied to the project?

FINANCIAL TOOLS FOR EVALUATING PROJECTS

Three common methods to evaluate projects are:

1. Simple Payback method;
2. Net Present Value (NPV); and
3. Internal Rate of Return (IRR).

The Appendix provides details on using these methods to evaluate a project.

GRANTS AND FINANCIAL INCENTIVES

There are a number of State and Federal Government grants available for energy saving projects which may be applicable for red meat processing facilities.

FUNDING - THE CLEAN TECHNOLOGY INVESTMENT PROGRAM (CTIP) / CLEAN TECHNOLOGY FOOD AND FOUNDRIES INVESTMENT PROGRAM (CTFFIP)

The CTIP/CTFFIP supports Australian manufacturers to maintain their competitiveness in a carbon-constrained economy through investment in energy efficiency capital equipment and low pollution technologies, processes and products.

The CTIP/CTFFIP programs provide grant funding over a six year period from 2011-12 to 2017-18. A total of $800 million is available for general industry under the CTIP and $200 million for the food and foundries industry under the CTFFIP.

Refer to the AusIndustry website for further information:
http://www.ausindustry.gov.au/programs/CleanTechnology/CleanTechnologyInvestment/Pages/default.aspx

A number of small to medium scale red meat processing facilities have been successful in receiving grant offers under the CTFFIP. Three examples are provided below.

1. Cedar Meats will replace its boiler network with a new high efficiency boiler and heat exchanger. The project is expected to reduce the carbon emissions intensity of Cedar Meats' boiler system by 35% and result in savings of over $60,000 in energy costs per year. The project was $400K and they received a grant of $212K.

2. Afflick Abattoirs will install solar panels and upgrade their refrigeration system. The project is expected to reduce Afflick Abattoirs' site-wide carbon emissions intensity by 38% and result in savings of $44,000 in energy costs per year. The project was $224K and the grant was $111K.

3. E.C. Throsby will install a new high efficiency burner and PLC to an existing water tube boiler. The project is expected to reduce carbon emissions intensity of E.C. Throsby's boiler by 15% and result in savings of $46,000 in energy costs per year. The project was $116 K and the grant was $38K.

ENERGY SAVING CERTIFICATES - NSW ENERGY SAVINGS SCHEME (ESS)

Businesses can generate revenue from electricity saving projects by creating Energy Savings Certificates (ESCs). Under the ESS rules, one ESC represents one tonne of carbon dioxide saved through reductions in the consumption of electricity. The monetary value of one ESC is driven by the market and currently can range anywhere up to $34 per ESC.

Some projects such as lighting can be 'deemed' for 10 years. This means that the accrued monetary value of the certificates over the anticipated 10 year life of the project can be claimed upon project commissioning. This can significantly improve the economics of some projects such as lighting upgrades. Refer to the website for further information: http://www.ess.nsw.gov.au/Home.

ENERGY SAVING CERTIFICATES-VICTORIAN ENERGY EFFICIENCY TARGET (VEET) SCHEME

This scheme is similar to the NSW scheme and has only recently been introduced.

Refer to the website for further information: https://www.veet.vic.gov.au/Public/Public.aspx?id=Home.

CLEAN ENERGY FINANCE CORPORATION (CEFC)

The Australian Government announced that it will establish a $10 billion commercially oriented Clean Energy Finance Corporation (CEFC) as part of its Clean Energy Future Package

The objective of the CEFC is to overcome capital market barriers that hinder the financing, commercialisation and deployment of renewable energy, energy efficiency and low emissions technologies.

The Low Carbon Australia (LCA) is now linked to the CEFC. The LCA Energy Efficiency Program provides finance and advice to Australian businesses through innovative loan and lease arrangements to catalyse investment in take-up and use of technologies and practices for achieving cost-effective reductions in greenhouse gas emissions. Refer to the CEFC website for more details: http://www.cefcexpertreview.gov.au/content/Content.aspx?doc=home.htm.

OTHER

There are other funding schemes which are also applicable to meat processing sites. This includes the NSW OEH Sustainability Advantage Program which provides services such as subsidised energy audits. In addition, the Sustainability Victoria's Smarter Resources, Smarter Business Program provides various business and investment support.

Refer to the websites for more details:

http://www.environment.nsw.gov.au/sustainbus/sustainabilityadvantage.htm

http://www.sustainability.vic.gov.au/www/html/3528-smarter-resources-smarter-business-program.asp

OVERCOMING BARRIERS TO GOOD ENERGY MANAGEMENT

Although energy management best practices assist companies in reducing costs and their environmental impact, there may be barriers which prevent sites from implementing energy efficiency measures.

The potential barriers and best practice examples to overcome these barriers are detailed below.

Barrier	Energy management best practice checks
Lack of capital	☐ Identify available public funding sources such as the Clean Technology Investment Program and the Energy Efficiency Program. ☐ Consider available private funding sources such as private equity or third party ownership contracts such as Build, Own, Operate and Maintain (BOOM).
Projects not having the required payback or internal rate of return (IRR)	☐ Review electricity contracts and tariffs to ensure the business case includes the correct energy prices and considers future increases in energy cost. ☐ All available funding sources have been considered, particularly those with a lower cost of capital. ☐ Ensure the business case includes secondary financial benefits where applicable such as reduced maintenance costs, labour savings, improved product quality, etc.
Lack of time and human resources	☐ Involve and obtain support from external stakeholders such as suppliers, customers, industry associations (AMPC, MLA), specialist consultants for training and capability building purposes. ☐ Improved business systems to automate energy management practices where possible.
Staff awareness and training	☐ Report back to and discuss energy efficiency initiatives at regular meetings. ☐ Nominate energy champions and integrate energy into staff training programs.
Unsystematic approaches	☐ Establish an Environmental Management System (EMS). ☐ Hold regular team meetings with energy performance and reporting on the agenda and integrate into existing management meetings.
Lack of leadership or management support and difficulties in getting approval for projects	☐ Develop an attractive business case that effectively communicates the benefits to the business in a manner that appeals to the financial decision makers in the business. ☐ Develop an energy baseline to understand current energy use and costs. ☐ Develop management awareness, commitment and support for projects. ☐ Establish energy key performance indicators, targets and integrate energy management into the company strategy.

APPENDIX A – TEMPLATE ENERGY MANAGEMENT PLAN

The following appendix is an EMP template which a duly authorized and responsible employee at a small to medium meat processing business could adopt.

ENERGY MANAGEMENT PLAN FOR "XYZ" MEAT PROCESSING FACILITY

Prepared by: xxx

Date: DD/MM/YYYY

Table of Contents

SUMMARY

<Provide a short overview of the sites energy plan>

1. Specification of the energy plan targets and objectives
2. The baseline energy usage and energy intensity of the plant compared to meat industry standards
3. Top three to five high-potential energy savings areas/capital projects with estimated savings, incentives, capital costs and timelines
4. A brief outline of medium term strategic energy management activities planned
5. Communication strategy and employee awareness programs

INTRODUCTION

<Provide a short introduction of your site and energy plan>

XYZ Beef operates a meat processing plant and processed approx 10,000 tonnes of hot standard carcass weight in the financial year ending June 2012. During the same year, the plant consumed 8GWh of electricity and 40tonnes of LPG at a total cost of $1.1 million. The plant currently operates on a one shift per day basis, 5 days per week and 52 weeks per year. The plant has a significant refrigeration load due to its product range and storage requirements. Previously, there has been little formal attention to energy usage.

XYZ Beef values sustainable development and energy savings are seen as an important component of XYZ Beef's commitment to sustainable development. This plan is expected to identify significant opportunities to reduce electricity consumption to improve the efficiency of the operation and to reduce increasing energy costs.

This plan defines a new approach to energy management with the aim of reducing energy usage across the site by 10% over the next 3 years.

ENERGY POLICY

<Provide a short description of the sites energy policy.>

XYZ beef has a target of reducing energy usage across the site by 10% over the next 3 years.

ENERGY USAGE AND COST

<Describe the sites baseline energy usage.>

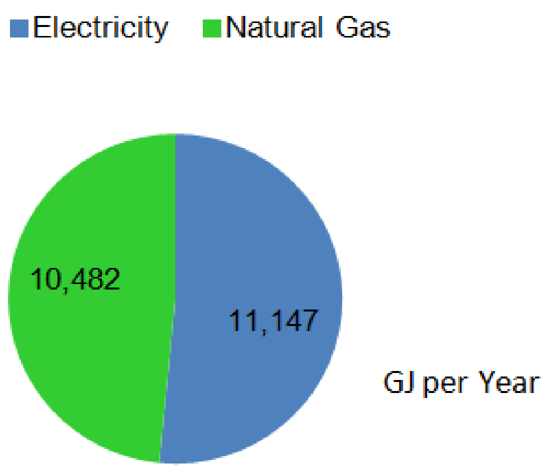
XYZ Beef has assessed the energy usage of the site for the period July 2011 to June 2012.

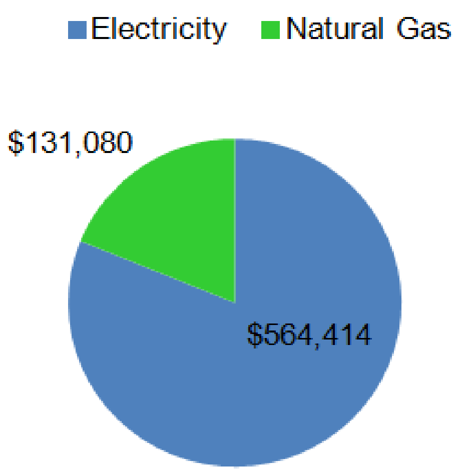
Template: Energy Baseline (an example shown from a NSW meat producer)

Baseline period	July 2011 to June 2012

Energy Type	**MWh per year**	**GJ per year**	**%**	**Annual energy cost $**	**GHG tCO2 per year**	**Cost $/MWh or $/GJ**
Electricity	3,097	11,147	52%	$564,414	3,313	$182
Natural gas	N/A	10,482	48%	$131,080	681	$12

Indicator	**KPI electricity consumption (12 month average) [kWh/tHSCW]**	**KPI electricity cost (12 month average) [$/tHSCW]**	**KPI gas consumption (12 month average) [GJ/tHSCW]**	**KPI gas cost (12 month average) [$/tHSCW]**
Energy Consumption per tonne hot standard carcass weight	259	$49	0.9	$11





Energy baseline – Consumption and Cost

The monthly energy usage (in GJ and GJ/tHSCW) for this period is shown below:

Baseline period	**Total GJ**	**GJ/tHSCW**
July		
August		
September		
October		

November		
December		
January		
February		
March		
April		
May		
June		

REVIEW OF MANAGEMENT SYSTEMS

Use the tables below to review your energy management systems.

This table has been adapted based on the OEH Energy Saving Actions plan (ESAP) guidelines and a sample assessment is shown below for a small (51,000 tHSCW) beef processor in New South Wales.

	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					

The following tables can be used below to assess your site.

A-Senior Management Commitment

Ranking	**Description**
Low	No Activity

Moderate	Informal practices
Minimum Sustainable	A management policy exists for improving energy efficiency or reducing energy costs that includes targets.
Industry Leader	In addition to minimum sustainable, this policy is reported on the organisation's website and in Annual Reports and communicated to all employees. Sub-targets are established for major facilities, and regularly updated.
Best Practice	In addition to industry leader, organisations can demonstrate that energy management is ingrained into corporate culture.

B- Understanding of energy savings potential

Ranking	Description
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Energy efficiency opportunities are based on a comprehensive review of energy use by major users, and of savings opportunities in each major operation covering operating procedures, maintenance procedures, and capital works.
Industry Leader	Cost-effective measures are routinely implemented, energy operating and maintenance procedures for energy intensive plant, and documented internal communications strategy implemented.
Best Practice	In addition to industry leader, all innovation measures implemented.

C-Energy targets and key performance indicators

Ranking	Description
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	KPIs established and tracked monthly for large sites, and grouped to allow for internal benchmarking of similar facilities where applicable. Sites have routine visibility of this data, and review thoroughly where they show large variance from target.
Industry Leader	In addition to minimum sustainable, KPIs are included in job description.
Best Practice	In addition to industry leader, KPIs are benchmarked against world best practice performance and facilities in top quartile.

D- Energy metering and monitoring

Ranking	Description
Low	No Activity

Moderate	Informal practices
Minimum Sustainable	Organisations maintain a baseline database for all sites, and basic plant monitoring enables access to interval metering data for major energy streams.
Industry Leader	In addition to minimum sustainable, sub-metering installed throughout plant and results reported and tracked at regular management meetings.
Best Practice	Energy consumption metered as per industry leader, regular reporting of consumption at board level.

E- Energy management reporting

Ranking	Description
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Organisations report savings opportunities with extended payback periods (>5 years) and whether they plan to implement these measures and over what time-frame.
Industry Leader	In addition to minimum sustainable, business practices are routinely audited, and publicly reported.
Best Practice	In addition to industry leader, organisations can demonstrate that energy management is ingrained into corporate culture.

F- Energy supply management

Ranking	Description
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Organisations have formal processes for energy procurement, and assess opportunities for alternative energy supply options based on capital and operating costs.
Industry Leader	In addition to minimum sustainable, product life cycles studies are carried out.
Best Practice	In addition to industry leader, organisation acts on product life cycle measures to reduce cradle to grave impacts.

G- Operating and maintenance procedures

Ranking	Description
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Opportunities assessment includes potential improvements to operating and maintenance

	procedures, and planned projects to improve energy efficiency incorporate formal operating procedures and training to ensure sustainability.
Industry Leader	In addition to minimum sustainable, product life cycles studies are carried out.
Best Practice	In addition to industry leader, organisation acts on product life cycle measures to reduce cradle to grave impacts.

H- Accountabilities for energy management

Ranking	**Description**
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Organisations have an executive-level manager who is accountable for energy management, together with at least one person at each site and an energy management group that coordinates energy management activities at major sites.
Industry Leader	In addition to minimum sustainable, KPIs are included in job description.
Best Practice	In addition to industry leader, KPIs are benchmarked against world best practice performance and in top quartile.

I- Training and awareness procedures

Ranking	**Description**
Low	No Activity
Moderate	Informal practices
Minimum Sustainable	Basic energy-awareness activities are in place at each major facility, and energy management training is provided to operations and maintenance teams in energy intensive areas.
Industry Leader	In addition to minimum sustainable, business practices are routinely audited, and publicly reported.
Best Practice	In addition to industry leader, organisations can demonstrate that energy management is ingrained into corporate culture.

J-Compliance with legal and other regulatory requirements

Ranking	**Description**
Low	Regularly fails compliance requirements.
Moderate	Occasionally fails compliance requirements.
Minimum Sustainable	Limited compliance failures.

Industry Leader	Compliance within allowable limits.
Best Practice	Consistently above compliance requirements.

ENERGY MANAGEMENT IMPROVEMENT PLAN

Following the management review, develop an action plan for management actions.

Template: Sample management action plan

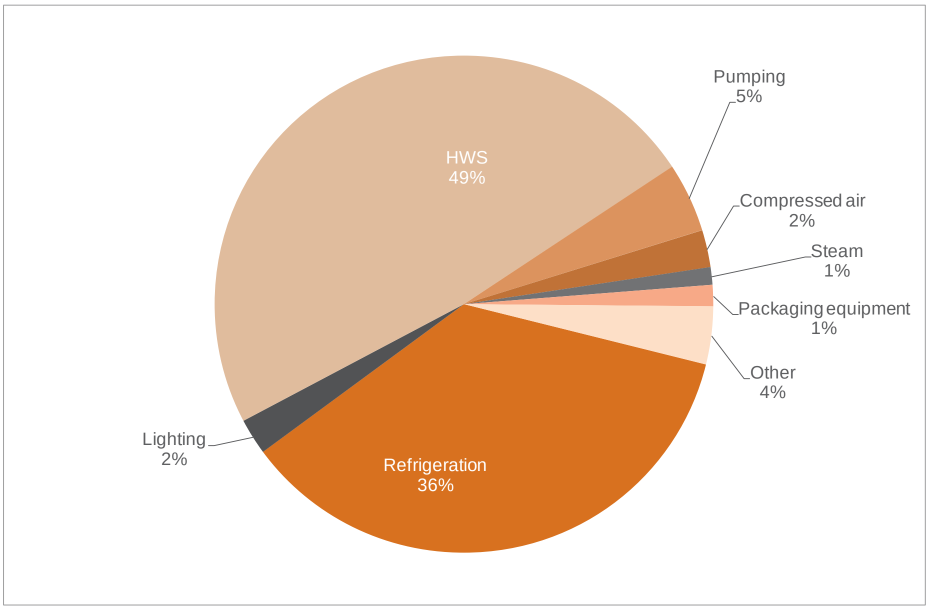
	Area	Action	Responsibility	Completion Date
B	Understanding of energy savings potential	Organise an energy audit of the refrigeration systems	Engineering manager	1/12/2013
C	Energy targets and key performance indicators	Develop energy KPIs and include these in the weekly meetings	Site manager	1/12/2013

ENERGY EFFICIENCY OPPORTUNITIES

<Describe the sites energy use by equipment or process based on recent audits or plant experience.>

The most significant portion of total site energy consumption at XYZ Beef is attributed to Hot Water Services (49%) which is related to the large amount of hot water that is used for cleaning and sterilisation of process cutting tools. Refrigeration (36%) is the next most significant load which includes energy consumption of the ammonia plant including compressor electric motors, evaporative condenser fans, condenser pumps, ammonia and glycol pumps and evaporator fan motor power consumption.

The balance of energy consumption is made up of smaller end uses such as pumping (5%), lighting (2%), compressed air (2%), Steam (1%), packaging equipment (1%) and other1 (4%) smaller consumers.



1 Other includes end uses not included in the site information but typical for a meat processing site such as conveyers, processing equipment, HVAC units etc.

<Describe the sites key energy saving areas based on audits and plant experience.>

Sample table:

Area/Equipment	Key Energy Saving Areas
Refrigeration	The refrigeration systems are 30 years old and are mostly on manual control. Significant opportunity for improvements but significant capital required.
Hot Water and Steam Systems	
Lighting Systems	Lighting systems were replaced with new roof. Some metal halide high bay lighting remains which could be replaced by induction lighting.
Compressed Air Systems	New compressors but a need for an annual leak audit.
Packaging Equipment	
Pumping Systems	2 pumps should be assessed for variable speed drive.
Metering and Energy Monitoring	Sub-metering on refrigeration should be considered
Other	

The following opportunities checklist can assist in identifying opportunities on your site.

Energy Costs

- ☐ Review your gas and electricity contracts and electricity network tariffs

Steam and Hot Water Systems

- ☐ Are the boilers over 20 years old and can they be replaced with more efficient technologies?
- ☐ Are the hot water and steam lines insulated?
- ☐ Are there any steam leaks?
- ☐ If electricity is more expensive than gas, can the hot water heating and boilers be switched from electricity to gas?
- ☐ Reduce mixing of cooler water with hot water at mid temperature watering stations
- ☐ Can you reduce the boiler operation time?
- ☐ Are there any anaerobic lagoons? Can methane be captured from these lagoons and used as boiler fuel?
- ☐ Are there any meters for natural gas?
- ☐ Are there any meters for steam use?
- ☐ Are you recovering the condensate?
- ☐ For rendering sites, are you recovering waste heat from the rendering plant at around 50°C and reusing this to heat water?

Refrigeration

- ☐ Is the refrigeration system over 20 years old? In particular, are there screw compressors of that age in use?
- ☐ Review manual or semi-automated control systems that require a lot of human intervention
- ☐ For fixed speed compressors, either fit with a VSD or use an operating strategy that avoids unloading
- ☐ Are the screw compressors running unloaded?
- ☐ Have you checked whether poor efficiency motors or rewound motors could be replaced by higher efficiency motors?
- ☐ Is the plant running at a fixed head pressure throughout the year?
- ☐ Are you using Freon-based or ammonia based refrigeration systems?
- ☐ Are freezer room and carcass chiller evaporator fans operating at fixed speeds?
- ☐ Are any evaporators on electric defrost?
- ☐ Does the facility remove air and water from the ammonia system effectively?
- ☐ Are the condensers in good condition and maintain acceptable pressures even in summer?

Compressed Air

- ☐ Is the compressed air close to the steam and hot water systems? Can this heat be recovered?
- ☐ Are there any long pipe runs with pressure drops?
- ☐ Are there any compressed air leaks?
- ☐ Do you have a scheduled leak detection program?
- ☐ Have you investigated compressor controls and staging?
- ☐ How efficient are your compressors and what is the payback on replacement?

Lighting

- ☐ Do you have twin and single 36 W T8 fluorescents and metal halides? T8 fluorescents can be retrofitted and Metal Halides replaced by induction lighting with around 50% saving
- ☐ Are there any lighting controls, including push button timers and sensors?
- ☐ For fluorescent lighting, have you applied voltage reduction?

VSDs and high efficiency motors

- ☐ When replacing motors check there efficiency against the maximum available.
- ☐ Review motors where variable load exists for a VSD.

IMPLEMENTATION, MEASUREMENT AND VERIFICATION PLAN

IMPLEMENTATION PLAN

<It is important to maintain an opportunity list which includes prioritization, capital expenditure and estimated savings.>

No.	Opportunity	Responsibility	Capital Cost ($)	Opex cost ($ p.a)	Energy Saving (GJ)	Cost Savings ($)	Payback (Years)	Completion Date	Status

MEASUREMENT AND VERIFICATION (M&V)

<It is important to measure the energy before and after the action is implemented>

Example M&V plan	Description
Energy efficiency opportunity	Pump efficiency improvement
Situation	There are ten existing pumps, which operate continuously and will be replaced with high efficiency pumps.
Factors affecting the M&V design	None
M&V plan	Measure the annual pump operating hours for a normal year, and multiply that number by measured power reductions. It was agreed that the installation contractor' measurement equipment would be adequately accurate to measure motor wattage requirements. Before removal, the contractor measured the power draw of each old motor after it had been running for at least 3 hours. Since the pumps are constant-flow, average annual operating hours were derived from the billed electricity kWh consumption of the past year divided by the measured kW power draw of the old pump motors. This computation showed that on average the pumps operated for 4,000 hours before retrofit.
Results	The energy savings were determined using IPMVP Option A, Equation 1d) as follows: Total load of all pumps before retrofit: 132 kW Total load of all pumps after retrofit: 98.2 kW Net load reduction: 33.8 kW Energy savings: = 34 kW x 4,000 hours/year = 136,000 kWh

COMMUNICATION AND REPORTING OF RESULTS

RESOURCING

<Describe the key roles and responsibilities for energy management at the site>

Person	Title	Energy Roles
	Plant Manager	Maintenance and review of the energy management plan
	Environmental Officer	Monthly Energy reporting and KPIs
	Financial Officer	Energy cost tracking and energy procurement

	Maintenance Supervisor	Refrigeration and compressed air performance tracking
	Electrical Supervisor	Metering, Power Factor correction
	Contractor	

ENERGY MANAGEMENT EDUCATION AND TRAINING

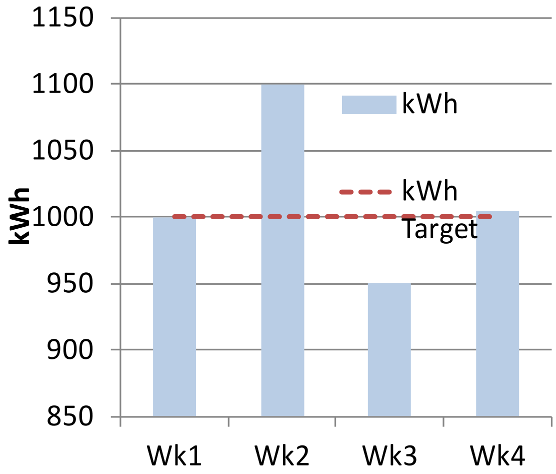
<Describe any required or planned education or training for the above personnel>

Training option	Training objectives	Person to be trained	Schedule of training
On the job training	Course on installation of new equipment	Maintenance engineer	
Tailor-made training run on-site using internal trainers	One day training on conducting energy assessments and identify energy efficiency opportunities	Operations and maintenance staff	

COMMUNICATION

<Consider who the communication is to, the best method of communication, and what information will be communication. >

Monthly team meeting agenda
1. Safety moment
2. Maintenance issues
3. Electricity use (current and target)



4. **Energy efficiency opportunities**

APPENDIX B– FINANCIAL EVALUATION

SIMPLE PAYBACK PERIOD

One of the most commonly used cost analysis methodologies is the simple payback period (SPP) method. The payback period determines the number of years required to recover an initial investment through project returns and is calculated by:

SPP = (initial cost) / (annual savings)

This method is commonly used for small investment decisions.

While the SPP method is quick and simple, shortcomings are:

- The time value of money is not taken into account;
- The process ignores all the cash flows occurring after the payback period;
- It does not account for the timing of the cash flow within the payback period - effect is small for energy projects with uniform annual savings; and
- The setting of the criteria (e.g. less than two years) for investing in projects is relatively 'arbitrary' compared to other methods.

Example calculation: Install lighting zone switching in the plant area

Annual energy savings: 17GJ

Annual cost savings: $837

Total cost to implement: $2,640

Simple payback period: Implementation cost / cost savings

= 2,640 / 837 = 3.15 years

Globally, the average industry payback for energy efficiency measures is 5 years[2]. Within Australia, the majority of energy savings adopted by EEO corporations had paybacks of two years or less. Specifically, 70% of adopted savings had a payback of two years or less, 15% had a payback of between two and four years and 15% had a payback of four years or more. This trend is also consistent for the food and manufacturing sector, highlighting that the majority of energy projects identified are highly cost effective.

Within the red meat sites participating in the EEO program, the average simple payback period ranged from 0-4 years. Lighting and refrigeration measures had the shortest payback period. Renewable energy opportunities had an average pay back of 4 years, and this is expected to be less the decreasing cost of renewable technology and government policies such as the carbon tax and the renewable energy target.

[2] IEA 2012, World Energy Outlook 2012

NET PRESENT VALUE METHOD

All the future cash flows (positive for savings and negative for costs) of a project are brought back to the present value and compared to the investment which is made at the start of the project. The larger the NPV is the better the investment.

NPV = (investment) +

[Savings$_1$/(1+r)^1] +

[Savings$_2$/(1+r)^2] +

[Savings$_n$1/(1+r)^n]

Where:

r is the prevailing market interest rate available to your firm

n is the total life of the project in years

NPV is the Net Present Value

Why is NPV commonly used in industry?

- Takes into account the time value of money;
- Simple method to use for evaluating whether to implement an energy project;
- Considers all the cash flows associated with the project beyond the payback period;
- Can easily handle variable annual cash flow (e.g. lower savings due to maintenance cost).

INTERNAL RATE OF RETURN

This method provides us with a single number (%) that can be used to decide whether implementing a project is financially worthy. The IRR method does not depend on any external interest rate and is independent of the prevailing interest rate.

NPV = (investment) + [Savings1/(1+r)1] +

[Savings2/(1+r)2] +

[Savingsn1/(1+r)n]

Where:

r is the calculated interest rate.

NPV is the Net Present Value.

IRR is the value of r when the NPV = 0

Consider implementing the energy saving project if the IRR is greater than the interest rate available to your firm. In other words you will get a higher return for your money if you finance the project than say, investing in a bank deposit.

Why is it commonly used in industry?

- Takes into account the 'time value of money';
- Considers cash flow throughout the life of the project;
- Can easily handle variable annual cash flow (e.g. fluctuating savings due to maintenance cost etc.).